Integrated Pollution Prevention and Control (IPPC) Licensing

Application Form

EPA Reg. Nº: *(Office use only)*	

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ABOUT THIS APPLICATION FORM

This form is for the purpose of making an application for an Integrated Pollution Prevention and Control (IPPC) Licence under the Environmental Protection Agency Acts, 1992 and 2003. There is a separate application form for applicants who wish to apply for the Pig & Poultry sector.

The Application Form **must** be completed in accordance with the instructions provided in the *IPPC Licensing Application Guidance Note*. The Guidance Note gives an overview of IPPC Licensing, outlines the licence application process (including number of copies required) and specifies the information to be submitted in the application. The Guidance Note and application forms are available to download from the IPPC Licensing pages of the EPA's website at www.epa.ie. A valid application for an IPPC licence must contain the information prescribed in the Environmental Protection Agency (Licensing) Regulations, 1994 to 2004. Article 10 of the Regulations sets out the statutory requirements for information to accompany a licence application. The application form is designed in such a way as to set out these questions in a structured manner and not necessarily in the order presented in Article 10. In order to ensure a legally valid application in respect of Article 10 requirements, please complete the Article 10 Checklist provided in Annex 2.

This Application Form does not purport to be and should not be considered a legal interpretation of the provisions and requirements of the Environmental Protection Agency Acts, 1992 and 2003 and the Environmental Protection Agency (Licensing) Regulations 1994 to 2004. While every effort has been made to ensure the accuracy of the material contained in the Application Form, the EPA assumes no responsibility and gives no guarantees, undertakings and warranties concerning the accuracy, completeness or up-to-date nature of the information provided herein and does not accept any liability whatsoever arising from any errors or omissions.

Should there be any contradiction between the information requirements set out in the Application Form and any clarifying explanation contained in the accompanying Guidance Note, then the requirements in this Application Form shall take precedence.

SECTION A: NON-TECHNICAL SUMMARY

A non-technical summary of the application is to be included here. The summary should identify all environmental impacts of significance associated with the carrying on of the activity/activities, and describe mitigation measures proposed or existing to address these impacts. This description should also indicate the normal operating hours and days per week of the activity.

The following information must be included in the non-technical summary:

A description of:

- the installation and its activities,
- the raw and auxiliary materials, other substances and the energy used in or generated by the installation,
- the sources of emissions from the installation,
- the environmental conditions of the site of the installation (e.g. soil and groundwater, air, noise, surface water),
- the nature and quantities of foreseeable emissions from the installation into each medium as well as identification of significant effects of the emissions on the environment,
- the proposed technology and other techniques for preventing or, where this is not possible, reducing emissions from the installation,
- where necessary, measures for the prevention and recovery of waste generated by the installation,
- further measures planned to comply with the general principles of the basic obligations of the operator i.e.

    (a) all the appropriate preventive measures are taken against pollution, in particular through application of the Best Available Techniques (BAT);
    (b) no significant pollution is caused;
    (c) waste production is avoided in accordance with Council Directive 75/442/EEC of 15 July 1975 on waste; where waste is produced, it is recovered or, where that is technically and economically impossible, it is disposed of while avoiding or reducing any impact on the environment;
    (d) energy and other resources are used efficiently;
    (e) the necessary measures are taken to prevent accidents and limit their consequences;
    (f) the necessary measures are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state.

- measures planned to monitor emissions into the environment.

Supporting information should form **Attachment No A.1**

A.1 Introduction

A.1.1 Company Background

ConocoPhillips is an international, integrated energy company. It is the third largest[1] U.S. integrated energy company, based on market capitalisation, as well as proved reserves and production of oil and natural gas, and the largest refiner in the United States. ConocoPhillips is the seventh-largest holder of proved reserves and the fourth-largest refiner worldwide, of nongovernment-controlled companies. ConocoPhillips is headquartered in Houston, Texas and operates in more than 30 countries.

The company has four core activities, *viz*:

- Petroleum exploration and production.
- Natural gas gathering, processing and marketing,
- Petroleum refining, marketing, supply and transportation.
- Chemicals and plastics production and distribution (through a 50 percent interest in Chevron Phillips Chemical Co. LLC).

In addition, the company is investing in several emerging businesses that provide current and future growth opportunities. These efforts include development of integrated power generation and technology projects to support Exploration and Production (E&P) and Refining and Marketing (R&M).

The Whitegate Refinery is one of 16 refineries operated globally by ConocoPhillips and one of three in Europe which the company operates. The refinery has a nominal capacity of 75,000 BPD (barrels per day) and employs approximately 155 people. For more information on the Refinery and its history see Section A.2.1.

A.1.2 Whitegate's Share of Transport and Heating Fuels in Ireland

Whitegate has been an important supplier of transport and home heating fuels to the Irish market since its construction in 1957-1959. In 2009 the refinery supplied the following share of products to the Irish market.

Table 1: Whitegate Share of Irish Oil Market 2009 (ktoe)2

Product	Whitegate Production 2009	Final Energy Demand in Ireland	% of 2009 National Demand supplied by Whitegate
LPG	39	114	34.2%
Gasoline	522	1,741	30.0%
Kerosene	211	1,080	19.5%
Gas Oil/DERV	1,070	3,483	30.7%
Residual Fuel Oil (Large exports for processing in overseas refineries)	911	266	n/a

Source: SEAI

[1] As of December 31st 2010
[2] 1.0 kilotonne of oil equivalent

A.1.3 Licence Review

This application by ConocoPhillips for a review of its current IPPC Licence (Register No: P0266 -01) follows from a decision by the EPA to deal with a proposed change in the method of sulphur recovery on the refinery by way of a Licence Review rather than a Technical Amendment. An overview of the new sulphur recovery process is provided in Section A.2.3.

This application presents an updated statement of the current operations, data on historical emissions to the environment and, in particular, the environmental implications of the change to the sulphur recovery processes at the Refinery and other changes which have taken place since the licence was issued in 2000. In particular, it sets out the implications for the current IPPC Licence (No: P0266 -01) of the change in sulphur recovery processing scheduled for commissioning in December 2011.

This application follows a notification of the change to the EPA on 28th October 2010 and a written submission providing an overview of the likely changes in emissions to atmosphere. The application also addresses a notification from the Agency of the requirement that Whitegate may be required to review its IPPC Licence under the new Environmental Objectives (Surface Water) Regulations, S.I. No. 272 of 2009.

A.2 Installation & Activities

A.2.1 Existing Installation & Activities

The Refinery was originally built in 1957-1959 as a hydro-skimming oil refining facility. It had a nominal capacity to process 41,000 barrels[3] per day of high sulphur Middle East crude. During the 1960s, the facility was revamped resulting in an increase in crude processing capacity to 65,000 barrels per day. Middle East crudes were run at the Refinery until 1981 when the refinery ceased operations temporarily. At that date the refinery was being run under Esso's management. Refining ceased in 1981.

The refinery was then acquired by the Irish State. Refining was recommenced in 1982 under the ownership of the Irish Government Agency –the Irish National Petroleum Corporation (INPC). In that period, low sulphur, North Sea crudes were processed. However, the design capacity allowed for only 55,000 barrels per day of North Sea crudes to be throughput. This was adequate to meet market demands until the mid-1990s, at which time the Refinery was again upgraded to restore its capacity to 65,000 barrel per day to meet increasing demand. Further installations and upgrades have facilitated a current nominal capacity of 75,000 barrels per day. A refinery schematic showing the key installations, activities and products produced at Whitegate is shown on Page 5 of the non technical summary.

A description of the main processing units is provided in Section D.1 A map showing the location of the site and a drawing showing the layout of the refinery are included in Attachment A.1.

3 1 US barrel is equivalent to 159 litres.

A.2.2 New Installation & Activities

Since the licence was granted in 2000 a number of changes have taken place at the site, including changes to the operational units. The key changes that have taken place include:

- Construction of a new hydro-desulphurisation plant to produce ultra low sulphur diesel (2003).
- Upgrading of the wastewater treatment plant (WWTP) (2005-2009).
- Changeover to natural gas from heavy fuel oil to supplement refinery gas usage in combustion plant (2009-2010).
- Replacement of existing sulphur recovery unit with an Amine Sulphuric Acid (ASA) process (2011).

A description of the new ASA plant is provided in Section A.2.3

A.2.3 Amine Sulphuric Acid Plant

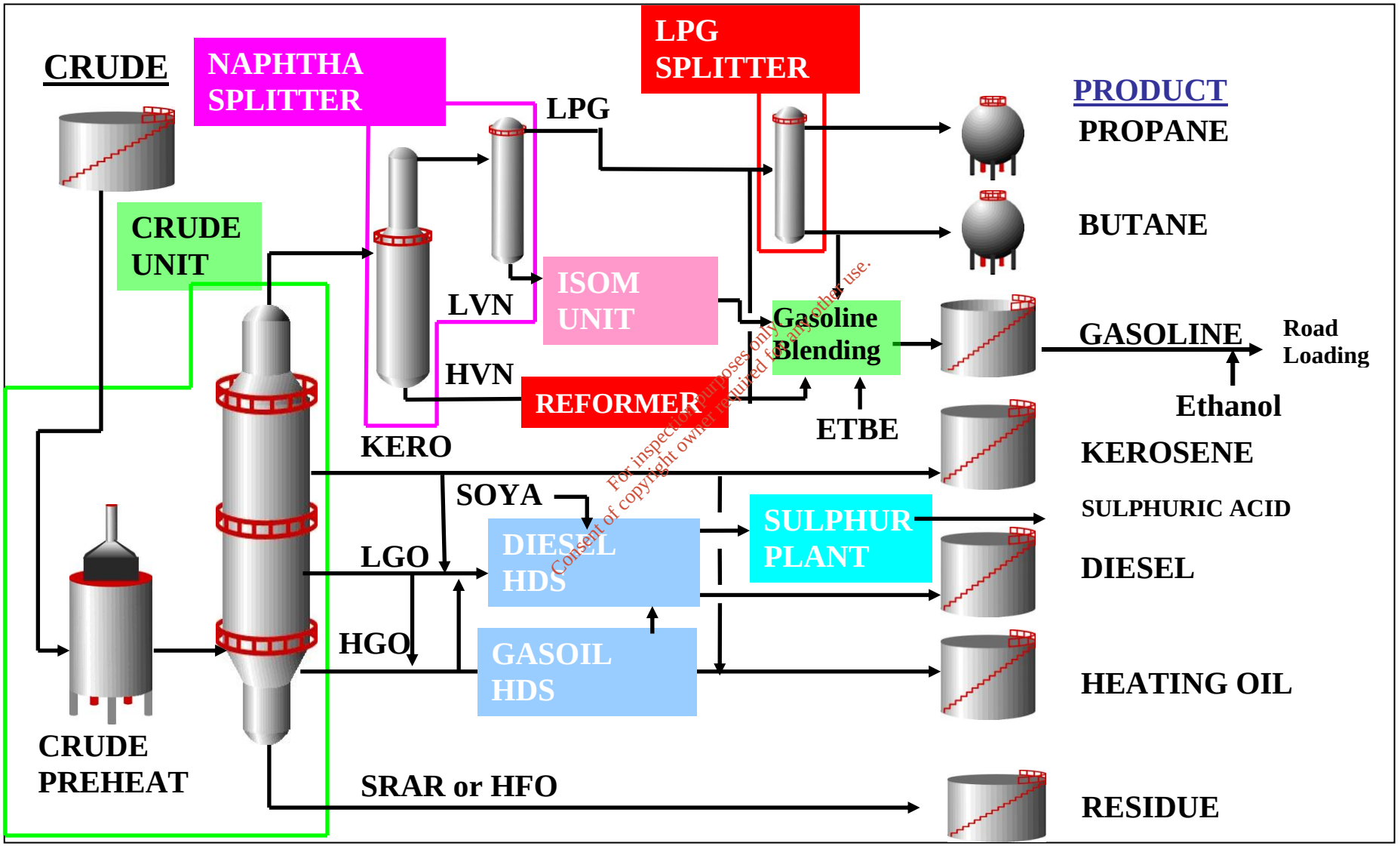
There are two types of crude oil used in the refining process: sweet (lower sulphur content) and sour (higher sulphur content). In recent years, the requirements for low sulphur transport fuels have become more stringent, requiring lower sulphur content refined products. This can be achieved either through the processing of sweet crudes, the reserves of which are declining, or through the removal (recovery) of sulphur from the processing of sour crudes. While the refinery has the capacity to process sweet crudes through the use of the existing Sulphur Recovery Unit, in order to process higher sulphur crudes it is installing a more efficient process for the recovery of sulphur, namely the Amine Sulphuric Acid Plant.

An Application for Planning Permission was submitted to Cork County Council in September 2010 and full planning permission was granted in January 2011. The installation of the new plant is scheduled to be completed in December 2011. In accordance with Condition 1.2 of its IPPC licence, the refinery notified the Agency of this change to the unit operations at the site in October 2010.

In addition to providing the refinery with the capability of processing higher sulphur crudes, the new plant will reduce the quantity of sulphur dioxide emissions to atmosphere, as well as resulting in a significant reduction in the use of caustic soda (which is currently used in the removal of sulphur compounds from LPG).

The installation of the ASA plant also satisfies one of the improvement conditions in the current IPPC licence. Under Condition 5.13 of the current licence, ConocoPhillips is required to investigate means for reducing ammonia emissions from the existing Sulphur Recovery Unit.

Figure 1: Schematic of Refinery Process



A.3 Materials & Energy Usage

The Refinery processes approximately 3 million tonnes of imported hydrocarbon crude oils annually. It also handles bio-ethanol and bio-diesel for blending into transport fuels, which became mandatory for all road transport fuels under the Energy (Biofuel Obligation & Miscellaneous Provisions) Act 2010.

Whitegate imports crude oil from various locations in Northern Europe, North and West Africa, and converts them into refined petroleum products for the Irish transport and heating markets. Residual heavy fuel oil from the crude distillation process is exported for further refining overseas; as there is a declining market for this heavy fuel oil in Ireland in light of the switchover of HFO-fired power stations to natural gas.

The refinery utilises a mixture of many energy streams on site, all of which are integrated to maximise the use of refinery gas streams and to maximise the energy content of the refined products placed on the market i.e. to maximise energy efficiency.

The energy streams used in combustion plant include

- Refinery Gases (HP Gas, Tail Gas, BH Gas GGD7 LP Gas, Isom gas)
- Pilot Gas
- SRAR (Straight Run Atmospheric Residue – a heavy fuel oil)
- Propane
- Gasoil
- Natural Gas (since 2010)

The refinery continually assesses the amount of energy used on site and has conducted audits of energy use periodically. Whitegate is a long term member of SEAI's LIEN Group (Large Industry Energy Network.)

As product specifications become more stringent the "energy intensity" of refining needed to meet new product specifications also increases. An analysis indicated that in 2007 the energy consumed on site was equivalent of 4.1% of the energy in the crude processed.

A.4 Sources of Emissions

A.4.1 Emissions to Atmosphere

There are currently 22 licensed main emission points to atmosphere at the site, as follows:

- 11 no. furnaces
- 4 no. boilers (including one associated with the CHP plant)
- 1 no. stack from the SRU unit
- 3 no. flares (for the safe operation of the refinery).
- 3 Compressor engine drivers

The emissions from the main emission points arise from the sulphur recovery process (one emission point) and combustion processes (21 in total) in furnaces, boilers and gas engines

and a gas turbine. The gas turbine is used to generate power for the site in the Combined Heat and Power (CHP) unit, and the gas engines used to drive process compressors in the Powerforming Plant

Following the construction of the ASA plant, there will be one new main emission point to atmosphere: the clean gas stack from the new ASA plant. This will replace the main emission point from the SRU, which will be decommissioned once the ASA plant has been commissioned.

Small quantities of fugitive emissions (mainly comprising volatile organic compounds such as gasoline vapours) are released from activities such as the storage of crude oil and other petroleum fractions in tanks. These emissions are controlled by storage of the more volatile compounds in floating roof tanks. Losses of VOCs at the road tanker loading facility are recovered in a dedicated Vapour Recovery Unit (VRU).

A.4.2 Emissions to Surface Water

Process effluent is treated in the waste water treatment plant, and the treated effluent is discharged to Cork Harbour via licensed discharge point SW-1. This effluent consists of a variety of streams from the unit operations, including condensate and sour water. The rain/stormwater collected in certain production areas of the site is also sent to the WWTP for treatment prior to discharge via SW-1. The WWTP has been upgraded between 2005 and 2010 at a total cost of €6.83 million, including upgrades to the pH control systems and the reduction of suspended solids, Biochemical Oxygen Demand and Chemical Oxygen Demand.

A second discharge point to surface water at Corkbeg Island (SW-2) was traditionally used to discharge ballast water from ships via an API separator (to remove oil). However, the new generation of oil tankers no longer requires the facility to discharge oily ballast water and therefore the ballast water facilities at the Refinery are seldom required, although the discharge point is occasionally used to discharge water used for hydrostatic testing of tanks.

Domestic effluent from the site is sent to an Imhoff tank to treat the effluent prior to discharge via a surface water emission point (SW-5) to Cork Harbour. The Imhoff tank has the capacity to treat effluent in the order of 200 population equivalent (there are currently 155 people employed at the site). This treatment operation has been licensed by Cork County Council since 1988, at which point the Refinery was granted a trade effluent licence (WP (W) 2/88).

There are two springs that arise at the site and discharge from the site at Glenagow and O'Driscoll Drive. While there are no emissions from the activities at the site via these springs, rain and stormwater at the site may be discharged and therefore these have been identified as discharge points to surface water, identified as SW-3 and SW-4.

A.4.3 Emissions to Sewer

There are no emissions to sewer from the site.

A.4.4 Emissions to Ground/Groundwater

There are no emissions to ground or groundwater. Under Conditions 9.2.3 and 9.4 of the site's current licence, a hydrogeological investigation was conducted in 2000. In light of the findings from the study, a programme for groundwater monitoring was established and has been continued to date. The results of the groundwater monitoring programme are provided to the Agency as part of the site's Annual Environmental Report.

A.4.5 Noise Emissions

ConocoPhillips operates 24 hours per day 365 days per year. Under the terms of the current licence, the Refinery monitors noise emissions at five locations around the periphery of the site, both on and off site. Two of these monitoring points are designated as Noise Sensitive Locations.

The noise emissions from the site are generated from the production activities in the main refinery area, with little or no noise generated from the tank farm areas or from Corkbeg Island. The installation and subsequent operation of the ASA plant is not expected to increase noise emissions from the site and will reduce local (on site) noise levels in the vicinity of the plant.

ConocoPhillps confirms there have been no complaints of noise in the period 2005-2011.

A.5 Conditions of the Site and Installations

Since acquiring the refinery from the State, ConocoPhillips has engaged in a series of upgrades to improve the economic and environmental performance of the refinery.

The refinery dates from 1957-1959. However many of the refinery units have been upgraded since then. Table 2 lists the main investments in environmental performance enhancement projects since 2002.

Table 2: Investments in Environmental Enhancement Projects

Process Units / Utilities	Cost	Rationale for Investment & Detail of Improvements	Year
Clean Fuels Project	€66 million	Investment in new hydrotreating technology to meet EU low sulphur fuel specifications for diesel fuels.	2002-2005
Waste Water Treatment	€6.8 million	Improve quality of discharge to the Lower Harbour, ensure compliance with licensed limits (using Dissolved Air Flotation (DAF), a biological treatment step and improved pH control).	2005-2010
Improved Energy Efficiency	€5.5 million	Improved fuel metering, use of "pinch" technology analysis of heat recovery potential, oxygen trim control on combustion processes, improved heater controls, switching to natural gas as supplementary fuel in 2009/2010, fitting low - NO_X burners to all main combustion equipment..	2005-2010

Process Units / Utilities	Cost	Rationale for Investment & Detail of Improvements	Year
Biofuels	€3.8 million	Installing of facilities for production of biodiesel and bio-gasoline.	2005-2010
ASA Plant	€29 million	Project to recover sulphur more efficiently, reducing site-wide SO_2 emissions, process listed as a BAT technology for sulphur recovery, process produces commercial grade sulphuric acid for sale in Irish market. Will position refinery to achieve these outcomes while treating higher sulphur crude oil blends in future and enhancing Whitegate's economic viability.	2010/2011
Total	***€111.1 million***		***2002-2010***

This expenditure on environmentally driven investments means that many of the refinery units and key utilities have been upgraded to meet increasingly stringent EU and Irish environmental requirements over the last 10 years. The refinery is now preparing for an era of returning to treatment of higher levels of sulphur in crude blends.

In previous years, a number of activities which could potentially impact on the site's on-site environment have been discontinued in line with the requirements of the IPPC licence. These include the cessation of land-filling and land-spreading on site. Following cessation of these activities, a series of studies, provided to the Agency, were carried out to assess the extent of any residual contamination. The refinery continues to monitor groundwater quality at the site under its groundwater monitoring programme.

The North-East of the Refinery site and a large portion of Corkbeg borders the Cork Harbour Special Area of Protection (SPA) (Site Ref: 004030) and the Whitegate proposed Natural Heritage Area (pNHA). Cork Harbour is a large, sheltered bay system, with several river estuaries – principally those of the Rivers Lee, Douglas and Owenacurra. The SPA site comprises most of the main intertidal areas of Cork Harbour, including all of the North Channel, the Douglas Estuary, inner Lough Mahon, Lough Beg, Whitegate Bay and the Rostellan inlet. For more information on the Cork Harbour SPA see Attachment I.2.

Cork Harbour is designated as coastal waters, with the nearest transitional water bodies located at Lough Mahon (River Lee Estuary) and the Owenacurra Estuary, both located over 5 km inland from Whitegate.

A.6 Nature and Quantities of Emissions

A.6.1 Emissions to Atmosphere

As described earlier, emissions to atmosphere from the site consist of emissions from boilers, furnaces, gas engines, the CHP plant and the SRU. Emissions to atmosphere are monitored in accordance with the site's IPPC Licence. Reports on these emissions are submitted to the EPA at the end of each calendar quarter.

The main emissions to atmosphere from the site consist of products of combustion (SO2, NO_X, CO and CO_2) as well as process emissions from the existing SRU in the form of ammonia vapour. The emissions to atmosphere from the new ASA plant, which replaces the SRU plant, will consist of oxides of sulphur and oxides of nitrogen. In addition, an acid mist

(sulphuric acid) will be emitted to atmosphere at high level, high temperature and in low concentrations. The combination of these factors will not result in a significant impact on the surrounding environment, as the ground level concentrations will be less than the relevant air quality guidelines. A dispersion modelling study of the emissions to atmosphere from the ASA plant is included in Attachment I.8, the results of which conclude that the impact on the surrounding environment will not be significant.

Table 3 summarises the mass emission rates to atmosphere for the four quarters in 2010. Each of the mass emission rates is less than the licence limit and there have been no exceedances of the licensed emissions to atmosphere since 2005.

Table 3: Summary of Emissions to Atmosphere from Licensed Stacks 2010

Parameter	Unit	Licensed level	Q1 average	Q2 average	Q3 average	Q4 average
SO_2	kg/h	245	116.5	45.1	72.3	71.5
NO_2 process	kg/h	98.7*	76.3	79.1	73.0	54.1
NO_2 engines	kg/h	130	26.5	25.6	14.5	16.2
NH_3	kg/h	8.5	0.16	0.16	0.16	0.16

* Derived from the sum of the process stacks.

It is expected that when the ASA plant is operating, the mass emission of SO_2 from the site will reduce from the current level of the order of 100 kg/h to the order of 33 kg/h. This level of mass emission is expected to occur during normal operations when processing higher crudes (than those processed currently) and when firing on natural as the supplementary fuel. In the event that the refinery uses heavy fuel oil as the supplementary fuel, the mass emission of sulphur dioxide is expected to be in the order of 160 kg/h.

The operation of the ASA plant is not expected to result in significant changes in the quantity of nitrogen dioxides emitted to atmosphere. During 2010, the average mass emission of NO_X from the site (both process and engine emissions) was in the order of 100 kg/h. This compares with a licensed mass emission equivalent to 228 kg/hr. The results of the dispersion modelling study conducted in 2010 (refer to Section I.1 and Attachment I.1), indicate that the emissions of NO_X from the refinery with the ASA plant operating will not result in a significant increase in the ground level concentrations of NO_X and the impact of the refinery emissions will be such as to continue to meet ambient air quality standards as they do at present.

Once the SRU plant has been replaced by the ASA plant, there will no longer be any emissions of ammonia (NH_3) to atmosphere. Historically, the maximum mass emission of ammonia has been less than 0.2 kg/h.

In normal operation, it is expected that the ASA plant will discharge in the order of 0.22 kg/h of sulphuric acid mist. This emission rate is less than the emission limit value established by the Danish EPA for emissions of sulphuric acid mist to atmosphere and, as outlined above, will result in ground level concentrations that are less than the guideline for ground level concentrations for the protection of people and the environment.

A.6.2 Emissions to Surface Water

There are three emission points to surface water from the site. The main emission to surface water arises from the site's waste water treatment plant which treats process effluent and a proportion of the storm water runoff from the site. This discharge consists primarily of, and is monitored for:

- Flow
- Biochemical oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Suspended solids
- Ammonia
- Phosphorous
- Nitrogen
- Phenols
- Petroleum Hydrocarbons
- Heavy Metals

The volume of effluent discharged from the plant via SW-1, excluding storm water runoff, is in the order of 800 to 1,200 m^3 per day. During 2010 there were no exceedances of the licence limits for discharges to surface water via SW-1; there was a single exceedance of the emission limit for BOD in 2011. The upgrades to the WWTP plant (as outlined in Section A.2.1) have contributed to the improvement in quality of effluent discharged from the plant.

As outlined in Section A.4.2, there are only infrequent discharges to surface water via SW-2, which consist primarily of sea-water (or fresh water) from hydrostatic testing of storage tanks on Corkbeg Island. This discharges via an API separator which removes any oil that may become entrained in the water during hydrostatic testing.

The sanitary effluent from the refinery is discharged via the Imhoff tank at SW-5. The Imhoff tank provides primary treatment for this effluent stream, reducing the BOD, COD and suspended solids loads prior to discharge to Cork Harbour. The Imhoff tank has a capacity in the order of 200 population equivalent, while there are a total of 155 people employed at the site. It is estimated that the emission from SW-5 may comprise in the order 20 m^3 per day, with a concentration of BOD in the order of 200 to 300 mg/l. The significance of this emission may be judged by the fact that the primary discharge point for sewage discharge from the Whitegate- Aghada agglomeration was estimated by Cork County Council to be 1,523 in 2009 i.e. some ten times higher in PE terms that the Whitegate refinery sewage which is treated in the Imhoff tank prior to discharge. As of 2009 the domestic waste waters from the Whitegate-Aghada agglomeration were discharged to the harbour without treatment.

The installation of the ASA plant will not increase the number of people at the site and therefore there will be no increase in sanitary effluent from the site.

A.7 Techniques for Reducing Emissions

ConocoPhillips currently employs a number of techniques for reducing emissions from its activities. These include:

- Use of floating roof tanks for minimisation of fugitive emissions of volatile organic compounds (VOC);
- Utilisation of oil-tanker onboard facilities for the management of ballast water;
- Vapour Recovery Unit at the hydrocarbon road loading facilities;
- Bunding of oil storage tanks, including an ongoing programme to maintain the conditions of the bunds and to reduce the permeability, where necessary;
- Upgrading of the waste water treatment plant and programmes to reduce effluent volume;
- Installing low-NO_X burners on all boilers and furnaces;
- Switching to natural gas as supplementary fuel from heavy fuel oil;
- Monitoring of energy consumption and implementing a series of energy efficiency measures;
- Installation of CHP plant to reduce primary energy usage compared to separate power generation off-site;
- Installation of the ASA plant to recover sulphur from refinery gas streams.

ConocoPhillips also monitors its performance against the guidance contained in Best Available Technique Reference Documents (BREFs) and the BAT Guidance Documents produced by the EPA. In 2007, ConocoPhillips conducted a comprehensive BAT assessment of the refinery operations and in light of this, ConocoPhillips assessed the options for enhanced sulphur recovery at the site. Subsequent to this assessment, as part of its review of refining operations in the context of declining reserves of low sulphur crudes, ConocoPhillips investigated the technologies that could achieve enhanced sulphur recovery, ultimately resulting in the current project to install the ASA plant.

A.8 Prevention & Recovery of Waste

The generation, prevention and recovery of waste at the site are managed in accordance with the site's Environmental Management Systems. The main wastes generated the site are from the refining process and include spent caustic solutions, waste sludges, together with waste sulphur from the Sulphur Recovery Unit. Other wastes are also generated from the administrative and ancillary activities at the site, including metals, paper & cardboard, domestic-type canteen and kitchen waste, and sludge from the wastewater treatment plant. The production of waste is minimised in the first instance through the efficient use of materials, the optimisation of the refinery unit operations, and through proactive waste reduction initiatives within the administrative and ancillary areas of the site. The recovery of waste is pursued in preference to the disposal of waste where practicable.

Historically, certain wastes were disposed of in onsite landfill areas or by means of landspreading. These activities ceased in December 2000, following which a detailed

Landfill Decommissioning Plan was prepared together with monitoring and analysis of ground and groundwater contamination from the historical activities at the site.

A.9 Compliance with Basic Obligations of the Operator

A.9.1 Use of Best Available Techniques

As outlined in Section A.9.1, ConocoPhillips employs a range of measures to reduce emissions from the site. These measures include those identified as Best Available Techniques. The most recent BAT measure implemented at the site is the installation of the ASA plant, which will result in a significant reduction in sulphur dioxide emissions to atmosphere.

As there is a wide range of activities carried out at the site, from refining to the treatment of process effluent, there are a number of BAT Reference Documents and BAT Guidance Notes applicable to the site. Within these guidance documents, a large number of BAT techniques are applicable to the site, many of which have been or are being implemented. These BAT measures include both technical measures (such as the installation of the ASA plant) and organisational/management techniques (such as the implementation of the site's Environmental Management System).

ConocoPhillips has conducted a comprehensive assessment of its performance against the range of BAT measures applicable to its site. In this assessment, it has considered the specific guidance contained in the following BAT Reference Guidance Notes:

- Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector
- Emissions from Storage
- Industrial Cooling Systems
- Mineral Oil and Gas Refineries

In addition, it has considered the general guidance contained in the related BREF guidance documents in areas such as energy efficiency, the general principles of monitoring and economics and cross media effects (the interrelation between competing and complimentary BAT techniques).

A.9.2 No Significant Pollution is Caused

The emissions from the site, including wastes, have been assessed in the context of the surrounding environment and are not considered to cause significant pollution. The main emissions to atmosphere from the site have been modelled using dispersion modelling software, and this has demonstrated that the emissions, both current and projected, do not result in significant pollution. In particular, the operation of the ASA plant will not result in significant pollution and will, instead, result in a reduction in ground level concentrations of SO_2 in the vicinity of the site.

Monitoring has been conducted in Cork Harbour by a variety of organisations and agencies. In addition, ConocoPhillips has undertaken some monitoring of Cork Harbour in order to assess the quality of the receiving waters. The results of monitoring undertaken in 2001 indicate that the discharges to surface water from the site have not resulted in significant pollution based on oxygen saturation levels and toxicity testing. Further monitoring will be

conducted by ConocoPhillips in Q3 and Q4 of 2011 in order to assess whether there is any impact from the discharges from the site on the receiving waters.

The historical landfilling activities and landspreading of certain productions wastes at the site ceased in 2000. Since then, a number of studies and assessments have been conducted to determine the extent of any residual pollution at the site, including a landfill decommissioning plan and a hydrogeological investigation. These were provided to the Agency. While the results of these studies indicate that there had been elevated concentrations of certain parameters in the ground at the site, the most recent groundwater monitoring report demonstrates that overall the status of the groundwater at the site is considered to be moderate to good.

A.9.3 Production of Waste is Avoided

The Refinery aims to minimise, and avoid where practicable, the production of waste in both the production processes and the administrative and ancillary activities at the site. Waste minimisation within the production process is a by-product of an efficient refining process and therefore in optimising the operation of the refinery, waste generation is minimised. For other areas of the site, the Refinery continues to investigate options to further reduce the quantities of both hazardous and non-hazardous wastes. In monitoring and recording the quantities of waste generated at the site on an annual basis, the Refinery tracks its progress in reducing wastes.

A.9.4 Energy is Used Efficiently

ConocoPhillips Whitegate Refinery is a member of the SEAI Large Industry Energy Network (LIEN). Over the years since the IPPC licence was first granted, it has invested in improvements in energy metering, combustion control and other techniques to improve energy efficiency. This is aimed at minimising the percentage of energy which is purchased in the form of crude oil that is used in converting crude into saleable energy products. Energy efficiency and the integrated management of a multitude of energy streams on the site is a fundamental part of good refining economics. Recent investments in energy efficiency include the conversion of all furnaces, boilers and compressor engines to natural gas firing, the upgrading of fuel meters, the upgrading of oxygen trim control on furnaces and boilers, and the installation of the CHP plant.

The ASA plant will also contribute to enhanced energy efficiency by removing sulphur compounds from liquid LPG and thereby recovering more LPG for sale as a commercial product which would otherwise be used as a lower value refinery fuel. The ASA plant also produces steam from recovered waste heat as part of its normal operation. This augments the generation of steam from other areas of the site, thereby improving the overall efficiency at which steam is generated.

A.9.5 Necessary Measures Taken to Prevent Accidents and Limit their Consequences

The Refinery is committed to putting in place all necessary measures to prevent major accidents at and to limit their consequences. As an Upper Tier Seveso site (under the European Communities (Control of Major Accident Hazards) Regulations), ConocoPhillips has conducted a comprehensive assessment of the potential accident scenarios at the site, in the context of impacts on both people and the environment, and has identified and put in

place all necessary measures to prevent these accident scenarios and to reduce the potential consequences. This assessment is reviewed on a routine basis and, under the Regulations, is submitted to the Health and Safety Authority for acceptance. The EPA is a consultee to this process and advises the HSA, when requested, on matters relating to the protection of the environment. The latest review of this assessment was undertaken in 2010 and accepted by the HSA in 2011.

The prevention of accidents at the site is managed under the Major Accident Prevention Policy, the site's Environmental Policy and Environmental Management System, as well as the Safety Statement.

A.9.6 Necessary Measures Taken on Cessation of Activities

It is not expected that the plant would be partially or fully decommissioned in the foreseeable future. However, any shutdown of the Whitegate facility would be a well planned and well resourced event and the shutdown date would be known in advance. The EPA would be notified well in advance of any partial or full closure of the plant. As required under Condition 13 of the current licence, the Refinery prepared a Closure, Restoration and Aftercare Management Plan (CRAMP) for the site to consider the various potential closure scenarios. The scenarios that were considered as part of this study were:

- Closure and decommissioning of the production area and crude oil storage tanks, with the road-loading facility, marine terminal and product tanks remaining operational.
- Closure and decommissioning of the production area, crude oil storage tanks and the road-loading terminal, with the marine terminal and product tanks remaining operational.
- Closure and decommissioning of the entire facility.

The CRAMP is reviewed on an annual basis to take into account any changes that have taken place at the site and to review the closure costs estimated for the identified scenarios. Following the installation of the ASA plant and decommissioning of the SRU, the CRAMP will be reviewed and updated accordingly.

A.10 Plans for Emissions Monitoring

ConocoPhillips plans to continue its existing programme for monitoring its emissions to atmosphere, to surface water and for the monitoring of noise emissions.

- Monitoring of emissions to atmosphere is conducted using a combination of a quantitative surrogate approach and mass balance (as set out in the BAT Reference Document on the General Principles of Monitoring). This monitoring approach has been applied since the licence was granted in 2000. The current surrogate approach will be updated to take account of the impact of the ASA plant on the other process units at the site.

- Biannual stack monitoring for oxides of nitrogen (NO_X), sulphur dioxide (SO_2) and carbon monoxide (CO).

- Continuous monitoring of the acid mist from the clean gas stack (A2-18) on the ASA plant.

- Continuous monitoring of flow and pH from the WWTP to surface water at SW-1.
- Weekly monitoring of emissions to surface water at SW-1 of pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, ammonia and oil.
- Monthly monitoring of emissions to surface water at SW-1 of phenols and heavy metals.
- Annual monitoring of emissions to surface water at SW-1 for effluent toxicity.
-
- Annual monitoring of emissions to surface water at SW-1 for VOC contamination.
- Daily monitoring of discharges to surface water at SW-1 for appearance/odour.
- Grab sampling and visual inspection of discharges to surface water at SW-2, as required; this discharge point is only in operation following hydrostatic testing of storage tanks and discharge of the test water to Cork Harbour.
- Monthly monitoring of emissions of surface water at SW-3 and SW-4 (natural springs) for pH, BOD, ammonia, nitrogen, conductivity and Total Petroleum Hydrocarbons, and a visual inspection for colour and odour.
- Weekly visual inspection of the discharge from the Imhoff tank at SW-5.
- Annual noise monitoring along the perimeter of the site, including at the closest Noise Sensitive Locations.
- Groundwater monitoring at the existing borehole locations. The extent of this groundwater monitoring programme is reviewed on a routine basis taking into account the results and the trend analysis and any proposed changes to this programme would be agreed with the Agency in advance.

Monitoring of emissions of ammonia from the SRU will cease following commencement of operation of the ASA plant and decommissioning of the SRU.

Monitoring of emissions to atmosphere is carried out by the Refinery's laboratory, which is accredited to the international standard ISO 17025 *General Requirements for the Competence of Testing and Calibration Laboratories*. Monitoring and analysis is also undertaken by a variety of Third Party contractors, who carry out the monitoring in accordance with relevant international standards and guidance documents published by the Agency.

SECTION B: GENERAL

B.1 Owner/Operator

Name*:	ConocoPhillips Whitegate Refinery Ltd.
Address:	Whitegate
	Midleton
	Co. Cork
Tel:	+353 21 4622200
Fax:	+353 21 4622222
e-mail:	

* This should be the name of the applicant which is current on the date this IPPC Licence Application is lodged with the Agency. It should be the name of the legal entity (which can be a limited company or a sole trader). A trading/business name is not acceptable.

Name and Address for Correspondence
Only application documentation submitted by the applicant and by the nominated person will be deemed to have come from the applicant.

Name:	Mr. John McCarthy
Address:	ConocoPhillips Whitegate Refinery Ltd
	Whitegate
	Midleton
	Co. Cork
Tel:	+353 21 4622232
Fax:	+353 21 4622222
e-mail:	John.mccarthy@conocophillips.com

Address of registered or principal office of Body Corporate (if applicable)

Address:	ConocoPhillips Whitegate Refinery Ltd
	Whitegate
	Midleton
	Co. Cork
Tel:	+353 21 4622232
Fax:	+353 21 4622222
e-mail:	

If the applicant is a body corporate, the following information must be attached as Attachment B1:

a) a Certified Copy of the Certificate of Incorporation.
b) the Company's Registration Number from the Companies Registry Office. (See certificate)
c) Particulars of Registered Office of the Company. (as above)

Name and address of the proprietor(s) of the Land on which the Activity is situated (if different from applicant named above):

Proprietor's Name:	Not applicable
Address:	
Tel:	
Fax:	
e-mail:	

Name and address of the owner(s) of the building and ancillary plant in which the activity is situated (if different from applicant named above):

Name:	Not applicable
Address:	
Tel:	
Fax:	
e-mail:	

Comment

The Company Register Number for ConocoPhillips Whitegate Refinery Limited is 16576. A copy of the Certificate of Incorporation for ConocoPhillips Whitegate Refinery Limited (formerly Irish Refining Public Limited Company) is included in Attachment B.1 to this application.

B.2 Location of Activity

Name:	ConocoPhillips Whitegate Refinery Limited
Address*:	Whitegate
	Midleton
	Co. Cork
Tel:	+353 21 4622232
Fax:	+353 21 4622222
Contact Name:	Mr John McCarthy
Position:	HSE Lead
e-mail:	John.mcCarthy@conocophillips.com

* Include any townland.

National Grid Reference (12 digit 6E,6N)	183516E, 063130N

Location maps (≤A3), appropriately scaled, with legible grid references should be enclosed in **Attachment B.2.** The site boundary must be outlined on the map in colour.

Geo-referenced digital drawing files (e.g. AutoCAD files) in Irish Grid projection of the site boundary and overall site plan, including labelled emission, monitoring and sampling points, are also required. This data should be provided to the Agency on a separate CD-Rom containing sections B.2, E.6 and F.3.

Name of geo-referenced digital drawing files	Drawings # 1 to 15 – Conoco Series 8821-1040 and 8821-1037
Name of CD-Rom with digital drawing files	ConocoPhillips Electronic Locational Information

Comment

Attachment B.2 contains an Ordnance Survey Site Map with grid references. The area occupied by the activity is shown bordered in red on Drawing 8821-1037 in Attachment B.2. The site is located at Easting 183516, Northing 063130.

Geo-referenced digital drawing files of the site are included in the CD-ROM accompanying this application. Sections B.2, E.6 and F.3 of this application are also included on the CD-ROM.

B.3 Class of Activity

Identify the relevant activities in the First, Third or Fourth Schedule of the PoE Act 2004 to which the activity relates:

Schedule	Class	Description Note 1
First Schedule	9.3.1	The operation of a mineral oil refinery

Note 1: In order to give a precise identification **select only those words** from the description of the class or classes that best describes the nature of the activity for which the licence is being applied for.

B.4 Employees/Capital Cost

Give-

(i) In the case of an established activity, the number of employees and other persons working or engaged in connection with the activity on the date after which a licence is required and during normal levels of operation, or

(ii) In any other case, the gross capital cost of the activity to which the application relates.

Number of Employees (existing facilities):	155
Gross Capital Cost (new proposals) €	Not applicable

Comment

At the time of submitting this application to the Agency, there were a total of 155 employees at the site.

B.5 Relevant Planning Authority

Give the name of the planning authority in whose functional area the activity is or will be carried out.

Name:	Cork County Council
Address:	Planning Department
	Cork County Council Headquarters
	County Hall
	Carrigrohane Road, Cork
Tel:	+353 21 4276891
Fax:	+353 21 427 6321

Planning Permission relating to this application:

has been obtained	X	***is being processed***	
is not yet applied for		***is not required***	

Local Authority Planning File Reference N^{o}:	10/8114

Attachment B.5 should contain all planning permissions, including a copy of ***all*** conditions, and the required copies of any EIS should also be enclosed. For existing activities, **Attachment N^{o} B.5** should also contain all licences and permits past and present in force at the time of submission.

Comment

Table 4 summarises the planning permissions granted to ConocoPhillips since the current IPPC licence (Register No. P0266-01) was granted.

Table 4: Summary of Planning Permissions and Applications at ConocoPhillips Whitegate Refinery

Reference No.	Date	Planning Authority	Development
006838	14-Feb-2001	Cork County Council	Installation of 2 no. steel 23,250 tonne storage tanks for diesel oil.
032301	12-Sep-2003	Cork County Council	Installation of hydrotreater and associated equipment.
034726	10-Dec-2003	Cork County Council	Upgrade of electrical equipment in the existing 110 kV compound, installation of 2no. replacement transformers & equipment in new compound.
035609	24-Mar-2004	Cork County Council	Installation of a replacement flare tower of 51 m in height.
088727	28-Nov-2008	Cork County Council	Construction of 1 no. stainless steel column T302N of which 51 m will be above ground (including pipework), approx 1.4 m diameter at upper part and 2.06 m diameter at lower part.

Reference No.	Date	Planning Authority	Development
104683	21-Jun-2010	Cork County Council	Demolition of an existing two storey dwelling and outbuilding.
104684	22-Jun-2010	Cork County Council	Demolition of an existing single storey dwelling.
108114	10-Jan-2011	Cork County Council	Construction of a new Amine and Sulphuric Acid Plant consisting of a 28 metre high (including pipework) above ground level open steel structure incorporating an exhaust stack of 40 metres height above ground level (final height 30m) and a stand-alone aluminium clad steel tower, T-1003, 30 metres in height (including pipework) above ground level.

Table 5 lists the licences and permits that are and that have been in force at the site. At the time of submission of this application, the IPPC licence (P0266-01) and the Trade Effluent Licence (W.P.(W) 2/88) were in force.

Table 5: Permits and Licences

Type	Reference No.	Date of Grant
IPPC Licence	P0266-01	09-Nov-2005
IPC Licence	P0266-01	17-Jan-2000
Greenhouse Gas Emissions Permit	IE-GHG013-04	29-Sep-2008
VOC Permit	V0001-05	27-Aug-2010
Bulk Storage Licence	PBS/11/01	July 2011
Air Pollution Licence	A.P. 1/93	19-Apr-1993
Air Pollution Licence	A.P. 2/89	03-Jan-1990
Trade Effluent Licence	W.P.(W) 2/88	05-Apr-1988
Trade Effluent Licence	W.P.(W) 8/83	07-Dec-1983
Trade Effluent Licence	W.P.(W) 11/78	05-Dec-1980
Trade Effluent Licence	W.P.(W) 10/78	17-Sep-1980
Toxic & Dangerous Waste Disposal Permit	-	05-Jun-1996
Toxic & Dangerous Waste Disposal Permit	T.D. 1/89	18-Oct-1991

Copies of all planning applications, planning permissions (including conditions relating to the planning permission), licences and permits are maintained by ConocoPhillips and are available for review/inspection by the Agency. As agreed with the Agency, copies of the following permissions, licences and permits pertinent to this application are included in Attachment B.5:

- Planning Permission (10/8114) granted for the construction of the Amine and Sulphuric Acid Plant.
- Planning Permission (03/2301) granted for the construction of the new hydrotreater (September 2003).
- Greenhouse Gas Emissions Permit IE-GHG013-04.

- VOC Permit V0001-05.
- Trade Effluent Licence W.P.(W) 2/88.

B.6 Relevant Sanitary Authority

In the case of a discharge of any trade effluent or other matter to a sewer of a sanitary authority, give the name of the sanitary authority in which the sewer is vested or by which it is controlled.

Name:	Not applicable
Address:	
Tel:	
Fax:	

In the case of a discharge of any trade effluent or other matter to a sewer not vested by a sanitary authority, the applicant must supply as **Attachment N^{o} B.6**; (a) the name and address of the owner(s) of the sewer and the waste water treatment plant to which the sewer discharges and who are responsible for the quality of the treated effluent discharging to waters and (b) a copy of the effluent regulations and the agreement between the applicant and the aforementioned.

Name:	Not applicable
Address:	
Tel:	
Fax:	

Comment

Process effluent from the main production area of the site is directed to the site's waste water treatment plant; drainage water from the bunded areas on Corkbeg Island is directed to the catchment basin; domestic-type effluent from the office and administration buildings is directed to an Imhoff tank, with the discharge to Cork Harbour originally licensed under Trade Effluent Licence No. W.P.(W) 2/88.

B.7 Relevant Health Board Region

The applicant should indicate the Health Board Region where the activity is or will be located.

Name:	Health Service Executive South
Address:	Aras Sláinte
	Wilton Road
	Cork
Tel:	021 45 45 011
Fax:	021 45 45 748

B.8 Site Notice, Newspaper Advertisement and Planning Authority Notice

Attachment Nº B.8 should contain a copy of the text of the site notice, a map (no larger than A3) showing its location on site (in accordance with Article 7 of the Regulations) and a copy of the newspaper advertisement. A copy of the notice given to the Planning Authority should also be included.

Comment

Copies of the following documents are included in Attachment B.8 to this application:

- The newspaper advertisement including the name of the newspaper and the date of appearance of the advertisement (originals of the newspaper notice are included in the hardcopy application; the text of the newspaper notice is included in the PDF copy of the application). Irish Times Wednesday 31st August 2011.

- ConocoPhillips' letter advising Cork County Council of this application for review of an IPPC licence.

As agreed with the Agency, a site notice is not required for an application for an existing licence review.

B.9 Seveso II Regulations

State whether the activity is an establishment to which the EC (Control of Major Accident Hazards involving Dangerous Substances) Regulations (S.I. No. 74 of 2006) apply.

If yes, outline how the process comes under these regulations.

Supporting information should be included in **Attachment No B.9**.

Comment

Under the qualifying criteria set out in the European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations (SI No. 274 of 2006), ConocoPhillips Whitegate Refinery Ltd. comes under Article 9 of the Directive on the basis of the quantity of Dangerous Substances stored on the site. The Company has notified the Health & Safety Authority (HSA) and the Planning Authority (Cork County Council) that it is a Seveso II site. These notifications were made in accordance with requirements of the Third Schedule of the Regulations.

Under Section 12 of the Regulations, ConocoPhillips prepared a Safety Report which was submitted to the HSA. In accordance with Section 13 of the Regulations, this Safety Report is reviewed and revised at least every five years; the latest revision of the Safety Report was submitted to, and deemed acceptable by, the HSA in March 2011.

As part of the planning process for the construction of the ASA Plant, ConocoPhillips conducted an assessment of the land-use planning implications from the new plant. This assessment, which was submitted to the Health and Safety Authority, concluded that there would be no significant increase in the level of risk presented by the activities carried out at the site.

A summary of the process for determining whether the site falls within the scope of the Seveso Regulations is provided in Attachment B.9.

B.10 IPPC Directive

Specify whether the activity is a category of industrial activity referred to in Annex I of the IPPC Directive (2008/1/EC) and if yes specify the category.

Supporting information should be included in **Attachment No B.10**.

Comment

The activity carried out by ConocoPhillips Whitegate Refinery is identified in Annex I of Directive 2008/1/EC concerning integrated pollution prevention and control. The activity is listed under Category 1.2 *mineral oil and gas refineries*.

SECTION C: MANAGEMENT OF THE INSTALLATION

C.1 Site Management & Control
Details should be provided on the management structures for the activity. Organisational charts and all relevant environmental management policy statements, including provisions for on-going assessment of environmental performance, are required.

C.1 Site Management & Control

C.1.1 Overview

ConocoPhillips Whitegate Refinery Ltd. is organised into five Departments - Operations, Technical, HSE, Accounts and Personnel. The Departmental Managers report to the Lead Executive. The organisation structure is shown in Attachment C1.

The company operates a formal and comprehensive system that controls the operation, maintenance and modification of the Refinery complex such that management's duty to exercise due care for the safety of employees, of other people on site and of the public is properly discharged. Responsibilities are assigned unambiguously and a clear distinction drawn between supervision and advisory functions. The respective positions are all occupied by competent people in terms of qualifications, training, education and appropriate experience.

ConocoPhillips operates a formal performance management system for all staff personnel. Job descriptions, detailing the purpose, content and context, principal objectives, and the required knowledge and experience have been completed for all positions within the Refinery. Environment and Safety is one of the key performance areas within this system and forms part of all annual appraisals.

C.1.2 Organisational Structure

Schematics showing the organisational structure at the Refinery are provided in attachment C.1. The functions and responsibilities of the key personnel and management roles within this organisational structure are described in the following sections.

C.1.2.1 Lead Executive

The Lead Executive of Ireland is responsible for the total operation of the Refinery and its employees. He is accountable for the overall development and application of the HSE policies, implementation of this management system and setting company objectives. He champions the HSE function and ensures it is resourced in a way that is consistent with the needs of the business.

C.1.2.2 HSE Lead

The HSE Lead, who reports to the Lead Executive, is responsible for ensuring that HSE policies, systems, programmes and plans are developed to support the business need. The HSE Lead is responsible for collating and interpreting corporate and general legal requirements and for providing expert HSE guidance and oversight to the business. These responsibilities include co-ordination of the Risk Assessment Programme, identification,

recording and follow up of corrective and improvement actions, incident investigation, monitoring of performance, and co-ordinating audits and reviews.

The HSE Lead identifies, with the assistance of Managers and Supervisors, the job positions with specific responsibility for HSE matters. He is responsible for maintaining the HSE Management System and ensuring that it is subject to regular management review. He is accountable for co-ordinating with external authorities in relation to HSE aspects of the site.

The HSE Manager supervises the Fire/Safety/Environmental/Security functions through the Safety Officer, the Fire Leader, the Environmental Officer and the Process Safety Engineer.

C.1.2.3 Environmental Lead

The Environmental Lead is responsible for providing environmental support and advice to the Whitegate Refinery, in particular, but not limited to, the areas of waste, air emissions and effluent management, environmental legislation, environmental reporting, auditing and training.

C.1.2.4 Safety Officer

The Safety Officer is responsible for providing security, health and safety support and advice to the Whitegate Refinery, in particular for encouraging a safety culture amongst staff and contractors. He has particular responsibilities in the areas of occupational health, emergency preparedness, specific health and safety training, risk assessments and auditing, as well as organising such safety matters as the Safety Committee, and Safety Seminars. He is also a member of Refinery Management Safety Committee and Safe Operations Committee.

C.1.2.5 Management Team

Managers are accountable for implementing the HSE Management System in their area of responsibility. They ensure that the contents of the HSE Management System, and in particular the Health, Safety and Environmental Policies and roles and responsibilities, are communicated to all personnel. Job descriptions/charters reflect the roles and responsibilities assigned by this management system. General accountability and responsibility for health, safety and the environment lies with line management.

C.1.2.6 Line Management and Supervision

Line management and supervision have general accountability and responsibility for health, safety and the environmental management within their area. They are responsible for ensuring that the requirements of the HSE management system are implemented in their area.

C.1.2.7 Management Health Safety and Environmental Committee (MHSEC)

The MHSEC, which is comprised of the Management Team, HSE Lead, Safety Officer Whitegate Refinery and Bantry Bay Terminal Manager, reviews HSE issues on a quarterly basis. It considers all aspects of HSE performance and makes recommendations for appropriate changes/additions to procedures and programmes to ensure that the company objectives are met. Employee involvement in the MHSEC is ensured through direct employee involvement in other committees chaired by members of the MHSEC and via team member consultation with other employees.

C.1.2.8 Safe Operation Committee (SOC)

The SOC, chaired by the Operations Manager, comprises members from the various areas of the Refinery. The responsibilities of this committee are to ensure the safe operation of the Refinery by providing final approval for refinery standard operating procedures and any relevant changes that occur within the site, personnel training requirements, auditing and follow-up of actions arising out of investigations and audits.

C.1.2.9 Safety Committee

The safety committee, chaired by the Operations Manager, comprises a representative from each area of the Refinery as detailed in the Refinery's safety statement. The responsibilities of this committee are to discuss, communicate and receive feedback on health and safety and environmental issues applicable to the Refinery.

C.1.2.10 PSM Lead

The PSM (Process Safety Management) Lead is responsible for Process Safety Management, including the implementation of the Risk Assessment Programmes, the PHA program, identification, and follow up of corrective and improvement actions from a major accident prevention perspective, incident investigation, monitoring of performance and coordinating audits and reviews.

C.1.2.11 Employees & Contractors

Employees and Contractors have specific responsibilities for their own safety, for the safety of others and for the protection of the environment. They also have an obligation to conform to any programmes, procedures or contractual conditions specified by ConocoPhillips Ireland, which are designed to protect the environment and the safety of people including the general public. All employees and contractors must report any accidents, incidents or near misses.

C.1.3 Environmental Policy

A copy of ConocoPhillips' Health, Safety and Environment Policy is included in Attachment C.1 to this application. This policy has been established specifically for the Whitegate Refinery. It describes the commitment to protecting the health and safety of everyone who plays a part in company operations and to the carrying out of company business with respect and care for the environment.

C.1.4 Training Policy

ConocoPhillips is committed to a policy of providing training for its employees. In considering the need for training of individuals of the company, the following objectives are taken into account:

- To ensure that an individual achieves a satisfactory standard of performance in his / her present job and that cover can be provided for all jobs in the event of absences.

- To meet changes in an individual's present job, e.g. new plant, equipment, techniques or reorganisation calling for wider skills.
- To prepare an individual for planned promotion or development.

The Refinery has adopted the ConocoPhillips Corporate Operator Training & Maintenance Training Standards, which establishes requirements for the administration, development and delivery of all phases of operator training within ConocoPhillips Refineries and is based on the belief that incident-free performance is best achieved with well trained, professional operators. The standard consists of:

Operator Training Standard (five tiers of training):

Tier 1: Site Orientation

Tier 2: New Operator Training

Tier 3: Area Orientation & Process Overview Training

Tier 4: Job Specific Training (Initial & Refresher)

Tier 5: Advanced Operator Training

Maintenance Training Standard (five tiers of training):

Tier 1: New Employee Site Orientation

Tier 2: Maintenance Core Training

Tier 3: Craft Specific Training

Tier 4: Refresher Training

Tier 5: Advanced Training

The responsibility for identifying training needs lies with the managers of each Department. Identifying training needs and implementing training is an ongoing process. The annual appraisal is designed to ensure that at least once per year employees and supervisors/managers discuss training and training plans.

The implementation of the recruitment and training policies ensure that suitably qualified personnel are retained and provided with the necessary training and further education to meet the requirements of all positions. This ensures that the refinery complex is operated, maintained and modified to the specified standards and that this is achieved safely and cost effectively.

C.1.5 Communications Policy

The safe operation (Health, Safety & Environment) of the Refinery is an integral part of the daily production meeting, daily maintenance meeting and the weekly review meeting at Whitegate. This allows the upward and downward reporting of environmental and safety related concerns to all levels of personnel at the Refinery. In addition, senior management holds a management meeting every month, at which executive review of safety and environmental issues and concerns takes place.

C.1.6 Operation & Control of Abatement/Treatment Systems

No abatement systems are operated at the site; the wastewater treatment plant treats refinery process effluent and the Imhoff tank treats sanitary-type effluent before discharge to Cork Harbour, while the SRU and the ASA plant treat refinery off-gases prior to their discharge to atmosphere or their use in other areas of the site, ultimately discharging to atmosphere following combustion.

Control of ASA Plant

ASA Plant is part of the integrated refinery process and is considered as one of the processes listed as BAT for sulphur recovery in the BREF document on refining and in the EPA BAT Guidance Note.

The front end amine unit is a chemical absorbtion process in which hydrogen sulphide is initially chemically absorbed into an amine solution (MDEA) and subsequently desorbed. The amine processing is controlled by pressure, temperature and flow control to the various streams into and out of vessels comprising the amine treatment step.

The cleaned refinery gas from which H_2S has been removed is sent into the refinery gas system from where it is used as a clean gaseous fuel in the various furnaces, boilers and gas engines.

The second step in the ASA process is to convert the recovered H_2S, collected in the amine step into sulphuric acid in the Wet Sulphuric Acid Step (WSA). There are a number of control systems to ensure the correct operation of the WSA unit:

- The H_2S is combusted and converted to SO2 and SO3 as the first step in the WSA process. In some sulphuric acid plants, the NOx which is formed during the combustion poses a quality problem for the acid produced. In the Haldor Topsoe process being installed at Whitegate the levels of NOx in the combustion gases is reduced by passing the combustion products over a fixed catalyst bed – the Selective Catalytic Reactor (SCR). This is done to ensure that the sulphuric acid product produced has a clear and bright appearance. Any discolouration would render the sulphuric acid un-saleable for certain uses. In order to ensure acceptable product quality with respect to colour, the NOx within the WSA process prior to acid formation is checked by means of a continuous NOx monitor. This indicates to the operator when the catalyst needs to be replaced. The impact of the SCR on final NOx to the clean gas stack is not significant. At the start of the run i.e. when fresh catalyst is installed, the emission concentration is expected to be 110 mg/Nm3 of NOx and at the end-of-run i.e. when catalysts is due to be renewed, the NOx in the stack will be 165 mg/Nm3. In this regard the SCR unit is a product quality control rather than a traditional end-of- pipe abatement measure.

- There is also a Mist Control unit on the WSA Unit to control the concentration of acid mist in the ASA Clean Gas Stack. This operates by means of optical measurement of opacity.

Control of the WWTP

All waste process waters and rainfall landing on paved areas of the site enter a common drainage network that directs these waters to the sites wastewater treatment plants (WWTPs). The normal average dry weather flow to the site drains from the above streams is 50 m^3/h.

- Rainfall volumes in excess of 50 m^3/h, but less than 250 m^3/h, enter the API separator and are pumped to temporary storage tanks. This is controlled automatically. The contents of these storage tanks are returned to the API separator and downstream WWTPs during periods of dry weather.

- If rainfall volumes exceed 250 m^3/h, i.e. a 1 in a 10 year event, the excess flow receives primary treatment in the API separator and is then discharged through SW-1 outfall point.

The API separator (skim pond) provides < 30 hours residence time for its inflow waters from the site drainage system. It facilitates primary oil recovery, through fixed and mobile oil skimmers, which direct the oil to the "slop hydrocarbon" storage tanks. This recovered oil is subsequently reprocessed in the crude distillation unit.

The wastewater is pumped at 100 m^3/h (fixed) from the API separator to the DAF unit. The rate of pumping is set/controlled by the requirements of the subsequent Biological plant. A flocculant (polymer) and coagulant (aluminium sulphate) are injected into the DAF feed water and this combined stream enters the unit. Dissolved air is added to produce "white water" which lifts the flocculated suspended solid /oily wet sludge to the top. This wet sludge is automatically skimmed and sent to the 2 x 10 m^3 wet sludge (dry solid content 2-5%) tanks. The contents of these tanks are then pumped to a drying unit (centrifuge) where the dry solid content is raised to c. 25%.

The effluent from the DAF unit is directed to the biological treatment plant where:

1. An equalisation basin of working volume 1200 m^3/hr provides a 12 hour mixed buffer tank which protects the health of the biological plant from toxic shock.
2. A Carbon (Molasses) Supplementation System is used to maintain consistent substrate going to biological treatment.
3. A Nitrogen Supplementation System is installed to maintain consistent Nitrogen nutrient going to biological treatment.
4. A Phosphorus Supplementation System to maintain consistent Phosphorous nutrient going to biological treatment.
5. pH correction facilities consisting of automatic caustic dosing pumps controlled by a pH probe within the equalization basins is used to control pH in the unit and effluent
6. 2 No. Air Blowers (each 20 kW) provide aeration of 1055 Nm^3/hr to the Mixed Bed Bio Reactor (MBBR) systems. Aeration is controlled to maintain a residual dissolved O_2 level in the MBBRs of 3 mg/l.

The effluent from a clarifier flows to 3 No. Sand Filters for final effluent polishing.

C.1.7 Waste Control Systems

The site operates a number of procedures to manage and control both the generation of waste and the collection of waste from the site for offsite disposal or recovery. Responsibility for controlling waste in specific areas of the site, or during specific construction or maintenance works, rests with line management, with ultimate responsibility for the control of waste resting with the HSE Lead. The documentation of waste arisings at the site rests with the Environmental Lead, assisted by line management and other departments at the refinery in which the wastes are generated. For specific construction works, contractors are responsible for providing details of the wastes that are generated from their activities.

Waste collection areas are designated for both hazardous and non-hazardous wastes. They are subsequently collected by Waste Collection Contractors in possession of valid Waste Collection Permits appropriate for collection of wastes in Co. Cork. The Refinery maintains a list of Waste Collection Contractors that it has approved for use at its site, together with the waste routes for the ultimate disposal or recovery of the particular waste (s) collected by each contractor. More details on the Waste Management System and the wastes generated at the site are set out in Section H.2.

C.1.8 Quality Control System

The Refinery Laboratory operates a Quality Management System certified to the International Standard ISO 9001: 2008. The QMS was last certified in 2009. A copy of the certificate is included in Attachment C.1 to this Application.

C.2 Environmental Management System (EMS)

Indicate whether an Environmental Management System has been developed for the installation. If yes, specify which standard and include a copy of the accreditation certificate.

C.2 Environmental Management System (EMS)

C.2.1 Overview

In accordance with ConocoPhillips Corporate requirements, ConocoPhillips Ireland has implemented a Health, Safety and Environmental (HSE) Management System. The scope of the management system incorporates all facilities and activities controlled by ConocoPhillips Ireland and associated with the manufacture, storage and distribution of petroleum products, including all staff and contractors working at ConocoPhillips Whitegate Refinery and ConocoPhillips Bantry Bay Terminal.

The core elements of ConocoPhillips Ireland's HSE Management System are outlined in *ConocoPhillips Ireland Health, Safety and Environmental Management System Manual*, in addition to establishing key roles and responsibilities and referencing related supporting documentation. The objectives of the system are to comply with legal requirements, ConocoPhillips' HSE policies and standards, and to achieve continuous improvement in ConocoPhillips Ireland's HSE performance. The Manual, together with supporting procedures, details the scope, objectives and process that the refinery implements in order to meet the HSE requirements and goals under 15 separate headings.

1. HSE Policies & Leadership;
2. Risk Assessment;
3. Legal Requirements & Standards of Operation;
4. Strategic Planning, Goals & Objectives;
5. Structure & Responsibility;
6. HSE Programmes & Procedures;
7. Asset & Operations Integrity;
8. Emergency Preparedness;
9. Awareness, Training & Competency;
10. Non-Conformance, Investigation & Corrective Action;
11. Communications;
12. Document Control & Records;
13. Measuring & Monitoring;
14. Audits;
15. Review.

The ConocoPhillips Whitegate Refinery is audited once every year by ConocoPhillips Corporate. This audit process is conducted on a three year cycle, and covers HSE Management System, Health & Safety performance and Environmental performance.

In developing the HSE Management System, ConocoPhillips Ireland ensured that the system covers all environmental and safety requirements in addition to meeting the requirements of ConocoPhillips Corporate.

C.2.2 Operating Procedures

In addition to the requirements as set out in the various licences and permits under which the Refinery operates, activities at the establishment are controlled under a series of operating procedures. The operating procedures include the HSE Management System Manual and associated procedures, Process Unit Operating Manuals and Safe Operating Procedures (SOPs).

The procedures detail the steps to be undertaken by ConocoPhillips employees and contractors in carrying out activities at the Refinery in order to ensure safety and protection of the environment at the Refinery. The procedures within the HSE Management System are drawn up and reviewed on an ongoing basis – further procedures are developed as and when needs are identified.

C.2.3 Environmental Management Programme

The Refinery has an established Environmental Management Programme, which forms the basis of the company's strategy for the management of environmentally related matters at the site. There are eight elements to the Programme:

1. Emissions to water
2. Emissions to air
3. Solid waste
4. Surface and groundwater quality
5. Noise
6. Other environmental impact issues
7. Emergency response
8. Environmental Management System

The company's strategy for developing its environmental performance objectives, for both the short and long term, is based upon the first six elements, with element 7 assessed primarily in terms of the site's response capabilities and effectiveness. The Environmental Management System provides the framework in which the objectives are achieved. Progress in implementing the Environmental Management Programme is reported to the Agency in the site's Annual Environmental Report.

C.2.4 Environmental Objectives & Targets

The Refinery has established environmental objectives under each of the categories within the Environmental Management Programme and has set targets against each of the objectives. These targets are clearly defined, taking into account the requirements of the site's IPPC licence and current and forthcoming Environmental Legislation. Responsibility for fulfilling each of the individual objectives and meeting the targets is assigned to specific individuals with a particular expertise in the area or management responsibility.

Specific projects are identified to facilitate meeting the target, setting out the purpose of the project and how it will assist in meeting the target. A clear timeframe for completion of the project is set, although the project and/or target may be reviewed and updated over its lifetime. The current Environmental Objectives and Targets for the site are summarised in the Annual Environmental Reports which are provided to the Agency.

C.2.5 Monitoring Performance

C.2.5.1 Overview

Under the ConocoPhillips Ireland HSE Management System Manual, all audits at the Refinery are implemented in accordance with the HSE Auditing Procedure. The purpose of the procedure is to establish the means for carrying out health, safety and environmental audits in order that they are effective and efficient, consistently produce quality results, followed up to allow continuous improvement and documented and reported as appropriate. The audits provide valuable information for management to review and identify opportunities for improvement.

C.2.5.2 Responsibilities

The ConocoPhillips Management Health, Safety and Environmental Committee (MHSEC) is responsible to nominating annual audit requirements and objectives, and for reviewing the completion of recommendations and action points.

ConocoPhillips Ireland HSE Manager is responsible for assessing the training needs of auditors and taking appropriate action to maintain and improve their audit skills, for monitoring and continuously improving the audit programme through feedback and recommendations from all parties concerned, for reviewing and updating the audit procedure as required, and for complying with corporate audit requirements.

HSE Group Members are responsible for preparing the audit programmes, ensuring that appropriate departments are made aware of the audit requirements, carrying out internal audits with operations personnel as appropriate, monitoring audit activity through reports and information received from operations and issuing audit guidelines.

Departmental Heads are responsible for compiling an annual audit schedule for the Refinery, appointing personnel to carry out audits with the audit schedule, providing resources to ensure an effective and efficient audit process, assigning appropriate corrective actions to address audit findings and carrying out audits of suppliers of materials and services to ConocoPhillips Ireland as part of the vendor qualification process.

Personnel involved in undertaking audits are responsible for ensuring that they have received the appropriate training, carrying out the Level 1 audits (see below) in line with the schedule, communicating any issues to their Section Head, utilising the available guidance and Level 1 checklists and assisting with Level 2 audits (see below) as appropriate.

Finally, Supervisors are responsible for maintaining records of audit status, recording agreed corrective actions from audit findings, ensuring all corrective actions are followed up and tracked to completion and copying completed reports to the HSE Group.

C.2.5.3 Type of Audit

The audit procedure defines three levels within the audit system, as follows:

- Level 1 audits include inspections covering Whitegate Refinery and Bantry Bay Terminal wide aspects carried out by the members of the operational areas, under the

direction of the departmental heads, on topics agreed by the MHSEC. They are designed as either short specific area reviews of work in progress or task inspections and are carried out by area supervisors and the contractor management group. The inspections will take approximately one hour including preparation, the inspection and completion of the checklist. The minimum number of Level 1 audits to be carried out by each process shift unit is outlined in Standard Operating Procedure No. 38. Department Heads set out the audit frequency for each of their respective areas annually. This will include the topics to be covered. The schedules and topics are submitted to the MHSEC, who agree and approve the forthcoming yearly audits.

- Level 2 audits cover management system and compliance issues and are carried out by representatives who are independent of the area being audited, where this is practicable. The HSE Manager compiles an audit schedule defining the areas to be audited and timing of the audits. The frequency is based on the risk associated with each area/procedure, the results of previous audits, incidents that have occurred both within and external to ConocoPhillips Ireland, and available resources. The schedule is approved by the MHSEC as part of the annual review.

- Level 3 audits are carried out by personnel and teams external to ConocoPhillips Ireland, including ConocoPhillips Corporate or external parties assigned by Corporate Management and third party audits by regulating authorities or other interested parties.

C.2.5.4 Reporting & Follow-up of Audit Findings

Auditors prepare their reports using standard forms and templates. Corrective actions, including target dates, are agreed with the persons they are assigned to at the end of the audit and may be discussed further with Departmental Managers if necessary. External audit findings are submitted to ConocoPhillips Ireland HSE Manager for review.

Follow up on the corrective actions from audit findings shall be carried out via departmental meetings of the relevant area. The meetings review the status of action items, according to their due date, and the area supervisor shall include relevant information in the meeting notes. All corrective actions are tracked through a suitable tracking system. The results of all Level 2 and Level 3 audits are recorded and maintained in a central database.

Department Managers provide the HSE Manager with a summary of the status of all audits and closure of non-conformances at the Refinery on a quarterly basis. When all action items are completed to the satisfaction of the Whitegate departmental managers, the audit is then regarded as being closed

C.2.5.5 Monitoring of Audit Findings

The HSE Group tracks all Level 2 audits and corrective actions in the database, and reviews the audits performed by reference to the report forms, database reports, and relevant committee notes and monitors the progress of the audits against the overall programme. The Group also looks for any common issues that arise across ConocoPhillips Ireland operations in order that they may be fed into the audit schedule. These reviews are conducted at least twice yearly and cover both Level 1 and 2 audits. A written record of the reviews, including any corrective actions set as result of the process, is kept by the HSE Lead. A summary of

the key issues identified during these reviews is discussed at the MHSEC after the group review.

CPW tracks Level 2 and Level 3 audit action items in the corporate tool *IMPACT*. This tool is used for tracking; status, ownership, responsibility, due date and actual completion date.

C.2.5.6 Records

Level 1 audits and checklists are recorded and maintained by the relevant departmental managers and supervisors. The Department Managers keep records of the Level 2 and Level 3 audits performed within their departments. ConocoPhillips Ireland HSE Manager monitors the central database used to record all Level 2 audits and associated corrective actions. This database is used to track the progress of corrective actions and produce reports. The minimum retention period for Level 2 and Level 3 audits is four years.

C.3 Hours of Operation
Provide details of the hours of operation for the installation, including:

(a) Proposed hours of operation.

(b) Proposed hours of construction and development works and timeframes.

(c) Any other relevant hours of operation expected.

This information should form **Attachment No C**.

C.3 Hours of Operation

C.3.1 Proposed Hours of Operation

The refinery operates 24 hours per day, 7 days per week, 52 weeks per year, and will continue to operate on this basis following construction of the ASA Plant.

In common with normal refining industry practices, the refinery operates the main process units continuously for periods of four to five years without the need for major shutdowns. This method of operation is required to achieve optimum economic performance. However some unit operations (including the new ASA Plant) will be shut down periodically within the four to five year period in order to conduct routine inspection and maintenance, including, for example, statutory inspections of pressure vessels.

As the new ASA Plant will operate to reduce the emission to atmosphere of certain parameters, including sulphur dioxide (refer to Sections E and F), during the shut-down periods while the refinery continues to operate, the emissions to atmosphere of these parameters may increase for short periods of time. Sections E and F of this application set out ConocoPhillips' proposals for managing the emissions to atmosphere during periods in which the ASA Plant is offline.

C.3.2 Proposed Hours of Construction & Development

Construction on the ASA Plant commenced in the first quarter of 2011. Normal construction works take place between the hours of 08:00 and 20:00. Specific construction works may also take place outside of these normal working hours, taking into consideration the requirements of the normal production activities at the site. It is expected that construction works on the plant will be completed by December 2011 in anticipation of commencement of commissioning.

SECTION D: INFRASTRUCTURE & OPERATION

D.1 Operational Information Requirements

Describe the plant, methods, processes, ancillary processes, abatement, recovery and treatment systems, and operating procedures for the activity, to include a copy of such plans, drawings or maps, (site plans and location maps, process flow diagrams), and such other particulars, reports and supporting documentation as are necessary to describe all aspects of the activity. Maps and drawings must be no larger than A3 size.

A development and operational history of the site should be included here.

Attachment No D should contain a list of all unit operations (processes) to be carried out, including flow diagrams of each with any relevant additional information.

D.1 Operational Information Requirements

D.1.1 Overview

The Whitegate Refinery comprises of a 75,000 barrels per day crude distillation unit (Pipestill) and associated refining processes together with blending and storage areas, and a deepwater Marine Terminal.

The crude tank storage area is situated on Corkbeg Island, with the Marine Terminal attached to the north of the island, and the Refinery itself is situated on the mainland to the south of this island. The island and the mainland are connected by a land bridge, which carries the pipetrack and allows vehicular traffic onto the island.

Crude oil arrives by sea, in tankers of c. 100,000 tonnes displacement. The crude oil is taken ashore from the tanker at the Marine Terminal and stored in floating roof tanks on Corkbeg Island. The crude is pumped to the Pipestill unit for initial distillation. This unit is rated for 75,000 barrels per day.

A number of the distillation streams are then further refined in additional processes. The result is to refine the crude oil into a number of different products - heavy fuel oil, diesel, kerosene, gasoline, naphtha and liquid petroleum gas (LPG). It is a continuous process, 24 hours/day, 365 days/year except for shutdowns for maintenance or operational reasons.

The refined products are stored in tanks or spheres (LPG) on the main site. All high vapour pressure materials (Crude oil, naphthas, gasoline blendstocks, gasolines) are stored in floating roof tanks to eliminate the vapour space and minimise vapour losses. For some products a number of refined streams need to be blended together to make on grade products - this is carried out in the blending area. The majority of the product exports are by sea. A significant share of the Munster market for gasoline, diesel and kerosene is supplied directly to road tankers at the Road Loading Terminal. A small amount of LPG is also road loaded through a separate facility with the balance moved by pipeline to a neighbouring gas bottling facility. Petroleum blendstocks are also imported and exported as required via the Marine Terminal.

A selection of the relevant Process Flow Diagrams, which provide an overview of the unit operations at the site, is included in Attachment D.1 to this application.

D.1.2 Main Operating Areas within Refinery

There are three main areas in the physical layout of the Refinery site. These are:

- Marine Terminal;
- Corkbeg Crude Oil Tank Farm;
- Refining Area/Product Tank Farm.

A schematic flow plan of the Refinery operation is given in Attachment D.1. The main operating areas are described in the following sections.

D.1.2.1 Marine Terminal

The Marine Terminal is linked to Corkbeg Island by a 725 metre long, concrete pile supported trestle, which provides access and carries the crude oil, product and utility lines. The Terminal has two berths. Berth 1 is designed for ocean going tankers up to 160,000 tonnes displacement. Actual displacement is currently smaller than this due to draft limitations elsewhere in the harbour. Berth 2 can handle coasters up to 5,000 tonnes displacement. Hose handling facilities and valve manifolds are provided for importing or exporting of all petroleum products / raw materials. Disposal facilities are also provided for handling oily ballast water and slops on Corkbeg Island.

D.1.2.2 Corkbeg Crude Oil Tank Farm

Corkbeg Island is a small island connected to the mainland by a causeway. Crude oil is pumped ashore from crude tankers at the Marine Terminal and stored in seven tanks on Corkbeg Island. These are all floating roof tanks to minimise crude vapour losses and storage hazards. The crude is then pumped from these tanks to the Refining area on a continuous basis. Three utility tanks are also provided on Corkbeg Island for storing ship ballast & slops, draining water from crude tanks prior to pumping to the Refining area and providing potable water to ships at the Marine Terminal. An API (American Petroleum Institute) separator is provided for treating all wastewater from ballast/slop handling prior to discharge to Cork Harbour.

D.1.2.3 Refining Area/Product Tank Farm

The Refining area / Product tank farm is located on an elevated site on the mainland. Process units, utilities, intermediate and finished product storage, blending facilities, road loading terminals, effluent treatment facilities, fire fighting facilities, workshops, warehouses, site offices, canteen and medical centre are located within this area. The main processes are the Pipestill unit, Powerformer unit, Isomerisation unit, Hydrofiner unit and Sulphur Recovery unit. These are described in the following sections. Section 4.B of this Licence Review Application contains further detail regarding the operation of the processing units.

D.1.3 Main Refinery Process Units

The main refinery process units are described in the following sections.

D.1.3.1 Pipestill Unit

The Pipestill unit is designed to separate crude into four fractions. These are Overheads, Jet Fuel/Kerosene, Diesel/Gasoil and Heavy Fuel Oil. The unit consists of a crude feed surge drum, crude desalter unit, preheat furnace, distillation tower and three side stream strippers together with associated heat exchangers, pumps, drums and other auxiliary equipment.

The overheads stream is fractionated further to yield light naphtha, naphtha and propane/butane LPG. The light naphtha is pumped to the Isomerisation unit, where the octane is catalytically increased. The naphtha stream is sent to the Powerformer. The LPG stream is washed with a caustic solution to remove Hydrogen Sulphide and then sent to a propane/butane splitter tower in the Powerformer unit.

D.1.3.2 Powerformer Unit

The Powerformer was built in 1958 to process 9.0 kB/day of naphtha. In 1966 the unit was revamped to achieve a throughput of 14.5 kB/day. In 1976 the catalyst was changed from a platinum type to a more active platinum / rhenium type.

The Powerformer catalytically upgrades naphtha produced by the Pipestill unit into high octane gasoline blendstock. It achieves this by passing treated naphtha and hydrogen through a series of reactors containing catalyst. It produces reformate, which is the main component of gasoline, propane and butane LPG and a hydrogen rich gas which is used to desulphurise naphtha and gas oil. The catalyst deactivates over time. A regeneration unit is also provided for restoring the catalyst activity.

D.1.3.3 Isomerisation Unit

The Isomerisation unit was built in 1999/2000 to process 6.25 kB/day of light naphtha. It is a proprietary process licensed by UOP, and the unit was designed and engineered by Foster Wheeler. It has achieved the design throughput and, following a design safety review by Foster Wheeler and an operational review by CPW, has currently been approved to operate up to 7.44 kB/day. The unit can also be operated at higher fresh feed rates with a corresponding reduction in the recycle rate, within the overall design. This has product quality implications.

The light naphtha feedstock is initially treated in the hydrotreater section. This reduces the sulphur content to less than 0.5 parts per million, as well as removing other catalyst poisons such as nitrogen and water. This is achieved by vaporising the naphtha and passing it over a cobalt-molybdenum catalyst in the presence of hydrogen. This process is similar to the hydrotreater section of the Powerformer unit.

The Penex section then upgrades the light naphtha catalytically to a high octane blend stock for gasoline production. It achieves this by converting straight chain C5 and C6 paraffins to their corresponding branched isomers. Any unsaturated cyclic components of the light naphtha are also converted to their corresponding saturated compounds. The reaction rate is limited by thermodynamics. The reactor product is fractionated to separate the straight chain and branched isomers. The straight chains are recycled through the unit, the branched isomers are sent to tankage for blending to gasoline.

The reactions take place in the presence of hydrogen over a fixed bed of catalyst. A chlorinated platinum catalyst is used. Mild operating conditions (31 bar, 200^{o}C) are used to optimise isomerisation reactions and minimise fuel gas production.

D.1.3.4 Hydrofiner Units

There are two Hydrofiner Units at the site: the older U500 Hydrofiner Unit and the newer U900 Hydrofiner Unit.

The old Hydrofiner (U500) was built in 1958 to process 6.1 kB/day (removing 7.3 tonnes of sulphur / day) of diesel produced ex high sulphur Middle East crudes. The unit was mothballed in 1982 when processing of low sulphur crudes commenced. A European Directive reducing the sulphur content of Auto Diesel from October 1996 resulted in the unit being revamped. The unit is currently rated at 14.0 kB/day (removing 4.67 tonnes of sulphur / day) of diesel produced ex low sulphur North Sea crudes. The Hydrofiner has also been used to produce Jet fuel from a kerosene feedstock. This operation is similar to diesel operation but at a reduced severity. Jet fuel production at the Refinery has ceased this decade.

The U500 Hydrofiner was shut down until December 2007, following the commissioning of the new unit, but was maintained in operating condition. The unit is now back in continuous operation, producing Heating Oil with a sulphur content less than 1,000 ppm, which is in accordance with the new specification which reduced the Sulphur content from 2,000 ppm to 1,000 ppm in January 2008.

In order to meet increasingly stringent European legislation on the level of sulphur in automotive fuels to limit emissions of sulphur dioxide, the Refinery has constructed a second Hydrofiner Unit (U900) which is capable of desulphurising a combination of kerosene and atmospheric gas oil to meet the latest automotive diesel specification EN590. The Hydrofiner has been in operation since December 2004 and is capable of meeting the Auto Oil II proposals for 2005 and a further sulphur limit of less than 5 wppm (weight parts per million).

The U900 Hydrofiner desulphurises 26,000 bpd (173 m^3/h) of kerosene and atmospheric gas oil to meet the latest automotive diesel specification EN 590.

For both hydrofiners, gas oil and kerosene from the Pipestill are contacted with hydrogen from the Powerformer over a catalyst, where the sulphur is converted to hydrogen sulphide. The hydrogen sulphide is then removed in the vapour stream from the Hydrofiner, and is subsequently converted to water and elemental sulphur in the Sulphur Recovery Unit (SRU). From 2012 onwards, the sulphur recovery process will be carried out in the new ASA Plant.

D.1.3.5 Existing Sulphur Recovery Unit (SRU)

The existing Sulphur Recovery Unit was installed in 1996, in association with the re-commissioning of the Hydrofiner unit. It is currently used to remove hydrogen sulphide from gas produced in the hydrofiner operation by converting it to water and elemental sulphur which is then removed as a moist solid using a vacuum belt filter.

Sour gas, (i.e. gas containing hydrogen sulphide), enters the absorber section and is bubbled through the scrubbing liquid. Sweet gas is then discharged to the refinery fuel gas mains.

The sweetening of the sour gas is accomplished by absorbing the hydrogen sulphide into the LO-CAT II catalyst solution and the subsequent conversion of hydrogen sulphide to elemental sulphur and water. The elemental sulphur is shipped offsite for disposal or use as fertiliser. This unit will be replaced by the ASA Plant from 2012 onwards.

D.1.3.6 Amine Sulphuric Acid (ASA) Plant

The ASA plant was granted planning permission in January 2011. Construction on the plant commenced in February 2011 and is due to be completed in December 2011. It will be used to remove the hydrogen sulphide from sour gas produced in the hydrotreating operations by converting the H_2S in the sour gas into a commercial grade sulphuric acid. This product will replace up to 40% of acid presently imported into Ireland.

Sour gas, (i.e. gas containing hydrogen sulphide), enters the amine absorber section and is absorbed into the amine solution. Sweet gas (i.e. without the H_2S or sulphur) is then discharged to the refinery fuel gas mains.

The desorbed sulphur compounds from the first stage (the amine process) will be converted into a commercial grade concentrated sulphuric acid using a patented Wet Sulphuric Acid (WSA) Process. There are over 80 such units operating worldwide. The combined amine and WSA units are referred to as the ASA Plant. Amine treatment is listed as one of the technologies in the EPA BAT Note for Refineries and in the 2003 BREF.

The ASA plant will have the capacity to remove a much greater quantity of H_2S from the refinery gas compared to the existing SRU. The ASA plant will also treat an LPG stream to remove sulphur, also converting this recovered sulphur also into sulphuric acid.

The capacity of the ASA unit, when the refinery is processing higher sulphur crude oil blend, will be 30 tonnes per day of sulphuric acid. Sulphuric acid is already handled on site in the demineralisation plant.

D.1.3.7 Demineralisation Plant

The Demineralisation Plant was built and commissioned in 2008. The plant treats raw Council water for use as boiler feed water. The plant consists of the following process stages:

- Cartridge Filters (BH-FIL- 003A & B): to remove suspended solids from the feed water.
- Dual compartment unit with WAC (weak acid cation) & SAC (strong acid cation) resins (BH-A-001,002): to remove dissolved solids present as positive ions from the feed water.
- Degasser (BH-T-001): to remove alkalinity (CO_2) from the feed water.
- Dual compartment unit with WBA (weak base anion) & SBA (strong base anion) resins (BH-A-003,004): to remove dissolved solids present as negative ions from the feed water.

In addition to the main plant items there are ancillary equipment items used for backwashing and regeneration and waste discharge compliance. The regeneration equipment utilised includes the following systems:

- Caustic Soda system, including bulk tank (BH-TK-010), measure tank (BH-TK-003), caustic dilution system (ejector (BH-J-001)) and regeneration water pumps.
- Sulphuric acid system, including bulk tank (BH-TK-012), measure tank (BH-TK-013), sulphuric acid injection pumps, and sulphuric acid dilution system (ejectors (BH-J002, 003)).
- Effluent neutralisation system, including effluent tank (BH-TK-014), effluent pumps, and acid & caustic injection pumps.
- Regeneration water pumps (BH-P-4C, 4D).
- Degassed water pumps (BH-P-2AN, 2BN, 2CN), including associated steam turbine.
- Air Blowers (BH-BL-001NA, 001NB), including filters.
- De-aerator feed pumps (BH-P-4A & 4B), including associated steam Turbine.

D.1.4 Refinery Utilities

All the main processes described above are continuous operations and depend on the continuous availability of utilities to operate. In general, all equipment is designed to go to a fail safe mode on loss of power. However, the following arrangements mean that a shutdown due to loss of service is rare.

D.1.4.1 Electricity

The site has two 110 kV supply lines from the national grid. There is also a 6.2 MW gas turbine (CHP plant); this is now the main source of electricity for the site. The gas turbine can also export surplus power to the national grid if site demand is lower than turbine output. Critical services have a spare steam turbine driver or diesel engine driver and critical instrumentation is supported by UPS (Uninterruptable Power Supply).

D.1.4.2 Steam

The site has two water tube boilers: one with a capacity of 13.5 tonnes of steam per hour, and one with a capacity of 20 tonnes of steam per hour. There is also an 11 tonne per hour waste heat boiler associated with the gas turbine (CHP plant).

Historically, the normal steam load had been 25 tonnes per hour, including the demand from the diesel hydrofiner (Unit 900). Ongoing energy efficiency programmes have reduced this demand to below 20 tonnes per hour and an expected 16 tonnes per hour from Q2 2012. This reduction has consequential reductions in site flue gas emissions.

D.1.4.3 Air

The site has two electrically driven, oil free air compressors for supplying utility and instrument air. Only one compressor is normally on line at any time. A diesel driven compressor is also installed to provide further back up to the instrument and utility compressed air supply.

D.1.4.4 Process Cooling

In general cooling is provided by means of air coolers. These coolers typically have 30% capacity due to natural draft on loss of electrical power to drive the cooling fans.

D.1.5 Crude/Intermediate/Product Tank Farm & LPG Spheres

A tank farm is provided adjacent to the process units. Tanks are provided for intermediates, products and utility services. High vapour pressure material (crude oil, gasolines, gasoline blendstocks, naphthas) are stored in floating roof tanks. This eliminates the vapour space, minimises storage hazards and reduces VOC emissions. Low vapour pressure materials (kerosenes, gasoil, diesel, heavy fuel oil) and slops are stored in cone roof tanks. Four pressurised spheres are also provided for the storage of LPG.

Blending facilities are provided to produce on-grade gasolines and bio-gasolines from the various blendstocks. Pumping facilities are also provided to pump finished products to the Marine Terminal for dispatch by sea, and to the road loading facilities for dispatch by road. Pipelines are also provided for transferring LPG to the adjacent Calor bottling facility.

D.1.6 Road Loading Terminal

The main road loading terminal consists of five bottom loading islands. The products loaded are gasoline (unleaded), gasoil (auto diesel and central heating) and kerosene. Facilities are provided for injecting marker dye and customer specified additives into the products. There are also separate road loading terminals for loading LPG, aviation fuel (currently inactive) and heavy fuel oil (currently inactive).

D.1.7 Laboratory

The laboratory is staffed by chemists who are responsible for quality control of all feedstocks, intermediate products and finished products. The laboratory staff conducts testing of samples from ships delivering crude and product for signs of contamination, and also conducts testing of non-routine production streams, calibrates the laboratory test equipment and performs the response checks on the combustible gas indicators.

D.2 Development & Operational History

D.2.1 Summary

The Refinery was built between 1957 and 1959 by four major oil companies: ESSO, Shell, Texaco and British Petroleum. It was managed by ESSO until 1982, when it became a subsidiary of the Irish National Petroleum Corporation (INPC).

The Refinery was built as a hydroskimming refinery with a nominal capacity of 41 kB/day of Middle East crudes. Subsequent revamps during the 1960s resulted in an increase in actual capacity to 65 kB/day; the Refinery ran these crudes until 1981.

Refining ceased in 1981 and recommenced in 1982 following the takeover by the Irish National Petroleum Corporation. At this stage the company changed to refining North Sea crudes. The design basis of the various units reduced the capacity to 55 kB/day when running these low sulphur crudes.

An investment programme was undertaken from 1994 to 1996 to upgrade the Refinery, which restored the crude capacity to 65 kB/day for North Sea crudes. New items of equipment installed in this programme were designed for a nominal capacity of 75 kB/day. This capacity has subsequently been achieved following a further revamp in 1999.

Investment in process units and utilities such as waste water treatment and energy efficiency has been ongoing since 2000.

In 2001, Tosco Corporation completed the purchase of the operating assets of the Irish National Petroleum Corporation, including both the Refinery and Bantry Terminals Ltd. at Bantry, Co. Cork. Tosco Corporation was subsequently taken over by Phillips Petroleum Corporation in early 2001. Following the merger in 2002 between Conoco Inc. and Phillips Petroleum Corporation, the Refinery is now owned by ConocoPhillips.

D.2.2 Environmental Studies

A list of the main environmental studies undertaken at the site and submitted to the Agency since the licence was granted in 2000 is provided in the following table.

Table 6: List of Once-Off Reports Prepared under Conditions of IPPC Licence P0266-01

Report	Carried out by	Report Date
Hydrogeological Assessment of Whitegate Refinery, Co. Cork	URS Dames & Moore	January 2001
Environmental Assessment of the Landfill Area at Whitegate Refinery, Co. Cork	URS Dames & Moore	January 2001
Bund Integrity Assessment (final report)	Byrne Ó Clérigh	July 2006
Environmental Liabilities Risk Assessment	Byrne Ó Clérigh	August 2006
Closure, Restoration and Aftercare Management Plan	Byrne Ó Clérigh	October 2007
Landfill Decommissioning Plan	WYG	August 2004
Site Investigation & Laboratory Data supporting the Landfill Decommissioning Plan	WYG	June 2004

Report	Carried out by	Report Date
Chemical Storage Bunds - Bunding Integrity Inspection	Malachy Walsh & Partners	January 2005

D.2.3 Historical Environmental Incidents

There have been no environmental incidents since the IPPC Licence was granted in 2000.

Details of licence non conformances have been submitted in quarterly reports and AERs to the Agency. Instances of non conformances have declined progressively since 2005 as the WWTP was progressively upgraded. There were no non-compliances in 2010.

SECTION E: EMISSIONS

E.1 Emissions to Atmosphere

E.1.A Details of all point emissions to atmosphere

Details of all point emissions to atmosphere should be supplied. Complete Table E.1(i) for Boiler Emissions and Table E.1(ii) and E.1(iii) for all other main emission points. Complete Table E.1(iv) for minor emission points.

A summary list of the emission points, together with maps and/or drawings (no larger than A3), and supporting documentation should be included as **Attachment No E**. Plans of emission elevations, relevant roof heights, etc., should also be included, as should detailed descriptions and schematics of all abatement systems.

The applicant should address in particular any emission point where the substances listed in the Schedule of S.I. 394 of 2004 are emitted.

For emissions outside the BAT guidance limit, a full evaluation of the existing abatement/treatment system must be provided. A planned programme of improvement towards meeting upgraded standards is required. This should highlight specific goals and a time scale, together with options for modification, upgrading or replacement as required to bring the emissions within the limits as set out in the BAT guidance note(s). These notes can be found on the EPA website at www.epa.ie.

E.1.B Fugitive and Potential emissions

Give summary details of fugitive and potential emissions in Table E.1(v).

In relation to activities listed in the Schedule of Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations;

- specify the relevant category of activity in the Schedule
- specify how the requirements in relation to fugitive emissions will be met.

Full details and any supporting information should form **Attachment E.1.B.**

E.1 Emissions to Atmosphere

In the following sections, we provide an overview of the emissions to atmosphere from the current and future (the ASA plant) operations at the site. The emissions to atmosphere are categorised in accordance with the Agency's guidance note, as follows:

- Boiler Emissions
- Main Emissions
- Minor Emissions
- Potential and Fugitive Emissions.

Drawing # 4,5,6,7 in Attachment E.1 to this application identifies the location of each of the emission points to atmosphere.

Boiler and process emissions to atmosphere are related to one another via the refinery fuel system. In the course of producing refined products, off-gases are produced which contain hydrogen sulphide (H_2S), hydrogen and hydrocarbons. These off-gases are sent to the site's sulphur recovery unit (currently the SRU which will be replaced by the ASA plant in Q1 2012) where the sulphur content is reduced[4]. From the ASA Plant the off-gases (also referred to as refinery gases) are then sent to a variety of combustion plant, primarily the refinery furnaces, boilers and gas engines where they are used as fuel. The combustion of refinery gas and other hydrocarbon fuel inputs in the site's combustion plant results in emissions to atmosphere of combustion products, some of which arise from boilers and are therefore categorised under the *boiler category* – see Section E.1.A.1; and some of which arise from non-boiler combustion plant and are therefore categorised under the *main emissions category* – see Section E.1.A.2.

In addition to these combustion emissions to atmosphere, there is a single process-type emission to atmosphere arising from the sulphur recovery process. At present, this emission arises from the SRU and gives rise to emissions of ammonia. The main emission point from the SRU unit will be replaced by the main emission point from the ASA plant once it becomes operational and the SRU plant is decommissioned. The main emission point from the ASA plant includes emissions of combustion products as well as emissions of sulphuric acid mist. This emission point is therefore categorised within the *main emissions category*.

Due to the nature of the refining process, there is a wide range of fuel options that may be used in practice. The precise fuel mix is determined by a complex mix of variables, taking into account the specific process unit operations. For the purpose of assessing the emissions to atmosphere from the site, three generic fuel mix scenarios have been identified and considered. These scenarios are summarised in Table 7 and include the operation of the ASA plant; as the SRU plant will shortly be decommissioned, a detailed assessment is not considered necessary.

The normal operation of the processing units will use "clean" refinery gas from the ASA plant and this will be supplemented with natural gas. It is anticipated that this will be the prevailing condition for 98% of the time over any 2 year period for the foreseeable future. This normal condition is referred to as Scenario 1 in emissions tables.

[4] The new ASA plant will convert 99.5% of the sulphur in the feed gases to commercial grade sulphuric acid for the Irish market.

Table 7: Generic Fuel Mix Scenarios

Scenario	Sulphur Recovery Process Status	Main fuel	Supplementary fuel [Note 1]
1	Online	Refinery gas	Natural Gas
2	Online	Refinery gas	Heavy fuel oil (0.55% - 1.0% sulphur)
3	Scheduled Downtime [Note 2]	Refinery gas	Natural Gas

Note 1: Supplementary fuel is required to augment the refinery gas used in the combustion plant, as the quantity of refinery gas produced in normal operations is not sufficient to meet the full energy demands of the plant, although it can typically supply over 50% of the site's requirements.

Note 2: For example, scheduled maintenance in accordance with the manufacturers' requirements and the statutory steam plant inspection requirements. Typically, planned maintenance will involve a shut-down of the ASA plant for 2 weeks every 2nd year. This is Scenario 3. During this time the refinery will be run on sweet crude to reduce SO_2 emissions.

Historically, the refinery has operated primarily under Scenarios 1 and 2 and in accordance with the current limits set out in the licence. The introduction of the ASA plant will provide the refinery with the ability to process higher sulphur content crudes under Scenario 1. While this investment is expected to reduce the mass emission of sulphur dioxide from the entire site below the historical emission levels, it does not preclude the necessity for the refinery to operate under Scenario 2 in the future in which case the mass emission of sulphur dioxide will not be substantially different from those in the current licence limits.

For short periods the refinery will operate in Scenarios 3 mode for ~ 2% of the time or 2 weeks in every 2 years.

Under Scenario 1, it is expected that the total mass emission of sulphur dioxide from all main emission points (boiler and combustion/main emission points) will not exceed 150 kg/h of SO_2 . In practice, the refinery is expected to achieve a substantially lower average level of emissions than 150 kg/h (potentially less than 30 kg/hr). However, even within Scenario 1, there can be some fluctuations in the precise fuel mix and therefore individual hourly sulphur dioxide mass emission rates may also fluctuate.

In Scenario 3 the projected emissions for 2% of the time would exceed the current licence limit of SO_2 emissions (245 kg/hr) and could be of the order of 370 kg/hr. Dispersion modelling conducted in 2009 has indicated that this emission of SO_2 (even were it to be emitted continuously for a full year) would not breach any air quality standard for SO_2. See dispersion modelling reports in Attachment I, some of which have already been provided to the Agency.

In light of the above, ConocoPhillips considers that the following would appropriate mass emission limits for SO_2 emissions from the licensed stacks on the site once the ASA plant has been put into operation.

Table 8: Proposed Sulphur Dioxide Mass Emission Limits

	Scenario 1 Normal Operation – Natural Gas as Supplementary Fuel	**Scenarios 2 – Heavy Fuel Oil as Supplementary Fuel**	**Scenario 3 – Planned ASA shutdowns (2 weeks in every 104 weeks)**
Sulphur Dioxide Site Mass Emission Limit from licensed emission points	150 kg/h	245 kg/h [Note 1]	370 kg/hr
Anticipated Annual Mass Emissions (tonnes SO2)	262 (668 actual in 2010)	1,400 (Current licence limit = 2,146 tonnes/yr)	376[Note 2]

Note 1: Condition 5.10 in the current IPPC licence states *The total emissions of sulphur dioxide (as SO_2) to atmosphere from the site (as detailed in Schedule 1(i) Emissions to Atmosphere) shall not exceed 245 kg/h*

Note 2: This includes ~ 124 tonnes during planned maintenance and the balance 252 tonnes under normal operations for balance of year.

There are also a large number of minor emission points, potential emission points and fugitive emission points at the site. These are described in more detail in Sections E.1.B.

E.1.A Details of all point emissions to atmosphere

E.1.A.1 Boiler Emissions

There are three boiler emission points at the site. These boilers provide steam for the various refinery processes and can be operated on a variety of fuels, including natural gas, refinery gas, distillates and heavy fuel oil. The basis for running the boilers on a particular fuel is dictated by a range of factors, including:

- fuel costs;
- the refinery throughput;
- the demand for steam;
- the sulphur content of the incoming crude supply;
- the sulphur content of the refinery gas; and
- the availability of the sulphur recovery systems (e.g. down time due to scheduled maintenance activities)

The thermal inputs for the three boilers are summarised in Table 9. As each of the boilers has a thermal input rating greater than 5 MW when firing on gaseous fuels and greater than 250 kW when firing on liquid fuels, they are regarded as significant in accordance with the Agency's guidance. In normal use, the boilers may fire on a combination of both gaseous and liquid fuels.

The primary boilers are A1-2 and A1-3, with boiler A1-1 normally operating in a standby mode with a natural gas pilot. Boiler A1-2 is the waste heat boiler on the CHP plant and

operates in a variety of modes. In normal operation, this boiler is operated in conjunction with the gas turbine fired on natural gas or gas oil. In normal operation, Boiler A1-3 is typically fired on a mixture of refinery gas and natural gas. However, depending upon the particular demands from the site, any of the three boilers may be operated on any of the possible fuel inputs.

Table 9: Boiler Thermal Inputs

Boiler	Gas Fuel	Liquid
A1-1	12 MW	12 MW
A1-2	45 MW	16 MW
A1-3	6.6 MW	20 MW

As described in Section E.1, the boilers may be fuelled on a variety of fuels depending on the particular operational requirements and circumstances. The details for the three boiler emission points (A1-1, A1-2 and A1-3) are provided in Tables E.1(i) and are based upon the normal operational conditions. For each boiler the characteristics of the emissions when firing under different scenarios are described in the footnotes to the tables.

Table E.1(i) BOILER EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point:

Emission Point Ref. Nº:	A1-1	
Location:	SG-4: Boiler No. 4 - See Drawing Ref. 8821-1040-SH.3 Major Emission Points	
Grid Ref. (12 digit, 6E,6N):	E183107 N 62995	
Vent Details	Diameter: 1.52	Height above Ground(m): 30
Date of commencement of emission:	1998	

Characteristics of Emission: *Scenario 1 from Table 7*

Boiler rating			
Steam Output	1,500 kg/hr		
Thermal Input:	1.5 MW		
Boiler fuel			
Type:	Natural Gas (Normal current operation)		
Maximum rate at which fuel is burned	120 kg/hr		
% sulphur content:	0.0005%		
NOx	45 mg/Nm^3 0°C. 3% O_2(Liquid or Gas), 6% O_2(Solid Fuel)		
Maximum volume* of emission	13,317 m^3/hr 0°C, 3 % O_2 (liquid or gas), 6 % O_2 (solid fuel)		
Temperature	120°C(max)	70°C(min)	90°C(avg)

Characteristics of Emission: *Scenario 2 from Table 7*

Boiler rating			
Steam Output	14,515 kg/hr		
Thermal Input:	12 MW		
Boiler fuel			
Type:	Heavy Fuel Oil (Possible future fuel – unlikely in medium term)		
Maximum rate at which fuel is burned	1,035 kg/hr		
% sulphur content:	0.55% to 1%		
NOx	450 mg/Nm^3 0°C. 3% O_2(Liquid or Gas), 6% O_2(Solid Fuel)		
Maximum volume* of emission	15,500 m^3/hr 0°C, 3 % O_2 (liquid or gas), 6 % O_2 (solid fuel)		
Temperature	240°C(max)	94°C(min)	177°C(avg)

*

Periods of Emission (avg)	60 min/hr	24 hr/day	365 day/yr

Emission Point:

Emission Point Ref. Nº:	A1-2	
Location:	SG-5 Boiler No. 5 (See Drawing Ref. 8821-1040-SH.3 Major Emission Points)	
Grid Ref. (12 digit, 6E,6N):	E183083 N62954	
Vent Details	Diameter: 1.52	Height above Ground(m): 30
Date of commencement of emission:	1997	

Characteristics of Emission:

Boiler rating	
Steam Output	11,500kg/hr
Thermal Input:	45 MW
Boiler fuel	
Type:	Pilot burner and Gas Turbine exhaust
Maximum rate at which fuel is burned	150 Nm^3/h to pilot burner, 2800 Nm^3/h to Gas Turbine (CHP plant)
% sulphur content:	0.1% when gas oil is burned during gas turbine downtime
NOx	450 0°C. 3% O_2(Liquid or Gas), 6% O_2(Solid Fuel)
Maximum volume* of emission	82,607 m^3/hr 0°C, 3% O_2 (liquid or gas), 6 % O_2 (solid fuel)
Temperature	150°C(max) 90°C(min) 130°C(avg)

* Volume flow limits for emissions to atmosphere shall be based on Normal conditions of temperature and pressure, (i.e. 0oC, 101.3kPa), dry gas; 3% oxygen for liquid and gas fuels; 6% oxygen for solid fuels.

(i) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (start-up/shutdown to be included):

Periods of Emission (avg)	60 min/hr	24 hr/day	20 day/yr

Emission Point:

Emission Point Ref. Nº:	A1-3	
Location:	SG-6 Boiler No. 6 (See Drawing Ref. 8821-1040-SH.3 Major Emission Points)	
Grid Ref. (12 digit, 6E,6N):	E183091 N62924	
Vent Details	Diameter: 1.2	Height above Ground(m): 40
Date of commencement of emission:	2004	

Characteristics of Emission:

Boiler rating	
Steam Output	8,000 kg/h
Thermal Input:	6.6 MW
Boiler fuel	
Type:	Refinery gas and natural gas
Maximum rate at which fuel is burned	177 Nm^3/h to the pilot (natural gas) 481 Nm^3/h to main burner (refinery gas & natural gas)
% sulphur content:	0.0005%
NOx	450 mg/Nm^3 0°C. 3% O_2(Liquid or Gas), 6% O_2(Solid Fuel)
Maximum volume* of emission	26,696 m^3/hr 0°C, 3% O_2 (liquid or gas), 6 % O_2 (solid fuel)
Temperature	240°C(max) 95°C(min) 170°C(avg)

* Volume flow limits for emissions to atmosphere shall be based on Normal conditions of temperature and pressure, (i.e. 0oC, 101.3kPa), dry gas; 3% oxygen for liquid and gas fuels; 6% oxygen for solid fuels.

(i) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (start-up/shutdown to be included):

Periods of Emission (avg)	60 min/hr	24 hr/day	345 day/yr

E.1.A.2 Main Emissions

At present, there are eighteen main emission points to atmosphere in operation, consisting of seventeen combustion plants[5] and a single process emission point to atmosphere from the SRU.

Once the ASA plant becomes operational, the SRU plant will be taken out of service and decommissioned. Therefore, there will remain eighteen main emission points to atmosphere once the ASA plant becomes fully operational.

The predominant main emission points to atmosphere are from combustion processes associated with the furnaces, which provide heat to various refinery process units, including the pipestill, hydrofiner, powerformer and isomerisation unit. These main emission points are designated as A2-1 to A2-11.

The main emission points designated as A2-12 to A2-14 are associated with compressor drives i.e. the engines serving the powerformer compressors. Main emission points A2-15 to A2-17 are the three flares required for the safe operation of the refinery. These emission points are normally in a pilot-type mode, but in the event of a disruption to the refinery process or an emergency event, intermediate refinery materials and refinery gases may be directed to one or more of the flares where they are combusted with the release of normal products of combustion to atmosphere.

The main emission point from the ASA plant (which is the only emission point to atmosphere from the unit) is designated as A2-18. The main emissions to atmosphere from this point are normal products of combustion (SO_2 and NO_x) as well as a sulphuric acid mist at a low concentration generated in the process of removing sulphur compounds from the refinery gas streams.

The details for each of the main emission points to atmosphere are provided in Tables E.1(ii) and E1.(iii). The characteristics of the emissions in the tables are based upon the average volumetric flow rates and operation under the Scenario 1 fuel input (refer to Table 7). In general, the average concentration and mass emission data corresponds to Scenario 1, while the maximum concentration and mass emission data corresponds to either Scenario 2 (using fuel oil as fuel in certain furnaces) or Scenario 3. Scenario 3 conditions represent conditions during the planned shutdown of the ASA plant for 2 weeks every two years i.e. 2% of the time as an overall average. During this time the refinery will revert to sweet crude processing to limit SO_2 emissions.

[5] Including 3 flares normally in pilot mode.

Table E.1(ii) MAIN Emissions to Atmosphere (1 Page for each emission point)

Emission Point Ref. N^{o}:	A2-1
Source of Emission:	F-401 Furnace Stack
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183188, N063060
Vent Details Diameter: Height above Ground(m):	 1.9 m 54 m
Date of commencement:	1959 (Note in 2009, the 2 stacks on F-401 were replaced by one larger stack)

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	1,275,000 Nm^3/d	Maximum/day	1,500,000 Nm^3/d
Maximum rate/hour	62,500 Nm^3/h	Min efflux velocity	6.9 $m.sec^{-1}$
(ii) Other factors			
Temperature	340^{o}C(max)	240^{o}C(min)	266^{o}C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. √ dry. _____3___%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (start-up /shutdown to be included):

Periods of Emission (avg)	___60___min/hr ___24___hr/day ___365___day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-1***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	Not applicable				Combustion	20	1,700	1.1	107	9,650	937,350
NO_X	Not applicable				Combustion	250	450	13.3	28.2	116,550	247,050
CO	Not applicable				Combustion	20	100	1.1	6.3	9,650	55,200

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Values for "Average column" represent Scenario 1 operation with ASA running and natural gas as supplementary fuel – expected normal operation for foreseeable future
3. Values in max column represent operation in Scenario 2 – i.e. heavy fuel oil as main furnace fuel
4. Emissions of SO_2 in Scenario 3 – planned shutdown of ASA will be 94 kg/hr i.e. < Max case

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-2
Source of Emission:	F-402 Furnace Stack
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183211 N063078
Vent Details Diameter: Height above Ground(m):	 1.575m 47.24m
Date of commencement:	1996

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	693,600 Nm^3/d	Maximum/day	816,000 Nm^3/d
Maximum rate/hour	34,000 Nm^3/h	Min efflux velocity	2.4 $m.sec^{-1}$
(ii) Other factors			
Temperature	340°C(max)	240°C(min)	304°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. √ dry		_____3___%O_2	

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr	24 hr/day	365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-2***

Parameter	Prior to treatment[1]				Brief description of treatment	Combustion					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	Not applicable				Combustion	35	1,700	1.1	58	9,350	508,100
NO_X	Not applicable				Combustion	250	450	7.3	15.3	63,950	134,050
CO	Not applicable				Combustion	20	100	0.6	3.4	5,300	29,800

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Values for "Average column" represent Scenario 1 operation with ASA running and natural gas as supplementary fuel – expected normal operation for foreseeable future
3. Value for max column represents operation in Scenario 2 – heavy fuel oil as the furnace fuel
4. Value for max concentration column when ASA plant is planned shutdown is 51 kg/hr i.e. < max fuel oil case

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-3
Source of Emission:	F-501 Furnace Stack (hydrotreater)
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183233 N063091
Vent Details Diameter: Height above Ground(m):	 1.3 21.3
Date of commencement:	1959

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	50,000 Nm^3/d	Maximum/day	386,400 Nm^3/d
Maximum rate/hour	16,100 Nm^3/h	Min efflux velocity	1.6 $m.sec^{-1}$
(ii) Other factors			
Temperature	575°C(max)	425 °C(min)	479°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. √ dry _____3___ $\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	___60___min/hr ___24___hr/day ___365___day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-3***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	Not applicable				Combustion	0	0	0	0	0	0
NO_X	Not applicable				Combustion	250	450	0.5	7.3	4,600	63,950
CO	Not applicable				Combustion	20	100	0.3	1.6	350	14,050

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Values for "Average column" represents expected normal operation for foreseeable future
3. No SO_2 emissions from this furnace due to clean gas source independent of ASA plant
4. This furnace is normally run with a pilot burner.

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-4
Source of Emission:	F-204: Powerformer Stabiliser Reboiler Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183253 N063105
Vent Details Diameter: Height above Ground(m):	 1.3m 21.3m
Date of commencement:	1959

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	181,560 Nm^3/d	Maximum/day	213,600 Nm^3/d
Maximum rate/hour	8,900 Nm^3/h	Min efflux velocity	1.64 $m.sec^{-1}$
(ii) Other factors			
Temperature	375°C(max)	260 °C(min)	333°C(avg)
For Combustion Sources:			
Volume terms expressed as :	☐ wet.	✓ dry	_____3%O_2

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr	24 hr/day	365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-4***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	No applicable				Combustion	0	0	0	0	0	0
NO_x	Not applicable				Combustion	250	450	1.9	4.0	16,650	35,050
CO	Not applicable				Combustion	20	100	0.2	0.9	1,750	7,900

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Average rates are for ASA online and N gas as supplementary fuel Scenario 1
3. No SO_2 emissions from this stack – sweet gas from ISOM – independent of ASA plant status

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. N^{o}:	A2-5
Source of Emission:	F-201: Powerformer Pre-heat Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183261 N063110
Vent Details Diameter: Height above Ground(m):	 2.13m 39.6m
Date of commencement:	1959

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	538,600 Nm^3/d	Maximum/day	753,400 Nm^3/d
Maximum rate/hour	31,391 Nm^3/h	Min efflux velocity	2.42m.sec^{-1}
(ii) Other factors			
Temperature	450^{o}C(max)	370 ^{o}C(min)	402^{o}C(avg)
For Combustion Sources:			
Volume terms expressed as :	☐ wet.	✓ dry.	_____3%O_2

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-5***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0.63	1700	0.03	67.8	256	563,750
NO_x	N/A	N/A	N/A	N/A	Combustion	250	450	5.6	18.5	49,000	161,400
CO	N/A	N/A	N/A	N/A	Combustion	20	100	0.75	3.75	6,550	32,700

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Average rates are for ASA online and N Gas as supplementary fuel - Scenario 1
3. Max emission values in columns – heavy fuel oil as supplementary fuel – Scenario 2
4. SO_2 emissions in Scenario 3 – ASA plant offline for 2 weeks every 2 years = 60 kg/hr < fuel oil case and only 336 hours per year.

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-6
Source of Emission:	F-202Bx/Cx: Powerformer Re-heat Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183272 N063118
Vent Details Diameter: Height above Ground(m):	 1.45m 21.3m
Date of commencement:	1959

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	219,800 Nm^3/d	Maximum/day	388,950 Nm^3/d
Maximum rate/hour	16,206 Nm^3/h	Min efflux velocity	1.63 $m.sec^{-1}$
(ii) Other factors			
Temperature	600°C(max)	510 °C(min)	547°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____$3\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-6***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
NO_x	N/A	N/A	N/A	N/A	Combustion	150	265	1.4	4.3	12,300	37,700
H_2S	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
CO	N/A	N/A	N/A	N/A	Combustion	20	100	0.18	1.62	1,580	14,200
Fuel - Oil	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Average & max rates are for ASA online and N Gas as supplementary fuel – Scenario 1
3. No SO_2 emissions from this stack – clean gas supply independent of ASA plant status

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-7
Source of Emission:	F-202AN: Powerformer Pre-heat Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183281 N063124
Vent Details Diameter: Height above Ground(m):	 1.68m 31.8m
Date of commencement:	1999

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	175,000 Nm^3/d	Maximum/day	314,400 Nm^3/d
Maximum rate/hour	13,100 Nm^3/h	Min efflux velocity	2.42m.sec^{-1}
(ii) Other factors			
Temperature	520°C(max)	450 °C(min)	485°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____3%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-7***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0.89	1600	0.01	21	88	184,000
NO_x	N/A	N/A	N/A	N/A	Combustion	171	306	1.25	4.0	10.950	35,100
CO	N/A	N/A	N/A	N/A	Combustion	20	100	0.13	1.12	1,147	9,807

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Average rates are for ASA online and N Gas as supplementary fuel - Scenario 1
3. Max emission values in columns – ASA plant offline for 2 weeks every 2 years – Scenario 3 for 336 hours plaus scenario 1 for balance of year.

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-8
Source of Emission:	F-206/207: Naphtha Hydrofiner/ Debutaniser Reboiler Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183293 N063136
Vent Details Diameter: Height above Ground(m):	 2.21m 36.7m
Date of commencement:	2009

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	503,649 Nm^3/d	Maximum/day	537,258 Nm^3/d
Maximum rate/hour	22,386 Nm^3/h	Min efflux velocity	1.62m.sec^{-1}
(ii) Other factors			
Temperature	450°C(max)	315 °C(min)	410°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____$3\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-8***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max[Note 4]
SO_2	N/A	N/A	N/A	N/A	Combustion	0.7	1600	0.01	55	88	18,540
NO_x	N/A	N/A	N/A	N/A	Combustion	250	450	5.25	10.07	45,958	93,800
H_2S	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
CO	N/A	N/A	N/A	N/A	Combustion	20	100	0.42	2.24	3,677	19,610
Fuel - Oil	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Average rates are for ASA online and N Gas as supplementary fuel - Scenario 1
3. Max emission values in columns – ASA plant planned downtime for 2 weeks every 2 years – Scenario 3.
4. Max kg/yr column for SO_2 reflects fact that planned downtime for ASA plant with higher SO_2 emissions occurs for 2 weeks in any one year i.e. 336 hours at scenario 3 and balance of year Scenario 1.
5. NOx levels do not vary significantly between Scenario 1 and 3.
6. No fuel oil scenario this furnace

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-9
Source of Emission:	F-203: Powerformer Regen Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183272 N63126
Vent Details Diameter: Height above Ground(m):	 0.9m 30m
Date of commencement:	2009

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	120,097 Nm^3/d	Maximum/day	196,948 Nm^3/d
Maximum rate/hour	8,206 Nm^3/h	Min efflux velocity	3.12 $m.sec^{-1}$
(ii) Other factors			
Temperature	450°C(max)	370 °C(min)	402°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____3%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-9***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
NO_x	N/A	N/A	N/A	N/A	Combustion	250	450	1.25	3.69	10,959	32,349
H_2S	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
CO	N/A	N/A	N/A	N/A	Combustion	220	100	0.1	0.82	878	7,189
Fuel - Oil	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. SO2 values are for normal operations Scenario 1 and are same for Scenario 3 i.e. no SO2 in gases used to fuel this furnace.
3. No fuel oil scenario this furnace

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-10
Source of Emission:	F-801/802: Isom Naphtha Hydrotreater Pre-heat Heater/ Hot Oil Heater
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183167 N063116
Vent Details Diameter: Height above Ground(m):	 1.764m 43m
Date of commencement:	1999

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	597,950Nm^3/d	Maximum/day	631,400 Nm^3/d
Maximum rate/hour	26,500 Nm^3/h	Min efflux velocity	2.14.m.sec^{-1}
(ii) Other factors			
Temperature	450°C(max)	315 °C(min)	340°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry 6 _____3%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-10***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	1.1	1600	0.06	43	525	14,500 Note 2
NO_x	N/A	N/A	N/A	N/A	Combustion	250	450	6.23	11.84	54,600	103,7500
CO	N/A	N/A	N/A	N/A	Combustion	20	100	0.5	2.63	4,365	23,045

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Max value for SO2 concentration represents Scenario 3 – ASA planned downtime. Max kg/year for SO2 reflects fact that this condition will exist for 2 weeks only during planned shutdown.
3. No fuel oil scenario this furnace

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-11
Source of Emission:	F-901 Furnace Stack
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183368 N063046
Vent Details Diameter: Height above Ground(m):	 1.4 41.6
Date of commencement:	2005

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	244,355 Nm^3/d	Maximum/day	413,648 Nm^3/d
Maximum rate/hour	17,235 Nm^3/h	Min efflux velocity	2.2m.sec^{-1}
(ii) Other factors			
Temperature	450°C(max)	300 °C(min)	390°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. √ dry _____3___$\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	___60___min/hr ___24___hr/day ___365___day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-11***

Parameter	Prior to treatment[1]				Brief	As discharged[1]					
	mg/Nm^3		kg/h		Description	mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max	of treatment	Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	1	1600	0.01	28	88.47	9,450 Note 2
NO_X	N/A	N/A	N/A	N/A	Combustion	250	450	2.54	7.75	22,250	67,890
H_2S	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
CO	N/A	N/A	N/A	N/A	Combustion	20	100	0.2	1.72	1,752	15,067
Fuel Oil	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Max value for SO2 concentration represents Scenario 3 – ASA planned downtime. Max kg/year for SO2 reflects fact that this condition will exist for 2 weeks only during planned shutdown.
3. No fuel oil scenario this furnace
4. Average emissions represent ASA plant running and natural gas as supplementary fuel – normal operation for foreseeable future

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-12
Source of Emission:	C-201A: Recycle Gas Compressor
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183258 N063043
Vent Details Diameter: Height above Ground(m):	 0.25m 15.25m
Date of commencement:	2008

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	74,772 Nm^3/d	Maximum/day	99,701 Nm^3/d
Maximum rate/hour	4,154 Nm^3/h	Min efflux velocity	27.44m.sec^{-1}
(ii) Other factors			
Temperature	600°C(max)	450 °C(min)	524°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____3%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-12***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
NO_x	N/A	N/A	N/A	N/A	Combustion	2,600	3,000	8.1	10.8	70,959	94,616
H_2S	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
CO	N/A	N/A	N/A	N/A	Combustion	800	1000	2.49	3.32	21,833	29,113
Fuel - Oil	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. No fuel oil scenario for this emission point
3. Fired on natural gas

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-13
Source of Emission:	C-201B: Recycle Gas Compressor
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183263 N063036
Vent Details Diameter: Height above Ground(m):	 0.25m 15.25m
Date of commencement:	2008

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	74,772 Nm^3/d	Maximum/day	99,701 Nm^3/d
Maximum rate/hour	4,154 Nm^3/h	Min efflux velocity	27.44m.sec^{-1}
(ii) Other factors			
Temperature	600°C(max)	450 °C(min)	524°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet.		✓ dry.	_____3%O_2

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-13***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
NO_x	N/A	N/A	N/A	N/A	Combustion	2,600	3,000	8.1	10.8	70,959	94,616
H_2S	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
CO	N/A	N/A	N/A	N/A	Combustion	800	1000	2.49	3.32	21,833	29,113
Fuel - Oil	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Fired on natural gas

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-14
Source of Emission:	C-202: Regen Gas Compressor
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183256 N063048
Vent Details Diameter: Height above Ground(m):	 0.25m 15.25m
Date of commencement:	2008

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	36,702 Nm^3/d	Maximum/day	48,943 Nm^3/d
Maximum rate/hour	2,039 Nm^3/h	Min efflux velocity	13.47m.sec^{-1}
(ii) Other factors			
Temperature	600°C(max)	450 °C(min)	524°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____3%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-14***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2	N/A	N/A	N/A	N/A	Combustion	0	0	0	0	0	0
NO_x	N/A	N/A	N/A	N/A	Combustion	2,600	3,000	3.98	5.3	34,830	46,447
CO	N/A	N/A	N/A	N/A	Combustion	800	1000	1.22	1.63	10,717	14,291

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Fired on natural gas

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-15
Source of Emission:	Ground Flare
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183383 N62841
Vent Details Diameter: Height above Ground(m):	 5.5 m 4 m
Date of commencement:	1959

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	13,706 Nm^3/d	Maximum/day	156,000 Nm^3/d
Maximum rate/hour	6,500 Nm^3/h	Min efflux velocity	0.00031 $m.sec^{-1}$
(ii) Other factors			
Temperature	310°C(max)	°C(min)	°C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____21%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-15***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
Butane	n/a	n/a	n/a	n/a	Ground Flare						

1. Concentrations should be based on Normal conditions of temperature and pressure (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Constant purge gas and pilot flame on refinery gas
3. Flare is integral part of refinery safety system e.g. for protection against overpressure or process equipment

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-16
Source of Emission:	Tall Flare
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E 183408 N62806
Vent Details Diameter: Height above Ground(m):	 0.6096 m 49 m
Date of commencement:	2004

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	12,173 Nm^3/d	Maximum/day	1,733,208 Nm^3/d
Maximum rate/hour	72,217 Nm^3/h	Min efflux velocity	0.139 $m.sec^{-1}$
(ii) Other factors			
Temperature	^oC(max)	^oC(min)	^oC(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____21%O_2			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-16***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
Butane	n/a	n/a	n/a	n/a	Tall Flare						

1. Concentrations should be based on Normal conditions of temperature and pressure (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. Constant purge gas and pilot flame on refinery gas
3. Flare is integral part of refinery safety system e.g. for protection against overpressure or process equipment

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-17
Source of Emission:	Sour Gas Tall Flare
Location:	See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E 183408 N6 62806
Vent Details Diameter: Height above Ground(m):	 0.2032 m 49 m
Date of commencement:	2004

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	19,090 Nm^3/d	Maximum/day	158,239 Nm^3/d
Maximum rate/hour	6,593 Nm^3/h	Min efflux velocity	1.97 $m.sec^{-1}$
(ii) Other factors			
Temperature	200 °C(max)	°C(min)	°C(avg)
For Combustion Sources: Volume terms expressed as :	☐ wet.	✓ dry	_____21%O_2

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-17***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
NH_3, H_2S	n/a	n/a	n/a	n/a	Sour Flare						

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^oC,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. H_2S originates from non ASA-treated gas streams e.g. spent caustic treatment in WWTP
3. Ammonia from sour water stripper.
4. Constant purge gas and pilot flame on refinery gas
5. Flare is integral part of refinery safety system e.g. for protection against overpressure or process equipment

TABLE E.1(ii) MAIN EMISSIONS TO ATMOSPHERE (1 Page for each emission point)

Emission Point Ref. Nº:	A2-18
Source of Emission:	ASA Plant Clean Gas Stack
Location:	ASA Plant See Drawing Ref. 8821-1040-SH.3 Major Emission Points
Grid Ref. (12 digit, 6E,6N):	E183383 N62845
Vent Details Diameter: Height above Ground(m):	 0.7 m 30 m
Date of commencement:	December 2011

Characteristics of Emission:

(i) Volume to be emitted:			
Average/day	331,200 Nm^3/d	Maximum/day	389,700 Nm^3/d
Maximum rate/hour	16,300 Nm^3/h	Min efflux velocity	$m.sec^{-1}$
(ii) Other factors			
Temperature	200 °C(max)	180 °C(min)	190 °C(avg)
For Combustion Sources: Volume terms expressed as : ☐ wet. ✓ dry. _____$3\%O_2$			

(iii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

Vendor Guaranteed on line time 96%.

TABLE E.1(iii): MAIN EMISSIONS TO ATMOSPHERE - Chemical characteristics of the emission (1 table per emission point)

Emission Point Reference Number: ***A2-18***

Parameter	Prior to treatment[1]				Brief description of treatment	As discharged[1]					
	mg/Nm^3		kg/h			mg/Nm^3		kg/h.		kg/year	
	Avg	Max	Avg	Max		Avg	Max	Avg	Max	Avg	Max
SO_2					Sulphuric Acid Production	250	260	3.5	4.3	30,700	37,700
NO_x as NO_2					From recovered	110	165	1.6	2.7	14,050	23,700
H_2SO_4					H_2S from refinery gases	17	28	0.24	0.46	2,100	4,050

1. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C,101.3kPa). Wet/dry should be the same as given in Table E.1(ii) unless clearly stated otherwise.
2. NOx emission rise to max 165 mg/Nm3 when fresh catalyst is introduced
3. SO2 max and average values represent start - of- run conditions and end- of -run conditions
4. Ditto H_2SO_4 average and max.

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E.1.A.3 Minor Emissions

There are a total of 39 No. minor emission points on the Refinery site. The majority of these (24 No.) consist of tank breather vents, which can emit small amounts of hydrocarbons as the tank "breathes" during filling. The remaining emission points consist of:

- Diesel driven pumps (1 No. Crude & 2 No. Fire Water)
- Emergency electrical generators (5 No.)
- Road Loading Bay Vents (2 No.)
- Building Heaters (2 No.)
- Reactor regenerator gas outlet (1 No.)
- Standby air compressor (1 No.)
- Laboratory Test Engine (1 No.)

A list of the minor emission points is contained in Table E.1(iv) overleaf.

TABLE E.1(iv): EMISSIONS TO ATMOSPHERE - Minor atmospheric emissions

Emission point Reference Numbers	Description	Emission details[1] material	mg/Nm$^{3(2)}$	kg/h.	kg/year	Abatement system employed
A3-1	Reactor Regenerator gas Outlet	Nitrogen/N Gas	minimal	minimal	minimal	Not Applicable
A3-2	Diesel Crude Pump Engine Exhaust	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-3	Diesel Fire Pump Engine Exhaust	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-4	Diesel Fire Pump Engine Exhaust	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-5	Emergency Generator Exhaust(Sub 2)	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-6	Emergency Standby Generator No. 1(Admin)	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-7	Emergency Standby Generator No. 2(Security)	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-8	Emergency Standby Generator No.3(HDS/Sub 8)	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-9	Emergency Standby Generator No.4(Utilities/Sub 9)	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-10	Stand by Instrument Air Compressor	Combustion products	minimal	minimal	minimal	Not Applicable
A3-11	Security/Medical Building heater	Combustion products	minimal	minimal	minimal	Not Applicable
A3-12	Laboratory Building heater	Combustion products	minimal	minimal	minimal	Not Applicable
A3-13	Laboratory Test Engines	Engine exhausts	minimal	minimal	minimal	Not Applicable
A3-14	Tk-P-7 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-15	Tk-P-8 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-16	Tk-P12 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-17	Tk-P-13 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable

Emission point Reference Numbers	Description	Emission details[1] material	mg/Nm$^{3(2)}$	kg/h.	kg/year	Abatement system employed
A3-18	Tk-P-14 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-19	Tk-P-15 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-20	Tk-P-16 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-21	Tk-P-17 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-22	Tk-P-18 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-23	Tk-P-19 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-24	Tk-P-20 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-25	Tk-P-21 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-26	Tk-P-22 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-27	Tk-P-23 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-28	Tk-I-1 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-29	Tk-I-4 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-30	Tk-I-15 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable

Emission point Reference Numbers	Description	Emission details[1] material	mg/Nm$^{3(2)}$	kg/h.	kg/year	Abatement system employed
A3-31	Tk-U-1 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-32	Tk-U-2 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-33	Tk-U-4 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-34	Tk-U-5 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-35	Tk-U-9 – vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-36	Tk-U-10 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-37	Tk-U-13 - vents	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-38	Road loading bay 4 vent	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable
A3-39	Road loading bay 5 vent	Hydrocarbon Vapour	minimal	minimal	minimal	Not Applicable

a. The maximum emission should be stated for each material emitted, the concentration should be based on the maximum 30 minute mean.
b. Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C101.3kPa). Wet/dry should be clearly stated. Include reference oxygen conditions for combustion sources.

E.1.B Fugitive and Potential Emissions

E.1.B.1 Fugitive Emissions

Fugitive emissions can be generated on site from the following:

- Breathing and working losses from liquid storage facilities
- Loading and unloading operations
- Emissions from waste water treatment
- Cleaning operations
- Leaks from valve seals, pump seals and flanges

Standard industry methods exist for estimating the emission rates for some of the above areas. These include American Petroleum Institute methods for estimating losses from storage and loading / unloading facilities, as follows:

API 2517 Evaporative Loss from External Floating-Roof Tanks.
API 2518 Evaporation Loss From Fixed-Roof Tanks.

Other correlations, developed by industry bodies, provide methods for establishing remaining fugitive losses. An estimate of total fugitive emissions from the site is given in Attachment E.1.

A number of significant steps are taken to minimise fugitive emission losses from tankage, loading / unloading operations, process equipment, etc. External floating roof tanks have been used for storing high vapour pressure material since the start of refining operations. In addition, all high vapour pressure products were constructed with shoe mounted secondary seals. These were upgraded to rim mounted secondary seals in the majority of product tanks since 1990, in parallel with tankage maintenance.

Conservation vents (Pressure / Vacuum vents) are fitted to the kerosene tanks to minimise standing losses. All gasoline loading to ships and trucks is done by bottom & closed loading. A Vapour Recovery Unit was installed in the Road Loading Facility in 2000 and serves to reduce fugitive emissions.

From operating experience fugitive emissions do not cause an odour nuisance off site.

The processes with the most significant potential for offsite odour nuisance are the addition of Ethyl Mercaptan to LPG (propane & butane) prior to sale and odours from the waste water treatment plants. LPG produced in the refining process is odourless, with Ethyl Mercaptan added before sale to give it a distinctive, unpleasant smell for safety purposes. The addition of the mercaptan is a requirement of fuel quality standards.

A proprietary facility was installed in 1990 to minimise fugitive emissions of Ethyl Mercaptan.

E.1.B.2 Potential Emissions

The main potential emissions are from safety relief valves which discharge directly to atmosphere. However records show that there has not been an incident of a safety valve that discharges to atmosphere having lifted in more than 10 years.

Included in this list of potential emissions is the bypass stack for the CHP unit, no monitoring of the emissions to atmosphere from the operation of this stack has been carried out. Emission through this stack are the diversion of the GHP gas turbine flue gases from SG-5 stack when SG-5 (boiler) is shut down for statutory inspection.

A list of potential emission points is contained in Table E.1(v) overleaf.

TABLE E.1(v): EMISSIONS TO ATMOSPHERE – Fugitive and Potential atmospheric emissions

Emission point ref. no. (as per flow diagram)	Description	Malfunction which could cause an emission	Emission details (Potential max. emissions)[1]		
			Material	mg/Nm^3	kg/hour
A4-1	CHP Bypass Stack		SO_2, NO_X, other products of combustion	Note 1	Note 1
A4-2	SV-203, T-201, 309.9psig	General power failure Partial power failure Single power failure Fire Blocked outlet	Hydrocarbon Vapour	Not Applicable	87,800
A4-3	SV-204, E204AX/BX, 550.0psig	Fire Blocked outlet	Hydrocarbon Vapour	Not Applicable	81,650
A4-4	SV-205, D204, 410psig	General power failure Partial power failure Single power failure Fire Blocked outlet	Hydrocarbon Vapour	Not Applicable	63,400
A4-5	SV-206 - C-201A discharge, set at 639.6psig	Blocked outlet	Hydrocarbon Vapour	Not Applicable	24,900
A4-6	SV-207 - C201B discharge, 639.6psig	Blocked outlet	Hydrocarbon Vapour	Not Applicable	24,900
A4-7	SV-209, C202 discharge, 165.1psig	Blocked outlet	Hydrocarbon Vapour	Not Applicable	41,200
A4-8	SV-211, T202X, 330.0psig	Single power failure Fire Blocked outlet Reflux failure Abnormal process heat input	Hydrocarbon Vapour	Not Applicable	37,750

Emission point ref. no. (as per flow diagram)	Description	Malfunction which could cause an emission	Emission details (Potential max. emissions)[1]		
			Material	mg/Nm^3	kg/hour
A4-9	SV-215, T204X, 330.0 psig	Single Power Failure Fire Blocked outlet Reflux failure Abnormal process heat input	Hydrocarbon Vapour	Not Applicable	25,600
A4-10	SV217, D215A, 255.3 psig	Fire	Hydrocarbon Vapour	Not Applicable	200
A4-11	SV218, D215B, 255.3 psig	Fire	Hydrocarbon Vapour	Not Applicable	200
A4-12	SV-238, AMR202, 60.0 psig	Failure of automatic controls	Hydrocarbon Vapour	Not Applicable	200
A4-13	SV-239, DR-201A, 165.3 psig	Fire	Hydrocarbon Vapour	Not Applicable	1,500
A4-14	SV-240, DR-201B, 165.3 psig	Fire	Hydrocarbon Vapour	Not Applicable	1,500
A4-15	SV242, C-204A discharge, 255.3 psig	Blocked outlet	Hydrocarbon Vapour	Not Applicable	50
A4-16	SV-243 - C204B discharge, set at 255.3 psig	Blocked outlet	Hydrocarbon Vapour	Not Applicable	50
A4-17	SV247 - T208, set at 274.1 psig	Abnormal process heat input Single power failure Fire Blocked outlet Reflux failure	Hydrocarbon Vapour	Not Applicable	76,400
A4-18	SV-262 - hydrogen supply line, 600.5psig	Blocked outlet	Hydrogen	Not Applicable	100 kg

Emission point ref. no. (as per flow diagram)	Description	Malfunction which could cause an emission	Emission details (Potential max. emissions)[1]		
			Material	mg/Nm^3	kg/hour
A4-19	SV-273, Nitrogen Supply to PERC IBC	Other	Nitrogen	Not Applicable	100
A4-20	SV-301 Protects T-301X and is set at 65.3psig	Single power failure Fire Reflux failure Abnormal process heat input	Hydrocarbon Vapour	Not Applicable	78,100
A4-21	SV401 - T401, set at 30psig	General power failure Partial power failure Single power failure Fire Blocked outlet Failure of automatic controls Reflux failure	Hydrocarbon Vapour	Not Applicable	278,100
A4-22	SV404 - F401X Superheater, set at 150psig	Fire	Hydrocarbon Vapour	Not Applicable	3,000
A4-23	SV-422, E420, 90.1 psig	Thermal Relief	Hydrocarbon Vapour	Not Applicable	50
A4-24	SV-803, T801, 165.3 psig	Other	Hydrocarbon Vapour	Not Applicable	20,850
A4-25	SV-853, T841, 230.55 psig	Other	Hydrocarbon Vapour	Not Applicable	32,600
A4-26	SV-857, T843, 79.75 psig	Other	Hydrocarbon Vapour	Not Applicable	102,350
A4-27	SV201		##	##	#

Emission point ref. no. (as per flow diagram)	Description	Malfunction which could cause an emission	Emission details (Potential max. emissions)[1]		
			Material	mg/Nm^3	kg/hour
A4-28	SV203X	General power failure Single power failure Fire Abnormal process heat input	Hydrocarbon Vapour		87,800
A4-29	PSV-1149B	Vessel overpressure	Steam/water vapour		2280
A4-30	PSV-1149A	Vessel overpressure	Steam/water vapour		2280
A4-31	PSV-1151B	Vessel overpressure	Steam/water vapour		2280
A4-32	PSV-1151A	Vessel overpressure	Steam/water vapour		2280
A4-33	PSV-1154A	Vessel overpressure	Steam/water vapour		2280
A4-34	PSV-1154B	Vessel overpressure	Steam/water vapour		2280
A4-35	Fire pad	Fire Training	Combustion Products	Not Applicable	

1 Estimate the potential maximum emission for each malfunction identified.

E.2 Emissions to Surface Waters

Tables E.2(i) and E.2(ii) should be completed.

A summary list of the emission points, together with maps/drawings (no larger than A3) and supporting documentation should be included as **Attachment No E.2**.

The applicant should address in particular any emission point where the substances listed in the Schedule of S.I. No. 394 of 2004 are emitted.

Details of all List I and List II substances listed in the Annex to EU Directive 76/464/EEC (as amended), contained in any emission must be presented. All surface water runoff and storm water drains discharging to surface water bodies must be included. A National Grid References (12 digit, 6E, 6N) must be given for all discharge points. The identity and type of receiving water (river, ditch, estuary, lake, etc.) must be stated.

For emissions outside the BAT guidance limit, a full evaluation of the existing abatement/treatment system must be provided. A planned programme of improvement towards meeting upgraded standards is required. This should highlight specific goals and a time scale, together with options for modification, upgrading or replacement as required to bring the emissions within the limits as set out in the BAT guidance note(s).

E.2 Emissions to Surface Waters

In terms of emissions from SW-1 the existing licence allows for a maximum discharge volume of 12,000 m3 per day. When the existing concentration limits are applied to this volume it equates to a maximum allowable mass emission for different time periods as shown in the following table.

Table 10: Mass Emissions from SW-1 at Current Licensed Values

Parameter	BOD	COD	Ammonia	SS
Existing Licence Limit SW-1 mg/l	150	450	20	60
Annual equivalent (kg)	657,000	1,971,000	87,600	262,800
Quarterly equivalent (kg)	164,250	492,750	21,900	65,700
Monthly equivalanent (kg)	54,750	164,250	7,300	21,900
Weekly equivalent (kg)	12,635	37,904	1,685	5,054

Emissions of rain water and treated process effluents are treated in the waste water treatment plant and the treated effluent is discharged to the Cork Harbour through a licensed discharge point SW-1. This WWTP has been progressively upgraded between 2005 and 2010 at a total

cost of €6.83 million. These upgrades were installed to address a number of difficulties in meeting some parameters in the period 2004/2005. It involved in particular, upgrades to the control of pH and reducing suspended solids levels, BOD and COD. The discharge is to the open sea in the lower Cork Harbour .

The discharge point SW-1 is shown on Drawing # 9 in Attachment E.2 [8821-1040 SH.4]

A second emission point on Corkbeg was traditionally used to discharge ballast water from ships. However the new generation of oil tankers have on-board facilities to retain ballast water in tanks and the emission point SW-2 is rarely used except for discharging waters used for hydrostatic testing of tanks and occasional ballasts waters.

The refinery operates an Imhoff tank for treatment of domestic sewage on site. This operation was licensed by Cork County Council in 1988 under the Local Government (Water Pollution) Act of 1977. Ref WP (W) 2/88. This licence was submitted as Attachment B-5 in the original IPPC licence application and the location of the discharge is included in Drawing # 8 in Attachment E.2 [8821-1040 SH.3] of the current application.

The plant treats sanitary waste generated by 155 staff and visitors and contractors. In flow terms and BOD terms ConocoPhillips estimates that the discharge is ~ 20 m3 per day and ~ 30 kg/week – this is ~ 4% of the BOD licence limit sought for SW-1 see table below.

Tests on the harbour water column in the vicinity of SW-1 discharge point, conducted on foot of condition of the current licence in 2001, showed that beyond 10 metres of the discharge point the dissolved oxygen content as measured was 98.5% of saturation which meets the propose EQS for DO for coastal water.

In the past SW-2 was used for the primary treatment of ballast waters received from ships at the marine terminal and water from crude oil storage tank bottoms. Nowadays, ConocoPhillips receive ballast water on a very infrequent basis (since modern ships have permanent ballast tanks). In addition to this, tank water bottoms are now pumped for treatment to the site WWTP prior to discharge through SW-1.

In the future, it is envisaged that there will only be discharges through SW-2 emission point when the site is required to emit uncontaminated waters (i.e. clean water from tank hydrostatic testing). These waters will receive primary treatment in the API separator located upstream of SW-2 emission point prior to discharge.

The emissions to surface waters from SW-1 and SW-2 are shown in the following tables.

TABLE E.2(i): EMISSIONS TO SURFACE WATERS (One page for each emission)

Emission Point:

Emission Point Ref. No:	SW-1
Source of Emission:	Site wastewater treatment plants
Location :	See drawing No. 9 – 8821-1040 SH.4
Grid Ref. (12 digit, 6E,6N):	E182596 N63221.2
Name of receiving waters:	Cork Harbour (mouth)
Flow rate in receiving waters:	N/A (Coastal Water) m3.sec^{-1} Dry Weather Flow 0.0557 (discharge) m3.sec^{-1} 95%ile flow
Available waste assimilative capacity:	Cork Lower Harbour

Emission Details:

(i) Volume to be emitted			
Normal/day	1200 m3	Maximum/day	12,000m3
Maximum rate/hour	500 m3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (start-up /shutdown to be included):

Periods of Emission (avg)	60	min/hr	24	hr/day	365	day/yr	

TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : SW-1

Parameter	Prior to treatment				As discharged	
	Max. hourly average (mg/l) Note 1	Max. daily average (mg/l) Note 2	kg/day	kg/year	Max. hourly average (mg/l) Note 1	Max. Daily average (mg/l)
BOD	N/A	240	346	126,144	Not available	150
COD	N/A	270	389	141,910	Not available	261
Suspended Solids	N/A	100	144	52,560	Not available	46
Ammonia (as N)	N/A	40	57.6	21,024	Not available	17
Phosphorous	N/A	10	14.4	5,256	Not available	2.0
Total Nitrogen (as N)	N/A	20	28.8	10,512	Not available	12
Phenol	N/A	7	10.08	3,680	Not available	0.8
Petroleum Hyrdrocarbons	N/A	100	144	52,560	Not available	17
Total heavy metals	N/A	1	1.44	526	Not available	0.18
Arsenic (as As)	N/A	0.01	0.0144	5.26	Not available	0.004
Lead	N/A	0.007	1.0	3.68	Not available	0.0009
mercury	N/A	0.01	1.0	5.26	Not available	0.00009
Cadmium	N/A	0.01	1.0	5.26	Not available	0.0004
Chromium	N/A	0.005	0.0072	2.63	Not available	0.00009
Copper	N/A	1	1.44	526	Not available	0.12
Zinc	N/A	0.5	0.7	263	Not available	0.03
Nickel	N/A	0.5	0.7	263	Not available	0.081

1. Note 1: *Sample methodology of this effluent stream is for an automatic flow proportion sample unit to take a 4 litre sample spread over 24 hours. This gives a daily average sample. There is no sample / analysis done on an hourly basis.*

2. Note 2: *Since feed to the wastewater treatment plants is a combination of effluent from the process units (and ancillaries) and storm water flows (rain falling on site) the "prior to treatment" max daily concentrations of each parameter are those of the effluent from the process units only. That is, they are the "undiluted" concentrations in the feed to the wastewater treatment plants during dry weather periods*

3. *Concentrations measured by means of 24 hour composite samples – hourly variations not available*

TABLE E.2(i): EMISSIONS TO SURFACE WATERS (One page for each emission)

Emission Point Ref. Nº:	SW-2
Source of Emission:	Tank hydrostatic test water & occasional ballast water
Location :	See Drawing No. 9-8821-1040 SH.4
Grid Ref. (12 digit, 6E,6N):	E182903 N63766.3
Name of receiving waters:	Cork Harbour
Flow rate in receiving waters:	Not Applicable (Coastal Water) $m^3.sec^{-1}$ Dry Weather Flow Not Applicable (Coastal Water) $m^3.sec^{-1}$ 95%ile flow
Available waste assimilative capacity:	Not Applicable

Emission Details:

(i) Volume to be emitted			
Normal/day	750 m^3	Maximum/day	6000 m^3
Maximum rate/hour	500 m^3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	60 min/hr 24 hr/day 10 day/yr

TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : SW-2

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l) Note 2	kg/day	kg/year	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year Note 3	
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Periodic use following hydrostatic testing of tanks – sea water or fresh water discharge.

TABLE E.2(i): EMISSIONS TO SURFACE WATERS (One page for each emission)

Emission Point:

Emission Point Ref. No:	SW-3
Source of Emission:	Natural spring on site
Location :	See drawing # 12-8821-1040 SH.3
Grid Ref. (12 digit, 6E,6N):	E 182762 N 62593
Name of receiving waters:	Glenagow (WhiteBay)
Flow rate in receiving waters:	N/A (Coastal Water) m3.sec^{-1} Dry Weather Flow 0.0557 (discharge) m3.sec^{-1} 95%ile flow
Available waste assimilative capacity:	

Emission Details:

(i) Volume to be emitted			
Normal/day	m3	Maximum/day	m3
Maximum rate/hour	m3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (start-up /shutdown to be included):

Periods of Emission (avg)	min/hr	hr/day	day/yr

Generally dry in summer or periods of low rainfall.

TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : SW-3

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l) Note 2	kg/day	kg/year	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year Note 3	

TABLE E.2(i): EMISSIONS TO SURFACE WATERS (One page for each emission)

Emission Point:

Emission Point Ref. No:	SW-4
Source of Emission:	Natural spring
Location :	O Driscoll Drive See Drawing #12 8821-1040 SH.3
Grid Ref. (12 digit, 6E,6N):	E 183320 N 63215
Name of receiving waters:	N/A
Flow rate in receiving waters:	N/A (Coastal Water) m3.sec^{-1} Dry Weather Flow 0.0557 (discharge) m3.sec^{-1} 95%ile flow
Available waste assimilative capacity:	N/A

Emission Details:

(i) Volume to be emitted			
Normal/day	m3	Maximum/day	12,000m3
Maximum rate/hour	m3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (start-up /shutdown to be included):

Periods of Emission (avg)	60	min/hr	24	hr/day	365	day/yr

TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : SW-4

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l) Note 2	kg/day	kg/year	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year Note 3	

TABLE E.2(i): EMISSIONS TO SURFACE WATERS (One page for each emission)

Emission Point:

Emission Point Ref. No:	SW-5
Source of Emission:	Site Sanitary Effluent
Location :	See Drawing # 9 8821-1040 SH.4
Grid Ref. (12 digit, 6E,6N):	E 182903 N 63766
Name of receiving waters:	Lower Cork Harbour (Coastal Water)
Flow rate in receiving waters:	Not Applicable Coastal $m3.sec^{-1}$ Dry Weather Flow Not Applicable Coastal $m3.sec^{-1}$ 95%ile flow
Available waste assimilative capacity:	Infinite

Emission Details:

(i) Volume to be emitted			
Normal/day	15 m3	Maximum/day	~ 20 m3
Maximum rate/hour	m3	~ 1.0	

(ii) Period or periods during which emissions are made or are to be made, including daily or seasonal variations (start-up /shutdown to be included):

Periods of Emission (avg)	60 min/hr 24 hr/day 365 day/yr

Emission point licensed by permit from Cork Council, 1988 - prior to IPPC licensing.

TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : SW-5

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l) Note 2	kg/day	kg/year	Max. hourly average (mg/l) Note 1	Max. daily average (mg/l)	kg/day	kg/year Note 3	
BOD	500 (TBC)	500(TBC)	10	3,650	250 (TBC)	250	5	1825	50% (TBC)

Note 1: Sampling programme in Q4 2011 will provide confirmatory data. NB. BOD load of ~ 5 kg/day is ~ 0.3% of the currently permitted BOD load from SW-1 based on maximum flow rate and 150 mg/l BOD in SW-1 effluent = 1800 kg/day BOD.

E.3 Emissions to Sewer
Tables E.3(i) and E.3(ii) should be completed.

A summary list of the emission points, together with maps and/or drawings (no larger than A3) and supporting documentation should be included as Attachment No E.3. Details of all List I and List II substances listed in the Annex to EU Directive 76/464/EEC (as amended), contained in any emission must be presented. All relevant information on the receiving sewer, including any effluent treatment/abatement systems, not already described, with schematics as appropriate should also be included in **Attachment No E.3**.

For emissions outside BAT guidance limit (where given), a full evaluation of the existing abatement/treatment system must be provided. A planned programme of improvement towards meeting upgraded standards is required. This should highlight specific goals and a time scale, together with options for modification, upgrading or replacement as required to bring the emissions within any limits set out in the BAT guidance note(s).

E.3 Emissions to Sewer

There are no emissions to sewer from the Refinery. As stated previously, sanitary waste from the site is treated onsite in an Imhoff tank with the emission to Cork Harbour licensed by Cork County Council under a Trade Effluent Licence (W.P.(W) 2/88. A copy of this licence is included in Attachment B.5 of this application.

E.4 Emissions to Ground

Describe the existing or proposed arrangements necessary to give effect to Articles 3,4,5,6, and 7 of Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution by certain dangerous substances.

The applicant should supply details of the nature and quality of the substance (agricultural and non-agricultural waste) to be landspread (slurry, effluent, sludges etc) as well as the proposed application rates, periods of application and mode of application (e.g., pipe discharge, tanker).

For emissions outside the BAT guidance limit, a full evaluation of the existing abatement/treatment system must be provided. A planned programme of improvement towards meeting upgraded standards is required. This should highlight specific goals and a time scale, together with options for modification, upgrading or replacement as required to bring the emissions within the limits as set out in the BAT guidance note(s).

E.4 Emissions to Ground

E.4.1 Details of Emissions to Ground

There are no emissions to ground currently or proposed. A programme of borehole monitoring is undertaken on an ongoing basis to check the quality of groundwater under the site and the results submitted to the EPA.

E.4.2 Landspreading

The practice of landspreading of certain wastes on site was discontinued some 10 years ago.

TABLE E.4(i): EMISSIONS TO GROUND (1 Page for each emission point)

Emission Point or Area:

Emission Point/Area Ref. Nº:	Not Applicable
Emission Pathway: (borehole, well, percolation area, soakaway, landspreading, etc.)	Not Applicable
Location :	Not Applicable
Grid Ref. (12 digit, 6E,6N):	Not Applicable
Elevation of discharge: (relative to Ordnance Datum)	Not Applicable
Aquifer classification for receiving groundwater body:	Not Applicable
Groundwater vulnerability assessment (including vulnerability rating):	Not Applicable
Identity and proximity of groundwater sources at risk (wells, springs, etc):	Not Applicable
Identity and proximity of surface water bodies at risk:	Not Applicable

Emission Details:

(i) Volume to be emitted			
Normal/day	Not Applicable m^3	Maximum/day	Not Applicable m^3
Maximum rate/hour	Not Applicable m^3	Not Applicable	Not Applicable

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	___Not Applicable___min/hr __Not Applicable___hr/day __Not Applicable___day/yr

TABLE E.4(ii): EMISSIONS TO GROUND - Characteristics of the emission (1 table per emission point)

Emission point/area reference number: Not Applicable

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year	
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

E.5 Noise Emissions
Give particulars of the source, location, nature, level, and the period or periods during which the noise emissions are made or are to be made.

Table E.5(i) should be completed, as relevant, for each source.

Supporting information should form **Attachment No E.5.**

For emissions outside the EPA Guidance Note for Noise in relation to Scheduled Activities 2nd Edition (2006), a full evaluation of the existing abatement/treatment system must be provided. A planned programme of improvement towards meeting upgraded standards is required. This should highlight specific goals and a time scale, together with options for modification, upgrading or replacement as required to bring the emissions within the limits as set out in the Guidance Note.

E.5 Noise Emissions

ConocoPhillips carry out noise monitoring annually in accordance with Condition 8.3 of the site's current IPPC licence. The survey measures noise levels at five locations both on and off the site, including four Noise Sensitive Locations. The results of the 2011 noise survey are shown in Table 11 while Figure 2 identifies the locations of the Noise Monitoring points.

A copy of the 2011 Noise Monitoring Survey is included in Attachment E.5.

Table 11: Summary of Noise Survey 2011

	Sound Pressure Levels					
	$L(A)_{eq}$		**$L(A)_{10}$**		**$L(A)_{90}$**	
	Daytime	**Night-time**	**Daytime**	**Night-time**	**Daytime**	**Night-time**
Position 1:	47 - 60	46 - 47	48 - 56	46 - 47	43 - 50	44
Position 2:	52 - 59	41 - 44	53 - 62	42 - 44	43 - 44	39 - 40
Position 3:	43 - 47	37 38	46 - 50	39 - 40	36 – 40	34 - 35
Position 4:	54 - 55	54 - 55	55 - 56	53 - 54	52 - 53	52 - 53
Position 5:	50 - 52	44 - 48	53 - 54	45 - 48	45 - 48	43

Noise sensitive locations are located in the vicinity of measurement Positions 1, 2, 3 and 5.

In the results of the survey it was noted that at monitoring locations, 1, 2 and 5, noise from road traffic movements and other sources impacted on the measured LAeq values. During the daytime monitoring periods at Position 3 activities from the oil refinery were perceptible along with other non related noise sources. For the duration of the night-time periods other noise sources were observed as having a noticeable impact on the ambient night-time noise levels. Notwithstanding this both the daytime and night-time noise levels meet compliance with refinery's IPPC noise criteria.

At Position 4 the oil refinery was regarded as the dominant noise source for both the daytime and night-time periods. The daytime and night-time LAeq noise levels were in the order of 54dB to 55dB LAeq. The refinery would meet compliance with its daytime IPPC noise criteria but would exceed the night-time criteria. It should be noted however that this location is not a noise sensitive location.

Figure 2: Location of Noise Monitoring Points

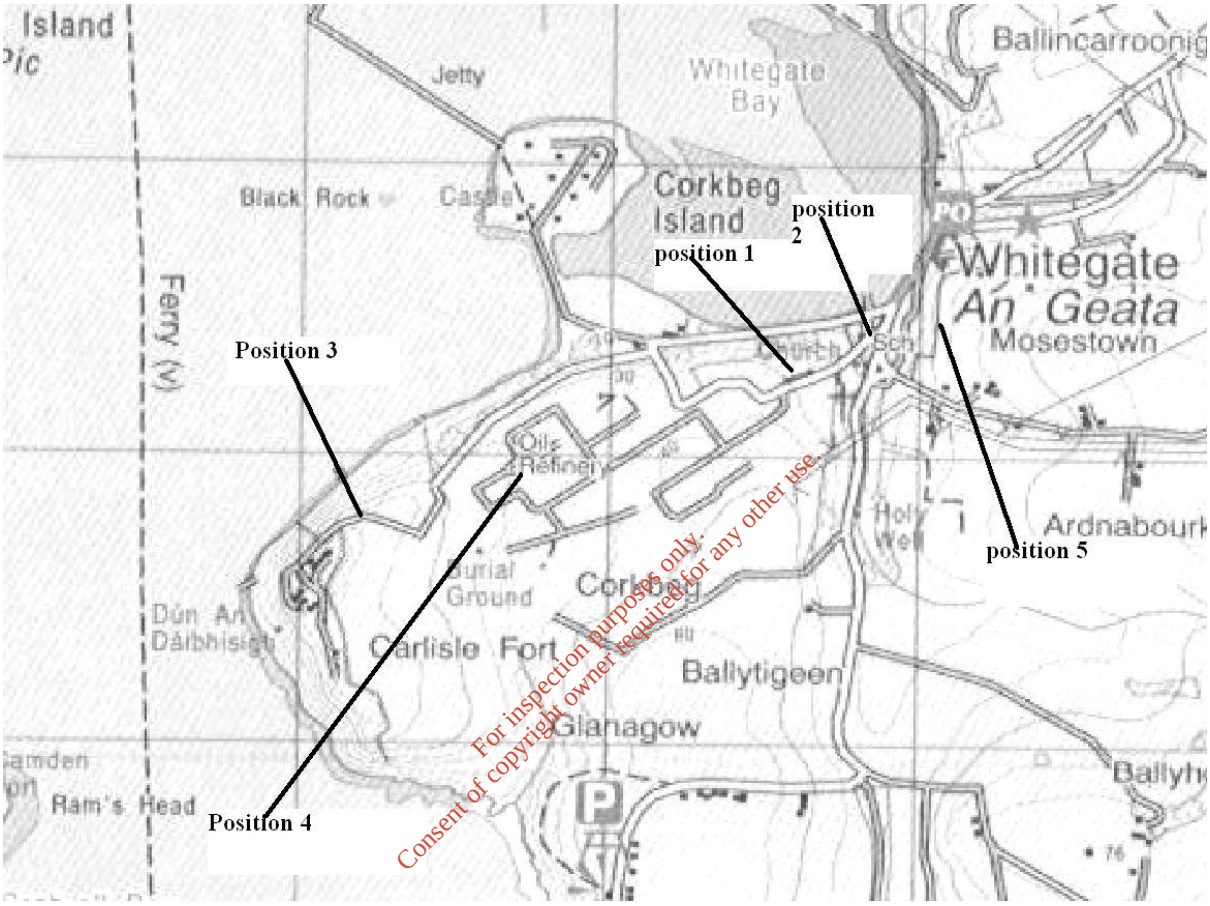

Table E.5 (i) overleaf contains a list of the Main Sources of Noise on-site which consist of furnaces and boilers.

In recent times the Refinery has quantified the noise levels of all equipment on-site for the purposes of compliance with the Safety, Health and Welfare at Work Act 2005. A table of the noise intensity levels observed at a reference distance of 1 meter is included in Attachment E.5.

Table E.5(i): NOISE EMISSIONS - Noise sources summary sheet

Source	Emission point Ref. No	Equipment Ref. No	Sound Pressure1 dBA at reference distance 1 meter	Octave bands (Hz) Sound Pressure1 Levels dB(unweighted) per band									Impulsive or tonal qualities	Periods of Emission
				31.5	63	125	250	500	1K	2K	4K	8K		
Boiler	N1	SG-4	77.8	95	98	100	101	98	97	97	96	96	None	Continuous
Boiler	N2	SG-5*	82.8	99	101	103	105	104	104	98	98	97	None	Continuous
Boiler	N3	SG-6	78.8	94	95	100	99	99	96	95	93	90	None	Continuous
Furnace	N4	F-401	95.2	113	116	114	115	116	115	114	113	110	None	Continuous
Furnace	N5	F-402	89.2	113	114	114	112	115	113	113	112	110	None	Continuous
Furnace	N6	F-201	80.8	99	99	101	103	103	100	98	98	96	None	Continuous
Furnace	N7	F-202AN	77.1	94	97	98	100	103	102	100	97	94	None	Continuous
Furnace	N8	F202BX/CX	82.5	97	98	100	101	102	103	103	100	99	None	Continuous
Furnace	N9	F-203N	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	Continuous
Furnace	N10	F-204	80.4	98	101	102	102	103	100	98	98	95	None	Continuous
Furnace	N11	F-206/7	96.1	98	100	101	103	106	102	99	97	97	None	Continuous
Furnace	N12	F-501	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data	None	Continuous
Furnace	N13	F-801/2	81.7	95	97	98	100	103.0	100	98	99	95	None	Continuous
Furnace	N14	F-901	77.3	97	99	100	103	102	100	100	98	96	None	Continuous

E.6 Tabular Data on Emission Points

Applicants should submit the following information for each emission point:

Point Code	Point Type	Easting	Northing	Verified	Emission
Provide label ID's assigned in section E	A=Atmospheric SW=Surface Water SE = Sewer GW=Groundwater N = Noise SL=Soil/Ground WS=Waste	6E-digit GPS Irish National Grid Reference	6N-digit GPS Irish National Grid Reference	Y = GPS used N = GPS not used	e.g. SO_2, HCl, NH_3

An individual record (i.e. row) is required for each emission point. Acceptable file formats include Excel, Access or other upon agreement with the Agency. A standard Excel template can be downloaded from the EPA website at www.epa.ie. This data should be submitted to the Agency on a separate CD-Rom containing sections B.2, E.6 and F.3.

E.6 Tabular Data on Emission Points

Table 12 lists the emission pointes identified in Sections E.1 to E.5. This data is included in a separate MS Excel file, based upon the Agency's template. A copy of the MS Excel file, together with Sections B.2, E.6 and F.3 of this application, is included in a separate CD-ROM to this application.

Table 12: Emission Points

Point Code	Point Type	Easting	Northing	Verified	Emission
Provide label ID's assigned in section E	A=Atmospheric SW=Surface Water SE = Sewer GW=Groundwater N = Noise SL=Soil/Ground WS=Waste	6E-digit GPS Irish National Grid Reference	6N-digit GPS Irish National Grid Reference	Y = GPS used N = GPS not used	e.g. SO_2, HCl, NH_3
A1-1	Atmospheric	183107	62995	Y	SO_2, NO_X, other products of combustion
A1-2	Atmospheric	183083	62954	Y	SO_2, NO_X, other products of combustion
A1-3	Atmospheric	183091	62924	Y	SO_2, NO_X, other products of combustion
A2-1	Atmospheric	183107	63060	Y	SO_2, NO_X, other products of combustion

Point Code	Point Type	Easting	Northing	Verified	Emission
A2-2	Atmospheric	183083	63078	Y	SO_2, NO_X, other products of combustion
A2-3	Atmospheric	183091	63091	Y	SO_2, NO_X, other products of combustion
A2-4	Atmospheric	183188	63105	Y	SO_2, NO_X, other products of combustion
A2-5	Atmospheric	183211	63110	Y	SO_2, NO_X, other products of combustion
A2-6	Atmospheric	183233	63118	Y	SO_2, NO_X, other products of combustion
A2-7	Atmospheric	183253	63124	Y	SO_2, NO_X, other products of combustion
A2-8	Atmospheric	183261	63136	Y	SO_2, NO_X, other products of combustion
A2-9	Atmospheric	183272	63126	Y	SO_2, NO_X, other products of combustion
A2-10	Atmospheric	183281	63116	Y	SO_2, NO_X, other products of combustion
A2-11	Atmospheric	183293	63046	Y	SO_2, NO_X, other products of combustion
A2-12	Atmospheric	183302	63043	Y	SO_2, NO_X, other products of combustion
A2-13	Atmospheric	183167	63036	Y	SO_2, NO_X, other products of combustion
A2-14	Atmospheric	183368	63048	Y	SO_2, NO_X, other products of combustion
A2-15	Atmospheric	183258	62841	Y	H_2S, SO_2, NO_X, other products of combustion
A2-16	Atmospheric	183263	62806	Y	H_2S, SO_2, NO_X, other products of combustion
A2-17	Atmospheric	183256	62806	Y	H_2S, SO_2, NO_X, other products of combustion
A2-18	Atmospheric	183383	62845	Y	H_2SO_4, SO_2, NO_X
A3-1	Atmospheric	183286	63105	Y	Nitrogen
A3-2	Atmospheric	182782	63790	Y	SO_2, NO_X, other products of combustion
A3-3	Atmospheric	183130	62966	Y	SO_2, NO_X, other products of combustion

Point Code	Point Type	Easting	Northing	Verified	Emission
A3-4	Atmospheric	183113	62954	Y	SO_2, NO_X, other products of combustion
A3-5	Atmospheric	183295	62973	Y	SO_2, NO_X, other products of combustion
A3-6	Atmospheric	183528	63088	Y	SO_2, NO_X, other products of combustion
A3-7	Atmospheric	183523	63153	Y	SO_2, NO_X, other products of combustion
A3-8	Atmospheric	183395	63082	Y	SO_2, NO_X, other products of combustion
A3-9	Atmospheric	183034	62942	Y	SO_2, NO_X, other products of combustion
A3-10	Atmospheric	183118	63016	Y	SO_2, NO_X, other products of combustion
A3-11	Atmospheric	183510	63136	Y	SO_2, NO_X, other products of combustion
A3-12	Atmospheric	183488	63048	Y	SO_2, NO_X, other products of combustion
A3-13	Atmospheric	183498	63032	Y	SO_2, NO_X, other products of combustion
A3-14	Atmospheric	182758	62945	Y	Hydrocarbon vapours
A3-15	Atmospheric	182826	62923	Y	Hydrocarbon vapours
A3-16	Atmospheric	183249	62883	Y	FAME
A3-17	Atmospheric	183210	62856	Y	Hydrocarbon vapours
A3-18	Atmospheric	183022	63153	Y	Hydrocarbon vapours
A3-19	Atmospheric	182985	63128	Y	Hydrocarbon vapours
A3-20	Atmospheric	182933	63093	Y	Hydrocarbon vapours
A3-21	Atmospheric	182909	63132	Y	Hydrocarbon vapours
A3-22	Atmospheric	182846	62927	Y	Hydrocarbon vapours
A3-23	Atmospheric	182778	62880	Y	Hydrocarbon vapours
A3-24	Atmospheric	182677	62897	Y	Hydrocarbon vapours
A3-25	Atmospheric	182627	62863	Y	Hydrocarbon vapours
A3-26	Atmospheric	183143	62786	Y	Hydrocarbon vapours

Point Code	Point Type	Easting	Northing	Verified	Emission
A3-27	Atmospheric	182686	62819	Y	Hydrocarbon vapours
A3-28	Atmospheric	183318	62869	Y	Hydrocarbon vapours
A3-29	Atmospheric	183289	62910	Y	Hydrocarbon vapours
A3-30	Atmospheric	183044	63027	Y	Hydrocarbon vapours
A3-31	Atmospheric	183259	62828	Y	Hydrocarbon vapours
A3-32	Atmospheric	183273	62838	Y	Hydrocarbon vapours
A3-33	Atmospheric	183154	63013	Y	Hydrocarbon vapours
A3-34	Atmospheric	182818	63799	Y	Hydrocarbon vapours
A3-35	Atmospheric	182854	63803	Y	Hydrocarbon vapours
A3-36	Atmospheric	182854	63803	Y	Hydrocarbon vapours
A3-37	Atmospheric	182683	63853	Y	Hydrocarbon vapours
A3-38	Atmospheric	183372	63209	Y	Hydrocarbon vapours
A3-39	Atmospheric	183377	63212	Y	Hydrocarbon vapours
A4-1.	Atmospheric	183078	62962	Y	SO_2, NO_X, other products of combustion
A4-2	Atmospheric	183276	63064	Y	Hydrocarbon vapours
A4-3	Atmospheric	183270	63064	Y	Hydrocarbon vapours
A4-4	Atmospheric	183270	63064	Y	Hydrocarbon vapours
A4-5	Atmospheric	183270	63064	Y	Hydrocarbon vapours
A4-6	Atmospheric	183270	63064	Y	Hydrocarbon vapours
A4-7	Atmospheric	183256	63050	Y	Hydrocarbon vapours
A4-8	Atmospheric	183309	63005	Y	Hydrocarbon vapours
A4-9	Atmospheric	183311	63003	Y	Hydrocarbon vapours
A4-10	Atmospheric	183247	63051	Y	Hydrocarbon vapours
A4-11	Atmospheric	183245	63049	Y	Hydrocarbon vapours
A4-12	Atmospheric	183263	63043	Y	Hydrocarbon vapours

Point Code	Point Type	Easting	Northing	Verified	Emission
A4-13	Atmospheric	183245	63049	Y	Hydrocarbon vapours
A4-14	Atmospheric	183247	63051	Y	Hydrocarbon vapours
A4-15	Atmospheric	183247	63043	Y	Hydrocarbon vapours
A4-16	Atmospheric	183249	63040	Y	Hydrocarbon vapours
A4-17	Atmospheric	183300	63095	Y	Hydrogen
A4-18	Atmospheric	183317	63143	Y	Nitrogen
A4-19	Atmospheric	183310	63102	Y	Hydrocarbon vapours
A4-20	Atmospheric	183240	62961	Y	Hydrocarbon vapours
A4-21	Atmospheric	183192	63038	Y	Hydrocarbon vapours
A4-22	Atmospheric	183192	63066	Y	Hydrocarbon vapours
A4-23	Atmospheric	183206	62798	Y	Hydrocarbon vapours
A4-24	Atmospheric	183130	63146	Y	Hydrocarbon vapours
A4-25	Atmospheric	183108	63095	Y	Hydrocarbon vapours
A4-26	Atmospheric	183112	63097	Y	Hydrocarbon vapours
A4-27	Atmospheric	183272	63064	Y	N. Gas
A4-28	Atmospheric	183273	63067	Y	Hydrocarbon vapours
A4-29	Atmospheric	183113	62858	Y	Steam/water vapour
A4-30	Atmospheric	183112	62859	Y	Steam/water vapour
A4-31	Atmospheric	183110	62861	Y	Steam/water vapour
A4-32	Atmospheric	183109	62862	Y	Steam/water vapour
A4-33	Atmospheric	183108	62864	Y	Steam/water vapour
A4-34	Atmospheric	183107	62864	Y	Steam/water vapour
A4-35	Atmospheric	182831	62775	Y	Steam/water vapour
SW-1	Surface Water	182596	63221	Y	Treated process effluent water
SW-2	Surface Water	182903	63766	Y	Seawater/fresh water
SW-5	Surface Water	182729	63349	Y	Treated sanitary effluent

SECTION F: CONTROL & MONITORING

Describe the proposed technology and other techniques for preventing or, where this is not possible, reducing emissions from the installation/facility.

F.1 Treatment, Abatement and Control Systems
Details of treatment/abatement systems (air and effluent emissions) should be included, together with schematics as appropriate.

For each Emission Point identified complete Table F.1(i) and include detailed descriptions and schematics of all abatement systems.

Attachment No F.1 should contain any supporting information.

F.1 Treatment, Abatement and Control Systems

F.1.1 Emissions to Atmosphere

The main emissions points are those of boilers and furnaces as can be seen from the table of emission points. There is no abatement of the emissions from these combustion sources. There are combustion controls in place which include, fuel metering and oxygen trim control on all furnaces and boilers. There are low NOx burners fitted to all furnaces.

The existing SRU plant and the ASA plant are designed to treat the refinery fuel gases containing H_2S to make it suitable for use as a combustion fuel by reducing / controlling SO_2 emissions in the various furnaces which use refinery fuel gas. The flow diagrams for the amine absorbtion and desorbtion processes (amine plant) and the wet sulphuric acid plants are included in Attachment F.1.

As part of the Haldor Topsoe sulphuric acid plant there is a selective catalytic reduction (SCR) unit to remove NOx from the sulphur bearing gas streams prior to the conversion to sulphuric acid. This unit prevents the NOx in the gas stream from being absorbed into the sulphuric acid product. The main purpose of this unit (SCR is normally used for abatement) is to prevent the NOx dissolving in the acid and impairing its clarity - which is a requirement of consumers of the acid product.

The ASA plant will be operated to control the acid mist content in the exit from the clean stack using a continuous opacity meter. This stack will be 30 metres high and the exit temperature will be 190 ^{0}C.

F.1.2 Emissions to Surface Water

Emissions from SW-1

Surface water emissions from SW-1 consist of treated storm-water run-off and process effluent from the site Waste Water Treatment Plant (WWTP). A Copy of the treatment plant schematic is provided as Attachment F.1.

This treated effluent is discharged to the Lower Cork Harbour through a licensed discharge point SW-1. The discharge is to the open sea in the lower Cork Harbour. The discharge point is shown in Drawing No. 9 [8821-1040 SH.4] in Attachment E.2. The WWTP has been progressively upgraded between 2005 and 2010 at a total cost of €6.83 million. These upgrades were installed to address difficulties in meeting some parameters during the period 2004 to 2005 in particular pH. It involved in particular, upgrades to the control pH and reducing suspended solids levels, BOD and COD.

In the EPA BAT Guidance note on Mineral Oil and Gas Refineries, the following unit processes are listed as components of BAT for waste water treatment:

1. Segregation of storm water and process effluent
2. Minimising water use at source
3. Use of buffer tanks to smooth out flows to the WWTP
4. Ongoing programmes to minimise the volumes of waste water to be treated
5. API Separators to skim off oil from the effluent prior to biological treatment
6. Use of DAF (dissolved air flotation) to aid solids removal
7. Use of biological treatment stage to reduce the oxygen demand of the final discharge
8. Use of final polishing steps.

BAT is to have segregated collection and treatment systems for rainwater and process effluents. However, as the refinery was constructed in the late 1950s and the drainage systems and process units have developed progressively since then, the segregation of rainwater and process effluents is not a practical option for Whitegate.

The refinery has recently upgraded the plant to treat process effluents and storm water in combination. There is an upper limit placed on the maximum quantity of storm water which can be sent through the WWTP at any time to ensure process effluents are adequately treated. This is controlled automatically.

The current licence sets limits for the parameters shown in Table 13. In 2009 and 2010 there were no exceedances of these limits but neither were the emission concentrations for individual parameters so low as to suggest that significantly lower limits should be set.

Table 13: Current Licence Parameters for Surface Water Emission Point SW-1 & 2010 Emission Concetrations

Parameter	Unit	Licensed level	Q1 average	Q2 average	Q3 Average	Q4 average
pH	pH unit	6.0 – 9.0	7.2	7.2	7.3	7.1
Sus. Solids	mg/l	60	15.6	10.3	7.3	4
Hydrocarbons	mg/l	50	4	6.1	4.8	5.7
BOD	mg/l	150	78.6	52.6	22.33	79.5
COD	mg/l	450	135.33	111.0	81.33	115.0
TDS	mg/l	---	---	---	---	---
Ammonia	mg/l	20	12.26	5.9	8.6	1.8
Phenols	mg/l	1	0.143	0.208	0.234	0.119
Hg	mg/l	1	0.00012	0.0002	0.0001	0.0001
Cd	mg/l	0.05	0.0004	0.0004	0.0004	0.0002
Zn	mg/l	0.5	0.039	0.056	0.049	0.056
Total heavy metals	mg/l	1	0.233	0.080	0.015	0.03

Reducing water usage at source vs effluent concentration levels

In considering BAT for effluent treatment, the Agency should note that Whitegate refinery has one of the lowest volumetric discharges of waste water per tonne of crude processed in Europe. A recent study by Concawe indicates that in surveys of European refineries (conducted in 2005 and 2008) the average effluent emission was in the range of 1.4 to 1.5 m^3 of process effluent per tonne of crude oil processed.

The volume of water discharged from SW-1 in 2010 was circa 620,000 m^3 or 0.2 m^3 per tonne of crude. It should be noted that this volume also includes the rainwater volumes that are sent to the WWTP. This volume at Whitegate is approximately 7 times lower than the average at refineries in Europe. In the EPA BAT Guideline it is stated that the maximum range of water discharges may reach as much as 5 tonnes of water per tonne of crude processed.

From above, it can be seen that Whitegate is at the very low end of water consumption per tonne of crude processed. In considering the proposed ELVs in the following tables, the Agency should note that the annual mass emissions of constituents of the effluent at Whitegate are in many cases more than one order of magnitude lower than the licensed mass emission (calculated from the maximum allowable flow rate of 12,000 m^3/day and the concentration limits as specified in the current IPPC licence).

When considering BAT, and in reviewing the actual measured concentrations from the WWTP, ConocoPhillips has normalised the actual volumetric discharges per tonne of crude oil processed to compare mass emissions at the existing limit e.g. BOD limit of 150 mg/l with refineries in Europe. The Whitegate effluent limit would equate in BOD mass emissions per tonne of crude throughput to the average volume of effluent in Europe at a concentration of ~ 21 mg/l BOD for the higher volumetric discharges from typical European refineries based on the Concawe findings.

To account for operational fluctuations, ConocoPhillips suggest the following concentration limits for emission point SW-1 for consideration by the Agency:

Table 14: Proposed ELVs and sampling frequency

Parameter	Unit	Monthly Average of 4 weekly samples	Quarterly Average of 13 weekly samples	Annual Average of 52 weekly samples
BOD	mg/l	175	150	140
COD	mg/l	525	450	420
Ammonia	mg/l	20	15	10
Suspended Solids	mg/l	60	50	40

ConocoPhillips further proposes that monthly samples for phenols, heavy metals etc will not be subject to any averaging times i.e. all monthly samples should continue to comply with the ELVs as set in the current licence for 100% of the samples.

Comparison of Annual Emissions with Licensed Quantities

The current concentration limits when applied to the current maximum daily volume in the licence equate to an annual mass emission limits in column 3 of the table below.

Table 15: Summary of 2010 Emissions against ELV (on a Mass Emission Basis)

Parameter	Unit	Licensed level (Max volume per day multiplied by ELV concentrations)	2010 Total	Whitegate Actual Mass Emissions as % of annual mass emission
Volume	m^3	4, 380, 000	619,594	14%
pH	pH unit	6.0 – 9.0	7.2	n/a
Suspended Solids	kg	262,800	6,083	2.3%
Hydrocarbons	kg	219,000	3,160	1.44%
BOD	kg	657,000	34,923	5.3%
COD	kg	1,971,000	68,279	3.46%
Total Dissolved Solids	kg	---	---	
Ammonia	kg	87,600	4,726	5.39%
Phenols	kg	4, 380	<112	< 2.5%
Hg	kg	43.8	<0.084	0.2%
Cd	kg	219	<0.023	0.01%
Zn	kg	2,190	<3.61	0.16
Total heavy metals	kg	4,380	<24.78	0.57%

As can be seen from **Table 15** there is no risk that the annual allowable mass emissions which may be discharged in compliance with the current licence would be exceeded based on the 2010 results.

As indicated elsewhere in the application, normal fluctuations in operating conditions mean that emissions vary. Notwithstanding this, the quarterly average concentrations of weekly samples are in full compliance with the emissions limits set by the EPA.

Under the Environmental Objectives (Surface Waters) Regulations, ConocoPhillips will be conducting a sampling programme in the water column in the lower Cork Harbour in the vicinity of SW-1 discharge in Q4 2011. The parameters to be monitored, as agreed with the Agency in August 2011 are: BOD, DO and DIN.

Based on the findings of sampling conducted in 2001[6] ConocoPhillips does not expect to observe any oxygen depletion from the effluent.

Emissions from SW-2

A second emission point on Corkbeg was traditionally used to discharge ballast water from ships, during a time when it was commonplace for ships to store ballast water in their product tanks and cross contamination would occur. Nowadays most modern oil tankers have dedicated ballast water tanks on board and so the storage of ballast is segregated from

[6] The samples taken in 2001 showed that at sample points located at 10, 100 and 500 metres from the SW-1 outfall, the percentage of oxygen saturation was between 98 – 99% at all points. This is comfortably within the limits for oxygen saturation for coastal waters in the Environmental Quality Objectives Regulations for Coastal Waters at the high salinity levels as measured.

product and no cross contamination can occur. The emission point SW-2 is rarely used except for discharging waters used for hydrostatic testing of tanks and, on rare occasions, ballasts waters from older ships.

Emissions from SW-5

Emissions from SW-5 consist of site sanitary waste which has been treated in the site Imhoff Tank. The Imhoff Tank has been in operation since the Refinery commenced operations in 1959 and was licensed by Cork County Council in 1988 under the Local Government (Water Pollution) Act of 1977 (Licence Ref: WP (W) 2/88). A copy of this licence is included in Attachment B5.

The Imhoff Tank treats sanitary waste generated on the site by 155 staff, visitors and contractors. ConocoPhillips estimates that the discharge to SW-5 is in the region of 20m^3 per day with a BOD load of less than 10 kg per day. Based on these estimates, the BOD emission from SW-5 corresponds to approximately 2% of the BOD licence limit for SW-1 (see table below).

Tests on the harbour water column in the vicinity of SW-1 discharge point conducted in 2001 on foot of a condition of the existing licence showed that beyond 10 metres of the discharge point the dissolved oxygen content measures as 98.5% saturation i.e. meets the proposes EQS for percentage of oxygen saturation for coastal waters.

Table 16 below shows the results of microbiological testing commissioned by ConocoPhillips and conducted on receiving waters at Corkbeg beach in 2006. Two samples were tested for Escherichia Coli (E-Coli) and Enterococci. Although this area of Cork Harbour is a not an officially registered bathing area under the Bathing Water Directive, the assessment values from the Bathing Water Quality Regulations 2008 are included in the table below for comparison with the findings of the ConocoPhillips sampling.

Table 16: Results from 2006 Sampling of Waters at Corkbeg Beach

Parameter	**Sample 1**	**Sample 2**	**Assessment Values Bathing Water Quality Regulations 2008**		
			Excellent Quality	Good Quality	Sufficient
Total Coliform Count - Colilert	517	488	Not an applicable requirement under 2008 Regs		
E. Coli Count – Colilert	86	49	250*	500*	500**
Enterocci (intestinal) water (CFU/100mls	48	54	100*	200*	185**

(*) based upon a 95% percentile evaluation
(**) based on a 90% percentile evaluation.

The discharge point for SW-5 is less than 20 metres from Corkbeg Beach.

These results suggest that, were the waters being monitored as a designated bathing area by Cork County Council, the water would qualify as “excellent” status according to the parameters in the 2006 Directive if the provisions of Annex II were applied for the classification of a designated bathing area.

As part of ConocoPhillips evaluation of emissions to surface water in the context of the new Environmental Objectives (Surface Water) Regulations 2009, sampling of the outflow of SW-5 is scheduled to take place in September 2011. The results of these tests will be made available to the Agency.

There will also be surveys of oxygen saturation levels, BOD, DIN and other parameters agreed with the Agency. These are planned to be carried out during September/October 2011 at distances of 10, 50 and 100 metres from the SW-1 outfall.

F.1.3 Emissions to Sewer

There are no emissions to sewer from the activities carried out at the site and therefore treatment, abatement and control systems are not applicable.

F.1.4 Emissions to Ground

There are no emissions to ground from the activities carried out at the site and therefore treatment, abatement and control systems are not applicable.

TABLE F.1(I): ABATEMENT/TREATMENT CONTROL

Emission point reference number : A2-18

Control[1] parameter	Equipment [2]	Equipment maintenance	Equipment calibration	Equipment back-up
SO_2	ASA plant - acid conversion stage. Design of Haldor Topsoe acid plant reduces SO2 emission based on minimum recovery of 99.5% of sulphur in feed gases.	High online time guaranteed – 2 week maintenance shutdown of unit every 2 years.	As per refinery maintenance / calibration schedule	None, ASA plant shuts down and emissions cease in the event of a malfunction. Process unit throughputs adjusted to minimise site wide emissions of SO2 emissions in event of unplanned ASA plant shutdown.
NOx	ASA plant SCR for controlling product colour	This is a small vessel containing a catalyst. There are no moving parts and no chemical additions. The Catalysts is replaced when required as indicated by acid product quality.	As per refinery maintenance / calibration schedule	None, ASA plant shuts down and emissions cease in the event of a malfunction.
H2SO4	ASA plant for sulphuric acid production. Entire plant design and 99.5% sulphur recovery ensures losses of H2SO4 to stack are minimised	High online time guaranteed – 2 week maintenance shutdown of unit every 2 years. Acid mist emissions monitored by opacity meter	As per refinery maintenance / calibration schedule	None, ASA plant shuts down, no H_2SO_4 is formed and acid emissions cease in the event of a malfunction.

Control[1] parameter	Monitoring to be carried out[3]	Monitoring equipment	Monitoring equipment calibration
SO_2	Stack sampling biannually as per other stacks on site	Whitegate stack gas sampler	As per refinery maintenance / calibration schedule
Nox	Stack sampling biannually as per other stacks on site	Whitegate stack gas sampler	As per refinery maintenance / calibration schedule
	Continuous Nox monitoring within process for acid quality		
H2SO4	Opacity measurement measures acid mist concentration.		As per refinery maintenance / calibration schedule
	Stack sampling biannually as per other stacks on site	Whitegate stack gas sampler	

[1] List the operating parameters of the treatment/abatement system which control its function.
[2] List the equipment necessary for the proper function of the abatement/treatment system.
[3] List the monitoring of the control parameter to be carried out.

F.2 Emissions Monitoring and Sampling Points
Identify monitoring and sampling points and outline proposals for monitoring emissions. Table F.2(i) should be completed (where relevant) for air emissions, for emissions to surface waters, for emissions to sewers, for emissions to ground, and for waste emissions. Where ambient environment monitoring is carried out or proposed, Table F.2(ii) should be completed as relevant for each environmental medium.

Include details of monitoring/sampling locations and methods.

Attachment No F.2 should contain any supporting information.

F.2 Emissions Monitoring and Sampling Points

The emissions monitoring and sampling points proposed by ConocoPhillips are listed in Table F.2(i). These monitoring and sampling points relate to emissions to atmosphere and emissions to surface water; there are no emissions to sewer and no proposed monitoring for emissions to ground (refer also to Section E.4). In addition, ConocoPhillips proposes to undertake ambient environmental monitoring in respect of sulphur dioxide, nitrogen oxides and noise at the locations listed in Table F.2(ii).

F.2.1 Emissions to Atmosphere

ConocoPhillips plans to continue its existing programme for monitoring its emissions to atmosphere, to surface water and for the monitoring of noise emissions.

- Monitoring of emissions to atmosphere is conducted using a combination of a quantitative surrogate approach and mass balance (as set out in the BAT Reference Document on the General Principles of Monitoring). This monitoring approach has been applied since the licence was granted in 2000. The current surrogate approach will be updated to take account of the impact of the ASA plant on the other process units at the site.

- Biannual stack monitoring for oxides of nitrogen (NO_X), sulphur dioxide (SO_2) and carbon monoxide (CO).

- Continuous monitoring of the acid mist from the clean gas stack (A2-18) on the ASA plant.

Monitoring of emissions of ammonia from the SRU will cease following commencement of operation of the ASA plant and decommissioning of the SRU.

Monitoring of emissions to atmosphere is carried out by the Refinery's laboratory, which is accredited to the international standard ISO 17025 *General Requirements for the Competence of Testing and Calibration Laboratories*. Monitoring and analysis is also undertaken by a variety of Third Party contractors, who carry out the monitoring in accordance with relevant international standards and guidance documents published by the Agency.

Drawings 10 and 11in Attachment F.2 to this application identifies the locations of the monitoring points for emissions to atmosphere.

F.2.2 Emissions to Surface Water

ConocoPhillips plans to continue its existing programme for monitoring its emissions to surface water as follows.

- Continuous monitoring of flow and pH from the WWTP to surface water at SW-1.
- Weekly monitoring of emissions to surface water at SW-1 of pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, ammonia and oil.
- Monthly monitoring of emissions to surface water at SW-1 of phenols and heavy metals.
- Annual monitoring of emissions to surface water at SW-1 for toxicity and VOC concentrations..
- Daily visual inspection for clarity and odour of discharges to surface water at SW-1.
- Grab sampling and visual inspection of discharges to surface water at SW-2, as required; this discharge point is only in operation following hydrostatic testing of storage tanks and discharge of the test water to Cork Harbour.
- Monthly monitoring of emissions of surface water at SW-3 and SW-4 (the two natural springs on site) for pH, BOD, ammonia, nitrogen, conductivity and Total Petroleum Hydrocarbons, and a visual inspection for colour and odour.
- Weekly visual inspection of the discharge from the Imhoff tank at SW-5.

F.2.3 Emissions to Sewer

This section is not applicable to the site as there are no emissions to sewer.

F.2.4 Emissions to Ground

This section is not applicable to the site as there are no emissions to ground.

Groundwater monitoring at the existing borehole locations.

The extent of this groundwater monitoring programme is reviewed on a routine basis taken into account the results and the trend analysis and any proposed changes to this programme would be agreed with the Agency in advance.

F.2.5 Noise Emissions

ConocoPhillips proposes to undertake ambient noise monitoring at the five locations shown on in Figure 2 in Section E.5 of this application on an annual basis, as set out in Table F.2(ii).

These monitoring locations are located adjacent to the boundary of the site and include three Noise Sensitive Locations. All five locations have been used in previous noise surveys, including the most recent survey carried out in May 2011.

Noise monitoring will continue to be carried out in accordance with the Agency's *Guidance Note for Noise in Relation to Scheduled Activities*. The standards to which the monitoring will be carried out are set out in Table 17, subject to the methods and procedures adopted by the noise monitoring contractor carrying out the survey on behalf of ConocoPhillips.

There have been no complaints of noise made to ConocoPhillips.

Table 17: Standards for Noise Monitoring

Standard	Title
ISO 1996-1:2003	Acoustics: Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures.
ISO 1996-2:2007	Acoustics: Description, measurement and assessment of environmental noise. Part 2: Determination of environmental noise levels.

TABLE F.2(i) : EMISSIONS MONITORING AND SAMPLING POINTS (1 table per monitoring point)

Emission Point Reference No. : ***A1-1to A1-3***

Parameter	Monitoring frequency	Accessibility of Sampling Points	Sampling method	Analysis method/ technique
NOx	Biannual		Flue gas sampler	On site accredited Laboratory
SOx	Biannual		Flue gas sampler	On site accredited Laboratory
CO	Biannual		Flue gas sampler	On site accredited Laboratory

Emission Point Reference No. : ***A2-1to A2-11 Furnaces***

Parameter	Monitoring frequency	Accessibility of Sampling Points	Sampling method	Analysis method/ technique
NOx	Biannual		Flue gas sampler	On site accredited Laboratory
SOx	Biannual		Flue gas sampler	On site accredited Laboratory
CO	Biannual		Flue gas sampler	On site accredited Laboratory

Emission Point Reference No. : A2-18 ASA Clean Gas Stack

Parameter	Monitoring frequency	Accessibility of Sampling Points	Sampling method	Analysis method/ technique
NOx	Biannual		Grab Sampling	On site accredited Laboratory
SOx	Biannual		Grab Sampling	On site accredited Laboratory
CO	Biannual		Grab Sampling	On site accredited Laboratory
H2SO4	Biannual		Grab Sampling	On site accredited Laboratory
H2SO4	Continous		Continuous monitor	Opacity Metering

TABLE F.2(ii): AMBIENT ENVIRONMENT MONITORING AND SAMPLING POINTS (1 table per monitoring point)

Monitoring Point Reference No: ***AA-1***

Parameter	Monitoring frequency	Accessibility of Sampling point	Sampling method	Analysis method/technique
SOx, NOx	Daily	At grade at boundary of Site	24-hour composite	Continuous sampler

Monitoring Point Reference No: AA-2

Parameter	Monitoring frequency	Accessibility of Sampling point	Sampling method	Analysis method/technique
SOx, NOx	Daily	At grade in Whitegate Village	24-hour composite	Continuous sampler

F.3 Tabular Data on Monitoring and Sampling Points

Applicants should submit the following information for each monitoring and sampling point:

Point Code	Point Type	Easting	Northing	Verified	Pollutant
Provide label ID's assigned in section F3	M=Monitoring S=Sampling	6E-digit GPS Irish National Grid Reference	6N-digit GPS Irish National Grid Reference	Y = GPS used N = GPS not used	e.g. SO_2, HCl, NH_3

An individual record (i.e. row) is required for each monitoring and sampling point. Acceptable file formats include Excel, Access or other upon agreement with the Agency. A standard Excel template can be downloaded from the EPA website at www.epa.ie. This data should be submitted to the Agency on a separate CD-Rom containing sections B.2, E.6 and F.3.

Point source monitoring/sampling refers to monitoring from specific emission points (e.g. from a boiler stack or outlet from a wastewater treatment plant). Examples of ambient monitoring includes monitoring of ambient air quality (e.g. boundary or off-site) or monitoring of river quality upstream/downstream of an effluent discharge.

F.3 Tabular Data on Monitoring and Sampling Points

Table 18:

Point Code	Point Type	Easting	Northing	Verified	Pollutant
Provide label ID's assigned in section F3	M=Monitoring S=Sampling	6E-digit GPS Irish National Grid Reference	6N-digit GPS Irish National Grid Reference	Y = GPS used N = GPS not used	e.g. SO_2, HCl, NH_3
Point Code	**Point Type**	**Easting**	**Northing**	**Verified**	**Pollutant**
A1-1	M	183107	62995	Y	SOx, NOx,CO
A1-2	M	183083	62954	Y	SOx, NOx,CO
A1-3	M	183091	62924	Y	SOx, NOx,CO
A2-1	M	183188	63060	Y	SOx, NOx,CO
A2-2	M	183211	63078	Y	SOx, NOx,CO
A2-3	M	183233	63091	Y	SOx, NOx,CO
A2-4	M	183253	63105	Y	SOx, NOx,CO
A2-5	M	183261	63110	Y	SOx, NOx,CO
A2-6	M	183272	63118	Y	SOx, NOx,CO
A2-7	M	183281	63124	Y	SOx, NOx,CO
A2-8	M	183293	63136	Y	SOx, NOx,CO
A2-9	M	183302	63126	Y	SOx, NOx,CO
A2-10	M	183167	63116	Y	SOx, NOx,CO
A2-11	M	183368	63046	Y	SOx, NOx,CO
A2-12	M	183258	63043	Y	SOx, NOx,CO
A2-13	M	183263	63036	Y	SOx, NOx,CO
A2-14	M	183256	63048	Y	SOx, NOx,CO

A2-15	M	183383	62841	Y	SOx, NOx,CO
A2-16	M	183408	62806	Y	SOx, NOx,CO
A2-17	M	183408	62806	Y	SOx, NOx,CO
A2-18	M	183098	62845	Y	SOx, NOx,CO
S-SW-1	S	182698	63149	Y	pH, Sus. Solids, Hydrocarbons, BOD, COD, Ammonia, Phenols, Hg, Cd, Zn, Total Heavy Metals, Toxicity
S-SW-2	S	182903	63766	Y	pH, Sus. Solids, Hydrocarbons, BOD, COD, Ammonia, Phenols, Hg, Cd, Zn, Total Heavy Metals, Toxicity
S-SW-3	S	182762	62593	Y	pH, BOD, ammonia, nitrogen, conductivity and Total Petroleum Hydrocarbons
S-SW-4	S	183221	63211	Y	pH, BOD, ammonia, nitrogen, conductivity and Total Petroleum Hydrocarbons
GW3	S	183120	62829	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW4	S	183024	62776	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW5	S	182860	62727	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW6	S	182780	62600	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW101	S	183072	62693	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons

GW102	S	182948	62736	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW103	S	182764	62583	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW104	S	182828	62754	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW105	S	182712	62688	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW106	S	182759	62605	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW107	S	182941	62966	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW108	S	182712	63143	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW109	S	182704	62960	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW110	S	182822	62827	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW111	S	182907	62752	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons

GW112	S	183161	62678	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW113	S	183476	63019	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW114	S	183466	63106	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW115	S	183255	63143	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW116	S	182972	63211	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW117	S	183208	63492	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW118	S	182683	64064	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW119	S	183009	64051	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW120	S	182969	63964	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW201	S	183176	62718	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons

GW202	S	183003	64056	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW203	S	183016	62762	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW204	S	183057	62744	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW205	S	182841	62684	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW206	S	182859	62748	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW207	S	182668	63054	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW208	S	183074	62949	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW209	S	182980	62775	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW210	S	183467	63105	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW211	S	183310	63152	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons

GW213	S	182991	63415	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW214	S	182975	63964	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW215	S	182830	63789	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW216	S	182896	63917	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
GW217	S	182899	63790	Y	PH, COD, Nitrate, Total Ammonia, Total Nitrogen, Conductivity, Chloride, Fluoride, Hydrocarbons
AN1	M	183530	63279	Y	Noise
AN2	M	183799	63463	Y	Noise
AN3	M	182284	62789	Y	Noise
AN4	M	182647	62726	Y	Noise
AN5	M	183894	63432	Y	Noise

SECTION G: RESOURCE USE AND ENERGY EFFICIENCY

G.1 Give a list of the raw and ancillary materials, substances, preparations, fuels and energy which will be produced by or utilised in the activity.

The list(s) given should be very comprehensive, all materials used, fuels, intermediates, laboratory chemicals and product should be included.

Particular attention should be paid to materials and product consisting of, or containing, dangerous substances as described in the EU (Classification, Packaging, Labelling and Notification of Dangerous Substances) Regulations 1994 [SI 77/94]. The list must classify these materials in accordance with Article 2 of these Regulations, and must specify the designated Risk Phrases (R-Phrases) of each substance in accordance with Schedule 2 of the Regulations

Tables G.1(i) and G.1(ii) must be completed. Copy as required.

Supporting information should be given in **Attachment No G**.

G.1 Raw & Ancillary Materials, Substances, Preparations, Fuels & Energy

In the following sections, we identify the raw and ancillary materials, substances, preparations, fuels and energy that are used at the site.

G.1.1 Raw & Ancillary Materials

The primary raw material used at the Refinery is crude oil, which is processed in the individual production units to produce refined products, including:

- LPG
- Gasoline
- Kerosene
- Diesel & Gas Oil
- Heavy Fuel Oil

In addition 100% bio-diesel (FAME) and 100% bio-gasoline (ethanol) is imported to produce road transport fuels to meet the Biofuels Obligation.

In addition to the hydrocarbon inventory stored and produced on site, a number of auxiliary materials are used in the refining production process, for the following purposes:

- A range of additives for incorporation into refined products is also handled on site.
- Process chemicals, such as hydrogen, which is used to desulphurise the hydrocarbon by combining to form Hydrogen Sulphide in the process, and perchlorethylene, which is used for catalyst activation in the Isomerisation Unit;
- Laboratory chemicals, including n-Heptane 99.5%, Octane 80 blend and Iso Octane 99%.

Compared to the hydrocarbon inventories at the establishment, the inventory of auxiliary materials on site is small. The materials are stored in small quantities within the process unit where they are required. Some inventory is also stored in the Chemical Stores, located adjacent to the Refinery Workshop.

G.1.2 Intermediate Materials/Preparations

During the refining process, a wide range of intermediate materials is produced prior to the final production of the refined products. These materials may be produced within a particular process unit as a direct input to a subsequent process unit, or they may be sent for temporary storage within the main tankfarm area at the site, before being used as an input to a later production process. The intermediate materials produced at the refinery may be categorised, generally, as follows:

- Powerformer feed
- Light naphtha
- Heavy naphtha
- Isomerate
- Reformate
- LPG

G.1.3 Finished Materials

The finished materials produced at the site are:

- LPG (butane and propane)
- Gasoline
- Bio-gasoline
- Kerosene
- Diesel & Gas Oil (including bio-diesel)
- Heavy Fuel Oil

These products are distributed from the site via a road loading area where particular additives may be added depending upon the requirements of the end customer.

The introduction of the ASA plant will not result in the production of any new intermediate products. The only new material that will be introduced at the site will be the amine solution used in the sulphur recovery process in the ASA plant. Sulphuric acid will be produced by the ASA plant and this material is already handled on site for water treatment/demineralisation.

Table G.1(i) Details of Process related Raw Materials, Intermediates, Products, etc., used or generated on the site

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
1.	17104 TFA-4909E	Mixture	Dangerous for the Environment	25	55	Gasoline Additive	65 51/53 66 36/38	Not available
2.	Activated Alumina 2-5 Grade D	1344-28-1	No Data	22	0	Adsorbent for gas and liquid treament	None	None
3.	Airoblock Lo	Mixture	Toxic		1	Water treatment	21, 22, 25, 36	Not available
4.	Aluminium Sulfate	10043-01-3	Harmful	15	96	Water treatment	36/37/38	26, 28, 37, 39
5.	Amberjet 1200 H Resin	Mixture	None	15	0	Demineralisation	None	None
6.	Amberlite IRA458RF CL Resin	Mixture	None	15	0	Demineralisation	None	None
7.	Amberlite IRA70RF Resin	Mixture	None	15	0	Demineralisation	None	None
8.	Amberlite IRC86RF	Mixture	None	15	0	Demineralisation	None	None
9.	Amine Steam condensate treatment	Mixture	Corrosive	2	6	Steam condenstate treatment	20, 21, 22, 10, 22, 35, 43, 52	23, 24, 25, 26, 36, 37, 39, 45
10.	Amorphous Aluminosilica Gel	1327-36-2	None	4	0	Dessicant	None	None
11.	Belzona 1321 (Ceramic S-Metal) Base	Mixture	Dangerous for the Environment	0.1	0.05	Erosion/corrosion resistant coating	43, 36/38, 51/53	Not available
12.	Belzona 1321 (Ceramic S-Metal) Solidifier	Mixture	Not available	5	5	Erosion/corrosion resistant coating	34, 37, 41, 43, 62, 20/21, 20/22, 21/22, 52/53	Not available
13.	Belzona 1392 (Ceramic HT2) Base	Mixture	Dangerous for the Environment	5	5	Erosion/corrosion resistant coating	43, 20/21/22, 36/38, 51/53	Not available

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
14.	Belzona 1392 (Ceramic HT2) Solidifier	Mixture	Dangerous for the Environment	0.1	0.01	Erosion/corrosion resistant coating	22, 34, 38, 41, 43, 50	Not available
15.	Belzona 4311 (Magma Cr1) Base	Mixture	Dangerous for the Environment	0.1	0.01	Erosion/corrosion resistant coating	43, 36/38, 51/53	Not available
16.	Belzona 4311 (Magma Cr1) Solidifier	Mixture	Not available	0.1	0.01	Erosion/corrosion resistant coating	34, 38, 41, 43, 20/22, 21/22	Not available
17.	Biocide EC-2593	55965-84-9	Toxic, Dangerous for the Environment	0	0.025	Biocide	34, 43, 52/53	24/25, 26, 36/37/38, 45, 61
18.	Biodiesel	Mixture	Harmful, Dangerous for the Environment	7275	31,500	Fuel/product	40, 51/53	Not available
19.	Butane	Mixture	Extremely Flammable	1,400	55,000	Fuel	12	2, 9, 16
20.	Carbohydrazide Oxygen Scavenger (Trasar 22130)	497-18-7	Harmful	2	6	Oxygen Scavenger	22,38,43	24/25, 26, 28, 36, 37
21.	Caustic Soda	001310-73-2	Corrosive	20	160	Regeneration of Water Treatment Plant	35	24, 25, 26, 28, 36, 37, 39, 45
22.	Caustic Soda Liquor / Sodium Hydroxide Solution (Solution greater than 5% Caustic)	001310-73-2	Corrosive	4	50	pH control	35	26, 37/39, 45
23.	Caustic Solution	001310-73-2	Corrosive	25	350	For Desalting purposes and caustic scrubbing of H2S	35	26, 37/39, 45
24.	Cetane Improver (Ci-0801)	27247-96-7	Harmful	58	30	Fuel Additive	44, 20/21	15, 23, 36/37
25.	CP 7300 L (Copolymers in solution in oil solvent)	Mixture	Dangerous for the Environment, Harmful	25	15	Fuel Additive	40, 51/53, 65, 66, 67,	23, 24, 57, 61, 62
26.	Criterion KX-120 Reforming Catalyst	Mixture	No Data	12	0	Metal Oxide Catalyst	None	22, 24, 38

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
27.	Criterion PR-9 Reforming Catalyst	Mixture	No Data	22	0	Metal Oxide Catalyst	None	22, 24, 38
28.	Crude Antifoulant (EC3289A)	Mixture	Harmful, Dangerous for the Environment	15	30	Anti foulant for heat exchangers	51/53, 65, 66, 67	23, 24/25, 37/39, 57, 62
29.	Crude Demulsifier (EC-2134A)	Mixture	Harmful, Dangerous for the Environment	1	12	Additive for Desalting purposes	51/53, 66, 67	23, 24/25, 37/39, 57
30.	Crude Oil	Various	Extremely Flammable, Toxic	180,200	3,200,000	Distillation	12, 45, 52/53. 65	45, 53
31.	Dimethyldisulphide	624-92-0	Highly Flammable, Harmful, Dangerous for the Environment	2	0.5	Sulphiding Agent	11, 20/22, 36, 51/53	16, 28, 61
32.	Ditertiary Butyl Polysulphide (TBPS 454)	68937-96-2	Irritant	3	1	Product for Industrial use	36/38	24, 26
33.	DMDS (Dimethyl disulphide)	624-92-0	Highly Flammable, Harmful, Dangerous for the Environment	3	1	Sulphiding Catalyst	11, 20/22, 36, 51/53	16, 26, 28, 61
34.	Dodiflow (4273)	Mixture	Harmful, Dangerous for the Environment	40	300	Fuel additive	52/53	36/37/39
35.	Dowtherm Q	Mixture	Highly flammable, Harmful, Dangerous for the Environment	58	40	Heat Transfer Fluid	11, 20, 50/53	Not available
36.	Dowtherm Q Heat Transfer Fluid	Mixture	Not available	20	10	Heat Transfer Fluid	Not available	Not available
37.	EC-1021A (Filming Amine)	Mixture	Harmful, Dangerous for the Environment, Corrosive	4	4	Corrosion inhibitor	34, 40, 65, 67, 51/53	23, 24/25, 26, 36/37/39, 57, 62
38.	EC-1495A (Neutralizing Amine)	108-01-0	Corrosive	4	12	Corrosion inhibitor	20/21/22, 34	24/25, 36/37/38, 45
39.	EC9076A	Mixture	Not available	6	12	Anti foaming agent	38, 41, 65	Not available

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
40.	EC9078A Antifoam	Mixture	Not available	6	12	Anti foaming agent	Not available	Not available
41.	Essolube X101	Mixture	No Data	10	10	Lube oil C201	Not available	Not available
42.	Ethanol	64-17-5	Flammable, Harmful	5,000	18,000	Biological gasoline	11	2, 7, 16
43.	Ethyl Mercaptan	75-08-1	Harmful, Highly Flammable, Dangerous for the Environment	1.3	1.78	Stenching Agent	11, 20, 50/53	2, 16, 25, 60, 61
44.	FGO	Various	Harmful, Dangerous for the Environment	26,610	389,500	Fuel/product	40, 51/53, 65, 66	36/37, 62, 23, 43, 29, 61
45.	Gas oil Marker	64741-90-8	Toxic	30	300	Marker Dye	40 65	24 36/36 43 62
46.	Gasoline	Various	Extremely flammable, Toxic, Dangerous for the Environment	4,680		Fuel/product	12, 45, 38, 51/53, 65	45, 53
47.	Generic Spent Pt Catalyst	Mixture	Not available	4	0	Metal Oxide Catalyst	None	22, 24, 38
48.	Heavy Virgin Naphtha (HVN)	Various	Extremely flammable, Toxic, Dangerous for the Environment	9,000	456,250	Gasoline production/blending	12, 45, 38, 65, 51/53	45, 53
49.	Hitec 4335	mixture	Harmful	25	55	Diesel fuel additive	36 38 10 37 20 65 66	Not available
50.	HiTEC 4670 Performance Additive	Mixture	Dangerous for the Environment			Fuel Additive	67, 36/38, 51/53	Not available
51.	HiTEC 4678 Diesel Fuel Additive	Mixture	Dangerous for the Environment	25	65	Fuel Additive	40, 65, 66, 67, 51/53	Not available
52.	Hitec 4679	Mixture	Dangerous for the Environment	25	35	Fuel additive	65 66 51/53 36/38 20 37	Not available
53.	Hydrated Lime (Calcium dihydroxide)	1305-62-0	Irritant	4	0	Water treatment	37, 38, 41	2, 25, 26, 37, 39

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
54.	Hydrogen	1333-74-0	Extremely flammable	7	25	Catalyst Regeneration	12	2, 9, 16, 33
55.	Hydrogen Sulphide	7783-06-4	Extremely flammable, Very Toxic	0		Refinery gas	12, 26	1, 9, 16, 33, 36, 45
56.	I-8 Isomerisation Catalyst	Mixture	Harmful	52	0	Catalyst	36/37	22, 26, 37/39
57.	IMPROVER C 250 (Alkylnitrates mixture)	Mixture	Not available	4	2	Water treatment	44, 20/21	Not available
58.	Infineum (R) 425	Mixture	Harmful, Dangerous for the Environment	2.2	6	Petroleum additive	51/53, 65, 66, 67	Not available
59.	Infineum R671	Mixture	Harmful, Dangerous for the Environment	30	100	Petroleum additive	51/53, 65, 66, 67	Not available
60.	Isomerate	Various	Extremely flammable, Toxic, Dangerous for the Environment	9,940	24,500	Blending	12, 45, 38, 65, 51/53	Not available
61.	Iso-Octane 99%	26635-64-3	Highly flammable, Harmful, Dangerous for the Environment	0.2	1	Gasoline blending	11, 38, 50/53, 65, 67	2, 9, 16, 29, 33, 60, 61, 62
62.	Kerofluid ES 7 K18	Mixture	Dangerous for the Environment	25	40	Gasoline Additive	36/38 65 51/53	Not available
63.	Keropur DP 403	Mixture	Dangerous for the Environment	25	150	Diesel fuel additive	65 66 67 51 53	Not available
64.	Keropur MPI S	Mixture	Dangerous for the Environment	25	75	Gasoline additive	65 51/53 38	Not available
65.	Keropur* 3699	Mixture	Dangerous for the Environment	25	125	Fuel additive	38, 40, 65, 66, 67, 51/53	Not available
66.	Keropur* DP 4510 LC	Mixture	Not available	25	125	Fuel additive	22, 40, 65, 66, 67, 36/38, 50/53	Not available

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
67.	Kerosene	Various	Harmful, Dangerous for the Environment	22,590	353,500	Refinery stream	10, 38, 51/53, 65	2, 23, 24, 62
68.	Kerosene Marker	Mixture	Harmful	30	110	Marker Dye	40	2, 24, 46
69.	KF-575 (Catalyst)	Mixture	Not available	7	7	Hydrotreating catalyst	48/20/22, 36/37/38, 43	22, 24/25
70.	Light Virgin Naphtha (LVN)	Various	Extremely flammable, Toxic, Dangerous for the Environment	1,710	0	Refinery stream	12, 45, 38, 65, 51/53	45, 53
71.	Longrun EC3087A	Mixture	Toxic, Dangerous for the Environment	3	8.8	Process Antifoulant	51/53, 65, 66, 67, 22, 50/53, 10, 20, 36/37/38, 51/53	23C, 24/25, 37/39, 57, 62
72.	Lubricity Additive (Summer)	Mixture	Harmful, Dangerous for the Environment, Irritant	6	45	Fuel Additive	65, 66, 67, 51/53, 40,	23, 36/37, 57, 62
73.	Lubricity Additive (Winter)	Mixture	Harmful, Dangerous for the Environment, Irritant	4	45	Fuel Additive	65, 66, 67, 51/53, 40,	23, 36/37, 57, 62
74.	Mask 'n Scrub	Not Applicable	Irritant	0.1	0.1	Industrial Deodorant	31, 36/38	26, 28, 50
75.	Methanol	67-56-1	Toxic, Highly Flammable	10	65	LPG Additive	11, 23/24/25, 9/23/24/25	1/2, 7, 16, 36/37, 45
76.	NALCO 2593	55965-84-9	Corrovie, Toxic, Dangerous for the Environment	0.15	1	Biocide	34, 43, 52/53	24/25, 26, 36/37/39, 45, 61
77.	Nalco 7330	Mixture	Corrosive	2	8.5	Biocide Cooling Water Treatment	34, 24/25, 43	24/25, 26, 28, 36/37/39
78.	NALCO 8539	Mixture	Corrosive, Harmful, Oxidising, Toxic, Dangerous for the Environment	1	0.5	Corrosion inhibitor	8, 22, 25, 35, 36/38, 50	24/25, 26, 28, 36/37/39, 45, 61

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
79.	Nalco EC1005A	Mixture	Dangerous for the Environment	2	1	Corrosion inhibitor	10, 34, 35, 43, 52, 20/21/22, 36/37/38	Not available
80.	Nalco EC1021A	Mixture	Dangerous for the Environment	4	3	Corrosion inhibitor	10, 20, 22, 34, 40, 65, 66, 67, 36/37/38, 50/53	Not available
81.	Nalco Resolv EC2134A	Mixture	Highly flammable, Harmful, Dangerous for the Environment	6	12	Corrosion inhibitor	11, 38, 50/53, 65, 67	Not available
82.	Nalco Thermogain EC3289A	Mixture	Dangerous for the Environment	21		Corrosion inhibitor	51/53, 66, 67	Not available
83.	Nalcool 90	Mixture	Toxic, Corrosive	2	8.5	Corrosion Inhibitor	8, 25, 35	24/25, 26, 36/37/39, 45
84.	Nemo 6104	Mixture	Dangerous for the Environment	6	10	Corrosion inhibitor	38, 65, 51/53	Not available
85.	Nitrogen (Oxygen free)	7727-37-9	No Data - High concentration can be an asphyxiant	52	7,200	Purging and Inerting	None	9, 23
86.	Perchloroethylene	127-18-4	Harmful, Dangerous for the Environment	10	75	Catalyst Reactivation	40, 51/53, 65, 66, 67	2, 23, 36/37, 61
87.	Powerformate	Various	Extremely flammable, Toxic, Dangerous for the Environment	8,500	28,000	Gasoline production/blending	12, 45, 38, 51/53, 65	45, 53
88.	Propane	74-98-6	Extremely flammable	500	24,500	Refinery stream	12	2, 9, 16
89.	RV 100 (2-Ethylhexyl Nitrate)	27247-96-7	Oxidising, Harmful,			Diesel fuel additive	5, 8, 20/21/22, 36/37/38	15, 26, 27, 36/37/39

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
90.	S-120 Unionfining Catalyst	Mixture	Harmful	5	0	Catalyst	43, 48/20	22, 36/37/39
91.	Sodium Hydrogencarbonate	144-55-8	None	5	5	Cleaning exchangers	Not available	Not available
92.	Stadis 425	Mixture	Highly Flammable, Harmful, Corrosive	1	5	Fuel additive	10, 11, 20, 22, 34, 52/53	Not available
93.	Stadis 450	Mixture	Harmful, Highly Flammable, Dangerous for the Environment	1	5	Fuel additive	11, 36/38, 40, 48/20, 51/53, 63, 65, 67	9, 16, 26, 36/37, 60, 62
94.	Straight Run Atmospheric Residue (HFO)	64741-45-3	Toxic	50,000	1,000,000	Refinery product	45	45, 53
95.	Sulfrzol ™ 54 - Polysulphides di-tert-bu, Hydrogen sulphide	Mixture	Harmful	2.61	6	Additive	12, 26, 43, 50, 53 H413	Not available
96.	Sulphuric Acid	7664-93-9	Corrosive	20	80	Regeneration of Water Treatment Plant	35	2, 26, 30
97.	TK-10	Mixture	Not available	1	0	Hydrotreating Catalyst	Not available	22
98.	TK-339	Mixture	Irritant, Harmful	1	0	Hydrotreating Catalyst	36/37, 48/20/22	22
99.	TK-437	Mixture	Irritant, Harmful, Toxic	1	0	Hydrotreating Catalyst	49, 43, 36/37, 48/20/22, 53	53, 36/37, 45
100.	TK-551 (bot bed)	Mixture	Irritant, Harmful	1	0	Hydrotreating Catalyst	49 43 48/20/22	53 45
101.	TK-574 (bot bed)	Mixture	Irritant, Harmful, Dangerous for the Environment	100	25	Hydrotreating Catalyst	43, 36/37, 48/20/22, 51/53	22, 24/25, 36/37, 57, 61
102.	TK-709	Mixture	Irritant, Harmful	1	0	Hydrotreating Catalyst	36/37, 48/20/22,	22
103.	TK-711 (top bed)	Mixture	Irritant, Harmful	1	0	Hydrotreating Catalyst	49, 43	53, 37, 45

Ref. Nº or Code	Material/ Substance[1]	CAS Number	Danger[2] Category	Amount Stored (tonnes)	Annual Usage (tonnes)	Nature of Use	R[3] - Phrase	S[3] - Phrase
104.	TK-743	Mixture	Irritant, Harmful, Toxic	1	0	Hydrotreating Catalyst	43, 36/37, 48/20/22, 53, 49	22, 24/25, 36/37, 57, 61
105.	Ultra Low Sulphur Diesel (ULSD)	Various	Harmful, Dangerous for the Environment	36,440	820,000	Refinery stream	40, 51/53, 65	45, 53
106.	Unleaded Gasoline	Mixture	Extremely Flammable, Harmful, Dangerous for the Environment, Irritant	25,000	650,000	Refinery stream	11, 12, 20, 23, 24, 25, 36, 38, 45, 46, 48, 62, 63, 65, 67, 51/53	45, 53
107.	UOP R-85.3X Platforming Catalyst	Mixture	No Data	6	0	Catalyst	23, 35, 43	None
108.	UOP R88-X Platforming Catalyst	Mixture	No Data	9	0	Catalyst	23, 35, 43	None

Notes: 1. In cases where a material comprises a number of distinct and available dangerous substances, please give details for each component substance.
2. c.f. Article 2(2) of SI No 77/94
3. c.f. Schedules 9 and 10 of SI No 62/2004

Table G.1(ii) Details of Process related Raw Materials, Intermediates, Products, etc., used or generated on the site

Ref. Nº or Code	Material/ Substance[1]	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold $\mu g/m^3$	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
1.	17104 TFA-4909E	-	Yes	Hydrocarbon	-	7	-	7	-
2.	Activated Alumina 2-5 Grade D	-	No	-	-	-	-	-	-
3.	Airoblock Lo	-	No	-	-	-	-	-	-
4.	Aluminium Sulfate	-	Yes	Slight	-	-	-	-	-
5.	Amberjet 1200 H Resin	-	No	-	-	-	-	-	-
6.	Amberlite IRA458RF CL Resin	-	No	-	-	-	-	-	-
7.	Amberlite IRA70RF Resin	-	No	-	-	-	-	-	-
8.	Amberlite IRC86RF	-	No	-	-	-	-	-	-
9.	Amine Steam condensate treatment	-	Yes	Acrid	-	-	-	-	-
10.	Amorphous Aluminosilica Gel	-	No	-	-	-	-	-	-
11.	Belzona 1321 (Ceramic S-Metal) Base	-	No	-	-	-	-	-	-
12.	Belzona 1321 (Ceramic S-Metal) Solidifier	-	No	-	-	-	-	-	-
13.	Belzona 1392 (Ceramic HT2) Base	-	No	-	-	-	-	-	-
14.	Belzona 1392 (Ceramic HT2) Solidifier	-	No	-	-	-	-	-	-
15.	Belzona 4311 (Magma Cr1) Base	-	No	-	-	-	-	-	-

Ref. Nº or Code	Material/ Substance[1]	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold µg/m^3	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
16.	Belzona 4311 (Magma Cr1) Solidifier	-	No	-	-	-	-	-	-
17.	Biocide EC-2593	-	Yes	Mild	-	7	-	7	-
18.	Biodiesel	-	Yes	Hydrocarbon	-	7	-	7	-
19.	Butane	-	No	-	-	7	-	7	-
20.	Carbohydrazide Oxygen Scavenger (Trasar 22130)	-	Yes	Pungent Sulphur Dioxide	-	-	-	-	-
21.	Caustic Soda	-	Yes	No info	-	-	-	-	-
22.	Caustic Soda Liquor / Sodium Hydroxide Solution (Solution greater than 5% Caustic)	-	No	-	-	-	-	-	-
23.	Caustic Solution	-	No	-	-	7	-	7	-
24.	Cetane Improver (Ci-0801)	-	Yes	Pungent/Strong	-	7	-	7	-
25.	CP 7300 L (Copolymers in solution in oil solvent)	-	Yes	Aromatic	-	7	-	7	-
26.	Criterion KX-120 Reforming Catalyst	-	No	-	-	-	-	-	-
27.	Criterion PR-9 Reforming Catalyst	-	No	-	-	-	-	-	-
28.	Crude Antifoulant (EC3289A)	-	Yes	Hydrocarbon	-	7	-	7	-
29.	Crude Demulsifier (EC-2134A)	-	Yes	Hydrocarbon	-	7	-	7	-
30.	Crude Oil	-	Yes	Hydrocarbon	-	7	-	7	-
31.	Dimethyldisulphide	-	Yes	Strong Stench	-	-	-	-	-

Ref. Nº or Code	Material/ Substance[1]	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold µg/m^3	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
32.	Ditertiary Butyl Polysulphide (TBPS 454)	-	Yes	Mild sweet	-	-	-	-	-
33.	DMDS (Dimethyl disulphide)	-	No	-	-	-	-	-	-
34.	Dodiflow (4273)	-	Yes	Hydrocarbon	-	7	-	7	-
35.	Dowtherm Q	-	No	-	-	-	-	-	-
36.	Dowtherm Q Heat Transfer Fluid	-	Yes	Aromatic	No Data	-	-	-	-
37.	EC-1021A (Filming Amine)	-	Yes	Hydrocarbon	-	-	-	-	-
38.	EC-1495A (Neutralizing Amine)	-	Yes	Amine	-	-	-	-	-
39.	EC9076A	-	No	-	-	-	-	-	-
40.	EC9078A Antifoam	-	No	-	-	-	-	-	-
41.	Essolube X101	-	Yes	Mild Petroleum	-	-	-	-	-
42.	Ethanol	-	Yes	Mild / pleasant	-	7	-	7	-
43.	Ethyl Mercaptan	1	Yes	Unpleasant, Penetrating	-	-	-	-	-
44.	FGO	-	Yes	Hydrocarbon	-	7	-	7	-
45.	Gas oil Marker	-	Yes	Aromatic	-	7	-	7	-
46.	Gasoline	-	Yes	Hydrocarbon	-	7	-	7	-
47.	Generic Spent Pt Catalyst	-	No	-	-	-	-	-	-
48.	Heavy Virgin Naphtha (HVN)	-	Yes	Hydrocarbon	-	7	-	7	-
49.	Hitec 4335	-	Yes	Aromatic	-	7	-	7	-

Ref. Nº or Code	Material/ Substance[1]	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold µg/m³	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
50.	HiTEC 4670 Performance Additive	-	Yes	Aromatic	-	7	-	7	-
51.	HiTEC 4678 Diesel Fuel Additive	-	Yes	Aromatic	-	7	-	7	-
52.	Hitec 4679	-	Yes	Aromatic	-	7	-	7	-
53.	Hydrated Lime (Calcium dihydroxide)	-	Yes	Slight earthy	-	-	-	-	-
54.	Hydrogen	-	No	None	-	-	-	-	-
55.	Hydrogen Sulphide	-	Yes	Rotten eggs	-	-	-	-	-
56.	I-8 Isomerisation Catalyst	-	No	-	-	-	-	-	-
57.	IMPROVER C 250 (Alkylnitrates mixture)	-	No	-	-	-	-	-	-
58.	Infineum (R) 425	-	No	-	-	-	-	-	-
59.	Infineum R671	-	No	-	-	-	-	-	-
60.	Isomerate	-	No	-	-	-	-	-	-
61.	Iso-Octane 99%	-	Yes	Gasoline	-	-	-	-	-
62.	Kerofluid ES 7 K18	-	No	-	-	7	-	7	-
63.	Keropur DP 403	-	Yes	Distinct Paraffinic	-	7	-	7	-
64.	Keropur MPI S	-	No	-	-	7	-	7	-
65.	Keropur* 3699	-	No	-	-	7	-	7	-
66.	Keropur* DP 4510 LC	-	No	-	-	7	-	7	-
67.	Kerosene	-	Yes	Petroleum	-	7	-	7	-
68.	Kerosene Marker	-	Yes	Distinct Paraffinic	-	7	-	7	-

Ref. Nº or Code	Material/ Substance[1]	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold µg/m^3	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
69.	KF-575 (Catalyst)	-	No	-	-	-	1(9), 1(17)	-	9, 17
70.	Light Virgin Naphtha (LVN)	-	Yes	Gasoline	-	7	-	7	-
71.	Longrun EC3087A	-	Yes	Hydrocarbon	-	-	-	-	-
72.	Lubricity Additive (Summer)	-	Yes	Fatty	-	7	-	7	-
73.	Lubricity Additive (Winter)	-	Yes	Fatty	-	7	-	7	-
74.	Mask 'n Scrub	-	Yes	Chlorinated	-	-	-	-	-
75.	Methanol	3	Yes	Pungent	-	-	-	-	-
76.	NALCO 2593	-	Yes	Mild	-	-	-	-	-
77.	Nalco 7330	-	Yes	Pungent	-	-	-	-	-
78.	NALCO 8539	-	Yes	Slight	-	-	-	-	-
79.	Nalco EC1005A	-	Yes	Mild	-	-	-	-	-
80.	Nalco EC1021A	-	Yes	Mild	-	-	-	-	-
81.	Nalco Resolv EC2134A	-	Yes	Mild	-	-	-	-	-
82.	Nalco Thermogain EC3289A	-	Yes	Mild	-	-	-	-	-
83.	Nalcool 90	-	No	-	-	-	-	-	-
84.	Nemo 6104	-	No	-	-	-	-	-	-
85.	Nitrogen (Oxygen free)	-	No	-	-	-	-	-	-
86.	Perchloroethylene	-	Yes	Distinctive	-	-	-	-	-
87.	Powerformate	-	Yes	Hydrocarbon	-	7	-	7	-
88.	Propane	-	No	-	-	-	-	-	-

Ref. Nº or Code	Material/ Substance[1]	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold µg/m^3	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
89.	RV 100 (2-Ethylhexyl Nitrate)	-	No	-	-	-	-	-	-
90.	S-120 Unionfining Catalyst	-	No	-	-	-	-	-	-
91.	Sodium Hydrogencarbonate	-	No	-	-	-	-	-	-
92.	Stadis 425	-	Yes	Aromatic	-	7	-	7	-
93.	Stadis 450	-	Yes	Aromatic	-	7	-	7	-
94.	Straight Run Atmospheric Residue (HFO)	-	Yes	Hydrocarbon	-	7	-	7	-
95.	Sulfrzol ™ 54 - Polysulphides di-tert-bu, Hydrogen sulphide	-	Yes	Strong	-	-	-	-	-
96.	Sulphuric Acid	-	Yes	Characteristic Bleach Odour	-	-	-	-	-
97.	TK-10	-	No	-	-	-	-	-	-
98.	TK-339	-	No	-	-	-	-	-	-
99.	TK-437	-	No	-	-	-	-	-	-
100.	TK-551 (bot bed)	-	No	-	-	-	-	-	-
101.	TK-574 (bot bed)	-	No	-	-	-	-	-	-
102.	TK-709	-	No	-	-	-	-	-	-
103.	TK-711 (top bed)	-	No	-	-	-	-	-	-
104.	TK-743	-	No	-	-	-	-	-	-
105.	Ultra Low Sulphur Diesel (ULSD)	-	Yes	Hydrocarbon	-	7	-	7	-
106.	Unleaded Gasoline	-	Yes	Pungent Petroleum	-	7	-	7	-

Ref. Nº or Code	Material/ Substance(1)	TA Luft Class 1, 2 or 3	Odour			EU Lists I and II (Tick and specify Group/Family Number)			
			Odorous Yes/No	Description	Threshold µg/m^3	Dangerous Substances Directive 76/464/EEC		Groundwater Directive 80/68/EEC	
						List I	List II +129[4]	List I	List II
107.	UOP R-85.3X Platforming Catalyst	-	No	-	-	-	-	-	-
108.	UOP R88-X Platforming Catalyst	-	No	-	-	-	-	-	-

Notes (cont.): 4. The European Commission priority candidate list

G.2 Energy Efficiency
A description of the energy used in or generated by the activity must be provided. Outline the measures taken to ensure that energy is used efficiently and where appropriate, an energy audit with reference to the EPA Guidance document on Energy Audits should be carried out.

G.2 Energy Efficiency

The refining of oil has as a core economic objective the maximum conservation of energy. Part of the energy in crude oil is converted into gases known as refinery fuel gases as a result of several of the unit processes needed convert crude oil into a range of refined petroleum products required by the market.

The specifications for these refined products are set *inter alia* by the EU. Because of concerns over acid rain, the sulphur levels at which products could be placed on the market has been continually reduced since the refinery began operations in 1959.

When the refinery was started up initially, the refinery fuel gases were supplemented by heavy fuel oils which, in those days, would have contained up to 3% sulphur. With the investment in sulphur recovery technology on the Whitegate site in the 1990s the refinery gas and fuel oil systems were integrated as the energy sources for the processing. This is an ongoing process.

The complexity of the energy balancing system on the refinery is shown in the Block Flow Diagram of the Refinery Fuel System [Drg # 100421-41-DR-001 Rev G) copy included in Attachment G.1.

The latest phase of integration and air pollution control has occurred in 2009 and is ongoing in 2011. In 2009 a project was undertaken to replace 1% fuel oil (known also as SRAR – straight run atmospheric residue) with natural gas as the supplementary fuel in many of the furnaces. This became economically feasible because of the sharp reduction in natural gas prices in Europe following their peak prices in 2008.

All furnaces and boilers are running on natural gas and or natural gas in combination with refinery fuel gases.

The move towards BAT and reducing SO2 and other emissions to atmosphere is a continual one and further progress in emissions reduction from combustion processes will be achieved in 2012 and beyond when the new ASA Plant, working in combination with natural gas as the supplementary fuel to refinery gas, will result annual SO_2 emissions to levels which will be, historically, the lowest emissions of SO_2 from the refinery since production began in 1959.

This will be the case even when the refinery is running at its full capacity of 75,000 barrels per stream day of a crude blend with somewhat higher sulphur levels in the crude than those crude blends currently processed.

This is notwithstanding the much greater intensity of refining processes which is now demanded by the increasingly stringent product specifications emanating from the EU.

The following energy sources can be seen in the Block Flow Diagram of the Refinery Fuel System and are all part of the integrated energy balance:

1. Natural gas
2. Low sulphur refinery gas following treatment in the existing SRU
3. "Sweet Gas" low in sulphur gas from isomerisation unit
4. Higher sulphur refinery gas not treated in SRU due to capacity constraints (see SRU bypass on Block Flow Diagram
5. Surplus LPG gases (C3 propane and C4 butane) which is sent to refinery fuel gas system due to product specification restrictions and on other occasions as a system balancing fuel.
6. Heavy Fuel oil (SRAR – to be used as back up fuel - not currently used in 2010 or 2011) but potentially a fuel at some time in the future
7. Fuel for the gas turbine CHP unit which produces electricity for the site at a much higher efficiency (68%) compared to the national grid average thereby saving primary energy in a national context. The fuels used for CHP are refinery fuel gas and/or gas oil.

As an indication of the downward trend in energy intensity on the site the following table of CO_2 emissions and crude oil throughput indicates the trend in CO_2 and an indicator of the energy performance indicator for the site.

Table 19: Trends in Carbon Dioxide Emissions

	2008	2009	2010	2011(f)
Tonnes CO_2	366,959	314,975	310,211	295,000

This shows that notwithstanding the increasing severity of refining needed to produce products of increasingly stringent specifications, the energy use and related CO2 emissions have declined progressively since 2008.

An analysis for 2007 energy use indicated that ~ 4.1 % of the energy in crude processed was consumed as energy.

Minimising the use of energy is a key objective of any oil refinery as the economic outcome is best when the maximum percentage of the energy purchased as crude oil is converted to saleable refined energy products demanded by the market.

The best outcome from an energy-use perspective, and for environmental protection will be achieved by setting emission limits which provide the refinery the opportunity to maximise energy efficiency while at the same time minimising (on an hourly, daily, annual or other basis) minimise the emissions of the products of combustion including SO_2 and NOx .

This is best achieved by the refinery operating for long periods even when some process units may be shut down for statutory inspections e.g. on stream raising equipment.

See Attachment G.1 for Schematic for the integrated use of energy sources on the Refinery.

This drawing shows the combustion equipment which represent the main emissions to atmosphere and which fuel combinations serve the combustion processes.

SECTION H: MATERIALS HANDLING

H.1 Raw Materials, Intermediates and Product Handling
All materials should be listed in Tables G.1(i) and G.(ii) of Section G.

Details of the storage conditions, location within the site, segregation system used and transport systems within the site should be outlined here. In addition, information relating to the integrity, impermeability and recent testing of pipes, tanks and bund areas should be outlined.

H.1 Raw Materials, Intermediates and Product Handling

H.1.1 Raw Materials

- Crude oil is imported in 85,000 tonne cargoes and pumped for storage in the seven crude oil storage tanks located on Corkbeg Island.
- 100% biodiesel is imported in 3,000 to 6,000 tonne cargoes and stored in TK-P12
- 100% bio-gasoline is imported in 3,000 tonne cargoes and stored in TK-I12.

H.1.2 Intermediates

The crude distillation tower produces the following intermediate /product streams

- Heavy fuel oil – stored in four cone roof tanks before being exported for further processing
- Heavy virgin naphtha – this intermediate stream is the feed raw material for the reformer unit. This unit increases the Octane Number of the intermediate to produce reformate.
- Light virgin naphtha - – this intermediate stream is the feed raw material for the isomerisation unit. This unit reduces the aromatic content (benzene) of the LVN by its conversion to isomerate.
- High sulphur gas oil – this intermediate stream is the feed raw material for the hydrotreating units. These units reduce the sulphur content of diesel/gas oil from c. 1000 ppm to < 10ppm.
- LPG – this stream is the feed material for the LPG splitter. This unit separates butane from propane.

The intermediates produced by the Reformer, and Isomerisation Units, i.e. reformate and isomerate are sent to tankage. These intermediates, together with butane are blend stocks for gasoline production.

The intermediates that feed the reformer and isomerisation units and those that are used in gasoline production are stored in floating roof tanks.

H.1.3 Product Handling

The refinery products :

- Heavy fuel oil- stored in cone roof tanks and exported by sea going tankers of 35,000 to 40,000 tonnes cargoes to other European refineries for further processing.
- Ultra Low sulphur diesel (ULSD) is stored in cone roof tanks and is "sold" via the road loading facility or the marine terminal.
- Gas oil (1000ppm sulphur) –is stored in cone roof tanks and is "sold" via the road loading facility or the marine terminal.
- Kerosene is stored in cone roof tanks and is "sold" via the road loading facility or the marine terminal.
- Gasoline/bio-gasoline is stored in floating roof tanks and is "sold" via the road loading facility or the marine terminal.
- Butane is stored in two x 600 tonne spheres and is shipped by pipeline to the nearby Calor facility. It is also "sold" by road tanker to LPG resellers.
- Propane is stored in 200 tonne spheres and is shipped by pipeline to the nearby Calor facility. It is also "sold" by road tanker to LPG resellers.

A Full list of tanks, their normal product stored and capacity in tonnes is provided as attachment H.1.

On occasions refinery intermediates "isomerate, powerformate, LVN and HVN are exported via the marine terminal to other refineries.

H.1.4 Storage Areas & Bunding

An overview of the main storage areas, containment and bunding arrangements at the site is provided in the following sub-sections.

Corkbeg Tank Farm

The containment system on Corkbeg Island uses a combination of grading and diversion bunds to control flow to channels. Apart from the bunds at Tanks C-6 and U-13, bunds on the Island were not designed to retain any spill. Where a spill occurs, surface flow is constrained by these diversion bunds. The position and orientation of the bunds are designed to ensure that drainage channels will intercept surface flow. The bunds vary in height, but most are between 0.5 m and 1.0 m high.

Improvements have been made to bunds in order to comply with the conditions of the Bulk Storage Licence which requires that releases from tanks be directed away from pipelines. These measures included the installation of culverts under pipelines through which releases are directed. This was achieved by the construction of bunds between a tank and a pipeline, or up gradient of a pipeline running to the tank. A collection sump collects the spill and conveys it via buried drainage pipes or channels away from the tanks and pipelines to the main channel. The drainage channels convey flow to a catch basin.

A weir joining the channels was constructed as part of the conditions for the Bulk Storage Licence which specified that spills of a quantity not exceeding 2,500 tonnes should be diverted to the mini-basin. The weir prevents small flows from entering the main basin and diverts flow along the north side of the main catch basin to the mini-basin. Where the head of flow exceeds the height of the weir, the flow enters the large basin directly.

Drainage from the area surround Tank C-6 is regulated by a valve outside the bund. Elsewhere, flow occurs along the graded surface of the Island. The mini-basin and main basin are drained regularly. Water from these basins is routed to the refinery's waste water treatment system.

The capacity of the catch basin on Corkbeg Island is approximately 30,900 m^3. The individual working capacity of Tanks C-1 to C-5 and Tank C-7 is approximately 26,600 m^3. The retention capacity of the basin is therefore 116% of the tank volume.

The working volume of Tank C-6 is 56,300 m^3. The bund surrounding Tank C-6 has a capacity to hold 28,000 m^3. Thus, the combined retention capacity between the bund and catch basin is 105% of the tank volume. CPW's Bulk Storage Licence, granted by Cork County Council's Fire Officer, requires that the capacity of crude stored in Tank C-6 does not exceed the joint capacities of the bund and the catchment basin. The condition also specifies that the bund and catchment basin are to be kept free of retained water and other materials that would deplete any excess retention capacity.

Intermediate & Product Tank Farm

With the exception of Tanks P-22 and P-23, which are bunded separately, the tanks in the Intermediate & Product Tank Farm are bunded in groups. Regulating valves outside the bunds control drainage and are opened periodically to drain the bunds in accordance with the procedure set-down in the Offsites Manual. Flow from the valves discharges to a network of surface water channels and buried concrete pipes which lead to a central collection sump and ultimately discharge to the skimming pond.

All bunds in the Intermediate and Product Tank Farm are capable of retaining the capacity of the largest tank in that bund and meet the requirements of the Dangerous Substances (Petroleum Bulk Stores) Regulations, 1979 (SI 313 of 1979).

H.1.5 Bund Structural Integrity & Permeability

Between March and July 2001, BÓC carried out a bund integrity assessment of the earthen bunds at the CPW. This assessment was undertaken to comply with Condition 9.3.1 of the refinery's IPC licence. The structural integrity of the bunds was assessed by calculating the response of the bund to full hydrostatic head. The specific gravity of seawater was used in the calculations to provide a conservative estimate. The report concluded that all bunds would remain stable while retaining seawater inside the bund. Bearing pressures were also found to be acceptable.

Following the initial assessment, a further assessment was carried out in January 2002. The outcome of these two assessments was a series of recommendations to improve the performance and integrity of the bunded areas.

In November 2005, a third assessment was carried out to review the remedial work undertaken. This assessment included a series of permeability tests in the bunds where a clay layer was added to improve their impermeability. The results of this assessment show that the condition of the bunds has been improved since the previous assessments were carried out. Where the clay layer has been added to the bund floors the permeability has decreased, improving the level of protection in these areas. CPW has completed the remedial work

identified in the bund integrity assessment reports. A planned maintenance programme is in place at the refinery in order to prevent deterioration of the bunds and bund walls. This maintenance programme includes visual inspections of the bund and mini-bund walls, vermin control, grass cutting and weed control.

Toe walls are provided around furnaces, pump areas and exchanger areas to confine leaks or spills to the smallest possible area. These areas are drained to the oily water sewer, via sealed manholes. In general, auxiliary chemical areas within the process units are also kerbed to allow any spills to drain directly to the oily water sewer. The chemical storage area for the storage of auxiliary chemicals is fully concrete lined and bunded. At the low point a sump collects all rain water and any spillages. The sump is designed for maximum anticipated volume of rain water plus 1 m^3 (the volume of one IBC of chemical), and, under normal operation, is manually pumped out to the oily water sewer.

H.2 Describe the arrangements for the recovery or disposal of solid and liquid wastes accepted into or generated by the installation/facility.
For each waste material, give full particulars of:

(i) Name
(ii) Description & nature of waste
(iii) Source
(iv) Where stored and integrity/impermeability of storage areas
(v) Amount (m^3) and tonnage
(vi) Period or Periods of generation
(vii) Analysis (include test methods and Q.C.)
(viii) European Waste Catalogue Code
(ix) Waste Category per EC Reg 1774/2002/EC where relevant

Where any waste would be classified as Hazardous Waste as defined in the Waste Management Acts, 1996 to 2003, this should be made clear in the information provided.

Summary Tables H.1(i) and H.1(ii) should also be completed, as appropriate, for each waste. The licence/permit register number of the waste collection agent or disposal/recovery operator should be supplied as well as the expiry date of the relevant permits.

Supporting information should form **Attachment No H.2**.

H.2 Recovery/Disposal of Solid and Liquid Wastes

H.2.1 Overview

The hazardous and non-hazardous wastes generated at the site are summarised in Tables H.1(i) and H.1(ii), respectively. Wastes generated at the site are managed in accordance with Condition 7 of the site's IPPC licence and in accordance with site procedures for the handling, recording and tracking of waste materials. A Waste Management Record (WMR) of all waste arisings at the site is maintained and reported under the site's Annual Environmental Report. In addition, the site maintains a register of the waste collection contractors and waste recovery/disposal contractors that it has approved for the recovery and disposal of waste. This register identifies the individual waste streams, the collection contractor and the recovery/disposal destination. In order to provide the Refinery with suitable flexibility in the management of its waste, certain waste streams may be collected and recovered/disposed of via a number of waste collection contractors and recovery/disposal routes.

H.2.2 Waste Management Objectives and Targets

Under its Environmental Management Programme (EMP), the Refinery has established objectives and targets for the management of waste at the site, from the generation of waste to the recovery/disposal routes. The high level objectives for the site are to minimise the production of waste materials and, where waste materials are generated, to segregate the

waste streams in order to avoid cross contamination and therefore ensure a suitable and efficient waste recovery/disposal route.

As part of the ongoing programme for further improving the management of waste at the site, new opportunities for diverting wastes from disposal routes to recovery routes are investigated and pursued where feasible. The latest waste stream that was assessed for segregation is the canteen/kitchen waste. This was previously collected as part of the general waste collection and segregated off site; canteen waste is now segregate at the site and is sent off site for recovery by means of

H.2.3 Non-Hazardous Wastes

Table 20 lists the non-hazardous wastes that arise at the site and identifies their storage locations.

Table 20: Non-Hazardous Waste Arisings

Waste	Description	Storage Location
Bio sludge	Sludge from the onsite waste water treatment plant.	Collected directly from the waste water treatment plant; no onsite storage prior to collection.
Sulphur	Sulphur cake from the desulphurisation process.	Collected directly from the sulphur recovery unit.
Sulphur-containing wastes	Other wastes from the desulphurisation process contaminated with sulphur	Collected directly from the sulphur recovery unit.
Iron/steel	Metal from scrap equipment.	Dedicated main storage area for non-hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.
Paper/cardboard	Paper and cardboard from incoming packaging and from office/administration activities	Dedicated main storage area for non-hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.
Paper/cardboard	Paper and cardboard from office/administration.	Dedicated main storage area for non-hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.
Glass	Glass from packaging materials and from the canteen.	Dedicated main storage area for non-hazardous waste.

Waste	Description	Storage Location
Biodegradable canteen waste	Canteen waste from the site canteens and dedicated food/biodegradable waste bins.	Dedicated storage area for biodegradable canteen waste. Smaller bins for biodegradable wastes are located at key locations in the office areas (e.g. at coffee stations).
Timber	Timber wastes arising from incoming packaging materials.	Dedicated main storage area for non-hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.
Metals	Metal wastes arising from incoming packaging materials.	Dedicated main storage area for non-hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.
General municipal waste	Mixed municipal waste from throughout the site, including office wastes.	Dedicated main storage area for non-hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.
Bulky municipal waste	Large items of mixed municipal wastes.	Dedicated main storage area for non-hazardous wastes.

H.2.4 Hazardous Wastes

Table 21 lists the hazardous wastes that arise at the site and identifies their storage locations.

Table 21: Hazardous Waste Arisings

Waste	Description	Storage Location
Contaminated tank scale	Scale from oil storage tanks, generated/collected during tank cleaning/repair works.	Collected directly from the specific storage tank.
Spent caustic soda solution	Spent caustic soda from the process units.	Dedicated utility storage tanks for spent caustic soda.
Waste solvent	Waste solvents from laboratory activities	Dedicated storage area within the laboratory for small scale wastes.
Degreasing waste	Waste kerosene arising from degreasing activities associated with maintenance and production.	Dedicated storage drums for waste degreasing materials within the hazardous waste area.

Waste	Description	Storage Location
Spent filters and rags	Waste rags and filters from production and maintenance related activities.	Dedicated storage drums for waste degreasing materials within the hazardous waste area.
Contaminated soil/stone	Soil and stone contaminated with oily material from site drainage channels	Dedicated storage area at the hazardous waste stores.
Solid combustible wastes	Solid combustible materials from the production process	Dedicated storage area for solid combustible materials located within the hazardous waste storage area.
Contaminated waste sludges	Sludge from the waste water treatment plant contaminated with dangerous substances.	Dedicated storage area for contaminated waste sludges located within the hazardous waste storage area.

H.2.5 Irregular Wastes

The wastes identified in Section H.2.3 and H.2.4 are generated throughout the production period at a consistent rate. There is no period of production that results in significant variance in waste quantities. However, during civil and mechanical construction works, and during periods of shut-down, larger quantities of waste may be produced. In addition, wastes not directly associated with the production activities may also be produced during such periods. These irregular waste streams are identified in Table 22.

Table 22: Irregular Waste Streams

Waste	Description	Hazardous	Storage Location
Asbestos containing material	Asbestos insulation from process equipment and asbestos containing construction materials	Yes	Removed directly from site by specialist asbestos contractor.
Non hazardous construction & demolition waste	Waste arising from construction and demolition activities.	No	The specific location depends upon the location and nature/extent of the construction works. Specific storage areas are identified prior to commencing construction works.
Waste electrical & electronic equipment (WEEE)	Waste electrical and electronic equipment from the office areas throughout the site.	Yes / No	Dedicated storage area for WEEE. Individual collection areas are also located at key locations throughout the site.

Spent batteries	Waste batteries from electrical/electronic equipment from throughout the site.	Yes / No	Dedicated main storage area for hazardous wastes. Intermediate storage areas are located throughout the site for the collection of this waste at source, with the waste subsequently transferred to the main storage area.

H.2.6 Waste Collection

All waste is collected from the site by licensed waste collection contractors issued with Waste Collection Permits appropriate for collection within Co. Cork. These wastes are transferred to appropriately licensed or permitted waste recovery or waste disposal facilities both in Ireland and abroad. All wastes are transferred in accordance with local and European waste legislation. No wastes are disposed of or recovered on-site.

Attachment H.2 contains a list of all the waste collection contractors used by the Refinery, the wastes collected by each contractor and the ultimate destination of each waste stream. This attachment also contains the waste permit number of the collection contractors and the licence or permit number for the ultimate destination. Not all of the waste contractors and waste routes listed in Tables H.1(i) and H.1(ii) are used at the same time. In order to provide flexibility to the Refinery's operations and the collection of waste, additional waste contractors and waste routes have been identified for a number of the waste streams generated at the site.

H.2.7 Waste Quantities

The quantities of waste listed in tables H.1(i) and H.1(ii) are the typical waste quantities that are generated at the site. The actual quantities of waste that arise are recorded within the site's Waste Management Record and are reported to the Agency on an annual basis within the AER and the Pollutant Release and Transfer Register. For the small quantities of waste that arise at the site, the monthly quantities have been rounded to the nearest ten kilograms (0.01 tonnes).

TABLE H.1(i): WASTE - Hazardous Waste Recovery/Disposal

Waste material	EWC Code	Main source[1]	Quantity		On-site Recovery/Disposal (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes/ month	m^3/month			
Contaminated tank scale	05 01 03*	Tank bottoms	2.5		Not applicable	Not applicable	D10 Incineration on land Germany Sonderabfall Verbrennungs anlange (SAVA) D10 Incineration on land Germany Remondis Industrie Service GmbH
Spent caustic soda solution	06 02 04*	Process units	48.0		Not applicable	Not applicable	D9 Physico chemical treatment Shannon ENVA Ireland
Waste solvent	07 01 04*	Laboratory	0.20		Not applicable	Not applicable	D10 Incineration on land Germany Sonderabfall Verbrennungs anlange (SAVA) D10 Incineration on land Germany Remondis Industrie Service GmbH

Waste material	EWC Code	Main source[1]	Quantity		On-site Recovery/Disposal (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes/ month	m^3/month			
Degreasing waste	11 01 13*	Parts washer	0.06		Not applicable	Not applicable	R2 Reuse as fuel United Kingdom SRM Limited
Spent filters and rags	15 02 02*	Site wide	0.08		Not applicable	Not applicable	D10 Incineration on land Germany Sonderabfall Verbrennungs anlange (SAVA) D10 Incineration on land Germany Remondis Industrie Service GmbH
Spent batteries	16 06 01*	Electrical equipment	0.13		Not applicable	R4 Metal recovery United Kingdom HJ Enthoven	Not applicable
Contaminated soil/stone	17 05 03*	Drain cleaning	0.14		Not applicable	Not applicable	D10 Incineration on land Germany Sonderabfall Verbrennungs anlange (SAVA) D10 Incineration on land Germany Remondis Industrie Service GmbH

Waste material	EWC Code	Main source[1]	Quantity		On-site Recovery/Disposal (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes/ month	m^3/month			
Asbestos-containing material	17 06 .01*	Site wide	Note 1		Not applicable	Not applicable	D1 Landfill Germany Otto Dörner Entsorgung GmbH
Solid combustible wastes	19 02 09*	Site wide	0.03		Not applicable	Not applicable	D10 Incineration on land Germany Sonderabfall Verbrennungs anlange (SAVA) D10 Incineration on land Germany Remondis Industrie Service GmbH
Contaminated waste sludges	19 12 11*	Wastewater treatment	4.20		Not applicable	Not applicable	D10 Incineration on land Germany Remondis Industrie Service GmbH D15 Storage Portlaoise ENVA Ireland

1. A reference should be made to the main activity / process for each waste.

TABLE H.1(ii) WASTE - Other Waste Recovery/Disposal

Waste material	EWC Code	Main source[1]	Quantity		On-site Recovery/Disposal[2] (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes/ month	m^3/month			
Bio sludge	05 01 10	Wastewater treatment plant	1.11		Not applicable	R1 Reuse as fuel, Youghal, Co. Cork, Eras Eco Co.	Not applicable
Sulphur	05 01 16	Desulphurisation process	53.3		Not applicable	R5 Inorganic substance recycling Norfolk, UK Omex Agri Ltd.	Not applicable
Sulphur-containing wastes	05 01 16	Sulphur sludge from desulphurisation process	0.0004		Not applicable	R5 Inorganic substance recycling Shannon Enva Ireland	Not applicable
Non hazardous construction & demolition waste	17 01 07	Site wide	2		Not applicable	Not applicable	D1 Landfill Cork Cork City Council (Kinsale Road Landfill) D1 Landfill Cork Cork City Council (Youghal Landfill)
Iron/steel	17 04 05	Scrap equipment	28.78		Not applicable	R4 Metal recovery Cork Cork Metal	Not applicable
Paper/cardboard	20 01 01	Office paper/incoming deliveries	1.02		Not applicable	R3 Organic Substance Recycling, Cork, Rehab Recycle	Not applicable

Waste material	EWC Code	Main source[1]	Quantity		On-site Recovery/Disposal[2] (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes/ month	m^3/month			
Paper/cardboard	20 01 01	Incoming packaging	0.30		Not applicable	R3 Organic substance recycling Cork CTO Environmental Solutions Ltd. R3 Organic substance recycling Cork Rehab Recycling	Not applicable
Glass	20 01 02	Packaging	0.03		Not applicable	R5 Inorganic substance recycling Cork Rehab Recycle	Not applicable
Biodegradable canteen waste	20 01 08	Canteen	0.42		Not applicable	R3 Organic substance recycling Waterford Molasin Compost R3 Organic substance recycling Cork McGill Environmental Systems (Ireland) Ltd.	D1 Landfill Cork Cork City Council (Kinsale Road Landfill) D1 Landfill Cork Cork City Council (Youghal Landfill)
Waste electrical & electronic equipment (WEEE)	20 01 36	Redundant office equipment	0.08		Not applicable	R5 Inorganic substance recycling Cork Rehab Recycle	Not applicable

Waste material	EWC Code	Main source[1]	Quantity		On-site Recovery/Disposal[2] (Method & Location)	Off-site Recovery, reuse or recycling (Method, Location & Undertaker)	Off-site Disposal (Method, Location & Undertaker)
			Tonnes/ month	m^3/month			
Timber	20 01 38	Incoming packaging	3.65		Not applicable	R3 Organic substance recycling Cork Midleton Skip Hire	Not applicable
Metals	20 01 40	Drinks cans	0.03		Not applicable	R4 Metal recovery Cork Rehab Recycle	Not applicable
General municipal waste	20 03 01	Site wide	11.1		Not applicable	R5 Inorganic substance recycling Cork Veolia Environmental Services Limited	D1 Landfill Cork Cork City Council (Kinsale Road Landfill) D1 Landfill Cork Cork City Council (Youghal Landfill)
Bulky municipal waste	20 03 07	Site wide	5.2		Not applicable	R5 Inorganic substance recycling Cork Veolia Environmental Services Limited	D1 Landfill Cork Cork City Council (Kinsale Road Landfill) D1 Landfill Cork Cork City Council (Youghal Landfill)

1. A reference should be made to the main activity/ process for each waste.
2. The method of disposal or recovery should be clearly described and referenced to Attachment H.1

H.3 Waste disposal by on-site landfilling
For wastes to be disposed of by landfilling on-site, full details of the disposal site should be submitted (to include inter alia, site selection procedures, location maps, (no larger than A3) geology, hydrogeology, operational plan, containment, gas and leachate management, post-closure care).

Supporting information should form **Attachment No H.3**.

H.3 Waste Disposal by On-Site Landfilling

No waste materials generated at the Refinery are landfilled on-site. All hazardous and non-hazardous wastes generated at the site are collected by Waste Collection Contractors issued with appropriate Waste Collection Permits for collection within Co. Cork and are brought to appropriately licensed or permitted waste facilities off site for disposal or recovery. Refer to Section H.2.

Historically, certain wastes that were generated at the site were disposed of by landfilling within designated areas at the site. These wastes included and their designated areas included:

- Industrial inert waste landfill;
- Domestic waste landfill;
- Oily waste disposal pits;
- Oily waste storage areas;
- Oily waste landfarms;
- Asbestos disposal pits;
- Lead scale disposal pits;
- Lead scale weathering areas;
- Sulphur storage areas;
- Scrap metal storage; and
- Catalyst disposal pits.

On-site landfilling of waste at the site ceased in December 2000, at which point all waste materials were disposed of or recovered off site. In 2005, a landfill decommissioning project was carried out at the site. The purpose of the project was to remove contaminated land from the site at a number of locations. Five areas of the site were excavated and approximately 10,000 tonnes of soil was removed for treatment. Table 23 lists the areas which were excavated.

Table 23: Excavation Areas for Landfill Decommissioning Project

Area	Location	Description of Contamination
A	Between Tanks P-18 & P-19	Heavy fuel oil
B	South-west corner of the site	Oily sludge pit
C	South-west corner of the site	Oily sludge pit
D	Beside Tank p-22	Oil spill debris & oily waste land farm

E	Beside Tank p-22	Oily waste land farm

An environmental monitoring project was undertaken by Fehily Timoney & Company in tandem with the landfill decommissioning project; the purpose of this was to determine the baseline environmental conditions and to determine the impact, if any, of decommissioning on the environment. Four media were sampled: surface water, groundwater, air and soil. The surface water and groundwater were monitored for volatile organic chemicals (VOCs), heavy metals, diesel range organics (DRO), petrol range organics (PRO) and BTEX (benzene, toluene, ethyl benzene and xylene). Both ambient and occupational air monitoring for VOCs and asbestos was carried out. The soil was measured for asbestos.

Measurements were taken prior to the removal of the material from a number of locations around the site and measurements were taken post removal. The conclusions from The Environmental Monitoring Report are presented in Table 24.

Table 24: Conclusions on the Environmental Impact of the Landfill Decommissioning Project

Media	Conclusion
Surface Water	*'In summary, the decommissioning operations at the site had a minimal short-term impact on surface water quality at the site. It is anticipated that surface water quality will improve at the site and no mitigation measures will be required.'*
Groundwater	*'In summary, the environmental monitoring data pre and post decommissioning has shown that contamination of the groundwater is occurring on site. This is particularly true of groundwater down gradient of the waste land farm and oily debris area. The removal of contaminated soil by this project may have intermittently increased some parameters during the excavation process. The removal of circa 10,000 tonnes of contaminated soil will only improve the groundwater quality down-gradient of the site over time. Further groundwater monitoring at site in accordance with its IPC licence will show the beneficial effects of the removal of the contaminated soil.'*
Soil	*'No asbestos fibres were detected in the soil samples.'* Four soil samples were taken from the south-west corner of the site.
Air	As part of the project, occupational monitoring was carried out to determine blood lead levels of the operators, occupational/ambient VOC levels and occupational/ambient asbestos levels during the excavation operations. *'The occupational monitoring conducted on the operators found no exceedences in the allowable eight hour time weighted averages for volatile organic chemicals (VOC's). No asbestos was found during the occupational monitoring and the operator's blood levels after decommissioning were below the occupational exposure level of 40 µg/dl.'* There were no conclusions presented on the results of the ambient air quality monitoring, but the results were included in an Annex to the Report. They show that, based on ambient air quality standards derived from the national occupational exposure limits6, there were no exceedences for the BTEX (Benzene, Ethylbenzene, Toluene & Xylene) substances.

Details of the decommissioning activities undertaken following cessation of landfilling activities are set out in the Landfill Decommissioning Plan, which was submitted to the Agency in compliance with Condition 7.7 of the site's licence.

SECTION I: EXISTING ENVIRONMENT & IMPACT OF THE ACTIVITY

Describe the conditions of the site of the installation.

Provide an assessment of the effects of any emissions on the environment, including on an environmental medium other than that into which the emissions are made.

Describe, where appropriate, measures for minimising pollution over long distances or in the territory of other states.

I.1 Assessment of atmospheric emissions

Describe the existing environment in terms of air quality with particular reference to ambient air quality standards.

Provide a statement whether or not emissions of main polluting substances (as defined in the Schedule of S.I. 394 of 2004) to the atmosphere are likely to impair the environment.

Give summary details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Attachment No I.1 should also contain full details of any dispersion modelling of atmospheric emissions from the activity, where required. When carrying out dispersion modelling, regard should be had to the "Guidelines for the Preparation of Dispersion Modelling Assessments for Compliance with Regulatory Requirements – an Update to Royal Meteorological Society Guidance" or similar guidelines from a recognised authority.

I.1 Assessment of Atmospheric Emissions

The ASA Plant will enable the refinery to eliminate ammonia emissions to atmosphere from the existing SRU. Some ammonia is currently sent to flare as Sour Water Stripper (SWS) off-gas.

NOx emissions from the combustion process within the WSA will be removed by converting the NOx to nitrogen in a Selective Catalytic Reduction (SCR) Unit, also within the WSA. The purpose of this SCR step is not for emissions abatement but primarily to improve the colour/clarity of the sulphuric acid product which the market demands.

Dispersion modelling has been undertaken to demonstrate that the existing licence limit of 245 kg/hr of SO_2 is quite conservative and that the existing ELVs are more than adequate to protect air quality when burning heavy fuel oil with emissions of SO_2 of 245 kg/hr. Copies of the dispersion modelling reports commissioned by ConocoPhillips have already been provided to the Agency and are included in Attachment I.1.

The installation in 2011 of a superior and proven sulphur recovery technology which represents BAT (The ASA Plant) will deliver the environmental benefits described in terms of reduced SO_2 emissions and, in normal operation, and will enable Whitegate to reduce its average hourly, daily and annual emissions of SO_2.

This annual reduction in SO_2 emissions will be substantial compared to 2009 emissions and even compared to Q4 of 2010 emissions where natural gas was the main supplementary fuel.

The refinery monitors ambient air for SO_2 and NOx continuously and computes daily average values of ambient air concentrations for these pollutants. These results are reported to the EPA quarterly/annually. These show that in 2010 the ambient levels of SO_2 and NOx were comfortably within the Air Quality Standards for these pollutants for all averaging times - hourly, daily and annually.

The impact of emissions to atmosphere has been checked by two means:

- Dispersion modelling of SO_2, NOx and H_2SO4 emissions from the site once the ASA plant is operational;
- The ambient air monitoring on the refinery and environs.

Both indicate that the current and proposed operations of the refinery cause no significant pollution. In the future the modelling suggests that the contribution to annual SO_2 concentrations will be less than the background concentrations.

Scenario 1: SO_2 Ground Level Concentrations (GLCs) (Normal Case – ASA Plant Running and Natural Gas As Supplementary Fuel)

The results from modelling of SO_2 for Scenario 1 (Normal Case – with ASA Plant operating and Natural gas as supplementary fuel) are presented in the Table 27 below. All results comply with the relevant Air Quality Standards (AQS) for SO_2 at all receptors.

Table 25 Scenario 1 Ground Level Concentrations of SO2 from Refinery

	Table 4 Maximum Predicted GLCs for SO2 for Scenario A (33kg/hr) SO2 GLC from Whitegate Emissions (µg/m³)	**Background Concentration (µg/m³)**	**Total GLC (µg/m³)**	**Air Quality Standard (µg/m³)**	**Location**
Annual	1.2	4	5.2	20	E183813 N63485
99.73rd %ile of 1-hour average	16.2	8[1]	24.2	350	E184250 N63500
99.18th %ile of 24-hour average	11.2	8[1]	19.2	125	E183750 N64000

[1] UK Environment Agency H1 p. 26 "Note that the background concentration in the case of assessing short term effects is assumed to be twice the long term ambient concentration. "

From the table it can be seen that the annual contribution of SO_2 concentrations from the refinery emissions at the point of maximum annual concentration is ~ 1/3rd of the background level and is ~ 1/20th of the annual AQS.

Scenario 2: SO2 Ground Level Concentrations (GLCs) (ASA Running and HFO being used as Supplementary Fuel

The results from modelling of SO_2 for Scenario 2 – emissions at 245 kg/hr with ASA Plant online are presented in the Table 28 below. All results still comply with the relevant Air Quality Standards (AQS) for SO_2 at all receptors.

Table 26: Scenario 2 Ground Level Concentrations of SO_2 from Refinery firing Heavy Fuel Oil as Supplementary Fuel

Averaging Period for AQS	Table 4 Maximum Predicted GLCs for SO2 for Scenario A (245 kg/hr) SO2 GLC from Whitegate Licensed Emission Points (µg/m³)	Background Concentration (µg/m³)	Total GLC (µg/m³)	Air Quality Standard (µg/m³)	Location
Annual Average	7.6	4.0	11.6	20	E183811 N63518
99.73rd %ile of 1-hour average	116	8[1]	124	350	E184250 N63500
99.18th %ile of 24-hour average	52.4	8[1]	60.4	125	E183500 N64000

[1] UK Environment Agency H1 p. 26 "Note that the background concentration in the case of assessing short term effects is assumed to be twice the long term ambient concentration. "

From the table it can be seen that at an emission rate of 245 kg/hr of SO2, the AQS for all averaging periods is met with a considerable safety margin. It should also be noted that when the refinery was previously run with heavy fuel oil, average emissions were less than 245 – on average ~ 160 kg/hr.

I.2 Assessment of Impact on Receiving Surface Water

Describe the existing environment in terms of water quality with particular reference to environmental quality standards or other legislative standards. Table I.2(i) should be completed

Provide a statement whether or not emissions of main polluting substances (as defined in the Schedule of S.I. 394 of 2004) to water are likely to impair the environment.

Give summary details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Full details of the assessment and any other relevant information on the receiving environment should be submitted as **Attachment No I.2**.

I.2 Assessment of Impact on Receiving Surface Water

The refinery has been running since 1959 and to date no evidence of adverse impacts on the harbour have been noted.

Heretofore there has been no requirement on ConocoPhillips to monitor the water quality in Cork Harbour on an ongoing basis. In 2001 ConocoPhillips conducted once off analysis of four samples from the water column in the lower Cork Harbour in the vicinity of the outfall (at distances of 10, 100, and 500 m of the outfall). The analysis by Enterprise Ireland indicated that the level of oxygen saturation at 98.5% at a salinity of ~ 32.5% . A value of 98.5% Dissolved Oxygen as a per cent of saturation comfortably meets the Upper and Lower Limits for Dissolved Oxygen in Coastal Water Body (summer).

The values measured by ConocoPhillips in May of 2001 were in fact almost exactly in the mid range between the upper and lower limits in the European Communities Environmental Objectives (Surface Waters) Regulations 2009 for coastal waters . The installation of enhancements to the WWTP outlined above occurred after 2001 so the current impact on the harbour is likely to be even less in 2011 and ongoing.

The results of testing by Enterprise Ireland and the Environmental Agency Laboratories in Lannelli in Wales included analysis of the effluent from SW-1 and SW-2.

The results were as per the following table.

Table 27: Sea Water and Effluent Sampling in Vicinity of Whitegate Refinery Outfalls May 2001

Sample Number	Sample Location	Metres Offshore	Metres form Outfall	pH	Dissolved Oxygen (% saturation)	Toxicity Units	Salinity% at 20 °C
1	Harbour 10 m from SW-1 outfall	10	10	8.0	98.4%	<1	32.4
2	Harbour 10 m from SW-1 outfall	100	100	8.1	98.8%	<1	32.6
3	Harbour 10 m from SW-1 outfall	100	500	8.1	98.5%	<1	32.5
4	**SW-1 Effluent** discharge pipe – composite 24 hour sample	N/al	nil	7.4	74.2%	<2.2	<1
5	Sea Water East of SW-2 outfall	200	200	8.1	99.9%	<1	31.7
6	SW-2 **Effluent** – low flow grab sample (ballast water)	N/a	n/a	7.2	66.8%	<2.2	18.8

The new Environmental Quality Directive requires that dissolved oxygen for coastal waters lie in a range between 80% saturation minimum and 120% saturation maximum both in summer. As can be seen from the above Table the dissolved oxygen status of all the sea water samples taken in the vicinity of the Whitegate Refinery outfalls – SW-1, the Imhoff Tank outfall (SW-5) and SW-2 lie comfortably at the mid-range within these limits.

A can be seen from the analysis of the water column in the Table the combined impact of SW-1 and the Imhoff Tank discharges has no apparent impact on dissolved oxygen levels in the harbour in the vicinity of the Whitegate outfalls even at 10 metres distance from the SW-1 discharge. Dissolved oxygen levels were well within the limits in the Environmental Quality Objectives Regulations for coastal waters.

I.2.1 Environmental Objectives Directive

The EPA is required to initiate a review of all IPPC licences which discharge to surface waters. From discussions with the Agency in June 2011 we noted that the first priority for the EPA is to review licences for ~ 15 sites which discharge into rivers. Discharges to coastal waters were a lower priority but must be addressed by the Agency and operators and this exercise must be completed before December 2012.

Following discussions with the Agency in August 2011, ConocoPhillips intends to conduct a series of sampling programmes around its outfalls in Q4 2011 in order to comply with the requirement for such monitoring before December 2012. Depending on the initial findings, the company may also review the need to model the dispersion from the outfalls. The upcoming sampling programme will be done in accordance with guidance on parameters to be measured as notified by the Agency to ConocoPhillips in August 2011.

I.2.2 Bathing Water Quality

ConocoPhillips has conducted a check on the Quality of Bathing Waters in the vicinity of the Refinery outfalls and on Corkbeg Beach to the north east of the outfalls. The analysis in 2006 returned values of Enterococci (intestinal) of 54 and 48 CFU/100mls respectively when tested in accordance with ISO 7899-2 as specified in the Bathing Water Directive 2006[7].

These two test results would meet the criteria for meet the criteria for "excellent" quality in respect of Coastal and Transitional Waters for this parameter. The standard for "excellent" bathing water on this parameter is less than 100 cfu/100 ml (based on a 95-percentile evaluation per Annex II of the Directive).

[7] Directive 2006/7/EC Of the European Parliament and the Council of 15th February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC

Table I.2(i) SURFACE WATER QUALITY

(Sheet 1 of 2) Monitoring Point/ Grid Reference: _____Monitoring to be undertaken in Q4 2011 – see results of 2001 and 2006 sampling in Section I.2 above._____

Parameter	Results (mg/l)				Sampling method[2] (grab, drift etc.)	Normal Analytical Range[2]	Analysis method/technique
	Date	Date	Date	Date			
pH							
Temperature							
Electrical conductivity EC							
Ammoniacal nitrogen NH_4-N							
Chemical oxygen demand							
Biochemical oxygen demand							
Dissolved oxygen DO							
Calcium Ca							
Cadmium Cd							
Chromium Cr							
Chloride Cl							
Copper Cu							
Iron Fe							
Lead Pb							
Magnesium Mg							
Manganese Mn							
Mercury Hg							

Parameters to be tested in harbour as agreed with Agency in August 2011 include BOD, DO and DIN.

Surface Water Quality (Sheet 2 of 2)

Parameter	Results (mg/l)				Sampling method (grab, drift etc.)	Normal Analytical Range	Analysis method/technique
	Date	Date	Date	Date			
Nickel Ni							
Potassium K							
Sodium Na							
Sulphate SO_4							
Zinc Zn							
Total alkalinity (as $CaCO_3$)							
Total organic carbon TOC							
Total oxidised nitrogen TON							
Nitrite NO_2							
Nitrate NO_3							
Faecal coliforms (/100mls)							
Total coliforms (/100mls)							
Phosphate PO_4							

See above for parameters to be tested in harbour as agreed with Agency in August 2011.

I.3 Assessment of Impact of Sewage Discharge
Give summary details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Full details of the assessment and any other supporting information should form **Attachment No I.3**.

I.3 Assessment of Impact of Sewage Discharge

See Section I.2 for historical results on DO as percentage of oxygen saturation in harbour, and microbiological testing of waters at Corkbeg Beach in 2006. The sewage receives primary treatment in an Imhoff Tank.

The population on site is 155 persons plus contracting personnel PE of 200. By comparison the Whitegate – Aghada agglomeration has a PE of over 1500. ConocoPhillips understands that the sewerage from this area was discharged untreated as recently as 2009.

I.4 Assessment of Impact of Ground/Groundwater Emissions
Describe the existing groundwater quality. Tables I.4(i) should be completed.
Give summary details and an assessment of the impacts of any existing or proposed emissions on the ground (aquifers, soils, sub-soils and rock environment), including any impact on environmental media other than those into which the emissions are to be made. This includes landspreading, land injection etc.

Land on which material may be landspread shall be identified on a suitable scaled map (1:10,560 and 1:50,000) and submitted as no greater than A3 size. All vulnerable (as a result of ground emissions) surface water bodies must be identified on these maps. Additional information should be included in **Attachment No I.4**.

Landspreading of Agricultural/Non Agricultural Wastes

Tables I.4(ii) and I.4.(iii) should be complete where applicable. Further information is available in the Application Guidance Document.

I.4 Assessment of Impact of Ground/Groundwater Emissions

There are no emissions to ground or groundwater at the site and therefore this section is not applicable.

Table I.4(i) GROUNDWATER QUALITY

(Sheet 1 of 2) Monitoring Point/ Grid Reference: _____

Parameter	Results (mg/l)				Sampling method (composite etc.)	Normal Analytical Range	Analysis method/technique
	Date	Date	Date	Date			
pH							
Temperature							
Electrical conductivity EC							
Ammoniacal nitrogen NH_4-N							
Dissolved oxygen DO							
Residue on evaporation (180^{o}C)							
Calcium Ca							
Cadmium Cd							
Chromium Cr							
Chloride Cl							
Copper Cu							
Cyanide Cn, total							
Iron Fe							
Lead Pb							
Magnesium Mg							
Manganese Mn							
Mercury Hg							
Nickel Ni							
Potassium K							
Sodium Na							

Detailed analyses of groundwater monitoring programmes are submitted regularly to the Agency and are available in the AERs on the Agency website.

Groundwater Quality (sheet 2 of 2)

Parameter	Results (mg/l)				Sampling method (composite, etc.)	Normal Analytical Range	Analysis method/technique
	Date	Date	Date	Date			
Phosphate PO4							
Sulphate SO_4							
Zinc Zn							
Total alkalinity (as $CaCO_3$)							
Total organic carbon TOC							
Total oxidised nitrogen TON							
Arsenic As							
Barium Ba							
Boron B							
Fluoride F							
Phenol							
Phosphorus P							
Selenium Se							
Silver Ag							
Nitrite NO_2							
Nitrate NO_3							
Faecal coliforms (/100mls)							
Total coliforms (/100mls)							
Water level (m OD)							

Detailed analyses of groundwater monitoring programmes are submitted regularly to the Agency and are available in the AERs on the Agency website.

TABLE I.4(ii): LIST OF OWNERS/FARMERS OF LAND

Land Owner	Townlands where landspreading	Map Reference	Fertiliser P requirement for each farm

Total P requirement of the client List _____

Not applicable

TABLE I.4(ii): LANDSPREADING

Land Owner/Farmer _____

Map Reference _____

Field ID	Total Area (ha)	(a) Usable Area (ha)	Soil P Test Mg/l	Date of P test	Crop	P Required (kg P/ha)	Volume of On-Farm Slurry Returned (m^3/ha)	Estimated P in On-Farm Slurry (kg P/ha)	(b) Volume to be Applied (m^3/ha)	P Applied (kg P/ha)	Total Volume of imported slurry per plot (m^3)

TOTAL VOLUME THAT CAN BE IMPORTED ON TO THE FARM:

Concentration of P in landspread material	- kg P/m^3
Concentration of N in landspread material	- kg N/m^3

Not applicable

I.5 Ground and/or Groundwater Contamination
Summary details of known ground and/or groundwater contamination, historical or current, on or under the site must be given.

Full details including all relevant investigative studies, assessments, or reports, monitoring results, location and design of monitoring installations, plans, drawings, documentation, including containment engineering, remedial works, and any other supporting information should be included in **Attachment No I.5**.

I.5 Ground and/or Groundwater Contamination

ConocoPhillips conducts extensive groundwater monitoring the results of which are contained in the annual AERs on the Agency Website. The geology is described below.

Bedrock Geology
Information supplied from the GSI Bedrock Map Series, scale 1:100,000 - Sheet 25 shows the area of main refinery consists of three geological formations consisting of inter-bedded siltstones, sandstones and shale's and which are collectively know as Devonian bedrock. These have an approximate east north east – west south west orientation and are found on the mainland portion of the site. The bedrock beneath Corkbeg Island and the northern portion of the site consists of Carboniferous aged massive unbedded Waulsortian fine grained limestone.

Aquifer Classification
The GSI classifies the three bedrock formations present on the main refinery site as a 'locally important aquifer that is moderately productive only in local zones' (LI). Typically this aquifer classification is classified as capable of having moderate well yields between 100-400m^3/day, although largely dependant on the intersection of bedrock fractures.

The Waulsortian Limestone to the south of Corkbeg Island is classified as a locally important karstified aquifer with well yield reported to be capable of between 100 to 400m^3/day. The limestone aquifer beneath Corkbeg Island are unclassified by the GSI, potential due to the extent of the bedrock saline influence on this small island.

Aquifer Vulnerability
The GSI classifies the vulnerability of the bedrock aquifer on the refinery site as extreme (E), indicating bedrock is within 3m of ground level. This corresponds largely with borehole records for the site apart from some areas where the overburden is up to 5m in thickness which would classify it as high (H) vulnerability.

Groundwater flow direction
Generally the water table is a subdued reflection of the topography. It can be seen that there is a groundwater divide roughly through the centre of the site in an east west orientation with an element of groundwater flow to the north and south which corresponds with the topography on-site. The groundwater flow to the south and southwest feeds into the Glanagow Stream Catchment while the northern groundwater flows to the O'Driscoll Drive Stream and Cork Harbour. Groundwater on Corkbeg Island is an isolated catchment which flows to the harbour.

I.6 Assessment of the Environmental Impact of On-site Waste Recovery and/or Disposal
Describe the arrangements for the prevention and recovery of waste generated by the activity.

Give details, and an assessment of the impact of any existing or proposed on-site waste recovery/disposal on the environment, including environmental media other than those into which the emissions are to be made.

This information should form **Attachment No I.6**.

I.6 Assessment of the Environmental Impact of On-Site Waste Recovery and/or Disposal

There is no on-site recovery or disposal of waste at the site and therefore this section is not applicable.

I.7 Noise Impact
Give details and an assessment of the impacts of any existing or proposed emissions on the environment, including environmental media other than those into which the emissions are to be made.

Ambient noise measurements

Complete Table I.7(i) in relation to the information required below:

State the maximum Sound Pressure Levels which will be experienced at typical points on the boundary of the operation. (State sampling interval and duration)
State the maximum Sound Pressure Levels which will be experienced at typical noise sensitive locations, outside the boundary of the operation.
Give details of the background noise levels experienced at the site in the absence of noise from this operation.

Prediction models, maps (no larger than A3), diagrams and supporting documents, including details of noise attenuation and noise proposed control measures to be employed, should form **Attachment No I.7**.

I.7 Noise Impact

In 2011 all these readings were within the limits set in the IPPC Licence.

The existing SRU has two particular items of equipment which are relevant to noise levels. These are a belt press for treating the sulphur cake and an air blower. The new ASA plant will not have such units as it handles liquid and gas streams only. Shutting down the belt press and air blower on the SRU once the ASA plant is operational would thus be expected to reduce local noise levels on the site at the location of the existing sulphur removal technology.

Table I.7(i): AMBIENT NOISE ASSESSMENT

Third Octave analysis for noise emissions should be used to determine tonal noises

	National Grid Reference	Sound Pressure Levels					
	(6N, 6E)	$L(A)_{eq}$		$L(A)_{10}$		$L(A)_{90}$	
SITE BOUNDARY		Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
Location 4:	627260N 182647E	54 - 55	54 - 55	55 - 56	53 - 54	52 - 53	52 - 53
NOISE SENSITIVE LOCATIONS		Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
Location 1:	632790N 183530E	47 - 60	46 - 47	48 - 56	46 - 47	43 - 50	44
Location 2:	634630N 183799E	52 - 59	41 - 44	53 - 62	42 - 44	43 - 44	39 - 40
Location 3:	627890N 182284E	43 - 47	37 38	46 - 50	39 - 40	36 – 40	34 - 35
Location 5:	634320N 183894E	50 - 52	44 - 48	53 - 54	45 - 48	45 - 48	43

NOTE: All locations should be identified on accompanying drawings.

Details of monitoring locations see map in Section E.5.

I.8 Environmental Considerations and BAT

Describe in outline the main alternatives, if any, to the proposals contained in the application.

Describe any environmental considerations which have been made with respect to the use of cleaner technologies, waste minimisation and raw material substitution.

Describe the measures proposed or in place to ensure that:

The best available techniques are or will be used to prevent or eliminate or, where that is not practicable, generally reduce an emission from the activity; no significant pollution is caused; waste production is avoided in accordance with Council Directive 75/442/EEC of 15 July 1975 on waste; where waste is produced, it is recovered or, where that is technically and economically impossible, it is disposed of while avoiding or reducing any impact on the environment; energy and other resources are used efficiently; the necessary measures are taken to prevent accidents and limit their consequences; the necessary measures are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state.

Supporting information should form **Attachment No I.8**.

I.8 Environmental Considerations and BAT

Overview

Table 28 Council Directive 2008/1/EC Requirements

Obligation	Assessment
All the appropriate preventive measures are taken against pollution, in particular through application of the best available techniques.	A full review in 2007 of the techniques used at the refinery compared to BAT in BREFs concluded that the main area for improvement was in the area of sulphur recovery which the ASA plant will fully address.
No significant pollution is caused.	None of the ambient monitoring exceeded air quality limits, or noise limits. Tests on the water column in 2001 suggest that no significant pollution of the harbour has occurred in over 50 years of refining.
Waste production is avoided in accordance with Council Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste; where waste is produced, it is recovered or, where that is technically and economically impossible, it is disposed of while avoiding or reducing any impact on the environment.	This has been pursued by, inter alia, changing from landfilling and land spreading on site to use of licensed offsite disposal alternatives. The refinery has a successful programme to minimise waste water volumes.

Obligation	Assessment
Energy is used efficiently.	The refinery is continually seeking to improve energy efficiency, it has a CHP unit which is much higher in overall thermal efficiency than the national grid average. Periodic studies are undertaken to ensure opportunities for increased energy efficiency are examined for cost effectiveness. CO_2 emissions are on a reducing path as a result.
The necessary measures are taken to prevent accidents and limit their consequences.	The site is a Upper Tier Seveso Site. On an ongoing basis operations are subjected to Hazard Identification nd Risk Assessments. A Safety Report is submitted to the Health and Safety Authority and this was updated as recently as 2010. This examined potential accident hazards with consequences for man and the environment.
The necessary measures are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state.	The refinery has conducted studies on the steps needed and costs incurred in the event of cessation and the resultant CRAMP report has been submitted to the EPA.

In addition to these general obligations placed on operators, Annex IV of Council Directive 2008/1/EC lists considerations to be taken into account generally, or in specific cases, when determining best available techniques as defined in the Directive, bearing in mind the likely costs and benefits of a measure and the principles of precaution and prevention. These twelve considerations are:

- the use of low-waste technology;
- the use of less hazardous substances;
- the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate;
- comparable processes, facilities or methods of operation which have been tried with success on an industrial scale;
- technological advances and changes in scientific knowledge and understanding;
- the nature, effects and volume of the emissions concerned;
- the commissioning dates for new or existing installations;
- the length of time needed to introduce the best available technique;
- the consumption and nature of raw materials (including water) used in the process and energy efficiency;
- the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risk to it;
- the need to prevent accidents and to minimise the consequences for the environment;
- the information published by the Commission pursuant to Article 17 (2) second paragraph, or by international organisations.

Table 29: Considerations on BAT

Topic	Assessment
The use of low-waste technology.	The new ASA plant will recover more sulphur in the incoming crude oil and convert it into a commercial product – sulphuric acid. The new technology will eliminate ammonia emissions to atmosphere from the existing SRU. The ASA Plant will reduce the quantity of caustic soda used of LPG sweetening by a factor of 10.
The use of less hazardous substances.	Oil refining coverts crude oil into refined products. There is little scope for substituting new substances for transport fuels and heating oils in the medium term. The refinery has put in place plant to incorporate biofuels (which are less impact on global warming than fossil fuels) – this will make the products produced have a lower carbon footprint.
The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate.	See use of low – waste technology above
Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale.	The refinery dates from 1959 and is a hydroskimming refinery. There are many processes which are possible on larger scale refineries than Whitegate but whose mimimum viable size and economies of scale precludes them for consideration. A full BAT assessment in 2007 only identified enhanced sulphur recovery as a major investment option for Whitegate. There are 80 such plants in operation worldwide. In the recent past extra processing steps have been added to the WWTP e.g. DAF and biological treatment stages.
Technological advances and changes in scientific knowledge and understanding.	Whitegate has a history of incorporating new technology and processes where these make economic sense and/or which are required to meet increasingly stringent EU product specifications – areas in which such investments have been made include – vapour recovery at road loading facility, Isomerisation Plant for enhanced gasoline production through octane improvement, new hydrodesulphurisation plant for ultra low sulphur diesel production, extra investment in WWTP, natural gas fuel supply project, and the ASA plant.
The nature, effects and volume of the emissions concerned.	The site uses dispersion modelling and ambient monitoring to assess the impacts given the nature and volumes of emissions (as well as stack heights). These are compared with the results of ambient monitoring. In Q4 2011 the refinery will undertake monitoring of the water column in the lower harbour for parameters agreed with the Agency in August 2011.
The commissioning dates for new or existing installations.	The Agency is kept aware of the commissioning dates of new installation
The length of time needed to introduce the best available technique.	All projects must receive sanction for capital expenditure based on a project rationale. The current ASA plant was in gestation for 3-4 years before capital was sanctioned by the Corporation. The Agency was informed at the same time as the Planning authority and the Health and Safety Authority i.e. in October 2010.

Topic	Assessment
The consumption and nature of raw materials (including water) used in the process and energy efficiency.	The refining of crude oil is a very traditional process and the products which can be produced depend on the market, the crude oils being processed, and increasingly the specifications for transport and other fuels which are set by the EU. Energy efficiency is of paramount importance to refinery operators. Whitegate refinery compares very favourable in terms of m3 of effluent per tonne of crude oil processed ~ 1/7th of the European average.
The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risk to it.	The ASA plant will reduce the overall impact of the refinery by reducing the emissions of SO_2 to atmosphere. It will also reduce ammonia emissions to air and minimise the use of caustic soda. The fitting of low-NOx burners to combustion equipment reduces these emissions.
The need to prevent accidents and to minimise the consequences for the environment.	As above: The site is a Upper Tier Seveso Site. On an ongoing basis operations are subjected to Hazard Identification and Risk Assessments. A Safety Report is submitted to the Health and Safety Authority and this was updated as recently as 2010. This examined potential accident hazards with consequences for man and the environment. It was accepted by the HSA in 2011.
The information published by the Commission pursuant to Article 17 (2) second paragraph, or by international organisations.	As part of its ongoing review of operations the refinery monitors all EU legislation relevant to refining, including safety and environmental legislation.

BAT Review 2007 – Energy Conservation

The refinery operations were compared with BREF notes and BAT for energy use in the sector in 2007. The assessment was independently conducted by ConocoPhillips Corporate personnel. The key findings in respect of energy use and efficiency were:

The activity employs an environmental management system that follows the principles of ISO14001 and includes energy management. Environmental management is integrated with other business systems where appropriate. The system includes for an environmental assessment of changes to the activity. Energy utilisation and efficiency are monitored regularly.

The BAT review highlighted the following

- The site is an existing activity.
- Energy is managed and reviewed in accordance with existing IPPC licence.
- Energy is a significant operating cost for the refinery and is monitored continually.
- A gas turbine is used to generate electricity and steam for use on the site.
- Continuous oxygen analysers are present on the majority of furnaces and boilers.
- Clean refinery fuel gas is used on gas fired heaters.
- The feasibility of adding a natural gas supply was investigated following the BAT review and this was installed in 2009/2010.
- Two heaters with appropriate controls were fired in 2007 using heavy fuel oil that was vaporised with steam. These have since been converted to natural gas firing.

- A dedicated clean gas supply is in place to a number of existing furnaces to as required by a condition of the existing IPPC licence. (See Block Diagram Attachment G.1).
- The Refinery Fuel Gas system is balanced on LPG.

- Advanced process control systems are used in operations on the refinery fuel gas system.

- Flaring is used as a safety system to protect process equipment in case of process upsets – this is a standard and essential feature of all refineries.

- When the refinery was running on heavy fuel oil (SRAR) (and if the need arose in the future due to gas prices or gas availability) the ratio of heavy fuel oil in the energy mix can be reduced if ever the readout from the ambient air quality monitors show an elevated SO_2 concentration that is approximately 50% of the air quality limit. This technique is not currently needed as all fuels used are gaseous fuels in 2011.

The existing activity has been operated on heavy fuel oil in the past in accordance with existing IPPC licence and has met existing ELVs for SO2 emissions from 1% sulphur in fuel oil firing (i.e.1700mg/Nm3). It also consistently operated within an SO_2 bubble emission limit value of 245 kg/hr for the licensed emission points in the existing IPPC licence. (see average SO_2 emissions of SO_2 in this Application.

There were no exceedances of either emission limit values or ambient air quality standards in the environs in 2010.

SECTION J: ACCIDENT PRVENTION & EMERGENCY RESPONSE

Describe the existing or proposed measures, including emergency procedures, to minimise the impact on the environment of an accidental emission or spillage.

Also outline what provisions have been made for response to emergency situations outside of normal working hours, i.e. during night-time, weekends and holiday periods.

Describe the arrangements for abnormal operating conditions including start-up, leaks, malfunctions or momentary stoppages.

Supporting information should form **Attachment No J**.

J.1 Overview

The site is regularly subjected to a Hazard Identification and Risk assessment process to identify potential accident s with potential to cause an adverse impact on persons or the environment. These assessments are submitted to the HSA on a regular basis .

The site operates and is manned 24 hours per day 365 days per year.

J.2 Storage of Liquid Materials

Liquids are stored in storage tanks designed to international standards such as API- Amercian Petroleum Institute. Tanks are bunded and the impermeability of the bunds has been upgraded in recent years.

J.3 Accidental Emissions

See Sections A.9.5 (Page 15) and also B9.

The site maintains a Major Accident Prevention Policy (MAPP) and has in place supporting procedures to implement the MAPP.

SECTION K: REMEDIATION, DECOMMISSIONING, RESTORATION & AFTERCARE

Describe the existing or proposed measures to minimise the impact on the environment after the activity or part of the activity ceases operation, including provision for post-closure care of any potentially polluting residuals.

Supporting information should be included as **Attachment No. K**.

K.1 Remediation, Decommissioning, Restoration & Aftercare

The refinery has conducted detailed studies on the methods and costing of remediation , decommissioning, restoration and aftercare in the CRAMP report already submitted to the Agency.

(See write up on CRAMP report in Section A.9.6)

SECTION L: STATUTORY REQUIREMENTS

Indicate how the requirements of Section 83(5)(a)(i) to (v) and (vii) to (x) of the EPA Acts, 1992 and 2003 shall be met, having regard, where appropriate, to any relevant specification issued by the Agency under section 5 (3) of the Act and the reasons for the selection of the arrangements proposed.

Indicate whether or not the activity is carried out, or may be carried out, or is located such that it is liable to have an adverse effect on –

(a) a site placed on a list in accordance with Chapter 1 of SI 94 of 1997, or

(b) a site where consultation has been initiated in accordance with Article 5 of the EU Habitats Directive (92/43/EEC), or

Indicate whether or not the activity is liable to have an adverse effect on water quality in light of S.I. No. 258 of 1998 (Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998).

Indicate whether any of the substances specified in the Schedule of the EPA (Licensing)(Amendment) 2004, S.I. 394 of 2004, are discharged by the activity to the relevant medium.

Fit and Proper Person

The PoE Act in Section 83(5)(xi) specifies that the Agency shall not grant a licence unless it is satisfied that the applicant or licensee or transferee as the case may be is a fit and proper person. Section 84(4) of the PoE Act specifies the information required to enable a determination to be made by the Agency.

- Indicate whether the applicant or other relevant person has been convicted under the PoE Act, the Waste Management Act 1996, the Local Government (Water pollution) Acts 1977 and 1990 or the Air Pollution Act 1987.
- Provide details of the applicant's technical knowledge and/or qualifications, along with that of other relevant employees.
- Provide information to show that the person is likely to be in a position to meet any financial commitments or liabilities that may have been or will be entered into or incurred in carrying on the activity to which the application relates or in consequence of ceasing to carry out that activity.

Supporting information should be included as **Attachment No L** with reference to where the information can be found in the application.

L.1 Compliance with Section 83(5)(a)(i)

Section 83(5)(a)(i) of the EPA Act 2003 refers to contravention of air quality standards specified under Sections 50 and 51 of the Air Pollution Act 1987.

There have been no infringement of air quality standards due to the operation of the refinery. This situation will be further enhanced by the addition of the ASA plant.

L.2 Compliance with Section 83(5)(a)(ii)

Section 83(5)(a)(ii) of the 2003 Act refers to compliance with, and contravention of, quality standards for waters, trade effluent and sewage effluents.

The plant complies with the requirements of its IPPC Licence issued in 2000.

L.3 Compliance with Section 83(5)(a)(iii)

Section 83(5)(a)(iii) of the 2003 Act refers to compliance with, and contravention of, standards prescribed under regulations made under the European Communities Act 1972.

The refinery operates at all times in compliance with EU Regulations.

L.4 Compliance with Section 83(5)(a)(iv)

Section 83(5)(a)(iv) of the 2003 Act refers to compliance with noise regulations. Noise surveys of the site show that the noise levels at the boundary to the site vary from 40.0 dB(A) to 63.1 dB(A). The limit on noise emissions at noise sensitive locations set in the Agency's guidance note for noise emissions are 55 dB(A) for daytime and 45 dB(A) for night-time operations.

The plant operates in accordance with the limits in its IPPC Licence. Furthermore there have been no complaints of noise made to the site since the IPPC licence was issued.2000.

L.5 Compliance with Section 83(5)(a)(v)

Section 83(5)(a)(v) of the 2003 Act refers to significant environmental pollution.

As verified by ambient monitoring and dispersion modelling the Whitegate refinery has not caused nor is projected to cause any significant air pollution. There have been no instances of water pollution of which the refinery is aware. Test on the receiving water in 2001 and 2006 indicated satisfactory quality for the parameters tested. Further sampling of the harbour waters is planned for Q4 2011.

L.6 Compliance with Section 83(5)(a)(vii)

Section 83(5)(a)(vii) of the 2003 Act refers to waste minimisation at the site.

Waste is minimised on the site as described in the application.

L.7 Compliance with Section 83(5)(a)(viii)

Section 83(5)(a)(viii) of the 2003 Act refers to efficient energy use at the site.

Efficient use of energy use is a primary concern for economic operation of an oil refinery. The application lists a series of measures installed to continually improve energy efficiency.

L.8 Compliance with Section 83(5)(a)(ix)

Section 83(5)(a)(ix) of the 2003 Act refers to accident prevention and emergency response.

The site has in place a Major Accident Prevention Policy and procedures for accident prevention and emergency response. Extensive documentation of the sites compliance with the requirements of the Seveso regulations is available on site for review by the Agency.

L.9 Compliance with Section 83(5)(a)(x)

Section 83(5)(a)(x) of the 2003 Act refers to measures to be taken upon the permanent cessation of the Activity.

The refinery has completed a CRAMP study and this is updated regularly and submitted to the Agency.

L.10 S.I. 94 of 1997

The European Communities (Nature Habitats) Regulations, S.I. 94 of 1997, give effect to Council Directive 92/43/EEC on the conservation of natural habitats of wild fauna and flora. The regulations were amended by the European Communities (Nature Habitats) (Amendment) Regulations, S.I. 233 of 1998 to give effect to Council Directive 97/62/EC of 27th October 1997 adapting to technical and scientific progress Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, and by the European Communities (Natural Habitats) (Amendment) Regulations, 2005.

The Refinery is aware of its responsibilities under the Directives and has operated in harmony with the environs of Whitegate since it began operations in 1959.

L.11 S.I. 258 of 1998

The European Communities Regulations, S.I. 258 of 1998, give effect to certain requirements arising under Council Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community. The Regulations provide for specified improvements in water quality conditions in rivers and lakes based on phosphorus concentrations or related water classification.

The Water Quality (Dangerous Substances) Regulations, 2001 give further effect to EU Council Directive 76/464/EC (the Dangerous Substances Directive) and give effect to certain provisions of EU Directive 2000/60/EC (the Water Framework Directive).

The regulations prescribe water quality standards in relations to certain substances in surface waters, e.g. rivers, lakes, tidal waters. The substances include certain pesticides, solvents and metals.

The Refinery is in discussion with the Agency on new testing programme of harbour water in its vicinity as part of the Environmental Quality Objectives Directive and Regulations. See tables of constituents of main effluent in Table 15 Page 137 e.g. BOD, COD, suspended solids, ammonia, phenols etc.

L.12 Substances Specified in the Schedule of the EPA (Licensing)(Amendment) Regulations, 2004

The substances discharged to air from the site which are specified in the schedule of the Environmental Protection Agency (Licensing)(Amendment) Regulations, 2004 (S.I. 394 of 2004) are SO2, oxides of nitrogen, carbon monoxide, VOCs (See emission tables Section E).

L.13 Fit and Proper Person

ConocoPhillips operates 16 refineries worldwide. It is a well resourced company which has a Corporate culture of strict adherence to the regulatory regime in its areas of operations. It had no incidents of non compliances with its IPPC licence in 2010.

A copy of the Corporations Corporate Environmental Policy is included in the Attachments.

It has developed rigorous Corporate Standards and Procedures for production, safety and environmental protection to which the operation at Whitegate adheres. The senior management at the refinery have many years experience in refinery operations and hold appropriate degrees in management, engineering and scientific disciplines.

In particular the HSE Lead and the Environmental Lead each have over 25years working experience of Whitegate Refinery. Both hold Honours Degrees in Environmental Science.

SECTION M: DECLARATION

Declaration

I hereby make application for a licence / revised licence, pursuant to the provisions of the Environmental Protection Agency Acts, 1992 and 2003 and Regulations made thereunder.

I certify that the information given in this application is truthful, accurate and complete.

I give consent to the EPA to copy this application for its own use and to make it available for inspection and copying by the public, both in the form of paper files available for inspection at EPA and local authority offices, and via the EPA's website. This consent relates to this application itself and to any further information, submission, objection, or submission to an objection whether provided by me as Applicant, any person acting on the Applicant's behalf, or any other person.

Signed by: _____ **Date:** _____
(on behalf of the organisation)

Print signature name: _____

Position in organisation: _____

Company stamp or seal:

CHECKLIST FOR ARTICLE 10 COMPLIANCE

Article 10 of the Environmental Protection Agency (Licensing) Regulations, 1994 to 2004 sets out the statutory requirements for information to accompany a licence application. The Application Form is designed in such a way as to set out these questions in a structured manner and not necessarily in the order presented in Article 10. In order to ensure a legally valid application in respect of Article 10 requirements, all Applicants should complete the following checklist and submit it with the completed Application Form.

Article 10(2)		Section in Application	Checked by Applicant ✓
(a)	give the name, address and telephone number of the applicant and, if different, any address to which correspondence relating to the application should be sent and, if the applicant is a body corporate, the address of its registered or principal office,	B.1	✓
(b)	give - (i) in the case of an established activity, the number of employees and other persons working or engaged in connection with the activity on the date after which a licence is required and during normal levels of operation, or (ii) in any other case, the gross capital cost of the activity to which the application relates,	B.4	✓
(c)	give the name of the planning authority in whose functional area the activity is or will be carried on,	B.5	✓
(d)	in the case of a discharge of any trade effluent or other matter (other than domestic sewage or storm water) to a sewer of a sanitary authority, give the name of the sanitary authority in which the sewer is vested or by which it is controlled,	B.6	n/a
(e)	give the location or postal address (including where appropriate, the name of the relevant townland or townlands) and the National Grid reference of the premises to which the activity relates,	B.2	✓
(f)	specify the relevant class or classes in the First Schedule to the Act to which the activity relates,	B.3	✓
(g)	specify the raw and ancillary materials, substances, preparations, fuels and energy which will be produced by or utilised in the activity,	A.1.2, A3, G1	✓
(h)	describe the plant, methods, processes, ancillary processes, abatement, recovery and treatment systems, and operating procedures for the activity,	D	✓
(i)	indicate how the requirements of section 83(5)(a)(i) to (v) and (vii) to (x) of the Act shall be met, having regard, where appropriate, to any relevant specification issued by the Agency under section 5(3) of the Act and the reasons for the selection of the arrangements proposed,	L	✓
(j)	give particulars of the source, nature, composition, temperature, volume, level, rate, method of treatment and location of emissions, and the period or periods during which the emissions are made or are to be made,	E	✓
(k)	describe the arrangements for the prevention or minimisation of waste and, where waste is produced, on and off site arrangements for the recovery or disposal of solid and liquid wastes,	H2	✓

Article 10(2)		Section in Application	Checked by Applicant ✓
(l)	specify, by reference to the relevant European Waste Catalogue codes as prescribed by Commission Decision 2000/532/EC of 03 May 2000, the quantity and nature of the waste or wastes produced or to be produced by the activity,	H.2.7	✓
(m)	provide: (i) details, and an assessment, of the impacts of any existing or proposed emissions on the environment, including on an environmental medium other than that or those into which the emissions are or are to be made, and (ii) details of the proposed measures to prevent or eliminate, or where that is not practicable, to limit, reduce or abate emissions,	I1, I2, I7	✓
(n)	identify monitoring and sampling points and outline proposals for monitoring emissions and the environmental consequences of any such emissions,	F3, I1,I2	✓
(o)	describe the condition of the site of the installation,	A5	✓
(p)	describe in outline the main alternatives, if any, to the proposals contained in the application which were studied by the applicant,	A.2.3	✓
(q)	specify the measures to be taken to comply with an environmental quality standard where such a standard requires stricter conditions to be attached to a licence than would otherwise be determined by reference to best available techniques,	A.2.3, A3	✓
(r)	describe the measures to be taken for minimising pollution over long distances or in the territory of other states,	A.2.3	✓
(s)	describe the measures to be taken under abnormal operating conditions, including start-up, shutdown, leaks, malfunctions, breakdowns and momentary stoppages,	E.1	✓
(t)	describe the measures to be taken on and following the permanent cessation of the activity or part of the activity to avoid any risk of environmental pollution and to return the site of the activity to a satisfactory state,	A.9.6	✓
(u)	describe, in the case of an activity which gives, or could give rise, to an emission containing a hazardous substance which is discharged to an aquifer and is specified in the Annex to Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances, the arrangements necessary to comply with said Council Directive,	D.2.2	✓

Article 10(2)		**Section in Application**	**Checked by Applicant ✓**
(v)	include any other information required under Article 6(1) of Council Directive 2008/1/EC of 15 January 2008 concerning integrated pollution prevention and control,	Application form and Attachments - various	✓
(w)	include a non-technical summary of information provided in relation to the matters specified in paragraphs (f) to (v) above,	A	✓
(x)	state whether the activity consists of, comprises, or is for the purposes an establishment to which the European Communities (Control of Major Accident Hazards involving Dangerous Substances) Regulations, 2000 apply,	B9	✓

Article 10(3) Without prejudice to Article 12(1), an application for a licence shall be accompanied by -		**Section in Application**	**Checked by Applicant ✓**
(a)	a copy of the relevant page of the newspaper in which the notice in accordance with article 6 has been published,	Atachment	✓
(b)	a copy of the text of the site notice erected or fixed on the land or structure in accordance with article 7, - **Licence Review of Existing operation – advised by Agency that this notice is not required for existing establishment**	n/a	
(c)	a copy of the notice given to the planning authority under section 85(1)(a) of the Act,	Attachments	✓
(d)	a copy of such plans, including a site plan and location map (no larger than A3), and such other particulars, reports and supporting documentation as are necessary to identify and describe -	Attachments	✓
	(i) the activity	Attachments D and Section D	✓
	(ii) the position of the site notice in accordance with article 7,	N/A see above	
	(iii) the point or points from which emissions are made or are to be made, and	Section E and Maps in Attachment E	✓
	(iv) monitoring and sampling points, and	Section F3 and Maps in Attachments	✓
(e)	a fee specified in accordance with section 94 of the Act.	Transmitted by electronic bank transfer to Agency	✓

Article 10(4)		**Checked by Applicant ✓**
(b)	A signed original and 2 hardcopies of the application and accompanying documents/particulars in hardcopy format plus 2 copies of all files in electronic searchable PDF format on CD-Rom shall be submitted to the headquarters of the Agency. In cases where an E.I.S. is required to be submitted to the Agency in support of the application, a signed original and 2 hardcopies of the EIS plus 16* copies of all files in electronic searchable PDF format on CD-Rom shall be submitted to the headquarters of the Agency. * Energy sector applicants = 18 copies	✓ **N/A**
	Hardcopies submitted.	✓
	CD version submitted.	✓