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Land and Groundwater Baseline Report.

A Risk Assessment with respect to the Effect on Land and Groundwater by the Use, Production, Storage and Release of Pollutants from the Sant' Antnin Waste Treatment Plant.

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Contents

Executive Summary.
1. Introduction
2. Sources of Emissions
3. Location and Site Plan of the Facility.
4. Classification of Pollutants that may Potentially Affect Land and Groundwater.
5. Quantification of Emitted Wastes
6. Air, Compost, Ground and Waste water Quality Measurements by WSM.
7. Environmental Impacts and Risks
8. Risk Management Plan for SAWTP

CONCLUSIONS.

Table List of Consulted Documents

List of Relevant Literature

Appendix A: Analytical Results of Compost
Appendix B: Analytical Results of Water Samples
Appendix C: Offsite Sampling and Analysis
Appendix D: On site Sampling and Analysis
Appendix E: MSDS of Oils and Chemicals used on site.

List of Tables

Table 1 Description of Possible Emissions from Identified Points within the SAWTP – STAGE 1.
Table 2A. General Characteristics of Some Pollutants that are emitted from the SAWTP
Table 2B. Relevant Literature on the listed Characteristics of the Pollutants
Table 2C. General Characteristics of Some Pollutants Emitted from the SAWTP that are Associated with Land Contamination
Table 2D. General Characteristics of Some Pollutants Emitted from the SAWTP that are Associated with Groundwater Contamination
Table 3A. General Characteristics of Pollutants that are emitted from the SAWTP
Table 3B. Relevant Literature on the listed Characteristics of the Pollutants
Table 3C. General Characteristics of Pollutants Emitted from the SAWTP that are Associated with Land Contamination
Table 3D. General Characteristics of Some Pollutants Emitted from the SAWTP that are Associated with Groundwater Contamination

Table 4A. EWC References and Quantities of Incoming Wastes at the Materials Recovery Facility (MRF) Hall, SAWTP.
Table 4B. EWC References and Quantities of Incoming Wastes at the Mechanical Treatment Process (MTP) Hall, SAWTP.
Table 5A. EWC References and Quantities of Incoming/ Outgoing Wastes from the Materials Recovery Facility (MRF) Hall, SAWTP.
Table 5B. EWC References and Quantities of Outgoing Wastes from the Mechanical Treatment Process (MTP) Hall, SAWTP.
Table 6 Limit Values of heavy metals in mg/kg in Composts from MSW.
Table 7. Calculated quantities of Particulate Matter collected by the Filtration Units.
Table 8. Emissions based on Euro 5. Preliminary draft proposal for a Regulation of the European Parliament and of the Council relating to the emissions of atmospheric pollutants from motor vehicles (Euro 5)
Table 9 Distances of the SAWTP from the nearest town centres.
Table 10. Results of Air Quality measurements at the MTP Hall.
Table 11. Results of Air Quality measurements at the MRF Hall
Table 12. Results of Air Quality measurements at the WAS Hall
Table 13. Condensed List of Analytical Measurements on Waste Waters collected from the SAWTP
Table 14A. Risks, Hazards and Action in terms of the Activities at SAWTP.
Table 14B. Risks, Hazards and Action in terms of the Activities at SAWTP.
Table 15 – Probability Risk Factors
Table 16 – Impact Risk Factors
Table 17 – Risk Quantification
Table 18 – Example of Impact and Probability
Table 19 Probability of Impact occurring.
List of Diagrams.

Diagram 1. Site Location of the SAWTP.
Diagram 2. Distance of Plant from nearest Town Centres
Diagram 3. Artist's Impression of the SAWTP Facilities.
Diagram 4. Wind Rose Ratio of Wind Direction over the SAWTP
Diagram 5. Site Plan of the Potential Emission Points to Land and Groundwater within the SAWTP as per Table 1.
Diagram 6. Sketch Diagram of the Potential Emission Points to Land and Groundwater within the SAWTP as per Table 1.
Diagram 7. Outline Borders of the SAWTP site.
Diagram 8. A geological Cross-Section of the SAWTP, showing the Rock Strata.
Diagram 9 Site Diagram from 2005.
Diagram 10. Site Plan of the Drainage System at the SAWTP.
Diagram 11 Location of the Boreholes
Diagram 12-24. Orthophotic Diagrams of the Plant 1978-2013

Environmental Management Services Limited.

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Executive Summary.

The SAWTP generates several possible pollutants in the normal handling of wastes coming to the Plant for sorting, treatment, packaging and export or transfer to the Ghallies Landfill. Some of the pollutants are potentially hazardous to land and groundwater quality either by direct deposition and leaching, or by percolation following disposal or spillages.
Airborne particulate matter is unlikely to present a hazard to land or ground water quality due to the negligible quantities of gaseous and particulate pollutants. Adequate environmental management on site precludes the emission of these types of pollutants in excessive quantities under normal circumstances, with adequate mitigation measures in place, such as auto shutdowns in case of spurious gas leaks, and filtration systems to mitigate against air-borne particulate matter. Sampling and analysis of gases and particulate matter and gases has been carried out over the past four years, yielding concentration levels acceptable to EC standard levels.
Inert solid wastes such as glass, metal wood etc., are separated and baled for export. These wastes do not pose a potential hazard to land and ground water.
Non-hazardous wastes are baled for use as a fuel (refuse derived fuel) and exported. Their management on site is adequate to prevent excessive leaching by rain water. Non-hazardous wastes are also sent to the Ghallies landfill. The waste classification forthcoming from WSM for this waste compost, is generated at the SAWTP is indeed classified as waste. It has the EWC 19 06 04. This waste is currently being disposed at the Ghallies non-hazardous waste landfill which is an engineered landfill and therefore any effluents or emissions from the compost are being controlled.
Filter media used to filter particulate matter in the MRF and MTP Halls are periodically changed and disposed at Ghallies. Furthermore knowledge of the standard safe handling methods of these filters should be established based on their physical and chemical composition.
Accidental spillages of liquids is unlikely to present hazards to land and ground water since adequate holding reservoirs and maintenance programmes are in place.
Chemical analysis of the Second Class water shows a moderate quantity of pollutants which are not a high risk to land and groundwater contamination. Its disposal into the mains sewers requires approval from the WSC, since domestic liquid wastes in Malta are treated and reused for agriculture. Chemical analysis of the Process Water tanks shows a number of pollutants with relatively high levels. This water cannot be discharged into the mains sewers due to these high values. Proper treatment has to be introduced to reduce the levels of the pollutants from the waste water prior to its disposal.
Compost produced on-site has generally acceptable pollutant levels when compared to international guidelines. The compost generated at SAWTP is classified as a waste, in fact its EWC code is 19 06 04. This waste is currently being disposed of at the Ghallis Non-Hazardous Waste Landfill.

1. Introduction

WasteServ Malta Ltd., (WasteServ), appointed the undersigned, Environmental Management Services Ltd (EMS) (Order to Start Works dated 6 February 2014, Advert WSMQ 116/2013) to carry out a Risk assessment with the following Specifications:

a) Prepare a risk assessment to identify whether the **use, production, storage or release** could result in the contamination of land or groundwater.
b) To compile **a list of these substances and wastes**, quantifying annual uses, production and releases and maximum storage at any time.
c) Consider **the level of toxicity, mobility, persistence and biodegradability**, as well as other considerations that may be considered relevant to determine whether such substances/ wastes are effectively capable of contaminating land or groundwater.
d) Consider **the nature of the substances**/ wastes (e.g. substances with acute toxicity, mutagenicity, carcinogenicity and reproductive toxicity could have more serious impacts than skin irritants).
e) Consider the **quantity of such substances**/ wastes: (whether they have the potential for significant contamination of groundwater/ land in the quantities used, produced, stored or released)
f) Consider **the ratio of the quantity of such substances**/ wastes and their hazardousness in respect of toxicity, mobility, persistence and biodegradability (as well as any other characteristics).
g) The **impact of a release**, including the potential for dispersal and the sensitivity of land and groundwater receptors in the area, e.g. Natura 2000 sites, groundwater protected zone.
h) Consider the **likelihood of an event happening** (e.g. 50%, 95%, etc.), indicating the precautions in place on site to prevent release of such substances/wastes (e.g. bunding, safety valves) and the basis on which the likelihood has been quantified.
i) Include recommendations for **any improvements in on site**, precautions to prevent release of such substances/ wastes.
j) Make a recommendation on whether land and groundwater **testing** is required.

The Sant'Antnin Waste Treatment Plant (SAWTP) is covered by several permits as follows:

a) An Environmental Permit for the Operation of a Materials Recovery Facility & Operation of a Mechanical Treatment Plant with Anaerobic Digester (EP021/09/C) which was approved by MEPA on 20 April 2012 and shall expire on 6 July 2015.
b) The Development Permit Application to MEPA (PA/02838/03) for the upgrading of the Sant' Antnin Waste Treatment Facility, was awarded to WasteServ on 27 September 2005, by MEPA, as well as a decision notice, (PA4607), on 30 January 2007, for the "Master Plan and full

development application for part demolition of existing plant and upgrading of the existing facility to accommodate a material recovery facility, a mechanical treatment plant, a digester plant and a composting plant".

Based on the information in the 2012 IPPC application, Annex 1, Table 1.1.1, plant's permitted activities are expected to be the following:

a) Operation of a Material Recovery Facility (MRF) for the collection, sorting, preliminary treatment (including paper shredding and glass crushing), baling and storage of permitted non-hazardous wastes.
b) Operation of a Mechanical Treatment Plant with Anaerobic Digester (MTP/AD):
    1. Dry mechanical treatment-collection, sorting baling and storage of wastes
    2. Wet mechanical treatment-production of biological waste suspension (slurry) through mixing, screening and sedimentation: production of biological waste suspension (slurry)
    3. Biological treatment – hydrolysis and digestion of the slurry: production of liquid digestion residue.
    4. Aerobisation – aeration of the liquid digestion residue, dewatering and compost storage: storage of dewatered substrate.
c) Associated activity of waste water treatment (reverse osmosis): discharge to sewers.
d) Associated activity of biogas production, handling and utilisation: production of combined heat and power plant (CHP)
e) General maintenance and repairs: recovery/ disposal of any waste material
f) Generators to produce energy: receipt of fuel to energy production.

For the purpose of this report, based on the projections presented, as well as the historical past uses and reported analytical measurements of past sampling and analysis programmes conducted on and off site, the emissions are considered to be of reasonably low concentrations. Consequently the effect on land and groundwater is expected to be insignificant. Furthermore the IPPC and EIA reports render the plant to be reasonably equipped to deal with accidental spillages and gross emissions. The impact on land due to possible accidental spillages is restricted to be on agricultural and soil on land, with possible seepage and leaching into the groundwater aquifers, rather than consider gross land and ground water contamination. The path of the impact on ground water is considered to be via the air emissions, deposition and percolation to the aquifers or boreholes. Percolation through the land due to spillages may occur in case of spillages; however the construction of the plant is properly equipped for spillage containment. Other land and groundwater contamination may occur from the stored or in-transit wastes delivered to the Ghallies engineered landfill.

This report makes use of the European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on Industrial Emissions. This Guideline advises a number of key tasks to be undertaken to determine:

a) whether a baseline report needs to be produced for a site such as the SAWTP
b) to produce the baseline report itself.

The main stages of preparing the report relevant to the SAWTP activities may be considered as follows:

STAGE 1: identify and produce a list of the hazardous substances that could influence the quality of land and groundwater
STAGE 2: some of the identified and listed hazardous substances in Stage 1 are incapable of contaminating soil and ground water: some of these hazardous substances may therefore be rejected with justification.
STAGE 3: find out the possibility of release and impacts from the hazardous substances identified in Stage 2, in terms of:

a) quantities,
b) source location,
c) mitigation measures to curb emissions

STAGE 4: Site History, in terms of toxic spillages and emissions:

a) previous use,
b) present use.

STAGE 5: Site's environmental settings - geology, aquifers etc.
STAGE 6: Site description in terms of current pollutant emissions as well as potential future emissions.
STAGE 7: Quantification of the potential hazards.
STAGE 8: Quantification of the potential impacts.

2. Qualitative Sources of Emissions: Stage 1 and Stage 2.

The activities from the SAWTP facilities are likely to generate gaseous, liquid and solid emissions that may affect the surrounding, or adjacent, land and groundwater, due to the following:

a) Emissions of gases and micro-particulate matter to the atmosphere which may settle on land, to be leached or washed away by surface waters and thence to ground water by percolation through the rock.
b) Larger solid particles that may be carried away, to the surrounding or adjacent areas of land by other mobile activities such as vehicles or animal scavengers, to contaminate the land or leached by rainwater to affect the ground water.
c) Liquid spillages and leaks which may overflow the catchment troughs and emit gases or particles on drying, or may percolate directly into the ground to contaminate land and water.

The point sources of possible emissions to the atmosphere from the SAWTP Facilities and which may affect Land and Groundwater, are listed as Site References in Diagrams 3, 5 and 6. A description of these point sources is given in Table 1. The points P1 to P9 refer to sampling points for monitoring air and water quality. The parameters were selected from the IPPC of 2013, as well as submitted laboratory reports (refer to Appendices), and are the typical pollutants that are normally expected to be potentially emitted from waste treatment facilities. Some of these pollutants are more toxic than others, depending on the emitted quantities and concentrations. Table 2 and Table 3 shall identify those pollutants (that also include gases), which may present a greater hazard to land and ground water, as required in Stage 2 of Directive 2010/75/EC.
The SLR EIA Report page 102 states that the majority of the agricultural land is irrigated by water supplied by the SAWTP. However the current Wasteserv EMS Manager, discounts this usage. The surrounding land area which covers 1125-3372 m^2, the major crops are wheat forage and spring potatoes. The immediate conclusions are that very little ground water extraction takes place and the crops are

hardy plants that are resistant to the chemical nature and concentration of the projected emissions. However, from reports submitted by WasteServ, there are a few private boreholes in the vicinity of the plant.

3. Classification of Pollutants that may Potentially Affect Land and Groundwater – STAGE 3.

The typical gaseous emissions from a municipal waste treatment plant such as the SAWTP facility, are the most difficult to mitigate when compared to solid and liquid wastes. The gaseous parameters include particulate matter, gases contributing to the greenhouse effect and causing acid rain: SO_x, H_2S, CO, Volatile Organic Compounds (VOCs, including CFCs and NOx), polycyclic aromatic hydrocarbons (PAHs), aldehydes, HCl and polycyclic aromatic compounds (PCAs), dioxins, octachlorostyrene (OCS), heavy metal particulates and a multitude of other organic compounds (Rowat 1999, pp. 389-396; anon. Saskatchewan Environment 2003). PAHs, dioxins, OCS, heavy metals and other organic compounds affect mainly the aquatic and terrestrial systems when they settle down from the atmosphere and are leached by storm or irrigation waters.

For the purpose of classifying the pollutants that are emitted from the SAWTP site, and which may potentially affect the quality of land and groundwater, the Emission Parameters and Classes listed in Table 1 have been re-grouped under general classes in Table-Sets 2 and Table-Sets 3 in order to simplify their description. Since emitted gases and particulate matter affect land and groundwater following emission, transport, precipitation and final deposition, all possible gases and particulate matter have been included for the scope of this report. The solid wastes that are handled at the SAWTP are mostly earmarked for recycling and disposal at landfills. Compost is produced that is sent to the Ghallies engineered landfill. Solid wastes may contain toxic substances that may affect land, notably agricultural land, as well as the water aquifer due to the leaching properties of these wastes.

Liquid wastes generated at the SAWTP fall into two major types, relevant to their potential as pollutant sources:

a) waste water collected in a reservoir from storm water run-off, and
b) Process Water from the Anaerobic Digester and Reverse Osmosis Plant.

The greatest risk for land and water contamination, associated with these waters, is the potential accidental spillages, which may easily find its way to the aquifers and agricultural land.

Table-Sets 2 and Table-Sets 3, aim to cover the following clauses of the terms of reference:

a) Compile **a list of these substances and wastes**
b) Consider **the level of toxicity, mobility, persistence and biodegradability**,
c) Consider **the nature of the substances**
d) The **impact of a release**,

Table 2A and Table 3A indicate the possible sources of the tabled pollutants from the Site's various activities, as well as the actual specific locations where these

sources might be on the Site. The mode of land and consequently ground water contamination is inferred.
Table 2B and Table 3B provide reference literature relevant to the respective pollutant groups. Table 2C, Table 2D, Table 3C and Table 3D describe the toxicity potential, environmental fate, nature of substance and impact of release, as requested in the terms of reference. This description considers the pollutant per se, with limited consideration for the probability or possibility of release. The possible effect of the pollutants from the plant depends on the quantities and frequencies of release, but these shall be dealt with later in this report.

4. Quantification of Emitted Wastes

Based on the grouped emission pollutants listed in Table-Sets 2 and Table-Sets 3, an attempt was made to quantify the pollutants.
It was found necessary to quantify the emitted wastes in the following way:

a) An exercise to find any excess or unaccounted-for wastes calculated from **the incoming and outgoing wastes** stated in the IPPC application.
b) The wastes going out of the SAWTP following treatment, namely:
    i. the **packaged inert wastes** from the MRF for export (reported as outgoing wastes),
    ii. the **non-hazardous wastes** submitted to the Ghallies engineered landfill,
    iii. the **compost** following dewatering sent to Ghallies.
c) The solid particulate wastes collected from the MRF and MTP **air-filtration units**.
d) The liquid wastes remaining from the RO **brine, spent Process Water** and **other Liquid Wastes**.
e) Other liquid wastes including **lubricating and treatment oils** and **chemical additives.**
f) Gaseous and particulate **vehicle combustion** emissions.
g) Gaseous and particulate from the **Combined Heat and Power plant and Gas Flare**.
h) Other gaseous and particulate emissions generated due to the **handling of the waste materials**.

a) <u>Incoming vs. Outgoing Wastes.</u>

In order to check the mass balance between the Incoming and Outgoing Bulk Wastes, and thus trace any losses of wastes, the quantities cited in the IPPC Application Annex 3 were tabulated in Tables 4 and 5.
Table 4A gives the quantities of the incoming wastes at the MRF. These bulk, inert wastes are separated and baled for export. The packaged material is stocked in the MRF yard to the north-east end of the plant. Apart from possible particulate matter, no other emissions are expected to be emitted from these inert wastes. Prior to their export, the site storage is relatively short and apart from their aesthetic appearance they do not present any problems to land or ground water.

Table 4B gives the quantities of incoming wastes according to the EWC at the MTP. The total annual weight of over 52,000 tonnes surpasses by far the wastes delivered to the MRF and it is this solid waste and its treatment that shall be considered more closely, as a possible source of land and groundwater contamination. Separation of the wastes is conducted within the MTP, including the diversion of organics for the AD plant to produce bio-gas and compost.

b) <u>Packaged Non-hazardous Wastes going out of the SAWTP following treatment.</u>

The total **non-hazardous wastes** submitted for recycling, mostly for export, according to the IPPC and listed in Table 4A totals 16,000.4 tonnes. This same annual quantity is baled and sent for export recycling as listed in Table 5B.
Table 5B gives a breakdown of the quantities of outgoing wastes according to the European Waste Code (EWC), from the MTP. This quantity has a mass difference of 2,722.52 tonnes less, when compared to the incoming wastes at the MTP (52,068.64 – 49,346.12). According to WSM this discrepancy is due to the losses at the AD as burnt biogas and soluble matter ending in the Process Water, as well as spill over quantities that may have been measured from the previous year's in-coming stock.
The solid wastes generated at the MTP, listed in Table 5B, are diverted to the MRF for recycling, others are sent for export for destruction or as fuel wastes, whilst other waste is send for land filling as follows:
Compost Used as landfill cover in Malta ..... 5,119.33 tonnes annually
Waste Directed from MTP to MRF as recyclable ..... 5,849.02 tonnes annually
Material sent to the Ghallies landfill ..... 176.16 tonnes annually
Fraction directed for export for energy recovery ..... 37,270.55 tonnes annually
Annual total .....48,415.06 tonnes

The compost deserves some special comments since it may be considered to be directed for agricultural land cover, and therefore any toxic substances are likely to contaminate land and ground water. At this moment in time, autumn 2014, the compost IS NOT being used for agricultural or land cover use. The major risks and hazards associated with the compost, as well as the other wastes sent to Ghallies, are the addition of salts, heavy metals and different organic compounds that may be present in these wastes. Pollutants in high levels change the properties of the soil and can be toxic for vegetation. Some metals are present in the wastes in higher concentrations than in agricultural soil, e.g. lead, zinc and copper, which can lead to the impairment of crops. If the bioavailability through leaching is high, these compounds can cause contamination in the whole food chain. The form in which the metal is found, determines the bioavailability. EC Directive 2003/33/EC lists the pollutants that have to be measured on leachates obtained from solid waste samples in order to classify the wastes into inert, non-hazardous (scheduled for engineered landfills) and hazardous.
The projected quality of the compost has already been established. The actual quality generated at the SAWTP should fall into two classes:

a) physical/chemical quality acceptable for use in agriculture, notably moisture, density, carbon, hydrogen, nitrogen and oxygen,
b) presence of toxic compounds, notably arsenic, cadmium, chromium, mercury and lead.

In case the produced compost is not up to marketable standards, the limitation may be rectified by fortifying the product with adjuncts, depending on the weak component. For this operation it may be necessary to acquire a mixer in order to homogenise the fortified compost.

In case the compost quality cannot be rectified, or the levels of toxic material exceeds the required limits, the compost has to be sent to the recyclable plant for possible use for incineration or landfilling, or it may be diluted with other waste material containing low values of toxic material. In case the compost is earmarked for landfilling, it must be classified according to Directive 2003/33/EC.

In order to retain the quality of compost production, it is crucial to ascertain the constant quality of the incoming raw wastes. In case the composition of the wastes varies, or the presence of a toxic compound is present, the waste should be:

a) rejected for compost production,
b) used only for biogas production,
c) discarded as reject.

Since the compost generated at the SAWTP may be earmarked for surface cover to soils, it may be pertinent to give it some more profound attention. Application of compost as fertilisers affects the soil's physical, chemical and microbiological characteristics such as:

- Physical characteristics: organic matter added to soils from compost improves the stability. It increases the water holding capacity and the porosity, which is beneficial for agricultural purposes.

- Chemical characteristics: the main positive effects are remarkable augmentation in the content of organic matter and an increase in pH in acidic soils. Both changes are also extremely beneficial for agricultural purposes.

- However, if the compost is contaminated, the levels of organic contaminants may increase. Also, the levels of some other pollutants, e.g. PAHs, PCBs, phenols and heavy metals may increase. The conductivity of the soil can change due to a higher concentration of salts, which affects negatively the uptake of nutrients from the plants.

- Microbiological characteristics: changes in the physical and chemical characteristics of the soil induce changes in its microfauna. Redistribution of organisms, changes in abundance and biodiversity and/or interferences with some of their metabolic activities might happen. This will affect the surrounding vegetation.

Some soils are much more susceptible to contamination than others (He at al. 1992, pp. 318-329). The biodegradable waste used for composting must be free of contamination. If not, the end product will also be contaminated. The contamination will be passed on to the soil whereto the compost is added. Appendix A gives several analytical measurements conducted on various compost from the SAWTP samples during 2012. The levels of heavy metals that have toxic rather than non-nutrient value , are high, such as chromium, copper and lead. The reports fail to state whether the measurements were conducted according to EC Directive 2003/33/EC, that is, whether the values of the metals and other pollutants were carried out on a volume of leaching water.
The European Commission IPPC Reference Document on the Best Available Techniques for the Waste Treatment Industry, published in August 2006, lists the following Ranges of Chemical Analysis of MSW-produced compost in the EU:

- Carbon 47-50%
- Sulphur 0.2-0.5 %
- Hydrogen 7%
- Nitrogen 0.5-0.8%
- Oxygen 30-34%
- Arsenic 0.4-160 mg/kg
- Cadmium 0.3-6 mg/kg
- Chromium 2.5-226 mg/kg
- Mercury 0.02-1.0 mg/kg
- Lead 2.4-300 mg/kg

Perhaps these values may be used as an objective limit reference for the quality of compost that shall be produced at the Plant.

The analytical measurements given for the SAWTP laboratory reports for the compost, shown in Appendix A, are mostly within these values, except lead which shows a consistently high value of >200 mg/kg but generally <300 mg/kg. No guidelines are given for the quality of composts produced at typical MSW, however one would consider the compost NOT to release pollutants to the water table. The best guideline would be to consider the compost as 'inert' waste. Referring to the EC Directive on waste classification, inert wastes should not exceed the following values for the heavy metals:

- Cadmium 0.04 mg/kg
- Chromium 0.05 mg/kg
- Copper 2 mg/kg
- Lead 0.5 mg/kg

Perhaps a more reliable guideline would be the national guidelines given for the UK and Italy in the following Table 6

So how does the compost generated from the SAWTP compare to these values? During 2012 to-date, a thorough, routine sampling and analysis was performed on the generated compost. The Table 6 gives the mean values of the sixteen respective samples that were collected during 2012-14.
Based on the values submitted by the countries listed in the previous table, the heavy metal content in the compost produced at the SAWTP compares favourably. But the values are much higher than the EC Directive on Waste Classification, and therefore the current compost chemical composition is unacceptable for environmental use.

The main pollutants from the effect of the compost on ground water contamination and water systems, are caused by leaching and percolation processes of soils treated with compost as well as land contaminated with gaseous and particulate fall-out. Therefore, the contamination of water systems directly from the compost or from the stocked and other treated solid wastes, includes heavy metals, different organic compounds, e.g. phenols, PAHs, PCBs, etc., and salts, e.g. NO^{3-}, NH^{4-}, Cl^{-} etc. (He at al. 1992, pp. 318-329; Peigne & Girardin 2004, pp. 45-68).

No analytical measurements for the leachability of substances from the compost generated at the SAWTP were ever undertaken. It is important to evaluate such measurements in case the heavy metals most importantly, are readily leached into the soil and hence providing a hazard for the soil as well as the aquifer.

c) Solid Particles collected from the Air-Filtration Units.

The air present in the MRF and MTP halls is filtered by means of blowers and filter screens. This is followed by oxidative filters to remove micro-particles and odorous gases. Table 7 shows the calculated quantities of particulate matter that is potentially collected by the filters in the MRF and MTP Halls. The calculated quantities are substantial and worth considering since they may include potentially toxic substances that were filtered off. These substances may include heavy metals and PCB's, PAH's, dioxins, bacteria adsorbed to microparticles, as well as the inevitable PM's.

Table 7 gives a total calculate quantity of about 3.75 tonnes annual dust that is collected by the respective filters from the MRF Hall, the MTP Hall and the AD Unit. This quantity works out to be 3.75 tonnes annually.

It is highly recommended that WSM keeps records of the handling of these contaminated filters, especially their temporary storage, packaging and disposal. Any rapture of the filters is bound to emit dusts which are potentially hazardous due to settling on the ground and eventual leaching by water and percolation

through the ground, even though the leachate is unlikely to have high levels of dissolved pollutants.
WasteServ could not justify or contradict these masses since no data exist on the quantities that are sent for disposal at the Ghallies Landfill. Furthermore, no classification of the waste according to Directive 2003/33/EC has been carried out.

Table 7 also refers to the calculated H_2S that is potentially generated in the same Halls. The total quantities are 972 kg annually. However air quality monitoring conducted by private contractors several times inside these Halls, did not reveal any alarming concentrations.

d) <u>Liquid wastes from the RO brine, Process Water and other Liquid Wastes.</u>

The Process Water Tank collects all waters from the Plant following general cleaning as well as dewatering of the compost (or digestate). This water is re-cycled for the digestate. However, following several re-cycles, the water is bound to become spent and cannot be used for further treatment processes. The spent Process Water is retained on site. According to WSM this water is awaiting permits from the Water Services Corporation for its disposal. The RO Plant is currently not in operation and has not been for some time. Therefore no liquid brine is being produced.
Analytical measurements have been carried out in the past on this Process Water and the results can be seen in Appendix B. As reported further on, this type of water would not be acceptable for discharge through the main sewers due to the excessively high suspended solids, BOD, COD, ammonia nitrogen; however the levels of dissolved metals is normally <1.0 mg/l.
Measures should be introduced to mitigate against the emission of gases and odours in case of spillages of the Process water.

Spillages of stored waste water and oils may potentially occur at the SAWTP. However the containment management in operation is considered to be adequate, with containment troughs having adequate volumes with respect to the reservoirs. The second class water reservoir located in the MRF area lies below ground level. Spillages may occur due to cracks in the concrete-constructed walls of the reservoir, in which case WSM are aware and inspections form part of the general maintenance procedures.

e) <u>Lubricating and Treatment oils and Process Chemicals.</u>

Page 33 of the IPPC, Table 2 provides a list of additional chemicals that are used on site on an annual basis, including machine hydraulic oils 3.5 tonnes, diesel engine oil 2 tonnes, industrial oil 400 tonnes, Ferric Chloride Solution 42% 5 tonnes, Anti-foaming agent 50 tonnes, Flocculant 1 tonne and Deodorising agent 3.5 tonnes. The list of oils and chemicals is reproduced below, with the MSDS provided in Appendix E. None of these chemicals fall within Schedule 3 of the

Waste Regulations of LN 184 of 2011. Furthermore all of these chemicals are diluted with inert dusts or liquids, other than the hazardous substances already identified, such as air-borne particulate matter, compost, Process Water etc. The quantities are not significant considering the stock that is actually kept on site on a day-to-day basis. Furthermore, the lube-oil leaks are controlled through routine vehicle maintenance, especially the site vehicles such as the fork-lifters.

The following is a list of chemicals and chemical products used at the facility:

- Strukol SB 2031
- Gulf Harmony 68 Hydraulic Oil
- Castrol Tection Global 15W-40 Diesel Engine Oil
- Gulf Coolant XLL Cooling Fluid
- Gulf Harmony 100 Hydraulic Oil
- Gulf Harmony AW32 Hydraulic Oil
- Gulf Harmony AW46 Hydraulic Oil
- Gulf Superfleet Supreme 15W-40 Engine Oil
- Hydro Tech HV1 100
- Ferric Chloride Solution 42%
- Tillflockflocculant

Material Safety Data Sheets (MSDS) are provided in Appendix E to this document.

The following chemicals end up in the COMPOST and/or the Process Water:
- Ferric Chloride Solution 42% 5 tonnes, (equivalent to about 2 tonnes mass weight of $FeCl_3$),
- Flocculant 1 tonne

The following chemicals end up directly in the PROCESS WATER:
- Anti-foaming agent 50 tonnes,
- Deodorising agent 3.5 tonnes

The following chemicals are collected by a used oil contractor:
- Machine hydraulic oils 3.5 tonnes,
- Diesel engine oil 2 tonnes,

The following chemical is burnt at the AD and emitted to the atmosphere:
- Industrial oil 400 tonnes.

f) <u>Vehicle combustion emissions.</u>

Table 8 shows the complete calculations for the quantities of vehicular particulates and gases emitted by the total number of vehicles commuting within the SAWTP. The IPPC gives the total number of vehicles as 284 on a daily basis. We have arbitrarily divided this number as 70 petrol vehicles and 214 diesel

vehicles, as given in Row 5. The pollutants that are listed in Directive 1999/96/EC relates to the emissions of atmospheric pollutants from motor vehicles (Euro 5) as emission threshold limits in grammes per kilometre for vehicles. The values are reproduced in Row 3 of Table 8. The pollutants are CO, total hydrocarbons, NO_x and PM's.
Row 4 gives the estimated number of kilometres that each vehicle covers per trip, 0.75 km. The total number of km covered by all the vehicles (according to fuel type), per day, is given in Row 6. Based on this km value and Row 3, one can find the total **mass in grammes** emitted by vehicles inside SAWTP area over the 8-hour working day, which is given in Row 7.
Row 9 calculates the mean concentration in **micrograms per square metre**, over the 47,000 sq m area of SAWTP, during a 60 minute period, in order to provide the values of mass of pollutants in milligrammes per cubic metres emitted every hour. This value is found by estimating a height flux of 10 m (the estimated height of the MRF/MTP). The values are given in Row 10.
The limit values for **CO and benzene** (a hydrocarbon) are given in Directive 2000/69/EC, whereas for NOx and particulates are given in Directive 1999/30/EC (LN 224 of 2001).
As can be observed in the last two rows the calculated projected emissions from combustion fuels of vehicles commuting within the SAWTP are much lower than the limit values for ambient air quality. The emitted pollutants from vehicles are therefore insignificant as possible contaminants to the air and consequently to land and ground water.

g) Combined Heat and Power Plant and Gas Flare.

According to WSM, in 2012 (which was a full year) circa 1,100,000 Nm^3 of biogas were produced. Estimating a methane content at 60% of the biogas, 660,000 Nm^3 of methane were treated at the plant. The balance was composed mainly of CO_2, NH_3 and H_2S. The normal levels of H_2S found in biogas vary between 1000-4000 ppm according to the IPPC page 24. When converted to mg/m^3 of the biogas, this concentration is found to be 1.5-6 g/m^3. Therefore a quantity of at least 1,500 kg of H_2S was generated with the biogas. The amount of ferric chloride $FeCl_3$ that would be required to precipitate this amount of sulphide is:

$$\text{Annual amount of } FeCl_3 \text{ in kg} = \frac{1500\text{kg} \times MW_{FeCl_3}}{MW_{H_2S}}$$

$$= \frac{1500 \times 162}{34} = 5{,}257 \text{ kg}$$ **Ferric Chloride required on an annual basis.**

The quantity of 5,257 kg of ferric chloride which has been calculated is equivalent to 12.5 tonnes of 42% Ferric Chloride Solution. This quantity does not agree with the quantity of ferric chloride solution (42%) declared by WSM to have been used, namely 5 tonnes.
A volume of 1,100,000 Nm^3 per year is equivalent to about 3,000 Nm^3 per day, or 125 Nm^3 per hour over 24 hours. The flare that burns the excess generated biogas is able to handle this quantity in case the holding tank is full to capacity and the

Combined Heat and Power Plant is not in operation. The flare and generator flame temperatures are given as 850°C. According to Goodings JM et al (Sulphur anion chemistry in hydrocarbon flames with H_2S, OCS, and SO_2 additives, 1986, Can. J Chem Vol 64), the methane combustion gases generated due to the presence of sulphides may include SO_2, sulphur and sulphuric acid. (SO_2 is generally converted to sulphur acids when it reacts with moisture in the air). The quantity of SO_2 generated from the flame at the SAWTP is unknown since the levels of H_2S in the bio-gas are not known.

h) <u>Gases and Particulates Generated due to handling of the waste materials.</u>

It is not possible to calculate quantitatively other particulate and gaseous emissions that may be generated by the handling of waste materials, notably due to those activities that have not been listed above. These activities refer to the MRF yard as well as other routine activities on site such as maintenance works. It has to be assumed that the MRF yard may potentially emit particulate dusts consisting of inert material. In which case they do not present undue hazards to land and ground water.

5. History, Location and Site Plan of the Facility – STAGE 4.

The site lies between the following geographical bearings:

E 14°32'53" to E14°33'10" and N35°51'38" to N35°51'41"

It lies between the villages of Marsascala and Zabbar, on a road connecting the two villages. Diagram 1 gives the site location on the map of the area. The SAWTP is situated at various distances from the nearest town centres, as shown in Table 9, and pictorially in Diagram 1 and Diagram 2.

The artist impression with captions, shown in Diagram 3, depicts the various facilities that are available on the site.

The prevailing wind directions in Malta, for about 35% of the year, are mainly from the West and North-West; wind velocities exceeding 20km/h are not frequent. However it was essential that continuous monitoring of the microclimate at the facility was introduced in order to evaluate better the monitoring measurement data. Diagram 4 shows the proportion of average wind directions as reported by Malta International Airport statistics for Luqa Airport, based on typical annual observations. The large proportion of wind direction therefore drags any gaseous emissions towards the east-south-east.

Diagram 5 shows an architect's site plan of the SAWTP site for this IPPC, with the respective sampling points as listed in Table 1. Diagram 6 gives a more pictorial bird's eye view of the SAWTP layout. Table 9 gives the outline of the Plant's borders with respect to neighbouring areas adjacent to the Plant.

In retrospect, Diagram 7 is the original architect's site plan for the Plant, in order to compare with the current IPPC site plan.

Very limited historical data and records have been identified. According to the EIA 2005, the SAWTP site is part of a former landfill used during the 1970's. This

landfill is situated towards the south-east of the plant, where the current Family Park is located. It is estimated that this landfill at Marsascala accepted about 0.2M tonnes of waste that included unknown, separate quantities of domestic, construction and industrial wastes. Activites at the Plant with respect to the disposal of wastes, have been controlled since Wasteserv took over the operation. It must be said that in retrospect, the current air quality, soil and groundwater analytical results, indicate that any past misdemeanours, have not left any negative results that persist to date.
SAWTP report that no recorded instances of spillages or related accidents have ever occurred at the Plant.
Diagrams 12 to 24 show aerial photos of the plant area, developed during 1995 to 2013. Notable changes can be observed on the east side: the construction of the Compost Shed and the packaged inert waste. Further developments occurred for the new Family Park.

6. Topography of the SAWTP Location – STAGE 5.

According to the SLR EIS report of July 2004, the Topography of the site identifies the general landscape of the area with:

a) Gently rolling hills to south-south-west of the plant, and across Triq Haz Zabbar, to the north-north-west, mostly occupied by agricultural land.
b) Nearest main settlements of Zejtun and Marsascala, each about 1km away.
c) An existing and functioning quarry across the Latmija Road to the west.

The site occupies low lying plans within a natural valley, running on a broadley east/west alignment. Elevations over the site vary between 12 to 22 m from the lowest point on the south-east end of the plant: the slope from the south-west to the north-east has an overall gradient of 1:30.
The cross section of the site shown in Diagram 8, via a south-west to north-east section, shows a dip towards the valley, with excess storm water diverted towards the valley and onto the Marsascala Bay. The valley sides rise to the north, south and west to elevations of about 45m above the datum point. The valley continuous towards the Marsascala Bay due eastwards.
A major road artery flows to the north boundary of the site: Triq Haz Zabbar. The west boundary borders Triq il Latmija.
The major use of the agricultural land lying to the south, west and across Triq Haz Zabbar to the north, consists of small private fields growing fodder and sparse cash crops.

Geology of the Site.
Based on the information submitted by the SRL EIA, the geological setting of the site may be summarised as follows:

a) The site is founded upon an outcrop of Lower Coralline Limestone, with a member thickness of about 8-17m.
b) The geological strata dip gently to the north-west. This is shown on Diagram 8.
c) Groundwater recharge for the area is likely to be precipitation water directly on the surfaces of the surrounding area. Furthermore, since the Plant lies at the base of a drainage feature of Wied iz-Ziju and Wied Sant'Antnin, surface water runoff from the west, north and south drainage areas shall steer towards the site, thereby providing more effective rainfall for aquifer recharge, this shall dilute further any of the limited pollutants that may be emitted from the plant.

Direction of Groundwater flow,
The flow shall be through the unsaturated Lower Coralline Limestone bedrock, ultimately joining the groundwater in the underlying aquifer. The Lower Coralline Limestone formation according to the EIA 2005, is the primary freshwater aquifer for Malta. Although no groundwater level data are available for the Lower Coralline Limestone Formation aquifer in the vicinity of the SAWTP, available information surmises the following:

a) The thickness of the freshwater 'lens' thins out towards the coast, such as the case with the site of the SAWTP. The degree of rock formation, faults, karst development and boreholes influence the thickness of the 'lens'.
b) The SAWTP site setting is close to the coast, it is adjacent to a large geological fault, and therefore the aquifer thickness is considered to be relatively thin. The lowest elevation of the SAWTP is just 15m above sea level.
c) Groundwater flow direction is expected to be in an east flowing direction, towards the coast

Environmental Aspects.
In the preparation for the 2005 EIA it was observed that there are no natural habitants within the site except for local trees and shrubs including olive, eucalyptus, pine and oleander. The surrounding fringes are typical of disturbed areas from trappers and hunters and paths leading to small agricultural lands.
The Il-Maghluq area along the Marsascala bay is a Conservation 2000 area, housing salt tolerant marsh communities and endangered protected species such as the Maltese Killifish. The area is currently under study due to the invasive rearing of 'domestic' ducks that ply the inlet.
Another protected site is situated about 800m north of the SAWTP, which is Wied il-Baruni, scheduled as a Woodland Nature reserve. This site is, however, perched at a further high level than the SAWTP.
However, it is very unlikely that the emissions from the SAWTP emissions shall affect this site, due to the following:

a) the potential ground water contaminations due to the gaseous and particulate emissions are insignificant,
b) potential contamination due to storm water drainage and run-off collection from the site is most likely to be too dilute to effect any potential hazards.

Drainage system
The Drains and Service pipework within the SAWTP is shown in Diagram 10.
There are four dedicated drainage systems on the site which are kept separate:

a) Rainwater culverts passing through the site flowing towards the east boundary of the site, into the valley leading to Marsascala.
   Potential contamination: spillages of waste waters and oils generated on site.
   Risks: negligible (but perhaps occasional analytical measurements may be carried out).
   Justification: adequate containment measures and past analytical results.
b) Roof areas collection system which takes clean rainwater for irrigation purposes.
   Potential contamination: remote.
   Risks: negligible.
   Justification: no activities on roof; particulate matter deposition insignificant.

c) A domestic waste water collection system of staff facilities and discharges directly to the WSC sewer connection.
   Potential contamination: remote.
   Risks: negligible.
   Justification: no untoward activities to generate pollutants from administration and staff toilets; past analysis.
d) A second class run-off water reservoir located in the Compost Shed from all trafficked area, the AD-plant MRF and dry-MTP. This water is filtered through a sedimentation tank and stored in the 1,800 m^3 second class water reservoir. Discharge carried out by a bowser system. Connection with mains sewer subject to approval by Water Services Corporation (WSC).
   Potential contamination: likely with wastes from MRF and dry-MTP but especially from AD-plant; notably suspended and solids, ammonia and chlorides.
   Risks: moderate, can be rendered negligible by basic water treatment.
   Justification: inevitable presence of particulate matter and some process water contamination; past analysis of water samples.
e) Process Water: Second class water is used to top up the process water reservoir. The Process Water comes in contact with AD-Plant and is likely to contain extracts from the anaerobic plant.
   Potential contamination: most likely with wastes from organic anaerobisation.
   Risks: high to very high; can be rendered negligible by advanced water treatment.
   Justification: inevitable presence of odours, suspended and settleable matter, ammonia, chloride, heavy metals, BOD and COD; past analysis of water samples.

No fresh groundwater aquifers are present below the area of the site, the ground water was considered to be brackish water due to the proximity of seawater intrusion, and according to page 52 of this report, there were supposed to be no boreholes in the vicinity of the site, the closest being approximately 500m to the south-west of the site. However, WasteServ have been conducting routine sampling and analysis from the following available boreholes:

Groundwater Sampling:	Saliba Bros. BH1116
	Kalcidon Vella BH 1205/97
Blank Sampling:	Mr. Grazio Dalli BH2955/97
	Mr. Francis Mugliett BH1516/97

The location of the Boreholes is shown in Diagram 11. The results of the analysis carried out on samples from these boreholes may be observed in Appendix B.

No run-off or leakage water is allowed to flow to the surrounding roads, except storm water run-off from the grounds, or discharged into the government sewers except domestic sewage wastes. Storm water run-off is diverted to the valley, east of the Site. All other waters are collected in holding/storage water tanks for re-use. The analytical results of samples collected from these tanks (Process Water Tank) are shown in Appendix B.

7. Air, Compost, Ground and Waste water Quality Measurements by WSM. (STAGE 6 and 7)

WasteServ has appointed independent laboratories to carry out sampling and analytical measurements on air and ground water quality from within the SAWTP as well as other sampling points in the areas outside the Plant. The reports are shown in condensed form in the Appendices as follows:

Appendix A: Reports of Analytical Measurements on Compost samples collected from the Site at SAWTP.
Document Details:

Accredited Laboratory Reports from Scientific Analysis Limited of Manchester UK, for December 2014.

Appendix B: Reports of Analytical Measurements on Different Water Samples collected from the Site at SAWTP as well as Boreholes and Seawater.
Document Details:

Accredited Laboratory Reports from CEFIT of Avola, Italy, dated 29 January 2014.
Accredited Laboratory Reports from Scientific Analysis Limited of Manchester UK, dated 19 August 2014.

Appendix C: Reports of Analytical Measurements on Air Samples collected from Off-site SAWTP
Document Details:

Accredited Laboratory Reports from CADA of Sicily, dated 17 June 2014.

Appendix D: Reports of Analytical Measurements on Air Samples collected from On-site SAWTP
Document Details:

Accredited Laboratory Reports from CADA of Sicily, dated 17 June 2014.

Appendix E: MSDS's of the various oils and Process Chemicals used on site at SAWTP.

Air Quality.
From records submitted by WasteServ, air quality measurements off-site were conducted in 2014 for the following parameters as can be referred in Appendix C:

Total Particulate Matter
Ozone

Sulphur dioxide
Nitrogen dioxide
Hydrogen sulphide
Total hydrocarbons
Total VOC's
Benzene
Mercaptans
Methane
Carbon monoxide
Arsenic
Cadmium
Mercury
Nickel
Lead
Dioxins and furans
Polycyclic aromatic hydrocarbons
Microbiological measurements
PM_{10} and $PM_{2.5}$

The reports show that all these parameters were within normal European and WHO limits (the reports by the CEFIT labs refer to standard Italian National limits which comply with EC and WHO limits). This shows that the area within the plant as well as within a few meters radius, the air quality was acceptable.
ACTION FOR MITIGATION: Reports confirm acceptability of the air quality. No action.

WasteServ conducted additional air quality measurements on-site, through a different laboratory on a quarterly basis, for the following parameters shown in Appendix D:

Ozone *Average*
Ozone *Max*
Total Hydrocarbons
Total VOC's
Benzene
Methane
Dioxins and Furans
Carbon Monoxide
Arsenic
Cadmium
Mercury
Nickel
Lead
PM10
PM 2.5
Total Particulates
Hydrogen Sulphide

Sulphur Dioxide
Ammonia
Esters
Mercaptans
Indoles
Skatoles
Aspergillus
Ecoli
Yeasts
Total Coliforms

The laboratory reports indicate that the measured levels WITHIN THE GROUNDS of the SAWTP were once again within international limits.
ACTION FOR MITIGATION: Reports confirm acceptability of the air quality. No action.

It may be relevant to reproduce the results of the air quality measurements undertaken by WasteServ WITHIN THE VARIOUS UNITS of the SAWTP, notably the various Halls, in this report.
Table 10, Table 11 and Table 12 list the relevant results. These measurements were conducted on schedule according to the IPPC programme and may be referred in Appendix D.
The results indicate very high readings for particulate matter as follows:

	Limits	**Inside** Halls Monthly MEAN	**Outside** Halls Quarterly MEAN
MTP PM10 (µg/Nm³)	50	587.766	64.475
MTP PM2.5 (µg/Nm³)	25	300.927	24.893
MRF PM10 (µg/Nm³)	50	581.612	
WAS PM10 (µg/Nm³)	50	768.299	89.99

These values are substantially higher than the EC ambient levels. However the United Kingdom Health and Safety Executive **Workplace Exposure Limits** EH40/2005, lists the exposure limits for dusts containing cellulose, ferrous particles, gypsum, pvc and silicon, as the long-term exposure limit (8-hr TWA reference period), as follows:

Inhalable dust ..... 10,000 µg/m³
Respirable dust ..... 4,000 µg/m³
The United Kingdom Health and Safety Executive "Methods for the Determination of Hazardous Substances" Number 14/3, General Methods for Sampling and Gravimetric Analysis of Respirable and Inhalable dust, issued in February 2000,

gives the definition of inhalable as well as respirable dust. Particles lower than 10 microns in diameter, **known as PM_{10}'s**, are considered as particles that are able to be **inhalable**, comprising also, the smaller particles that are considered to be small enough to reach the lungs, the **respirable** fractions, considered to be **$PM_{2.5}$**.

The reported measurements should therefore be evaluated from the following views:

a) The Quarterly Mean values for measurements carried out OUTSIDE the Halls give somewhat higher values than those for AMBIENT EC limits. However considering the very active traffic activity on site, as well as the adjacent busy main road, and the typical PM values for certain urban areas in Malta, we consider the values not to be excessively alarming.
b) The Monthly mean values for the measurements carried out INSIDE the Halls are within the UK HSE occupational health and safety limits. However, no species analysis was carried out to investigate the composition of these particles. Although the other parameters were within the international guideline limits, the limits for some parameters are not normally given. As examples, some gaseous PCB components were high, as well as microbiological and nitrogen dioxide values. It is therefore advisable to measure the composition of the PM particles at least once a year on composite samples, in order to evaluate the possibility of land or water contamination should these particles deposit on land.

The projected IPPC dust concentrations in the Halls according to Table 8, were considered to be less than 10 mg/m^3. This projection was more than vindicated in the measured values which were indeed less than 1 mg/m^3. Therefore if these results are considered, the values calculated to be collected by the filters may be revised to just 10% of the given values as follows:

Source	No. 1MRF hall:	No. 2 MTP hall:
Projected total daily DUST amounts in grammes	**3,040**	**5,320**
Revised total daily DUST based on measured PM values	**304**	**532**

It must be stressed however that reference is being made to PM dusts, which are light enough in mass to be extracted and filtered. Larger diameter particles >10 μg are considered to settle inside the Halls' floors. Perhaps it would be advisable to conduct a quarterly Total Particulate Dust measurement rather than restrict to the PM's. Admittedly the latter is of more concern but then, so is other dust which may be nuisance dust and which may sorb other substances of concern. An annual composite analysis for the components of such dust is also recommended.

These high, air-borne levels of particulate matter should be captured by the air-filters in the Halls. Therefore should not present a hazard to land and groundwater due to possible settling outside the Hall and eventual leaching or transport and percolation.

ACTION FOR MITIGATION:

a) **need to speciate the composition of the PM's.**
b) **Need to measure the quantity of dust deposition inside the Halls as well as their speciation.**

Compost Quality.
Appendix A gives the analytical results of several sample of compost carried out during 2014. Comments on compost and the standard values of pollutant parameters are referred in Section 4 of this report.
ACTION FOR MITIGATION:

a) **need to carry out the analysis of the leachate of the compost sample in order to determine the 'active' ions that may be leached and potentially contaminate land and groundwater.**
b) **Need to classify the compost as INERT waste, NONHAZARDOUS waste or HAZARDOUS waste, for whatever application it may found to be fit.**

Refuse Derived Fuel
Table 6B gives a total of about 37,000 tonnes of wastes directed for export for energy recovery. Analytical measurements on this waste have been conducted however the levels are not high and have been acceptable for export to EU countries for use as a fuel.
ACTION FOR MITIGATION: Reports confirm acceptability of the RDF quality. Retain current management practice.

Wastes sent to Ghallies.
Table 6 B gives a total of 180 tonnes annually that are sent to the Ghallies landfill. Surprisingly, we could not trace and records of chemical analysis that have ever been carried out on this waste. It is normal practice in Malta, that Wastserv and MEPA request waste contractors to provide an analytical report of the wastes according to Directive 2003/33/EC. This directive classifies the waste as being acceptable at an Inert, Non-hazardous or Hazardous landfill, or indeed, that the waste is toxic and has to be processed.
Along with these wastes, the filter media described in Section 5 C, are also sent to Ghallies. No trace and records of chemical analysis were found about this waste. As reported in Section 5C, this waste may contain hazardous substances which may require proper handling and disposal of this waste.
ACTION FOR MITIGATION: Chemical analysis should be carried out on the two types of wastes in order to classify their handling and disposal methods.

Waste waters.
Appendix B gives a breakdown of the analysis carried out on the various waters collected from inside and outside the SAWTP, including borehole waters, Process

Waters, reservoir etc. The results indicate that there are two waste waters of concern:

- the Second Class water Reservoir located in the Compost Shed, and
- the Process Waste Water.

Table 12 condenses the mean results of the analysis carried out on various waste water samples, compared to LN139 of 2002 concerning the parameter limits for waste waters intended to be discharged through the WSC waste water sewers . It can be seen that the Process Water and Reservoir samples have elevated levels of several parameters.

The Second Class water reservoir has high levels of:

- suspended solids,
- ammonia,
- chloride.

The levels of the ubiquitous chloride are high but are typical of typical local second class or waste waters. In case the WSC object to these high levels, the solution would be to desalinate via reverse osmosis.

The high levels of suspended solids can be resolved through the use of flocculation; ammonia may be reduced by chemical means.

Based on the concentrations of these two parameters, this water does not affect the ground water quality if used for irrigation since the suspended particles settle in the soil and ammonia is absorbed by the soil.

ACTION FOR MITIGATION: Permission from WSC has to be sought for approval to discharge.

The Process Water quality has high levels of:

- settleable particles,
- suspended particles,
- ammonia,
- chloride,
- lead,
- total boron,
- chemical oxygen demand (COD),
- biological oxygen demand (BOD).

This quality of waste water is not acceptable for discharge into the mains sewers due to the high levels of boron and lead. The levels of chlorides are also excessively high, notwithstanding the ubiquitous presence of this anion in local waste waters. The settleable and suspended particles are high but can be treated. COD and BOD need to be reduced.

Born and lead are toxic to plants and the levels are hazardous. It must be pointed out however that the presence of boron (an ingredient in detergents) is surprising since this element has been precluded for use in detergents imported into Malta. Perhaps a more thorough chemical analysis may prove that the levels of boron found in the Process Water were an odd occurrence.

ACTION FOR MITIGATION: Permission from WSC has to be sought for approval to discharge, subject to proper advanced treatment to reduce parameters in high concentrations.

8. Environmental Impacts and Risks on the Quality of Groundwater and Land

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Having examined the qualitative and quantitative emissions that could potentially contaminate land and groundwater, we may now pinpoint the potential **hazards** and mitigating **actions** that may be effected to curtail the emissions originating from the SAWTP.
Section 5 of this report, details the air, liquid and solid wastes that are generated and emitted from the plant, both in terms of type of waste as well as quantity. Table 14A and Table 14B lists the risks and hazards associated with these emissions

A Risk Management Plan should include a table depicting the respective risks in terms of a quantitative equation for the risk exposure to receptors. The following information should be inserted in an appropriate table:

1.) Emission: Which specific risk is likely to occur?
2.) Event: What could happen?
3.) Probability: How likely is it to happen?
4.) Impact: How bad will it be if it happens?
5.) Mitigation: How can you reduce the Probability (and by how much)?
6.) Contingency: How can you reduce the Impact (and by how much)?
7.) Reduction = Mitigation X Contingency
8.) Exposure = Risk – Reduction

The evaluation of Probability risk factors is explained in Table 15:

For each risk element on the list, the likelihood of it actually materialising, the Probability function, may be High, Medium, or Low. It is advisable to use factor number in order to figure Probability on a scale from 0.00 to 1.00, namely 0.01 to 0.33 = Low, 0.34 to 0.66 = Medium, 0.67 to 1.00 = High.
For each risk element on the list, the likelihood of it actually posing an impact function on receptors may be High, Medium or Low. It is advisable to use factor numbers in order to figure Probability on a scale from 0.00 to 1.00, namely 0.01 to 0.33 = Low, 0.34 to 0.66 = Medium, 0.67 to 1.00 = High. It should be necessary to include also the NI (need information) and TBD (to be determined) factors in case no knowledge of the emission is available. The evaluation of Impact risk factors is explained in Table 16.

Before conducting any mitigation and contingency exercise, it is necessary to quantify the Risk associated with the specific emission; otherwise, chasing expensive mitigation and contingence measures would be worthless. Table 17 is constructed in order to quantify the Risk. The latter will depend on the Impact, as well as the Probability of the impact actually occurring. The Low, Medium, High functions for Probability and Impact, may be used for Table 18.

For a quantitative, albeit relative quantification using the numeric factor values, a slightly more complex rating system is used, such as Table 18. There is no universal formula for combining Probability and Impact. It will vary between experts and between projects. This is only an example (albeit a real-life one). In the example of Table 18 the mean of the sum of the Impact and Probability is given in the corresponding cell.

Tables 18 and 19 indicate that:

a.) When the Impact has a high hazardous effect, the Risk is HIGH in spite of the Probability of occurrence being NI or TBD or indeed Medium.

b.) On the other hand, a Low Impact may become a Medium Risk when the Probability of occurrence is NI or TBD.

These tables may be specifically demonstrated by applying them to the emission of:

a) H_2S and mercaptans from the AD plant.
b) Spillages (or disposal) occurring from the Spent Process water tank.
c) Particulate Matter (PM's), emissions (notably the filtration units).
d) Heavy metals in solid wastes.

In order to commission a Risk Management Plan for accidental occurrences from the AD Plant, the quantitative measurements of H_2S and mercaptans shall be considered crucial, even though these two gases constitute a relatively medium risk **to land and groundwater contamination.** However they are useful tools to utilise as sentinels for any malfunction of the AD Plant since they are relatively easier to measure analytically.
Possible spillages from the Process water tank are curtailed by containment troughs. However, due to the current accumulation of this water, the risk is considered to be TBD until such time that:

a) the quality of the water is improved,
b) a solution for its disposal is found.

The measurement data available for the Particulate Matter from the MTP is used in this assessment of the Probability of the Impact Occurring (PIO). The heavy metals present in the compost analysis are considered adequate as a guide for the composition of other solid wastes delivered to Ghallies, and is used for the PIO.

Table 19 gives a quantitative assessment of the potential situation as a function and quantitative factor respectively.

It can be observed from Table 19 that:

1) The Risk is generally HIGH for:
   a. Spillage of accumulated Process Water.
   b. MTP and MRF PM's.
   c. Compost Heavy Metals.

2) The Risk is HIGH for the MTP and MRF plant since the impact is still To Be Determined (TBD).

CONCLUSIONS.

The effects on land and ground water quality from the emissions generated by the activities at the SAWTP are as follows:

1. No reports are available on the effect of past use of the area as a dumping ground for domestic, agricultural and industrial wastes. But the air quality analytical measures as well as ground and seawater samples collected over the past five years do not indicate any persistent high levels of toxic material that may be traced to past contamination of the land and ground water.
2. There are no records of any untoward accidental spillage or spurious emissions of toxic substances on or from the SAWTP.
3. There are no present risks to land or groundwater quality due to possible precipitations from gaseous and particulate emissions from the SAWTP to the air. Routine analytical measurements carried out over the past months within the site, as well as outside the site, did not result in high levels that exceed international ambient levels. These measurements were carried out on samples collected from the following sampling points:
    a. Air Quality.
        i. from various points within the SAWTP grounds,
        ii. from different points of the surrounding areas such as the Belvedere, Inspire and the St Anthony Chapel on the hill to the south of the Plant.
    b. Water Quality.
        i. samples of borehole waters from points about 200m,
        ii. samples of sweater from Marsascala Creek,
        iii. water reservoir as well as well water from inside the Plant.
4. There are no risks to land or groundwater quality due to the solid wastes from the MRF, although the stock of RDF wastes should be controlled against collapse of the stocked pallets.
5. The Second Class water reservoir water may be moderately hazardous to land and ground water in case of gross spillages.
6. The Process Water has a toxic potential to land and water in case of spillage or disposal. Proper treatment should be contemplated before possible disposal.

Table List of Consulted Documents

	AUTHOR	ACTION	PROPOSAL	APPLIC NR	DATE
1	MEPA	Approval	To rehabilitate existing unused dumpsite to a family park	PA 04886/06	Approved 17/12/2009
2	MRA	Approval	To rehabilitate existing unused dumpsite to a family park	PA 04886/06	Approved 17/12/2009
3	MEPA	Development Permission	To rehabilitate existing unused dumpsite to a family park	PA 04886/06	Approved 12/3/2010
4	iAS Ltd JM Bianchi	Proposal	Development of Sant Antnin Family Park		18/07/2010
5	MEPA	ToR for EPS	To rehabilitate existing unused dumpsite to a family park	PA 04886/06	
6	MEPA	Application	To operate a Mechanical Treatment Plant with Anaerobic Digester (MTP/AD)	EP 00021/09	22/03/2010
7	MEPA	Decision Notice	Master Plan and full development application for part demolition of existing plant and upgrading of the existing facility to accommodate a material recovery facility, a mechanical treatment plant, a digester plant and composting plant	PA 4607/06	30/01/2007
8	MEPA	Outline development permission	Part demolition of existing plant and upgrading of the existing facility to accommodate a material recovery facility, a mechanical treatment plant, a digester plant and composting plant	PA 02838/03	27/09/2005
9	WasteServ	EIS V05			
10	MEPA	Application; renewal (2010)	To operate a Material Recovery Facility	WM 00022/06/A	
11	Silsoe Odours Ltd	Report to WasteServ	Olfactometric Survey		08/08/2009
12	Sammut & Ass	Report to WasteServ	Noise Monitoring		30/07/2010
13	MEPA	application	To operate a Mechanical Treatment Plant with Anaerobic Digester (MTP/AD)	EP 00021/09	22/03/2010
14	WasteServ	Working Plan	To operate a Material Recovery Facility	2nd Version	Jul-08
15	WasteServ	Working Plan	Working Plan for the MTP plant with AD	Version V1	
	WasteServ	IPPC	Operation of a Materials Recovery Facility & Operation of a Mechanical Treatment Plant with Anaerobic Digester	(EP021/09/C)	Jul-13
	SLR Consulting	EIS			June 2005

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Table 1 Description of Possible Emissions from Identified Points within the SAWTP – STAGE 1.

Site References in Diagrams 3, 5 and 6	Site Description	Geographical Bearings East	Geographical Bearings North	Emission Parameters/Classes
P1	MRF Hall	14°32'55"	35°51'40"	Odours, Microorganisms, Non-methane VOC's
				Ammonia, arsenic, asbestos, Cadmium, dioxins and furans, hydrogen sulphide, lead, mercaptans, Mercury, methane, microorganisms, Nickel, non-methane VOC's, PCB, PM_{10}, $PM_{2.5}$, PAH
P2	MRF Bring-in Area			NO_2, SO_2, noise and PM_{10}'s
				Oil spillages.
				Benzene, carbon monoxide, nitrogen dioxide, noise, non-methane VOC's, PM10, sulphur dioxide, total hydrocarbons, total suspended solids
P3	MTP plant	14°32'56"	35°51'40"	Ammonia, arsenic, asbestos, cadmium, dioxins and furans, hydrogen sulphide, lead, mercaptans, mercury, methane, microbiology, nickel, non-methane VOC's, PCB, PM_{10}, $PM_{2.5}$, PAH
P4	AD Plant	14°33'	35°51'	
P5	Biogas burning	14°33'	35°52'	Particulates, chlorine as HCl, TOC, odours, CO, NO_x, SO_2
P6	Scrubber			
	Compost Shed	14°32'	35°51'33"	
P7	Reservoir AD Process Water	14°33'	35°52'	Ammonium, Arsenic, BOD, Cadmium, Chlorides, Chromium, COD, Conductivity, Mercury, Nitrates, PAH's, Phosphates, Total hydrocarbons
P8	RO Plant feed, permeate and brine waters	14°33'	35°52'	Dissolved salts in the reject water
P9	Domestic wastewater	14°32'56"	35°51'42"	Dissolved salts and microorganisms

Table 2A. General Characteristics of Some Pollutants that are Emitted from the SAWTP

	Description	particulate matter: PM10, PM2.5	suspended and nuisance dust	asbestos fibres	heavy metal particles and ions: arsenic, cadmium, lead, mercury, nickel, chromium, tin	metal sulphides and chlorides	non-methane VOC's: dioxins, furans, PCB's, PAH's, mercaptans and volatile amines	VOC's: methane
general characteristics	**potential source**	fragmentation of solid waste; combustion particles due to site vehicles, both as emissions and re-suspension particulate matter		fragmentation of asbestos containing material	fragmentation of metal wastes	precipitation of hydrogen sulphide with ferric chloride	incineration/ combustion of wastes	methanogenesis: microbiological formation
	Possible Site Locations	P1, P2, P3, P4, P5 and P6		P1, P2 And P3	P1, P2, P3 and P6	P3, P6 and P9	P1, P2, P3, P4, P5 and P6	
	mode of contamination	land settling and leaching	land settling and leaching	land settling	land settling and leaching	leaching at low pH water	on land adsorption	adsorption on land

Table 2B. Relevant Literature on the listed Characteristics of the Pollutants

	particulate matter: PM10, PM2.5	suspended and nuisance dust	asbestos fibres	heavy metal particles and ions: arsenic, cadmium, lead, mercury, nickel, chromium, tin	metal sulphides and chlorides	non-methane VOC's: dioxins, furans, PCB's and PAH's	VOC's: methane
References	**FACTA UNIVERSITATIS** Series: **Working and Living Environmental Protection** Vol. 9, No, 2012, pp. 27 – 44 **EFFECTS OF PARTICULATE MATTER ON HUMAN HEALTH, THE ECOSYSTEM, CLIMATE AND MATERIALS: A REVIEW** *UDC 539.12:613:504.75* **L. A. Jimoda** Department of Chemical Engineering, Ladoke Akintola University of Technology, Ogbomosho, Nigeria		USA EPA Safewater Fact sheet: Asbestos 2012	Peter B. WoodburyBoyce Thompson, Institute for Plant Research at Cornell University, 1993. Potential Effects of Heavy Metals in Municipal Solid Waste Composts on Plants and the Environment. Cornell Waste Management Institute	http://www.hc-sc.gc.ca/ewh-semt/alt_formats/hecs-sesc/pdf/pubs/water-eau/sulphide-sulfure/sulphide-sulfure-eng.pdf	Heidelore Fiedler, 2002. Polychlorinated Biphenyls (PCBs):Uses and Environmental Releases. UNEP Proceedings, Bangkok. J. Kielhorn, U. Wahnschaffe and I. Mangelsdorf. 2003. Environmental health criteria for Selected nitro- and nitro-oxy-polycyclic aromatic hydrocarbons. (WHO Environmental health criteria ; 229)	United Nations Environment Programme: Climate and Clean Air Coalition http://www.unep.org/ccac/

Table 2C. General Characteristics of Some Pollutants Emitted from the SAWTP that are Associated with Land Contamination

risks associated with land contamination	**Description**	**particulate matter: PM10, PM2.5**	**suspended and nuisance dust**	**asbestos fibres**	**heavy metal particles and ions: arsenic, cadmium, lead, mercury, nickel, chromium, tin**	**metal sulphides and chlorides**	**non-methane VOC's: dioxins, furans, PCB's and PAH's**	**VOC's: methane**
	toxicity potential	leaching of heavy metals: plant uptake/ absorption; may contain microorganisms		transported; dry fibres carcinogenic	leaching of heavy metals: plant uptake; soil toxicity	release of toxic volatile hydrogen sulphide to flora and fauna	plant uptake: persistent carcinogens	asphyxiant, explosive
	environmental fate: mobility degradability	may travel >100 km; conglomerate and precipitate	may travel <1 km; settles or agglomerates and precipitate	may travel >10 km; conglomerates with humidity and other particles to precipitate	persistent; rendered soluble in soils; soluble in water	at pH <7.5 sulphides start to be converted to hydrogen sulphide; sulphide microbial oxidised to elemental sulphur; air oxidization converts it to sulphate	bound to particulate and organic matter, persist through the food chain	contributes to global warming;
	nature of substance	asthmatic; irritant; EC ambient limits imposed	asthmatic; irritant; nuisance to more sensitive receptors	irreversible carcinogen; WHO environmental limits;	cumulative blood poisoning or slow body secretion	metal sulphides (low levels) and chlorides (relatively high levels), naturally occurring in Maltese soils	persistent, relatively stable, with high global mobility	very volatile; relatively innocuous to land contamination
	impact of release	minimal unless very heavy conspicuous fallout			stems plant growth; cumulative levels if continuous contamination; alkaline nature of Maltese soils renders metals to be innocuous to water drainage	high alkalinity of Maltese soils impedes the dissolution of sulphides to hydrogen sulphides; water drainage carries chlorides to water table..	half-life 2-18 months; cumulative effect on soils in the absence of anaerobic or aerobic oxidation	apart from contribution to GH effect, little or no effect

Table 2D. General Characteristics of Some Pollutants Emitted from the SAWTP that are Associated with Groundwater Contamination

risks associated with ground water contamination	**Description**	**particulate matter: PM10, PM2.5**	**suspended and nuisance dust**	**asbestos fibres**	**heavy metal particles and ions: arsenic, cadmium, lead, mercury, nickel, chromium, tin**	**metal sulphides and chlorides**	**non-methane VOC's: dioxins, furans, PCB's and PAH's**	**VOC's: methane**
	toxicity potential	leaching and dissolution of heavy metals; microorganism contamination of water		low, unless high concentration levels present and water are evaporated leaving free dry fibres.	leaching and dissolution of heavy metals	aesthetic limits recommended at <50µg/l as H2S; toxic levels in the region of 200 mg/l	leaching from land	slightly soluble and percolation
	environmental fate	onset of leaching or contamination may proliferate ground water streams			permanent state in ionic forms	oxidised to harmless sulphate by aeration and chemical oxidation	very slightly soluble in µg/l range, unless presence of organics	very low solubility renders it irrelevant to water contamination
	nature of substance	permanent state in ionic forms		persistent but relatively harmless as a suspension in water (the USA EPA guideline limits is 7M fibres/l for drinking water)		low stability with half life of < 3-5 days	persistent: 2-18 months	biodegradable of its low soluble fraction < 5 weeks
	impact of release	minimal unless very heavy conspicuous fallout; microbiological contamination reversible by air exposure and/or chlorine treatment			EC drinking water limits unlikely to be exceeded			no effect

Table 3A. General Characteristics of Pollutants that are Emitted from the SAWTP

	Description	VOC's: benzene, carbon monoxide, hydrocarbons	organic acids and alcohols: butanoic acid, propanoic acid, ethanoic acid	bacteria: aspergillus, E coli, yeasts, total coliforms	inorganic gases: hydrogen, ammonia, sulphides, mercaptans, indoles, skatoles	inorganic salts: sulphates, nitrates, nitrites, chlorides	liquid spillages of wastewater, fuel oils, lube oils
general characteristics	**potential source**	fuel evaporation and combustion	incomplete reduction to methane and carbon dioxide	aerobic growths on organic wastes	odours emanating from decay of organic wastes	drying of leached percolates	bring-in trucks and vehicles
	Possible Site Locations	P1, P2 and P3	P1, P2, P, P4, P5, P6,	P1, P2, P3, P4, P6 and P11		P4 and P9	P1, P2, P3 and circular road
	mode of contamination	adsorption on land; partially soluble in water	settling on land; soluble in storm water	settling on land	settling and adsorption	settling and leaching	seepage and percolation

Table 3B. Relevant Literature on the listed Characteristics of the Pollutants

	VOC's: benzene, carbon monoxide, hydrocarbons	organic acids and alcohols: butanoic acid, propanoic acid, ethanoic acid	bacteria: aspergillus, E coli, yeasts, total coliforms	inorganic gases: hydrogen, ammonia, sulphides, mercaptans, indoles, skatoles	inorganic salts: sulphates, nitrates, nitrites, chlorides	liquid spillages of wastewater: fuel oils, lube oils
references	Tom Parkerton, 2001. A Preliminary Analysis of Benzene Fate in Industrial Wastewater Treatment Plants: Implications for the EU Existing Substances Risk Assessment. CEFIC Aromatics Producers Association and CONCAWE	UNEP Small Island Developing States: Assessment report. Paris, France May 27-30, 2003: Category name: n-butyric acid/n-butyric anhydride category	James E. Shelton, **Using Municipal Solid Waste Compost**. *1991*.North Carolina Cooperative Extension Service. **Publication AG-439-19**	Impact on Health of Emissions from Landfill Sites. Health Protection Agency 2011		

Table 3C. General Characteristics of Pollutants Emitted from the SAWTP that are Associated with Land Contamination

	Description	VOC's: benzene, carbon monoxide, hydrocarbons	organic acids and alcohols: butanoic acid, propanoic acid, ethanoic acid	bacteria: aspergillus, E coli, yeasts, total coliforms	inorganic gases: hydrogen, ammonia, sulphides, mercaptans, indoles, skatoles	inorganic salts: sulphates, nitrates, nitrites, chlorides	liquid spillages of wastewater : fuel oils, lube oils
risks associated with land contamination	**toxicity potential**	carcinogens	decreases pH in water	may produce a variety of fungal metabolites in soil and plants	nutrient depletion of soil	depletion of ion exchange properties of soil	clogging of air and water penetration
	environmental fate: mobility degradability	volatile and does not undergo partitioning or accumulation	atmospheric photo oxidation within 5 days; low partition coefficient with soil precludes its stability	mobility bound to particulate matter; stability dependent on temp., humidity wind	partitions with soil and water; half life estimated to be 3-6 months	naturally occurring in land and water; uptake by plants	mobility by vehicular tyres, wind and rain
	nature of substance	carcinogen by blood absorption	easily hydrolysed and low partition constant with soil renders them harmless	may cause intestinal diseases	toxic to plants and small fauna	increase of soil soluble salts	soil contamination
	impact of release	EC limits on ambient air quality	very low effects		nauseating, unpleasant small in ground water	total dissolved salt increase	little effect

Table 3D. General Characteristics of Some Pollutants Emitted from the SAWTP that are Associated with Groundwater Contamination

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	Description	VOC's: benzene, carbon monoxide, hydrocarbons	organic acids and alcohols: butanoic acid, propanoic acid, ethanoic acid	bacteria: aspergillus, E coli, yeasts, total coliforms	inorganic gases: hydrogen, ammonia, sulphides, mercaptans, indoles, skatoles	inorganic salts: sulphates, nitrates, nitrites, chlorides	liquid spillages of wastewater: fuel oils, lube oils
risks associated with ground water contamination	**toxicity potential**	slightly soluble and percolation	at ambient pH form the anions which are environmentally harmless at low levels	water suspension through land	high solubility and percolation; toxic in high concentrations	high solubility and percolation	form suspensions
	environmental fate	biodegradable with normal half-life of 4 weeks	anions relatively stable with half lives for biodegradation of <5 days	stable in nutrient rich waters	usually biodegradable < 10 weeks	Permanent residence	Permanent residence of metals; biodegradability of oils
	nature of substance					permanent	Metals permanent; biodegradable < 24 weeks
	impact of release	EC drinking water limits unlikely to be exceeded	no effect	Little or no increase to natural identical contaminants	Odour renders	High TDS relegates quality of ground water	Little or no increase to normal environmental contamination

Table 4A. EWC References and Quantities of Incoming Wastes at the Materials Recovery Facility (MRF) Hall, SAWTP.

Waste Description (EWC)	bio/ chemical composition	storage method	mean weekly quant, tonnes	location of site(s) of stockage	period on site of stockage prior to treatment
15 01 01	paper/cardboard packaging	MRF shed	44.79	MRF shed	max. 5 days
15 01 02	plastic packaging	MRF shed	15.83	MRF shed	max. 5 days
15 01 04	metal packaging	MRF shed	28.52	MRF shed	max. 5 days
15 01 06	mixed packaging	MRF shed	141.26	MRF shed	max. 5 days
15 01 07	glass packaging	MRF open yard	50.78	MRF open yard	3-4 months
20 01 01	paper/cardboard	MRF shed	14.5	MRF shed	max. 5 days
20 01 39	Plastics	MRF shed	8.96	MRF shed	max. 5 days
20 01 40	Metals	MRF shed	3.06	MRF shed	max. 5 days
		TOTAL WEEKLY	**307.7 tonnes**		
		TOTAL MONTHLY	**1,230.8 tonnes**		
		TOTAL ANNUALLY	**16,000.4 tonnes**		

Table 4B. EWC References and Quantities of Incoming Wastes at the Mechanical Treatment Process (MTP) Hall, SAWTP.

Waste Description (EWC)	**bio/ chemical composition**	**storage method**	**mean weekly quant, tonnes**	**location of site(s) of stockage**	**period on site of stockage prior to treatment**
20 01 08	biodegradable kitchen waste	MTP shed	37.15	MTP shed	max. 2 days
20 03 01	mixed municipal waste	MTP shed	954.21	MTP shed	max. 2 days
20 03 02	waste from markets	From MRF shed to MTP	9.96	MTP shed	max. 2 days
		TOTAL WEEKLY	**1001.32**		
		TOTAL MONTHLY	**4,005.28**		
		TOTAL ANNUALLY	**52,068.64**		

Table 5A. EWC References and Quantities of Incoming/ Outgoing Wastes from the Materials Recovery Facility (MRF) Hall, SAWTP.

Incoming at MRF						Outgoing at MRF	
Waste Description (EWC)	bio/ chemical composition	storage method	mean weekly quant, tonnes	location of site(s) of stockage	period on site of stockage prior to treatment	Packaged for Export - INERT, weekly	Packaged for Export - INERT, annual
15 01 01	paper/cardboard packaging	MRF shed	44.79	MRF shed	max. 5 days	44.79	2,329.08
15 01 02	plastic packaging	MRF shed	15.83	MRF shed	max. 5 days	15.83	823.16
15 01 04	metal packaging	MRF shed	28.52	MRF shed	max. 5 days	28.52	1,483.04
15 01 06	mixed packaging	MRF shed	141.26	MRF shed	max. 5 days	141.26	7,345.52
15 01 07	glass packaging	MRF open yard	50.78	MRF open yard	3-4 months	50.78	2,640.56
20 01 01	paper/cardboard	MRF shed	14.5	MRF shed	max. 5 days	14.50	754.00
20 01 39	plastics	MRF shed	8.96	MRF shed	max. 5 days	8.96	465.92
20 01 40	metals	MRF shed	3.06	MRF shed	max. 5 days	3.06	159.12
					TOTAL	**307.70**	**16,000.40**

Table 5B. EWC References and Quantities of Outgoing Wastes from the Mechanical Treatment Process (MTP) Hall, SAWTP.

Incoming at MTP						Outgoing at MTP										
Waste Description (EWC)	bio/ chemical composition	storage method	mean weekly quant, tonnes	location of site(s) of stockage	period on site of stockage prior to treatment	EWC	Description	Weekly	Annual	Directed to	Packaged for **Export** - NON-HAZARDOUS, weekly	Packaged for Export - NON-HAZARDOUS annual	Packaged for Ghallies Landfill - NON-HAZARDOUS, weekly	Packaged for Ghallies Landfill - NON-HAZARDOUS, annual	Packaged for Compost Land Cover - NON-HAZARDOUS, weekly	Packaged for Compost Land Cover - NON-HAZARDOUS, weekly
20 01 08	biodegradable kitchen waste	MTP shed	37.15	MTP shed	max. 2 days	19 06 04	digestate from anaerobic treatment of municipal waste	98.45	5,119.33	Used as landfill cover					98.45	5,119.33
20 03 01	mixed municipal waste	MTP shed	954.21	MTP shed	max. 2 days	19 12 01	paper and cardboard	5.12	266.38	Directed from MTP to MRF to be processed as recyclable	5.12	266.38				
20 03 02	waste from markets	MRF shed	9.96	MTP shed	max. 2 days	19 12 02	ferrous metal	25.51	1,326.45	Directed from MTP to MRF to be processed as recyclable	25.51	1326.45				
						19 12 03	non-ferrous metal	0.39	20.08	Directed from MTP to MRF to be processed as recyclable	0.39	20.08				
						19 12 04	plastic and rubber	5.93	308.4	Directed from MTP to MRF to be processed as recyclable	5.93	308.4				

Table 5B. EWC References and Quantities of Outgoing Wastes from the Mechanical Treatment Process (MTP) Hall, SAWTP, ***cont'd***.

Outgoing at MTP										
EWC	Description	Weekly	Annual	Directed to	Packaged for **Export** - NON-HAZARDOUS, weekly	Packaged for Export - NON-HAZARDOUS annual	Packaged for Ghallies Landfill - NON-HAZARDOUS, weekly	Packaged for Ghallies Landfill - NON-HAZARDOUS, annual	Packaged for Compost Land Cover - NON-HAZARDOUS, weekly	Packaged for Compost Land Cover - NON-HAZARDOUS, weekly
19 12 10	combustible waste	3.39	176.16	To Landfill - whilst this fraction may be treated in the same way as 19 12 10 from the MRF, the material was sent to landfill due to high cost related to export as well as potential odour problems during export			3.39	176.16		
19 12 12	other wastes from mechanical treatment	792.00	To Landfill – this fraction consists of a mixture of materials as outlined below.							
Rejects from dry MTP			23939.05	included as part of 19 12 12 – This fraction may be directed for energy recovery (Refuse Derived Fuel) but due to current lack of local facilities would need to be exported at high cost.	460.37	23,939.05				
Bulk material from dry MTP			13331.5	included as part of 19 12 12 - This fraction may be directed for energy recovery (Refuse Derived Fuel) but due to current lack of local facilities would need to be exported at high cost	256.38	13,331.50				
Organics from dry MTP			193.58	included as part of 19 12 12	3.72	193.58				
Heavy rejects from sand trap (wet MTP)			3,734.13	included as part of 19 12 12 – consists mainly of inert materials.	71.81	3,734.13				
Organic fraction to wet MTP		931.06	48415.06	To wet MTP						
TOTAL					829.22	43,119.57	3.39	176.16	98.45	5,119.33

OVERALL TOTAL 49,346.12 tonnes annually

Table 6 Limit Values of heavy metals in mg/kg in Composts from MSW.

Country	United Kingdom		Italy	
Regulation	UKROFS 'Composted household waste'	Composting Association Quality Label	Limit values for solid organic fraction	Green (ACV) and MIXED Composted Amendment (ACM)
Cd	0.7	1.5	10	1.5
Cr, total	70	100	500	N/A
Cu	70	200	600	150
Hg	0.4	1	10	1.5
Ni	25	50	200	50
Pb	45	150	500	140
Zn	200	400	2500	500
As	N/A	N/A	10	N/A

Table 6B. Some Typical Analytical Results obtained on Compost from the SAWTP.

	Parameters	**Unit of measure**	
Nutrients	Total organic carbon	21.4	%
	Total nitrogen	28288	mg/kg
	Organic Nitrogen	27900	mg/kg
	Ammonium Nitrogen (NH4-N)	812	mg/kg
	Nitrite Nitrogen (NO2-N)	0.8125	mg/kg
	Nitrate Nitrogen (NO3-N)	0.875	mg/kg
	Total Phosphorus (P)	5783	mg/kg
	Soluble Phosphorus (P)	3.125	mg/kg
	Total Potassium (K)	6056	mg/kg
	Soluble Potassium (K)	1418	mg/kg
	Soluble Magnesium (Mg)	245	mg/kg
	Calcium	69813	mg/kg
	Soluble Sulphur (S)	34.375	mg/kg
	Soluble Iron (Fe)	98.8	mg/kg
	Soluble Boron (B)	1.8	mg/kg
	Soluble Manganese (Mn)	1.375	mg/kg
	Water soluble chloride (Cl-)	3454	mg/kg
Heavy Metals	**Parameters**	**Unit of measure**	
	Cadmium	<1	mg/kg
	Chromium	39.1	mg/kg
	Copper	107.25	mg/kg
	Mercury	0.188	mg/kg
	Nickel	21.5	mg/kg
	Lead	242	mg/kg
	Zinc	415	mg/kg

Table 7. Calculated quantities of Particulate Matter collected by the Filtration Units.

Source	**No. 1MRF hall: Combined source and hall air collection**	**No. 2 MTP hall: Combined source and hall air collection (both dry and wet)**	**No.3 AD aerobisation tanks Exhaust air collection**
Flow daytime /night times m^3/hr	38,000 / 0	42,500 / 12,000	8,000 / 8,000
Dust mg/m^3	> 10, assume 10	> 10 assume 10	< 10 assume 10
Total daily DUST amounts in grammes (8 hour day and 16h night) dust collection at 100% efficiency	3,040	5,320	1,920
Total ANNUAL dust amounts in KILOGRAMMES (8 hour day and 16h night) dust collection at 100% efficiency	**1,110**	**1,942**	**701**
Odour OU/m^3	app. 1,000 – 2,000	1,000 - 10,000 average 4,000	2,000 - 10,000
according to the Technical Guidance Note IPPC H4 of the UK Environment Agency 2002, Odour Units may be converted to mg/m3 by the equation D = Ca/Ta D is the odour concentration of a mixture (dimensionless, odour units ouE m -3) Ca is the chemical concentration of compound (a) in mg m -3 Ta is the published odour threshold value of compound (a) in mg m -3. for example hydrogen sulphide is 0.00076mg/m3. Thus we can convert the Odour units into **mg/m^3 for H_2S**	1.52	3.04	7.6
Total daily H_2S amounts in grammes (8 hour day and 16h night) dust collection at 100% efficiency	462	1,617	584
Total ANNUAL H_2S amounts in KILOGRAMMES (8 hour day and 16h night) dust collection at 100% efficiency	**169**	**590**	**213**
Total organic carbon mg/m^3	app. 50	20 – 70 average 50	500 - 800 average 650
Total daily CARBON amounts in grammes (8 hour day and 16h night) dust collection at 100% efficiency	15,200	26,600	9,600
Total ANNUAL carbon amounts in KILOGRAMMES (8 hour day and 16h night) dust collection at 100% efficiency	**5,548**	**9,709**	**3,504**

Table 8. Emissions based on Euro 5. Preliminary draft proposal for a Regulation of the European Parliament and of the Council relating to the emissions of atmospheric pollutants from motor vehicles (Euro 5)

		Mass of CO		Mass of total hydrocarbons		Mass of NOx		Mass of PM's	
Calculation	**Location**	**Petrol**	**Diesel**	**Petrol**	**Diesel**	**Petrol**	**Diesel**	**Petrol**	**Diesel**
Emission threshold limits in **grammes per kilometre**, (for vehicles all vehicles), grammes per kilometre (Ref. Directive 1999/96/EC)		1	0.5	0.075	N/A	0.06	0.2	N/A	0.005
Maximum distance travelled by each vehicle, around SAWTP periphery approximately 0.75 kilometre		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Total number of **vehicle counts**	Weekday	70	214	70	214	70	214	70	214
Total **number of kilometres** covered by vehicles	Weekday	52.5	160.5	52.5	160.5	52.5	160.5	52.5	160.5
Total **mass in grammes** emitted by vehicles inside SAWTP area over the 8-hour working day	Weekday	52.50	80.25	3.94	N/A	3.15	32.10	N/A	0.80
Total **mass in grammes** emitted by vehicles inside SAWTP area, over a mean 60 minute period	weekday	6.56	10.03	0.49	N/A	0.39	4.01	N/A	0.10
Mean concentration in **microgrammes per square metre**, over the 47,000 sq m area of SAWTP, during a 60 minute period	Weekday	140	213	10	N/A	8	85	N/A	2
Mean concentration in **microgrammes per cubic metres**, dispersed through a mean of 10 m flux height.	weekday	14	21	1	N/A	1	9	N/A	0
Limit values for **CO and benzene** (a hydrocarbon) (Directive 2000/69/EC), NOx and particulates in Directive 1999/30/EC (LN 224 of 2001)	Upper assessment threshold, eight hour average ug per cu m	7000		benzene 3.5		32		14	
	Lower assessment threshold eight hour average ug per cu m	5000		benzene 2		26		10	

Table 9 Distances of the SAWTP from the nearest town centres.

Town Centre	Bearings from SAWTP	Distance from SAWTP
Fgura	north-west	2.7 km
Zabbar	north-north-west	2 km
Zejtun	south-west	1.2 km
Marsascala	East	1.8 km

Table 10. Results of Air Quality measurements at the MTP Hall

MTP	Limits	Inside Halls Monthly MEAN	Outside Halls Quarterly MEAN		MTP	Limits	Inside Halls Quarterly MEAN	Outside Halls Quarterly MEAN		MTP	Inside Halls Quarterly MEAN	Outside Halls Quarterly MEAN
Ammonia (mg/m^3)	**18**	**0.25**	**0.046**		**Ozone** ($\mu g/m^3$)	120	**5.433**	**44.667**		**PCBs(pg/m^3)**		
Arsenic (ng/m^3)	**6**	-	-		**NM VOCs**(mg/m^3)	-	-	-		***28***	**26.333**	**12.167**
Asbestos (f/ml)	**0.01**	-	-		**Benzene** ($\mu g/m^3$)	5	-	-		***52***	**17.367**	**7.533**
Cadmium (ng/m^3)	**5**	-	-		**Dioxins & Furans**(pg/m^3)	-	**0.02**	**0.04**		*77*	-	-
Hydrogen sulfide (mg/m^3)	7	**0.03**	**0.02**		**Sulfur Dioxide**($\mu g/m^3$)	125	**9.767**	**12.85**		***81***	-	-
Lead ($\mu g/m^3$)	**0.5**	**0.38**	-		**Esters**($\mu g/m^3$)	-	**517.5**	**20.33**		***101***	**6.633**	**4.4**
Mercaptans (mg/m^3)	**35**	-	-		**CO**(mg/m^3)	10	**1.547**	**0.89**		***105***	-	-
Skatoles ($\mu g/m^3$)	-	-	-		**PAHs** (ng/Nm^3)	-	-	**5.3**		***114***	-	-
Indoles ($\mu g/m^3$)	-	-	-		**PCBs** (pg/m^3)	-	**26.333**	**12.167**		***118***	**2.9**	**2.467**
Mercury (mg/m^3)	**0.1**	**0.000009**	**0.000007**		**PAHs(ng/Nm^3)**					***123***	-	-
Methane (ppm)	-	-	-		***Acenaphthene***		**6.575**	**0.69**		***126***	-	-
Polyamines ($\mu g/m^3$)	-	-	-		***Acenaphthylene***		**1.675**	**0.55**		***138***	**3.767**	**2.767**
Aspergillus (CFU/t)	-	-	-		***Anthracene***		**12.675**	**1.71**		***153***	**4.7**	**3.333**
Yeasts (CFU/t)	-	-	-		***Benz(a)anthracene***		**0.83**	**0.975**		***156***	-	-
PM10 ($\mu g/Nm^3$)	**50**	**587.766**	**64.475**		***Benzo(a)pyrene***		**0.743**	-		***157***	-	-
PM2.5 ($\mu g/Nm^3$)	**25**	**300.927**	**24.893**		***Benzo(e)pyrene***		**3.3**	**0.55**		***167***	-	-
Total Col. Counts (CFU/t)	-	-	-		***Benzo(b)fluoranthene***		**1.303**	**0.415**		***169***	-	-
Nickel (ng/m^3)	**20**	-	-		***Benzo(ghi)perylene***		**1.46**	**1.4**		***180***	**6.7**	**0.0014**
					Benzo(j)fluoranthene		**1.1**	-		***189***	-	-

Table 10, cont'd Results of Air Quality measurements at the MTP Hall

Benzo(k)fluoranthene		**0.553**	**0.55**
Chrysene		**1.377**	**0.37**
Coronene		**1.265**	**0.55**
Dibenz(a,h)anthracene		**0.69**	**0.83**
Fluoranthene		**16.6**	**2.533**
Fluorene		**24.55**	**2.508**
Indeno(1,2,3-cd)pyrene		**0.937**	**1.1**
Phenanthrene		**119**	**8.75**
Pyrene		**13.075**	**2.55**

Table 11. Results of Air Quality measurements at the MRF Hall

MRF	Limits	Inside Halls monthly MEAN	Outside Halls Quarterly MEAN
Ammonia (mg/m³)	**18**	**0.119**	**0.035**
Hydrogen sulfide (mg/m³)	7	**0.007**	**0.009**
Mercaptans (mg/m³)	**35**	-	-
Skatoles (µg/m³)	-	-	-
Indoles (µg/m³)	-	-	-
Methane (ppm)	-	-	-
Aspergillus (CFU/t)	-	-	-
Yeasts (CFU/t)	-	-	**18.5**
PM10 (µg/Nm³)	**50**	**581.612**	**43.303**
Total Col. Counts (CFU/t)	-	-	-

MRF	Limits	Inside Halls quarterly MEAN	Outside Halls quarterly MEAN
Arsenic(ng/m³)	**6**	-	-
NM VOCs(mg/m³)	-	**1.093**	**0.0099**
PM 2.5(µg/m³)	**25**	**276.5**	**30.966**
Asbestos(f/ml)	**0.01**	-	-
Nickel(ng/m³)	**20**	-	-
Dioxins & Furans(pg/Nm³)	-	**0.066**	**0.03025**
Mercury(mg/m³)	**0.1**	**0.0000039**	**0.0000056.5**
Cadmium(ng/m³)	**5**	-	-
Lead(µg/m³)	**0.5**	**0.37**	**0.0855**
Polyamines(mg/m³)	-	-	-
PAHs(ng/Nm³)	-	**51.75**	**24.125**
PCBs(pg/m³)	-	**310**	**19.25**

Table 12. Results of Air Quality measurements at the WAS Hall

WAS	Limits	Inside Halls Monthly MEAN	Outside Halls quarterly MEAN
Ammonia (mg/m³)	**18**	**0.482**	**0.033**
Hydrogen sulfide (mg/m³)	7	**0.033**	**0.019**
Mercaptans (mg/m³)	**35**	-	-
Skatoles (µg/m³)	-	-	-
Indoles (µg/m³)	-	-	-
Methane (ppm)	-	-	-
Polyamines (µg/m³)	-	-	-
Aspergillus (CFU/t)	-		-
Yeasts (CFU/t)	-	**260**	**62**
PM10 (µg/Nm³)	**50**	**768.299**	**89.99**
Total Col. Counts (CFU/t)	-	**156.333**	-

WAS	Limits	Inside Halls quarterly MEAN	Outside Hall quarterly MEAN
Benzene (µg/m³)	**5**	**2.725**	-
Carbon Monoxide (mg/m³)	**10**	**2.1306**	**0.622**
NM VOCs (mg/m³)	-	-	-
Nitrogen dioxide (µg/m³)	**40**	**335**	**14.866**
Sulphur dioxide (µg/m³)	**125**	**5.975**	**2.7**

Table 13. Condensed List of Analytical Measurements on Waste Waters collected from the SAWTP

Overall		LN139 of 2002	WSC Treated		Borehole water 2013					Process Water		Runoff water compost Shed	wastewater from MTP
		Discharge limits	mean 2013		Blank (Mugliet)	Saliba	Dalli	Vella					
pH		**6-10**	6.7		7.4	7.25	7.23	7.3		7.05		7.025	7.3
SETTLEABLE SOLID	mg/l	**20**	nd		nd	nd	nd	nd		**513**		Nd	na
SUSPENDED SOLIDS	mg/l	**500**	18.2		nd	nd	nd	nd		**1484**		**728.25**	100
TOTAL KJELDAHL NITROGEN	mg/l	**100**	53.2		35.2	37.35	31.8	23.5		1346		575.55	66.8
AMMONIUM NITROGEN	mg/l		2.8		0.16	nd	nd	1.05		**1382**		**608.45**	5.8
SULPHIDES and COMPOUNDS	mg/l	**10**	nd		nd	nd	nd	nd		0.93		Nd	<1
HYDROCYANIC ACID AND COMPOUND	mg/l as CN	**10**	nd		nd	nd	nd	nd		nd		Nd	<0.005
TOTAL SULPHATES	mg/l	**1000**	664.8		272	249.9	269.05	194.35		266		208.4	347
FREE AND EMULSIFIED GREASE	mg/l	**200**	28		9.5	12.75	4.75	5		70.8		22.85	<0.05
FREE CHLORINE	mg/l	**100**	nd		nd	nd	0.038	nd		2.75		Nd	<0.03
CHLORIDE	mg/l	**1000**	**4396**		**2468.8**	**1698.65**	**2122.6**	**1324.8**		**9049.4**		**7622.8**	**2782**
TOTAL CHROMIUM	mg/l	**5**	nd		nd	nd	0.028	0.024		0.035		0.019	<0.005
TOTAL SILVER	mg/l	**5**	nd		nd	nd	nd	nd		0.4		Nd	<0.0005
TOTAL NICKEL	mg/l	**5**	0.012		0.0013	0.0008	0.009	0.011		0.064		0.055	0.0048
TOTAL COPPER	mg/l	**5**	0.015		nd	nd	0.014	0.015		0.54		0.15	0.011
TOTAL LEAD	mg/l	**1**	0.099		0.002	0.002	0.012	0.012		**1.88**		0.16	0.0046
TOTAL ZINC	mg/l	**10**	0.28		0.063	0.0097	0.087	0.08		3.18		1.05	0.046
TOTAL NON-FERROUS METALS	mg/l	**30**	0.39		0.13	0.101	9.43	8.78		25.2		1.44	0.03
TOTAL SOLUBLE NON-FERROUS METALS	mg/l	**10**	0.28		0.064	0.08	3.97	2.68		6.3		0.63	0.028
TOTAL ARSENIC	mg/l	**0.05**	nd		nd	nd	0.025	0.003		0.025		0.025	<0.005
TOTAL FLUORIDE	mg/l	**10**	nd		nd	nd	nd	nd		0.38		nd	<0.2
TOTAL BORON	mg/l	**2**	1.46		0.74	0.5	0.86	0.78		**2.55**		1.33	0.92
CHEMICAL OXYGEN DEMAND	mg/l	**983**	267		161.75	45.75	97.25	97.5		**1543.3**		578.25	260
BIOLOGICAL OXYGEN DEMAND	mg/lO2	**492**	104		63.25	16.55	38	38		**404**		287	100

Table 14A. Risks, Hazards and Action in terms of the Activities at SAWTP.

SAWTP Activities	Risks and Hazards	Recommended Action
Incoming vs Outgoing Wastes.	The outgoing quantities correspond to the incoming quantities as far as the MRF is concerned. There is a far greater amount of wastes collected from households and markets. These constitute a more hazardous potential than the waste arriving at the MRF.	More special attention should be given to wastes arriving at the MTP, with proper documented descriptions of each load and details of the visually inspected composition and possible source.
Non-hazardous Wastes going out of the SAWTP following treatment.	There is a quantity of wastes that are sent to the Ghallies engineered landfill that may have various contaminants that may leach out. Furthermore no analytical measurements have been made to classify the waste as INERT, NONHAZARDOUS or HAZARDOUS according to Directive 2003/33/EC. These wastes are separated as : COMPOST (5,119.33 tonnes), REJECTS (3,734.13 tonnes), BALANCE (8,566.8 tonnes), COMBUSTIBLE (176.16 tonnes) REJECTS (23,939 tonnes), ORGANICS (193.58 tonnes). A total of about 41,500 tonnes annually. The possible contaminants that may be present include a quantity of iron sulphides which may liberate hydrogen sulphide at a low pH. Heavy metals are likely to be present as well. However it is imperative to investigate whether these metals are indeed leachable. it may well be that a study on these wastes may reveal that they are inert, in which case they may be discharged at an inert landfill; the tests may also indicate that disposal at an engineered landfill may be precluded.	Representative sampling and analysis according to Directive 2003/33/EC for each waste fraction sent to Ghallies.
Solid Particles collected from the Air-Filtration Units.	Filtered particles may contain several potential pollutants, which may be dispersed at the landfill and leached to ground water.	Filter wastes should be analysed according to Directive 2003/33/EC, and evaluated for the possible dispersion of the particles.

Table 14B. Risks, Hazards and Action in terms of the Activities at SAWTP.

SAWTP Activities	Risks and Hazards	Recommended Action
Liquid wastes from the RO brine and spent Process Water.	The quantity of spent Process Water is not known. It is retained in a tank that is contained in a spillage through, so accidental spillages are curtailed. However this spent Process Water is most likely to be highly contaminated with dissolved and suspended heavy metals, with a probably high quantity of iron and sulphides.	It is important to control the pH of this waste to >10. However its chemical composition must be known. Its disposal following treatment must also be resolved as soon as possible. Thorough documented maintenance programmes should be introduced to verify the mitigation programmes that are in place. This waste is perhaps the only potential hazard to contaminate the valley adjacent to the Family Park.
Lubricating and treatment oils.	The waste management of these wastes is in place. There exists a remote possibility of spillage on site.	Retain the current waste management
Vehicle combustion emissions.	The number of vehicles commuting within the SAWTP do not pose a risk or hazard to land or ground water	Retain the current waste management
Combined Heat and Power Plant and Gas Flare.	The given quantity of generated H2S is very high: 5257 kg annually. This does not correspond to the quantity of ferric chloride used to mitigate against this production of H2S.	The use of the ferric chloride solution should be investigated. Calculations presented in this report show that the amount of ferric chloride solution is much lower than the calculated generated quantity of hydrogen sulphide.
Gases and Particulates Generated due to handling of the waste materials.	According to the several analytical measurements carried out onsite and off-site at the SAWTP, no untoward hazardous levels of toxic gases were measured. The levels of PM'_s were found to be high, but acceptable to EU limits for ambient measurements and OHSA occupational levels for indoor.	Current environmental measures to be retained.

Table 15 – Probability Risk Factors

H	High	Exhibits high risk cues; has occurred in the past at the SAWTP; has a very high chance of it happening in the future
M	Medium	has happened occasionally; has a reasonable but not completely expected chance of it happening again
L	Low	has happened very infrequently or is expected not to happen except infrequently
N/A	not applicable	the risk is irrelevant to the project or facility
NI	need information	current available information impedes the determination of probability; information must come from outside sources; consider High probability until otherwise identified
TBD	to be determined	additional study will be required; consider High probability until actual measurements prove otherwise

Table 16 – Impact Risk Factors

H	high	The emission will have a major impact on the receptors (land and/or groundwater systems) and is likely to cause a significant disruption in the plant's services; a very visible event
M	medium	The emission will have some impact on the receptors and be detected by a number of receptors; possible disruption in the plant's services for some non-critical users.
L	low	No service disruption of service or negative effects are expected; any negative impact can be corrected with the minimum effort
N/A	not applicable	the risk is irrelevant to the project or facility
NI	need information	current available information impedes the determination of probability; information must come from outside sources; consider High probability until otherwise identified
TBD	to be determined	additional study will be required; consider High probability until actual measurements prove otherwise

Table 17 – Risk Quantification

Probability of Impact occurring: Function							
Impact		**L**	**M**	**H**	**NI**	**TBD**	**N/A**
	H	**M**	**H**	**H**	**H**	**H**	**N/A**
	M	**L**	**M**	**M**	**H**	**H**	**N/A**
	L	**L**	**L**	**L**	**M**	**M**	**N/A**
	N/A	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	NI	**M**	**H**	**H**	**H**	**H**	**N/A**
	TBD	**M**	**H**	**H**	**H**	**H**	**N/A**

Table 18 – Example of Impact and Probability

Probability of Impact occurring: Factor							
Impact		0.2	0.5	0.8	0.9	0.9	0
	0.8	0.5	0.65	0.8	0.85	0.85	N/A
	0.5	0.35	0.5	0.65	0.7	0.7	N/A
	0.2	0.2	0.35	0.35	0.55	0.55	N/A
	0.0	N/A	N/A	N/A	N/A	N/A	N/A
	0.9	0.55	0.7	0.85	0.9	0.9	N/A
	0.9	0.55	0.7	0.85	0.9	0.9	N/A

Table 19

Probability of Impact occurring.							
Impact as Function		**L**	**M**	**H**	**NI**	**TBD**	**N/A**
Biogas H_2S and Mercaptan	Current Impact considered to be = M	L	M	M	H	H	N/A
Spillage of Accumulated Process Water	Current Impact considered to be = TBD	M	H	H	H	H	N/A
MTP/ MRF PM's	Current Impact considered to be = TBD	M	H	H	H	H	N/A
Compost Heavy metals	Current Impact considered to be = H	M	H	H	H	H	N/A
Impact as Factor		**0.2**	**0.5**	**0.8**	**0.9**	**0.9**	**0**
Biogas H_2S and Mercaptan	Current Impact considered to be = M	0.35	0.5	0.65	0.7	0.7	N/A
Spillage of Accumulated Process Water	Current Impact considered to be = TBD	0.55	0.7	0.85	0.9	0.9	N/A
MTP/ MRF PM's	Current Impact considered to be = TBD	0.55	0.7	0.85	0.9	0.9	N/A
Compost Heavy metals	Current Impact considered to be = H	0.5	0.65	0.8	0.9	0.9	N/A

Diagram 1. Site Location of the SAWTP.

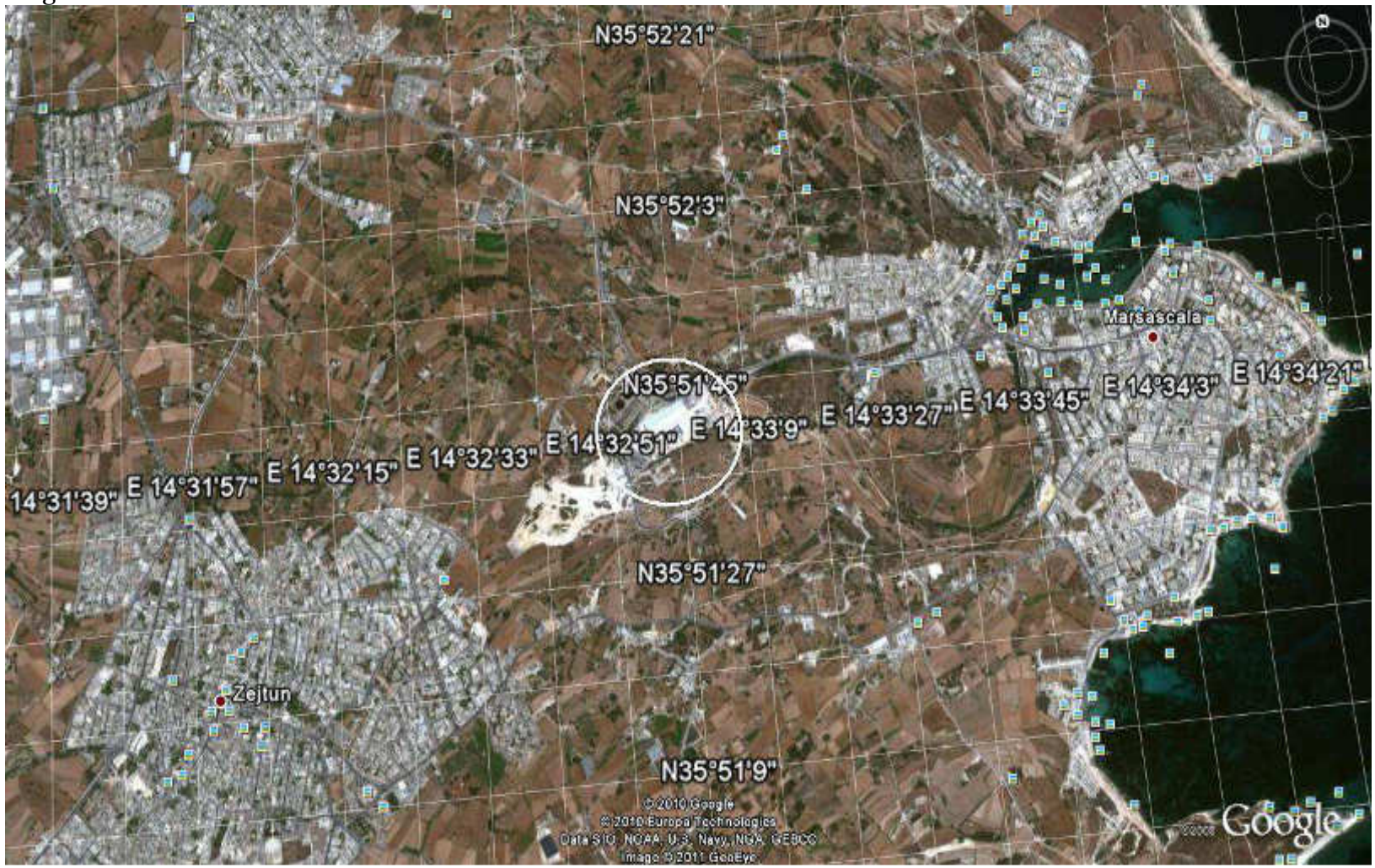
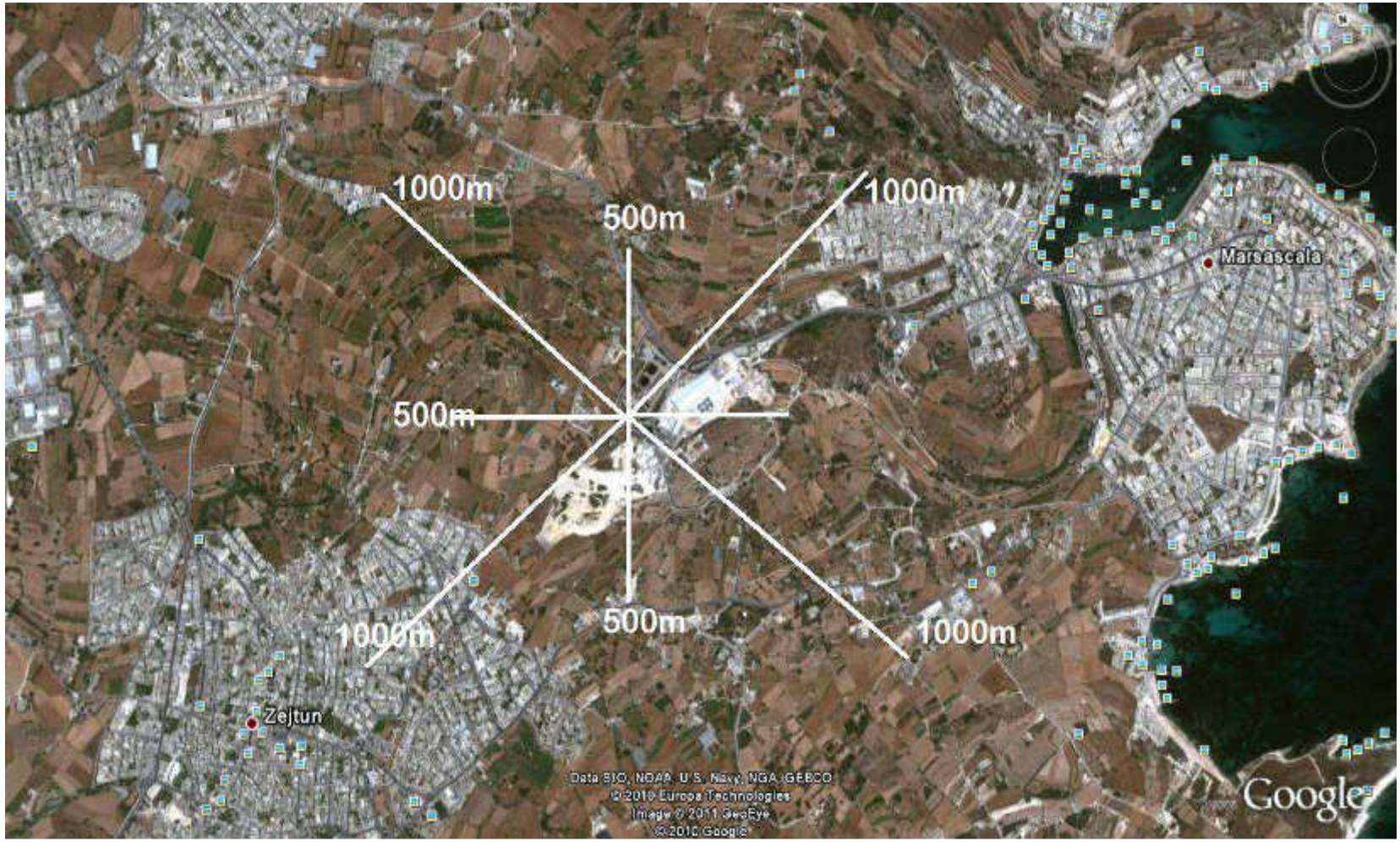


Diagram 2. Distance of Plant from nearest Town Centres



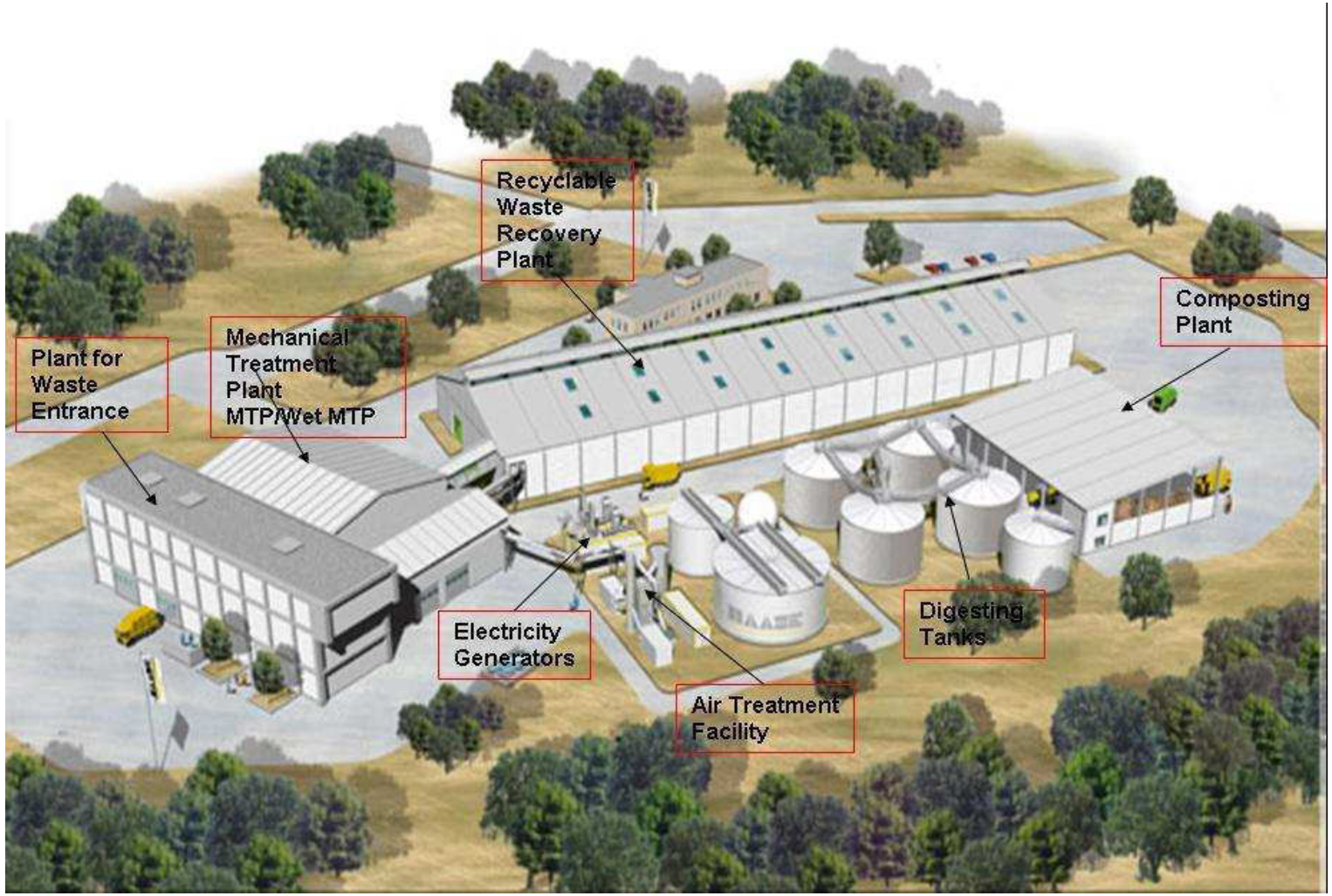


Diagram 3. Artist's Impression of the SAWTP Facilities.

Diagram 4. Wind Rose Ratio of Wind Direction over the SAWTP

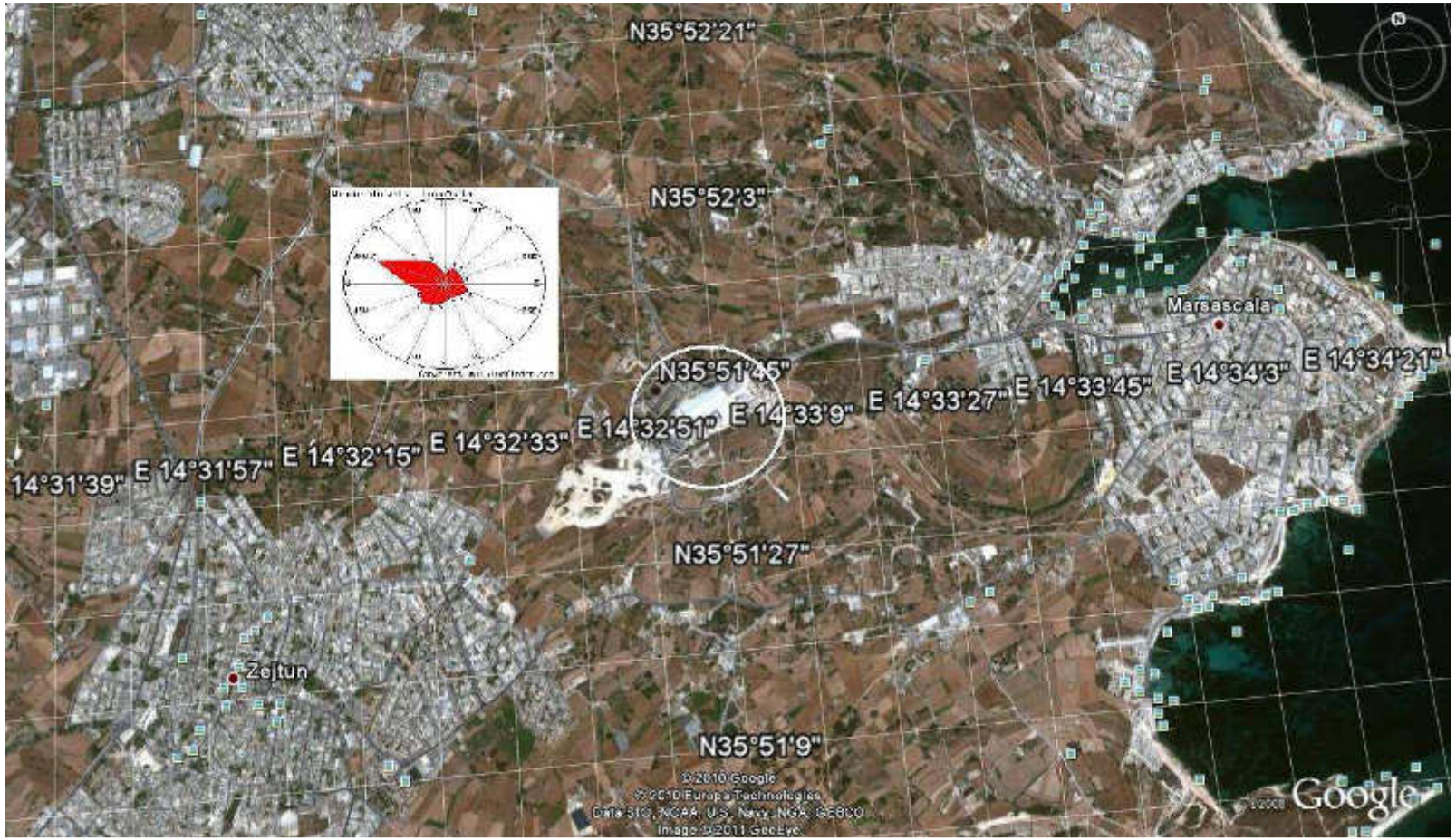


Diagram 5. Site Plan of the Potential Emission Points to Land and Groundwater within the SAWTP as per Table 1.

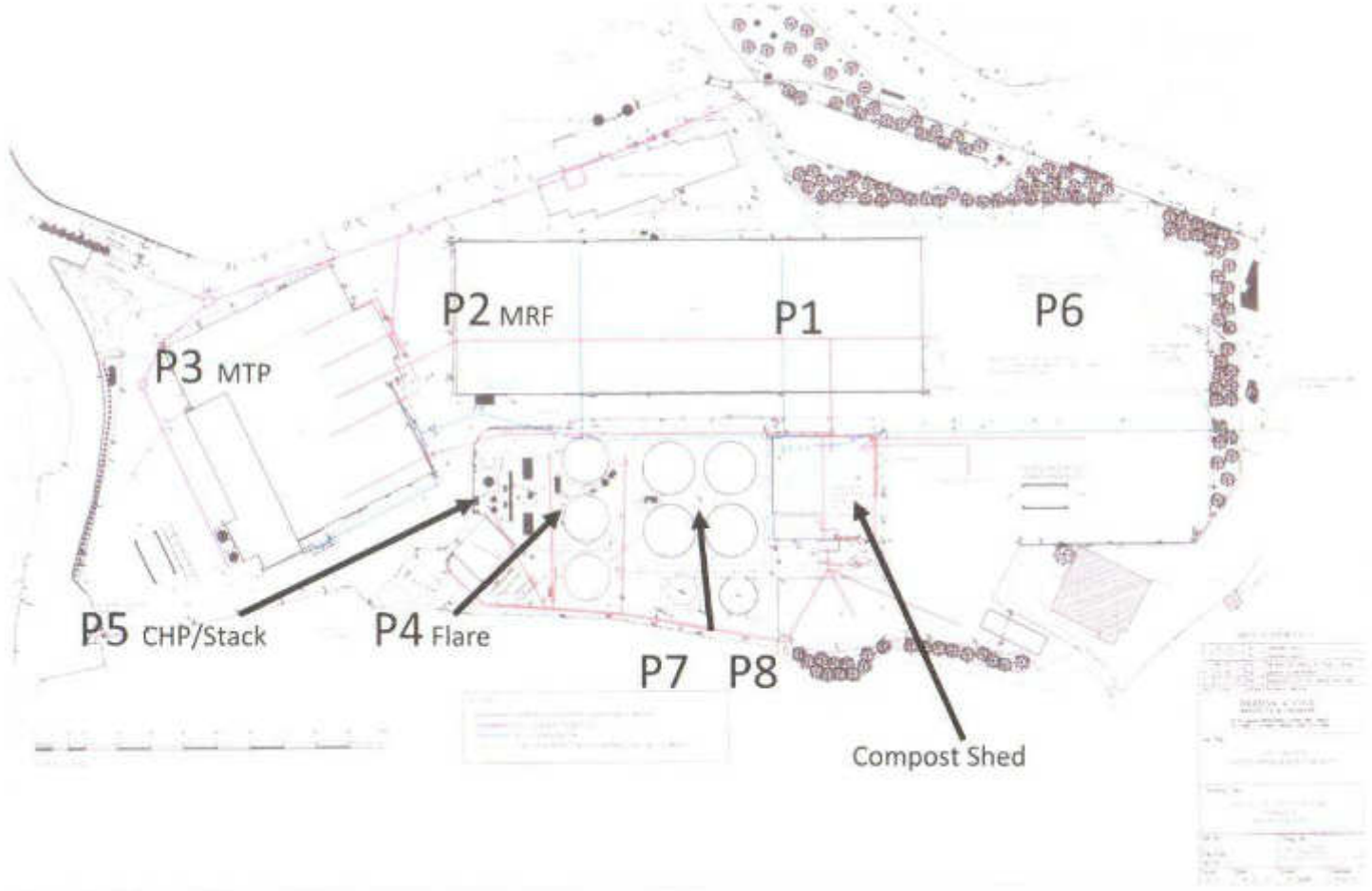


Diagram 6. Sketch Diagram of the Potential Emission Points to Land and Groundwater within the SAWTP as per Table 1.

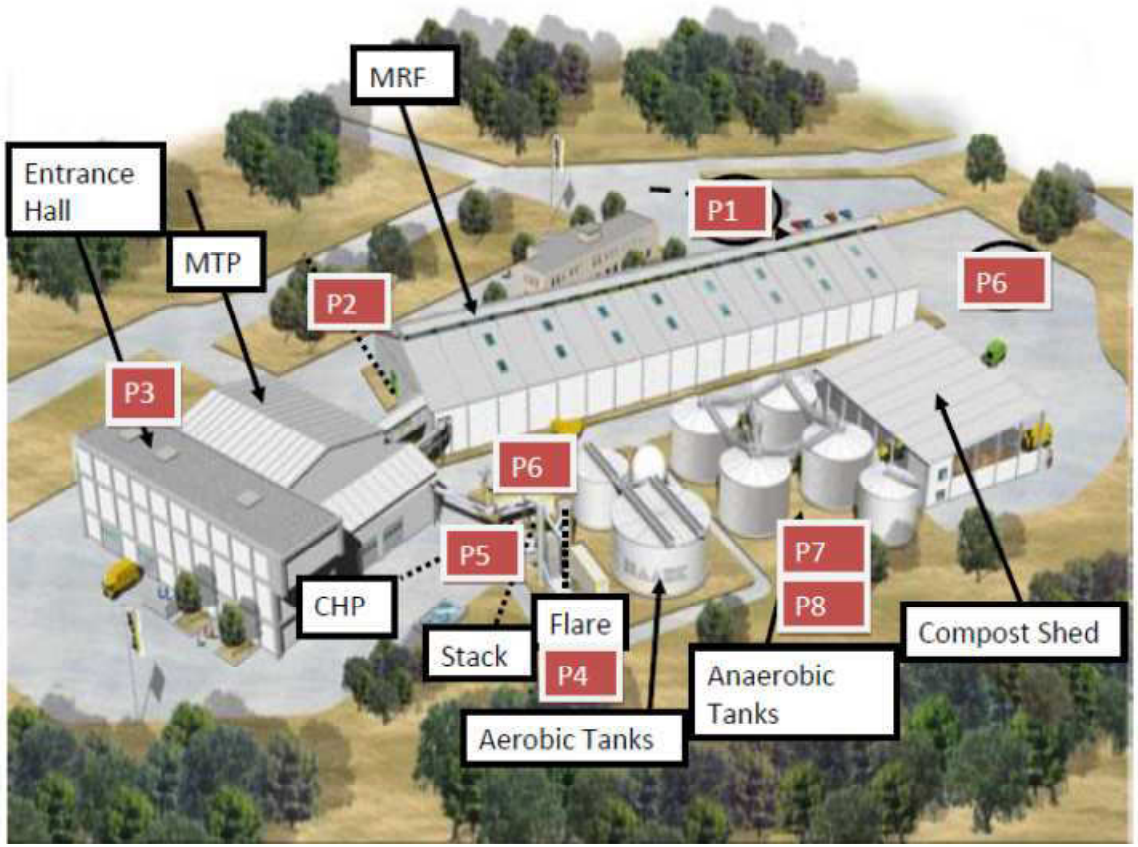


Diagram 7. Outline Borders of the SAWTP site.

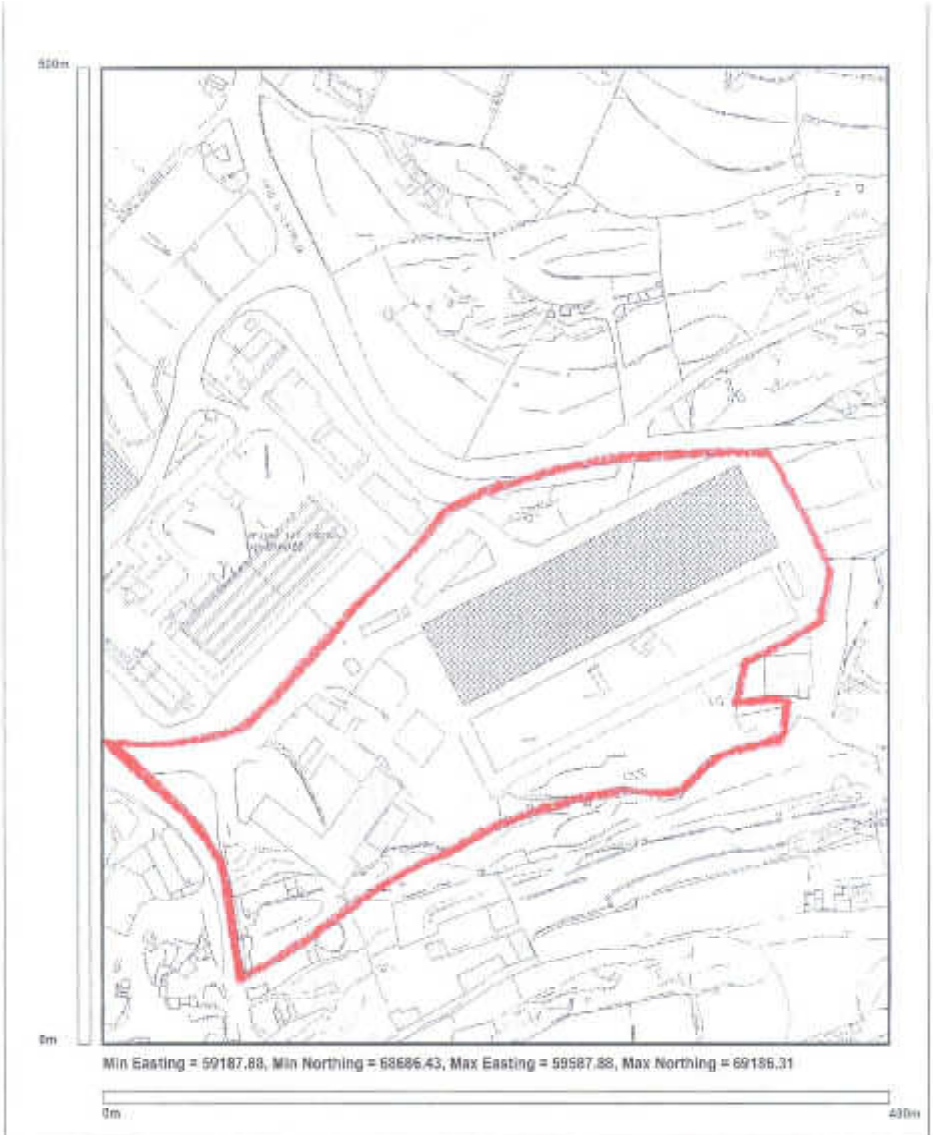


Diagram 8. A geological Cross-Section of the SAWTP, showing the Rock Strata.

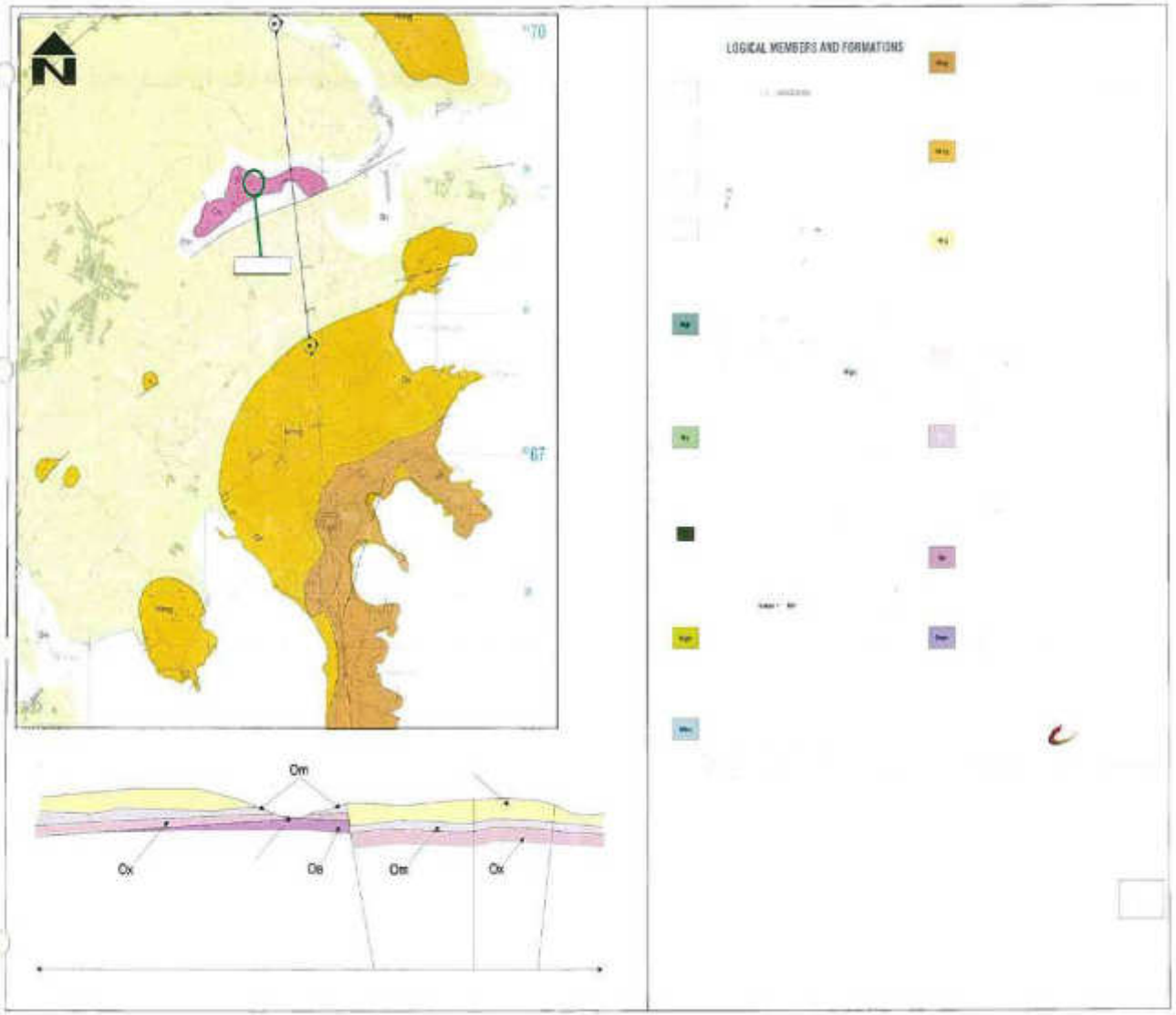


Diagram 9 Site Diagram from 2005.

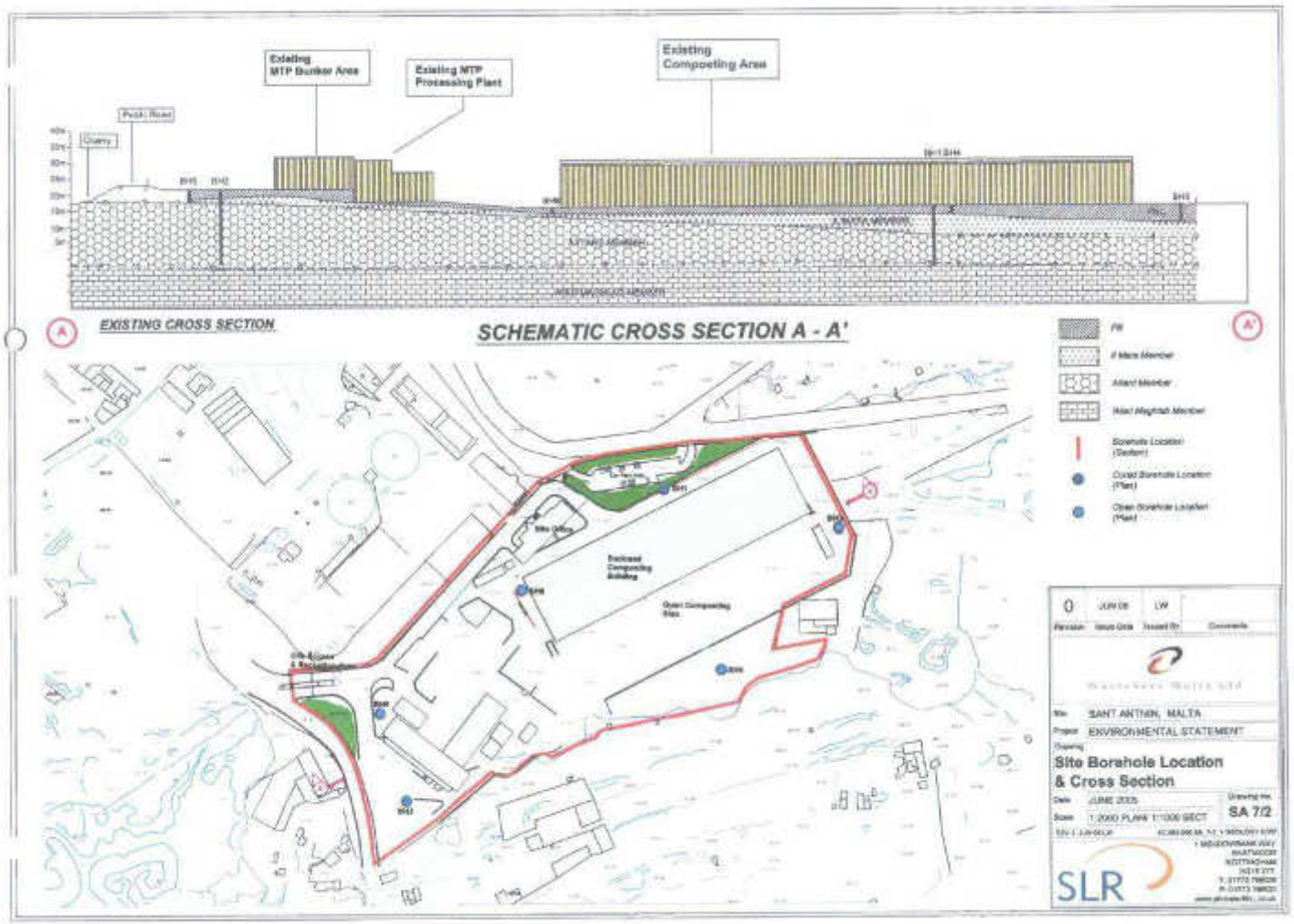


Diagram 10. Site Plan of the Drainage System at the SAWTP.

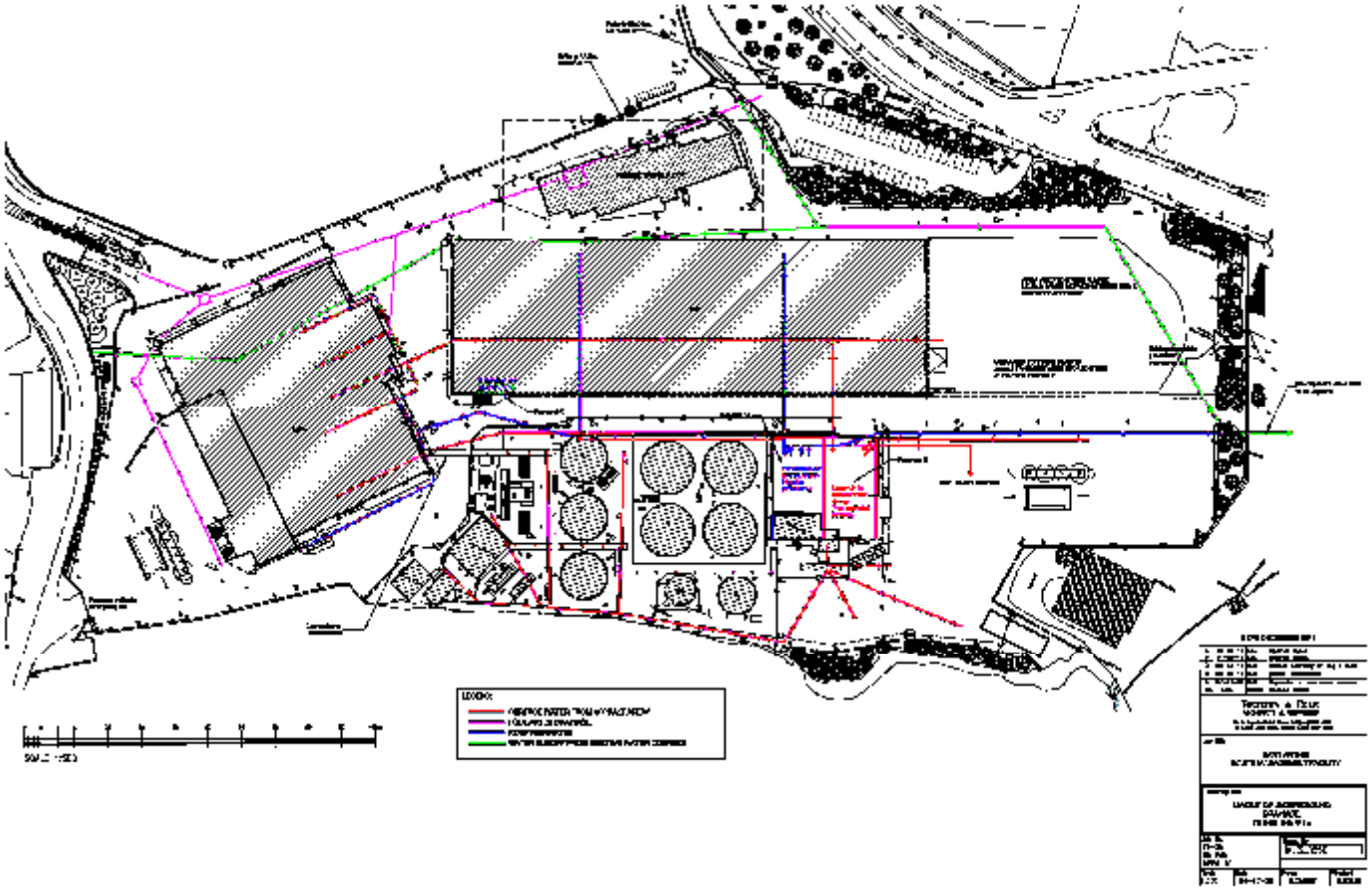


Diagram 11 Location of the Boreholes

Diagram 12: Orthophotic Diagram of the plant WSM 1978

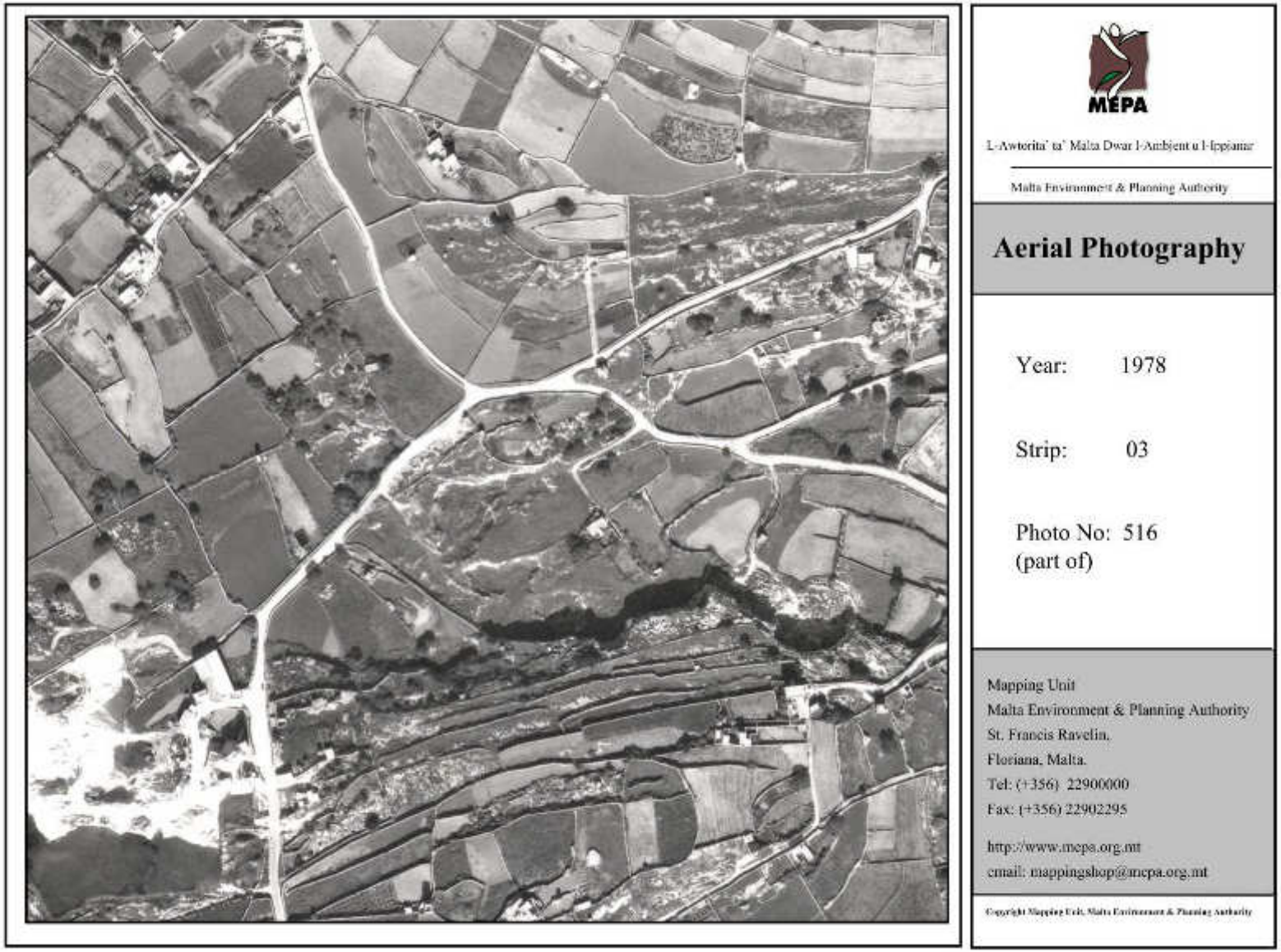
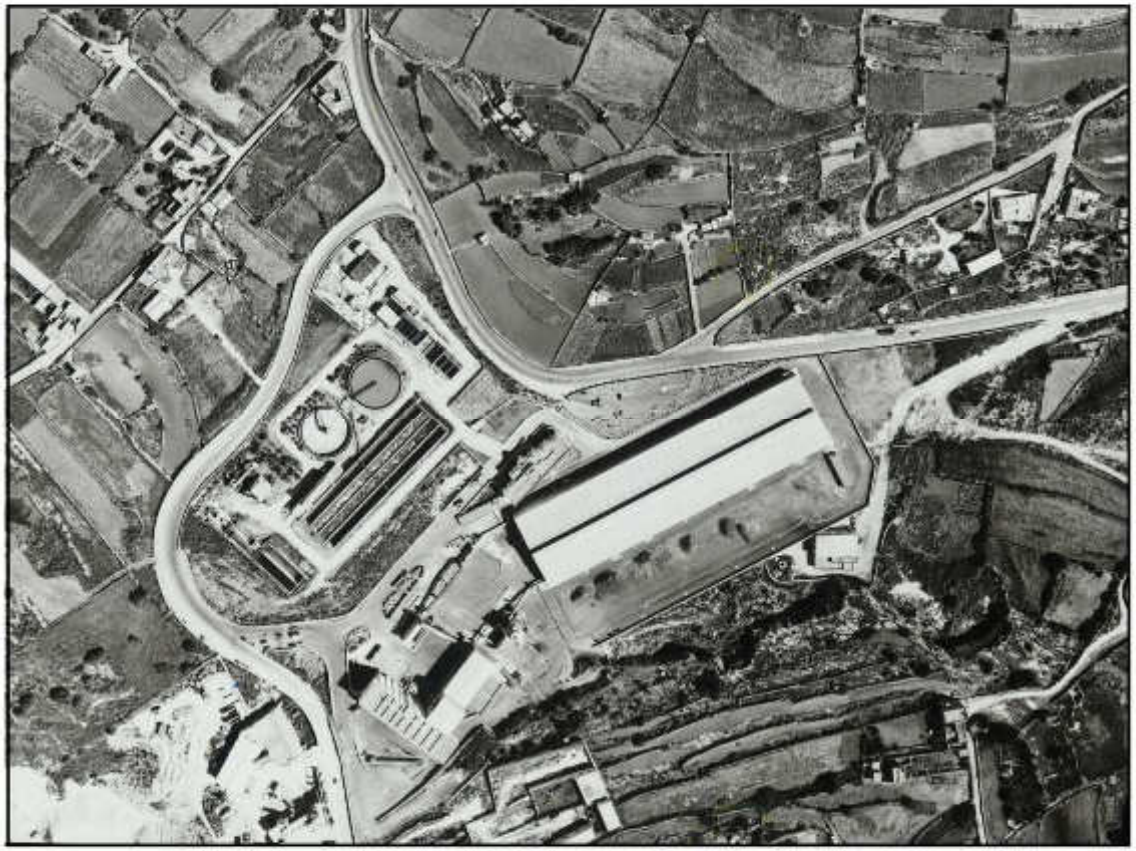


Diagram 13: Orthophotic Diagram of the area in 1994



MEPA

L-Awtorita' ta' Malta Dwar l-Ambjent u l-Ippjanar

Malta Environment & Planning Authority

Aerial Photography

Year: 1994

Strip: 32

Photo No: 1142
(part of)

Mapping Unit
Malta Environment & Planning Authority
St. Francis Ravelin,
Floriana, Malta.
Tel: (+356) 22900000
Fax: (+356) 22902295

http://www.mepa.org.mt
email: mappingshop@mepa.org.mt

Diagram 14. Orthophotic Diagram of the Plant. Google Map 1998

Diagram 15 Orthophotic Diagram of the Plant. Google Map 2002

Diagram 16 Orthophotic Diagram of the Plant: Google Map 2006

Diagram 17 Orthophotic Diagram of the Plant. Google Map 2009

Diagram 18 Orthophotic Diagram of the Plant. Google Map 2011

Diagram 19 Orthophotic Diagram of the Plant. Google Map 2012

Diagram 20 Orthophotic Diagram of the Plant. Google Map 2013

Diagram 21 Orthophotic Diagram of the Plant. MEPA Map 1998

Diagram 22 Orthophotic Diagram of the Plant. MEPA Map 2004

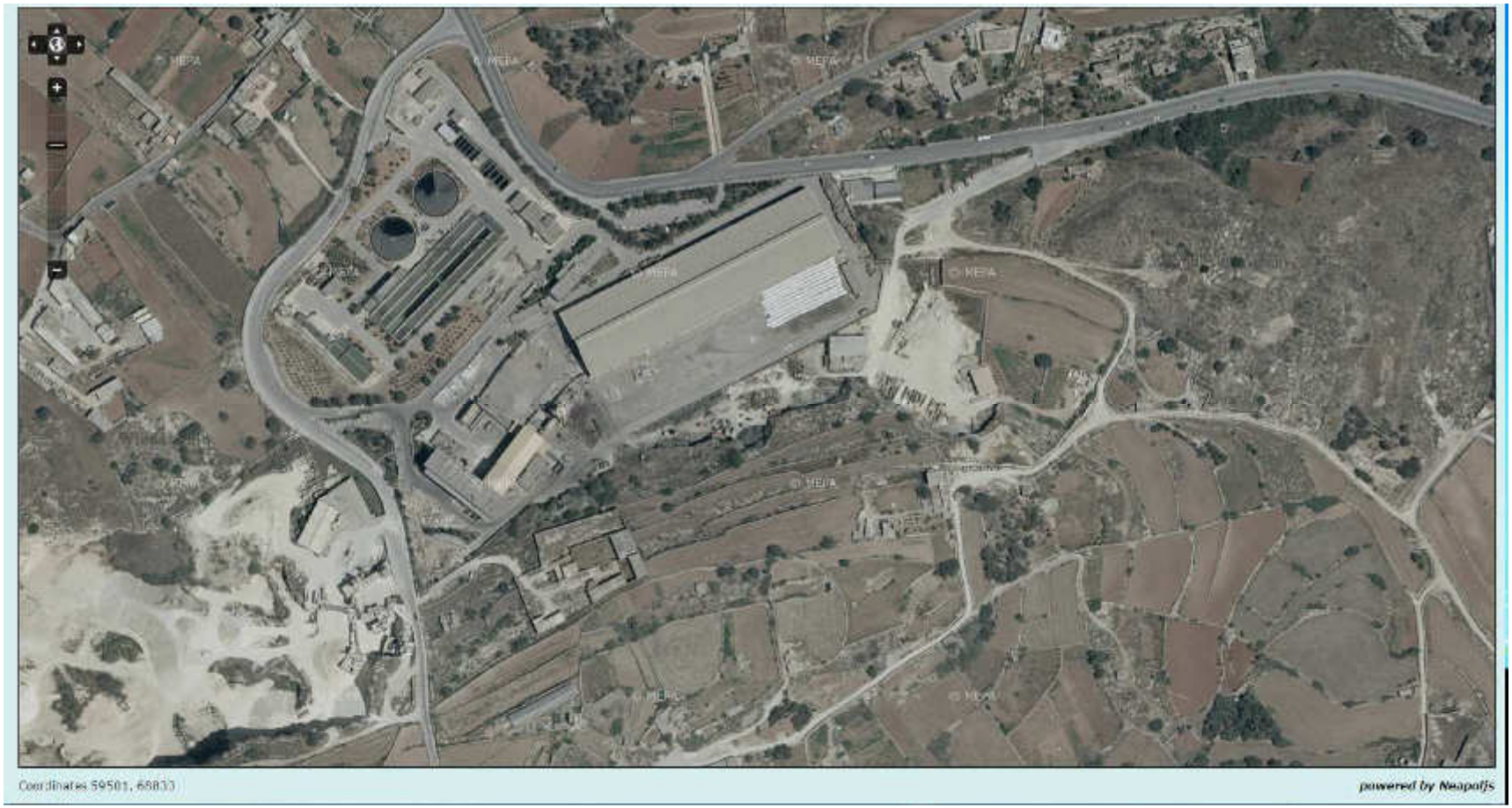
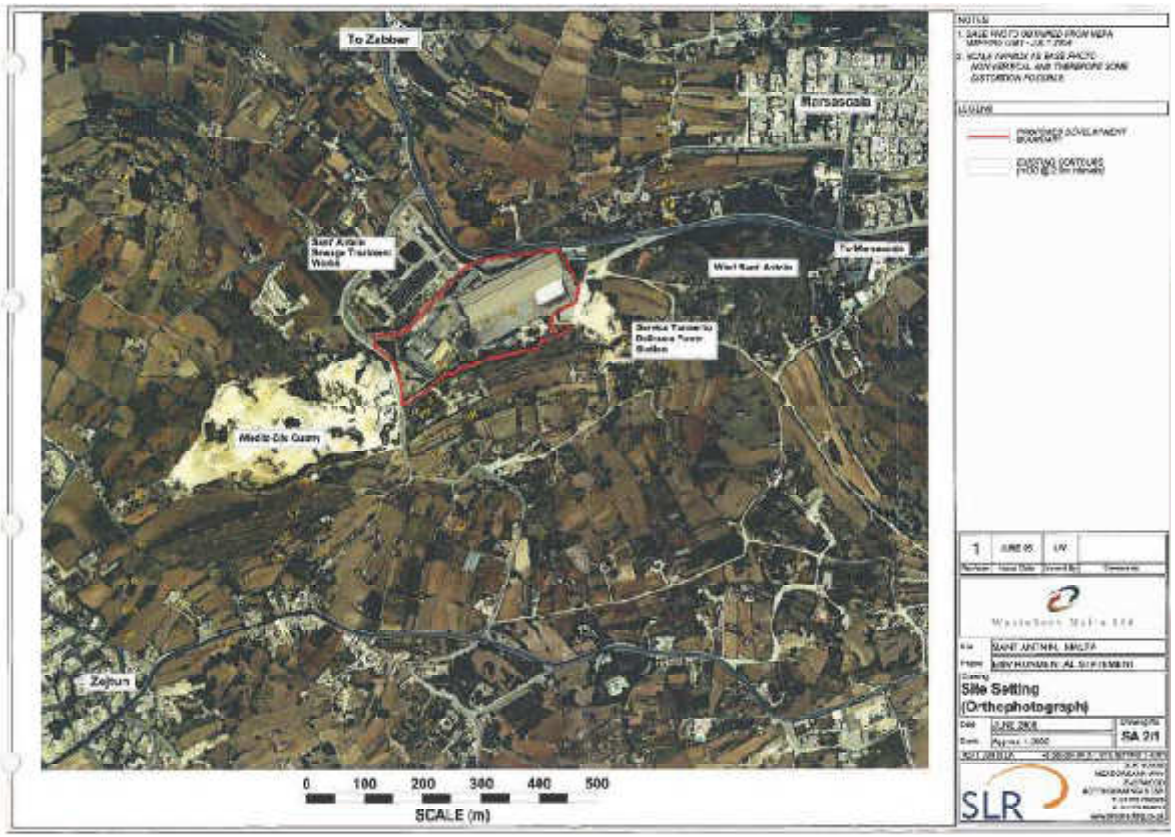


Diagram 23 Orthophotic Diagram of the Plant. MEPA Map 2008

Diagram 24: Orthophotic Diagram of the plant WSM 1995 prepared by SLR



Appendix A

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Report Number: Supplement to 372475-3

Date of Report: 19-Dec-2014

Customer: Robert Cortis
7
Little Danny Fl.2
Dun Xand Cortis Str
Birkirkara BKR 1530
Malta

Customer Contact: Mr Robert Cortis

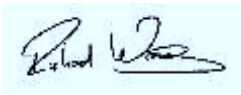
Customer Job Reference: Digestate
Date Job Received at SAL: 22-Jan-2014
Date Analysis Started: 23-Jan-2014
Date Analysis Completed: 19-Dec-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

UKAS TESTING
1549

Report checked and authorised by :
Mr Ross Walker
Customer Services Manager (Land)

Issued by :
Mr Richard Wong
Project Manager



SAL Reference: 372475
Customer Reference: Digestate

Soil Analysed as Soil
Soil Suite

SAL Reference	**372475 001**
Customer Sample Reference	**Digestate**
Date Sampled	**20-JAN-2014**

Determinand	Method	Test Sample	LOD	Units	
Ammonia expressed as N	T22	AR	5	mg/kg	**1500**
Carbon / Nitrogen ratio	T85	AR			Ratio 9:1
NO3 expressed as N	T11	AR	1	mg/kg	<1
NO2 expressed as N (2:1)	T275	AR	2	mg/kg	(176) <10
Nitrogen (Total)	T85	AR	70	mg/kg	**15000**
Nitrogen(Kjeldahl)	T116	AR	70	mg/kg	**15000**
PCB (Total Tri-Hepta)	T1	AR	0.00005	mg/kg	**0.012**
Naphthalene	T149	AR	0.01	mg/kg	**0.06**
Acenaphthylene	T149	AR	0.01	mg/kg	<0.01
Acenaphthene	T149	AR	0.01	mg/kg	**0.02**
Fluorene	T149	AR	0.01	mg/kg	**0.02**
Phenanthrene	T149	AR	0.01	mg/kg	**0.09**
Anthracene	T149	AR	0.01	mg/kg	**0.01**
Fluoranthene	T149	AR	0.01	mg/kg	**0.10**
Pyrene	T149	AR	0.01	mg/kg	**0.10**
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	**0.04**
Chrysene	T149	AR	0.01	mg/kg	**0.04**
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	**0.06**
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	**0.03**
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	**0.03**
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	**0.01**
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	**0.03**
PAH(total)	T149	AR	0.01	mg/kg	**0.64**
Arsenic	T6	AR	1	mg/kg	**4**
Cadmium	T6	AR	1	mg/kg	<1
Calcium	T6	AR	1	mg/kg	**150000**
Calcium expressed as Calcium Chloride	T6	AR	1.0	mg/kg	**421000**
Chromium	T6	AR	1	mg/kg	**30**
Copper	T6	AR	1	mg/kg	**88**
Lead	T6	AR	1	mg/kg	**210**
Mercury	T6	AR	1	mg/kg	<1
Nickel	T6	AR	1	mg/kg	**15**
Phosphorous	T6	AR	1	mg/kg	**15000**
Potassium	T6	AR	1	mg/kg	**5300**
Zinc	T6	AR	1	mg/kg	**280**
Bulk Density	T2	AR	0.1	g/cm3	**0.3**
Chloride	T11	AR	1	mg/kg	**2500**
Dry Matter	T276	AR	0.1	%	**40.7**
Electrical Conductivity	T7	AR	10	µS/cm	**6400**
Loss on Ignition	T2	AR	0.1	%	**51**
Moisture	T2	AR	0.1	%	**59**
Retained on 2mm	T2	AR	0.1	%	**11.1**
Retained on 5 mm Sieve	T2	AR	0.1	%	<0.1
Total Organic Carbon	T21	AR	0.1	%	**13**
pH	T7	AR			**8.2**

SAL Reference: 372475
Customer Reference: Digestate

Leachate Analysed as Water
Leachate Suite

SAL Reference	**372475 001**
Customer Sample Reference	**Digestate**
Date Sampled	**20-JAN-2014**

Determinand	Method	Test Sample	LOD	Units	
Boron	T85	10:1	0.1	mg/kg	**5.2**
Copper	T85	10:1	0.1	mg/kg	<0.1
Iron	T85	10:1	0.1	mg/kg	**4.1**
Magnesium	T85	10:1	1	mg/kg	**160**
Manganese	T85	10:1	0.1	mg/kg	**0.4**
Phosphorous	T85	10:1	10	mg/kg	**120**
Potassium	T85	10:1	1	mg/kg	**1500**
Sulphur (total)	T85	10:1	500	mg/kg	<500
Zinc	T85	10:1	0.1	mg/kg	**2.2**
Naphthalene	T85	10:1	0.0001	mg/kg	**0.0031**

Index to symbols used in Supplement to 372475-3

Value	Description
AR	As Received
10:1	Leachate
176	LOD raised due to interference from high levels of other anions present.
W	Analysis was performed at another SAL laboratory
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Nitrate Nitrogen : Ammonium Nitrogen Ratio = <1:1500
Supplemental report issued to amend the report format

Method Index

Value	Description
T2	Grav
T11	IC
T22	Titration
T149	GC/MS (SIR)
T276	Grav (4 Dec) (105C)
T85	Calc
T275	IC (2:1)
T6	ICP/OES
T21	OX/IR
T1	GC/MS (HR)
T7	Probe
T116	Titration (Kjeldahl-Dist)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Ammonia expressed as N	T22	AR	5	mg/kg	N	001
Carbon / Nitrogen ratio	T85	AR			N	001
NO3 expressed as N	T11	AR	1	mg/kg	N	001
NO2 expressed as N (2:1)	T275	AR	2	mg/kg	N	001
Nitrogen (Total)	T85	AR	70	mg/kg	WN	001
Nitrogen(Kjeldahl)	T116	AR	70	mg/kg	WN	001
PCB (Total Tri-Hepta)	T1	AR	0.00005	mg/kg	U	001
Naphthalene	T149	AR	0.01	mg/kg	U	001
Acenaphthylene	T149	AR	0.01	mg/kg	U	001
Acenaphthene	T149	AR	0.01	mg/kg	U	001
Fluorene	T149	AR	0.01	mg/kg	U	001

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: Supplement to 382914-3

Date of Report: 19-Dec-2014

Customer: Robert Cortis
7
Little Danny Fl.2
Dun Xand Cortis Str
Birkirkara BKR 1530
Malta

Customer Contact: Mr Robert Cortis

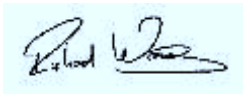
Customer Job Reference:
Date Job Received at SAL: 14-Mar-2014
Date Analysis Started: 17-Mar-2014
Date Analysis Completed: 19-Dec-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

UKAS TESTING
1549

Report checked and authorised by :
Mr Ross Walker
Customer Services Manager (Land)

Issued by :
Mr Richard Wong
Project Manager



SAL Reference: 382914
Customer Reference:

Soil Analysed as Soil
Soil Suite

SAL Reference	**382914 001**
Customer Sample Reference	**Digestate**
Date Sampled	**07-MAR-2014**

Determinand	Method	Test Sample	LOD	Units	
Ammonia expressed as N	T22	AR	5	mg/kg	<5
Carbon / Nitrogen ratio	T85	AR			Ratio 10:1
NO3 expressed as N	T11	AR	1	mg/kg	<1
NO2 expressed as N (2:1)	T275	AR	2	mg/kg	<2
Nitrogen (Total)	T85	AR	70	mg/kg	**25000**
Nitrogen(Kjeldahl)	T116	AR	70	mg/kg	**25000**
PCB (Total Tri-Hepta)	T1	AR	0.00005	mg/kg	**0.0048**
Naphthalene	T149	AR	0.01	mg/kg	**0.05**
Acenaphthylene	T149	AR	0.01	mg/kg	<0.01
Acenaphthene	T149	AR	0.01	mg/kg	**0.01**
Fluorene	T149	AR	0.01	mg/kg	**0.01**
Phenanthrene	T149	AR	0.01	mg/kg	**0.03**
Anthracene	T149	AR	0.01	mg/kg	**0.01**
Fluoranthene	T149	AR	0.01	mg/kg	**0.06**
Pyrene	T149	AR	0.01	mg/kg	**0.07**
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	**0.02**
Chrysene	T149	AR	0.01	mg/kg	**0.02**
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	**0.04**
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	**0.01**
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	**0.01**
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	**0.02**
PAH(total)	T149	AR	0.01	mg/kg	**0.36**
Arsenic	T6	AR	1	mg/kg	**6**
Cadmium	T6	AR	1	mg/kg	<1
Calcium	T6	AR	1	mg/kg	**100000**
Calcium expressed as Calcium Chloride	T6	AR	1.0	mg/kg	**275600**
Chromium	T6	AR	1	mg/kg	**29**
Copper	T6	AR	1	mg/kg	**100**
Lead	T6	AR	1	mg/kg	**240**
Mercury	T6	AR	1	mg/kg	<1
Nickel	T6	AR	1	mg/kg	**17**
Phosphorous	T6	AR	1	mg/kg	**9700**
Potassium	T6	AR	1	mg/kg	**9000**
Zinc	T6	AR	1	mg/kg	**380**
Bulk Density	T2	AR	0.1	g/cm3	**0.9**
Chloride	T11	AR	1	mg/kg	**3900**
Dry Matter	T276	AR	0.1	%	**30.4**
Electrical Conductivity	T7	AR	10	µS/cm	**6000**
Loss on Ignition	T2	AR	0.1	%	**49**
Moisture	T2	AR	0.1	%	**70**
Retained on 2mm	T2	AR	0.1	%	**18.7**
Retained on 5 mm Sieve	T2	AR	0.1	%	<0.1
Total Organic Carbon	T21	AR	0.1	%	**20**
pH	T7	AR			**7.7**

SAL Reference: 382914
Customer Reference:

Leachate Analysed as Water
Leachate Suite

SAL Reference	**382914 001**
Customer Sample Reference	**Digestate**
Date Sampled	**07-MAR-2014**

Determinand	Method	Test Sample	LOD	Units	
Boron	T85	10:1	0.1	mg/kg	**1.5**
Copper	T85	10:1	0.1	mg/kg	<0.1
Iron	T85	10:1	0.1	mg/kg	**2.0**
Magnesium	T85	10:1	1	mg/kg	**200**
Manganese	T85	10:1	0.1	mg/kg	**0.5**
Phosphorous	T85	10:1	10	mg/kg	**90**
Potassium	T85	10:1	1	mg/kg	**1400**
Sulphur (total)	T85	10:1	500	mg/kg	<500
Zinc	T85	10:1	0.1	mg/kg	<0.1
Naphthalene	T85	10:1	0.0001	mg/kg	**0.0003**

Index to symbols used in Supplement to 382914-3

Value	Description
AR	As Received
10:1	Leachate
W	Analysis was performed at another SAL laboratory
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Nitrate Nitrogen : Ammonium Nitrogen Ratio = <1:<5
Supplemental report issued to amend the report format

Method Index

Value	Description
T22	Titration
T21	OX/IR
T7	Probe
T6	ICP/OES
T2	Grav
T275	IC (2:1)
T1	GC/MS (HR)
T85	Calc
T116	Titration (Kjeldahl-Dist)
T11	IC
T149	GC/MS (SIR)
T276	Grav (4 Dec) (105C)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Ammonia expressed as N	T22	AR	5	mg/kg	N	001
Carbon / Nitrogen ratio	T85	AR			N	001
NO3 expressed as N	T11	AR	1	mg/kg	N	001
NO2 expressed as N (2:1)	T275	AR	2	mg/kg	N	001
Nitrogen (Total)	T85	AR	70	mg/kg	WN	001
Nitrogen(Kjeldahl)	T116	AR	70	mg/kg	WN	001
PCB (Total Tri-Hepta)	T1	AR	0.00005	mg/kg	U	001
Naphthalene	T149	AR	0.01	mg/kg	U	001
Acenaphthylene	T149	AR	0.01	mg/kg	U	001
Acenaphthene	T149	AR	0.01	mg/kg	U	001
Fluorene	T149	AR	0.01	mg/kg	U	001
Phenanthrene	T149	AR	0.01	mg/kg	U	001

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Anthracene	T149	AR	0.01	mg/kg	U	001
Fluoranthene	T149	AR	0.01	mg/kg	U	001
Pyrene	T149	AR	0.01	mg/kg	U	001
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001
Chrysene	T149	AR	0.01	mg/kg	U	001
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	001
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001
PAH(total)	T149	AR	0.01	mg/kg	U	001
Arsenic	T6	AR	1	mg/kg	U	001
Cadmium	T6	AR	1	mg/kg	U	001
Calcium	T6	AR	1	mg/kg	N	001
Calcium expressed as Calcium Chloride	T6	AR	1.0	mg/kg	N	001
Chromium	T6	AR	1	mg/kg	U	001
Copper	T6	AR	1	mg/kg	U	001
Lead	T6	AR	1	mg/kg	U	001
Mercury	T6	AR	1	mg/kg	U	001
Nickel	T6	AR	1	mg/kg	U	001
Phosphorous	T6	AR	1	mg/kg	N	001
Potassium	T6	AR	1	mg/kg	N	001
Zinc	T6	AR	1	mg/kg	U	001
Bulk Density	T2	AR	0.1	g/cm3	N	001
Chloride	T11	AR	1	mg/kg	N	001
Dry Matter	T276	AR	0.1	%	N	001
Electrical Conductivity	T7	AR	10	µS/cm	N	001
Loss on Ignition	T2	AR	0.1	%	N	001
Moisture	T2	AR	0.1	%	N	001
Retained on 2mm	T2	AR	0.1	%	N	001
Retained on 5 mm Sieve	T2	AR	0.1	%	N	001
Total Organic Carbon	T21	AR	0.1	%	N	001
pH	T7	AR			U	001
Boron	T85	10:1	0.1	mg/kg	N	001
Copper	T85	10:1	0.1	mg/kg	N	001
Iron	T85	10:1	0.1	mg/kg	U	001
Magnesium	T85	10:1	1	mg/kg	N	001
Manganese	T85	10:1	0.1	mg/kg	U	001
Phosphorous	T85	10:1	10	mg/kg	N	001
Potassium	T85	10:1	1	mg/kg	N	001
Sulphur (total)	T85	10:1	500	mg/kg	N	001
Zinc	T85	10:1	0.1	mg/kg	U	001
Naphthalene	T85	10:1	0.0001	mg/kg	U	001

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Report Number: Supplement to 412285-3

Date of Report: 19-Dec-2014

Customer: Robert Cortis
7
Little Danny Fl.2
Dun Xand Cortis Str
Birkirkara BKR 1530
Malta

Customer Contact: Mr Robert Cortis

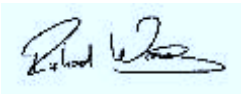
Customer Job Reference:
Date Job Received at SAL: 30-Jul-2014
Date Analysis Started: 02-Aug-2014
Date Analysis Completed: 19-Dec-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

UKAS TESTING
1549

Report checked and authorised by :
Mr Ross Walker
Customer Services Manager (Land)

Issued by :
Mr Richard Wong
Project Manager



SAL Reference: 412285
Customer Reference:

Bulk Product Analysed as Bulk Product
Bulk Product Suite 1

				SAL Reference	**412285 001**
				Customer Sample Reference	**DIGESTATE**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**	
Ammonia expressed as N	T22	AR	5	mg/kg	**970**
Carbon / Nitrogen ratio	T85	AR			Ratio 58:1
Nitrate	T686	AR	1	mg/kg	<1
Nitrite	T686	AR	1	mg/kg	<1
Nitrogen (Total)	T85	AR	70	mg/kg	**2800**
Nitrogen(Kjeldahl)	T116	AR	70	mg/kg	**2800**
PCB (Total Tri-Hepta)	T16	AR	0.0005	mg/kg	**0.0063**
Naphthalene	T16	AR	0.1	mg/kg	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	<0.1
Fluorene	T16	AR	0.1	mg/kg	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	<0.1
Anthracene	T16	AR	0.1	mg/kg	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	<0.1
Pyrene	T16	AR	0.1	mg/kg	<0.1
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	<0.1
Chrysene	T16	AR	0.1	mg/kg	<0.1
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	<0.1
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	<0.1
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	<0.1
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	<0.1
PAH(total)	T16	AR	0.1	mg/kg	<0.1
Arsenic	T6	AR	1	mg/kg	**5**
Cadmium	T6	AR	1	mg/kg	<1
Chromium	T6	AR	1	mg/kg	**29**
Copper	T6	AR	1	mg/kg	**110**
Lead	T6	AR	1	mg/kg	**250**
Mercury	T6	AR	1	mg/kg	<1
Nickel	T6	AR	1	mg/kg	**21**
Phosphorous	T6	AR	10	mg/kg	**10000**
Potassium	T6	AR	10	mg/kg	**7100**
Zinc	T6	AR	1	mg/kg	**440**
Bulk Density	T2	AR	0.1	g/cm3	**0.8**
Chloride	T686	AR	1	mg/kg	**2500**
Dry Matter	T2	AR	0.1	%	**25.9**
Electrical Conductivity	T7	AR	10	µS/cm	**6300**
Loss on Ignition	T2	AR	0.1	%	**30**
Moisture	T2	AR	0.1	%	**74.1**
Organic Matter	T2	AR	0.1	%	**48.1**
Retained on 2mm	T2	AR	0.1	%	**70.1**
Retained on 5 mm Sieve	T2	AR	0.1	%	<0.1
Total Organic Carbon	T21	AR	0.1	%	**16**
pH	T7	AR			**8.4**

SAL Reference: 412285
Customer Reference:

Leachate Analysed as Water
Leachate Suite

SAL Reference	**412285 001**
Customer Sample Reference	**DIGESTATE**

Determinand	Method	Test Sample	LOD	Units	
Boron	T85	10:1	0.1	mg/kg	**1.0**
Copper	T85	10:1	0.1	mg/kg	<0.1
Iron	T85	10:1	0.1	mg/kg	**6.3**
Magnesium	T85	10:1	1	mg/kg	**150**
Manganese	T85	10:1	0.1	mg/kg	**0.4**
Phosphorous	T85	10:1	10	mg/kg	**120**
Potassium	T85	10:1	1	mg/kg	**880**
Sulphur (total)	T85	10:1	500	mg/kg	<500
Zinc	T85	10:1	0.1	mg/kg	<0.1
Naphthalene	T85	10:1	0.0001	mg/kg	<0.0001

Index to symbols used in Supplement to 412285-3

Value	Description
AR	As Received
10:1	Leachate
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplemental report issued to amend the report format
Nitrate Nitrogen : Ammonium Nitrogen Ratio = <1:970

Method Index

Value	Description
T7	Probe
T85	Calc
T686	Discrete Analyser
T16	GC/MS
T6	ICP/OES
T116	Titration (Kjeldahl-Dist)
T2	Grav
T22	Titration
T21	OX/IR

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Ammonia expressed as N	T22	AR	5	mg/kg	N	001
Carbon / Nitrogen ratio	T85	AR			N	001
Nitrate	T686	AR	1	mg/kg	N	001
Nitrite	T686	AR	1	mg/kg	N	001
Nitrogen (Total)	T85	AR	70	mg/kg	SN	001
Nitrogen(Kjeldahl)	T116	AR	70	mg/kg	SN	001
PCB (Total Tri-Hepta)	T16	AR	0.0005	mg/kg	N	001
Naphthalene	T16	AR	0.1	mg/kg	N	001
Acenaphthylene	T16	AR	0.1	mg/kg	N	001
Acenaphthene	T16	AR	0.1	mg/kg	N	001
Fluorene	T16	AR	0.1	mg/kg	N	001
Phenanthrene	T16	AR	0.1	mg/kg	N	001
Anthracene	T16	AR	0.1	mg/kg	N	001
Fluoranthene	T16	AR	0.1	mg/kg	N	001
Pyrene	T16	AR	0.1	mg/kg	N	001
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	N	001

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Chrysene	T16	AR	0.1	mg/kg	N	001
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	N	001
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	N	001
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	N	001
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	N	001
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	N	001
PAH(total)	T16	AR	0.1	mg/kg	N	001
Arsenic	T6	AR	1	mg/kg	N	001
Cadmium	T6	AR	1	mg/kg	N	001
Chromium	T6	AR	1	mg/kg	N	001
Copper	T6	AR	1	mg/kg	N	001
Lead	T6	AR	1	mg/kg	N	001
Mercury	T6	AR	1	mg/kg	N	001
Nickel	T6	AR	1	mg/kg	N	001
Phosphorous	T6	AR	10	mg/kg	N	001
Potassium	T6	AR	10	mg/kg	N	001
Zinc	T6	AR	1	mg/kg	N	001
Bulk Density	T2	AR	0.1	g/cm3	N	001
Chloride	T686	AR	1	mg/kg	N	001
Dry Matter	T2	AR	0.1	%	N	001
Electrical Conductivity	T7	AR	10	µS/cm	N	001
Loss on Ignition	T2	AR	0.1	%	N	001
Moisture	T2	AR	0.1	%	N	001
Organic Matter	T2	AR	0.1	%	N	001
Retained on 2mm	T2	AR	0.1	%	N	001
Retained on 5 mm Sieve	T2	AR	0.1	%	N	001
Total Organic Carbon	T21	AR	0.1	%	N	001
pH	T7	AR			N	001
Boron	T85	10:1	0.1	mg/kg	N	001
Copper	T85	10:1	0.1	mg/kg	U	001
Iron	T85	10:1	0.1	mg/kg	U	001
Magnesium	T85	10:1	1	mg/kg	N	001
Manganese	T85	10:1	0.1	mg/kg	U	001
Phosphorous	T85	10:1	10	mg/kg	N	001
Potassium	T85	10:1	1	mg/kg	N	001
Sulphur (total)	T85	10:1	500	mg/kg	N	001
Zinc	T85	10:1	0.1	mg/kg	U	001
Naphthalene	T85	10:1	0.0001	mg/kg	U	001

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Phenanthrene	T149	AR	0.01	mg/kg	U	001
Anthracene	T149	AR	0.01	mg/kg	U	001
Fluoranthene	T149	AR	0.01	mg/kg	U	001
Pyrene	T149	AR	0.01	mg/kg	U	001
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001
Chrysene	T149	AR	0.01	mg/kg	U	001
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	001
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001
PAH(total)	T149	AR	0.01	mg/kg	U	001
Arsenic	T6	AR	1	mg/kg	U	001
Cadmium	T6	AR	1	mg/kg	U	001
Calcium	T6	AR	1	mg/kg	N	001
Calcium expressed as Calcium Chloride	T6	AR	1.0	mg/kg	N	001
Chromium	T6	AR	1	mg/kg	U	001
Copper	T6	AR	1	mg/kg	U	001
Lead	T6	AR	1	mg/kg	U	001
Mercury	T6	AR	1	mg/kg	U	001
Nickel	T6	AR	1	mg/kg	U	001
Phosphorous	T6	AR	1	mg/kg	N	001
Potassium	T6	AR	1	mg/kg	N	001
Zinc	T6	AR	1	mg/kg	U	001
Bulk Density	T2	AR	0.1	g/cm3	N	001
Chloride	T11	AR	1	mg/kg	N	001
Dry Matter	T276	AR	0.1	%	N	001
Electrical Conductivity	T7	AR	10	µS/cm	N	001
Loss on Ignition	T2	AR	0.1	%	N	001
Moisture	T2	AR	0.1	%	N	001
Retained on 2mm	T2	AR	0.1	%	N	001
Retained on 5 mm Sieve	T2	AR	0.1	%	N	001
Total Organic Carbon	T21	AR	0.1	%	N	001
pH	T7	AR			U	001
Boron	T85	10:1	0.1	mg/kg	N	001
Copper	T85	10:1	0.1	mg/kg	N	001
Iron	T85	10:1	0.1	mg/kg	U	001
Magnesium	T85	10:1	1	mg/kg	N	001
Manganese	T85	10:1	0.1	mg/kg	U	001
Phosphorous	T85	10:1	10	mg/kg	N	001
Potassium	T85	10:1	1	mg/kg	N	001
Sulphur (total)	T85	10:1	500	mg/kg	N	001
Zinc	T85	10:1	0.1	mg/kg	U	001
Naphthalene	T85	10:1	0.0001	mg/kg	U	001

Appendix B

ecoserv Ltd
12, Sir Arthur Borton Street
Mosta, MALTA

Telephone: (+356) 2143 1900
Fax: (+356) 2142 4137
Mobile: (+356) 7943 1900
e-mail: info@ecoserv.com.mt
VAT Reg no: 1623-1407

Our Report Reference: 142-13
Your reference: PO no. 013229 [dated 08/08/2013]

Ms Antonella Martin
WasteServ Malta Ltd
Eko Centre
Latmija Road
Marsaskala, MSK 9052

21 October 2013

Dear Ms Martin,

Re: WSM – 110413 – List 1 analysis of water (SAWTP)

We are pleased to enclose herewith the results of chemical analysis on one (1) sample of waste water (sample reference: W-0446-13) for which Ecoserv was commissioned by WasteServ Malta Ltd. (hereafter 'the client'). The sample intended for chemical analysis, was collected by the client and brought to Ecoserv Ltd. on 5th September 2013. Ecoserv provided sample containers.

The following parameters were requested for analysis:

Priority Substances	
Parameter	**Units of measurement**
Alachlor	µg/l
Anthracene	µg/l
Atrazine	µg/l
Cadmium and its compounds	µg/l
C10-13-chloroalkanes	mg/L
Chlorfenvinphos E	µg/l
Chlorpyrifos-methyl	µg/l
1,2-Dichloroethane	µg/l
Dichloromethane	µg/l
Di(2-ethylhexyl)phtalate	µg/l
Diuron	µg/l
Endosulfan	µg/l
Fluoranthene	µg/l
Hexachlorobenzene	µg/l
Hexachlorobutadiene	µg/l
Hexachlorocyclohexane	µg/l

Lindane	µg/l
Isoproturon	µg/l
Lead	µg/l
Mercury	µg/l
Naphthalene	µg/l
Nickel	µg/l
Nonylphenols	µg/l
4-Nonylphenols	µg/l
Octylphenols	µg/l
Pentachlorobenzene	µg/l
Benzene	µg/l
Pentachlorophenol	µg/l
Benzo(a)pyrene	µg/l
Benzo(b)fluoranthene	µg/l
Benzo (k) fluoranthene	µg/l
Benzo (g, h, i) perylene	µg/l
Indeno (1,2,3-c, d) pyrene	µg/l
Simazine	µg/l
Tributyltin	µg/l
Trichlorobenzene	µg/l
1,2,4-Trichlorobenzene	µg/l
Trichloromethane	µg/l
Trifluralin	µg/l
Pentabromodiphenylether	µg/l
Other Pollutants	
DDT	µg/l
p.p'-DDT	µg/l
Aldrin	µg/l
Dieldrin	µg/l
Endrin	µg/l
Isodrin	µg/l
Tetrachloroethylene	µg/l
Trichloroethylene	µg/l
Carbon tetrachloride	µg/l
New Proposed Priority Substances	
Dicofol	µg/l
Perfluorooctane sulfonic acid (PFOS)	µg/l
Quinoxyfen	µg/l
Dioxin and dioxin-like polychlorinated biphenyls	ng/Kg

Aclonifen	µg/l
Bifenox	µg/l
Cybutryne	µg/l
Cypermethrin	µg/l
Dichlorvos	µg/l
Hexabromocyclododecane (HBCDD)	µg/l
Heptachlor epoxide	µg/l
Terbutryn	µg/l
Ethinylestradiol	µg/l
Estradiol	µg/l
Diclofenac	µg/l

The sample was maintained in appropriate conditions as per standard guidelines, until the time of analysis. Analysis was carried out at CADA Laboratories s.n.c. (Italy), a laboratory that is accredited for chemical analysis according to ACCREDIA CEN/ISO 17025 certification (Accreditation number 0439). All parameters were analysed using standard methodology, as detailed in the certified reports attached herewith.

Please do not hesitate to contact us should you require any clarification.

Sincerely yours,

Sarah Debono B.Sc(Hons) MSc
Project Manager

Encl: Certified results for sample W-0446-13

Chimica Applicata Depurazione Acque s.n.c.
di Filippo Giglio & C.

Test Report n°: **2110858-001**

Description: **Waste Water S-445-13 ECOSERV LTD.**

Client:
ECOSERV LTD.
12, Sir Arthur Borton Str.
Mosta, MST 1881

Reception n°: **2110858**
Sampling Date: **10-set-13**
Sample Reception Date: **10-set-13** Test Start Date: **11-set-13**
Test Report Date: **07-ott-13** Test Finish Date: **07-ott-13**
Sampling Method: **Customer Care**
Reference for the Limits: ///

Tests	U.O.M.	Method	Result	Uncertainty	Recovery	L.Min.	L.Max.
CHEMICAL PARAMETERS							
METALS							
Cadmio *Cadmium*	µg/l	APAT CNR IRSA 3020 Man 29 2003	< 0,1				
Mercurio *Mercury*	µg/l	UNI EN ISO 17294-02:2005	< 0,05				
Nichel *Nickel*	µg/l	APAT CNR IRSA 3020 Man 29 2003	66				
Piombo *Lead*	µg/l	APAT CNR IRSA 3020 Man 29 2003	42				
Alaclor *Alachlor*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001				
Atrazina *Atrazine*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001				
Cloroalcani (C10-13) *Chloroalkanes (C10-13)*	mg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,01	(*)			
Clorfenvinfos E *Chlorfenvinphos E*	µg/l	APAT CNR IRSA 5100 Man 29 2003	< 0,01				
1,2-Dicloroetano *1,2-Dichloroethane*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01				
Diclorometano *Dichloromethane*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01				
Di(2-etilesil)ftalato *Di(2-ethylhexyl)phtalate*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	0,17	(*)			
Diuron *Diuron*	µg/l	APAT CNR IRSA 5050 Man 29 2003	< 0,1	(*)			

(*) = Le prove così contrassegnate a fianco del risultato, non sono Accreditate da ACCREDIA / The evidence thus marked by side with the result, are not accredited by ACCREDIA

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Continuation of Test Report n°: **2110858-001**

Tests	U.O.M.	Method	Result	Uncertainty	Recovery	L.Min.	L.Max.
Endosulfano *Endosulfan*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001				
Esaclorobenzene *Hexachlorobenzene*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001				
Esaclorobutadiene *Hexachlorobutadiene*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01				
Esaclorocicloesano *Hexachlorocyclohexane*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001				
Lindano	µg/l	EPA 3510C 1996 + EPA 3630C 1996 + EPA 8270D 2007					
Isoproturon *Isoproturon*	µg/l	APAT CNR IRSA 5050 Man 29 2003	< 0,1	(*)			
Nonilfenolo *Nonylphenols*	µg/l	APHA Standard Methods, ed 21 th 2005, 6410 B	< 0,01	(*)			
4-Nonilfenolo *4-Nonylphenols*	µg/l	APHA Standard Methods, ed 21 th 2005, 6410 B	< 0,01	(*)			
Octilfenolo *Octylphenols*	µg/l	APHA Standard Methods, ed 21 th 2005, 6410 B	< 0,01	(*)			
Pentaclorobenzene *Pentachlorobenzene*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,01				
Pentaclorofenolo *Pentachlorophenol*	µg/l	APHA Standard Methods, ed 21 th 2005, 6410 B	< 0,001				
IDROCARBURI POLICICLICI AROMATICI							
Benzene *Benzene*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01				
Benzo(a)pirene *Benzo (a) pyrene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Benzo(b)fluorantene *Benzo (b) fluoranthene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Benzo(k)fluorantene *Benzo (k) fluoranthene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Benzo(g,h,i)perilene *Benzo (g, h, i) perylene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Indeno(1,2,3-c,d)pirene *Indeno (1,2,3-c, d) pyrene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Naftalene *Naphthalene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Fluorantene *Fluoranthene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				
Antracene *Anthracene*	µg/l	APAT CNR IRSA 5080 Man 29 2003	< 0,001				

(*) = Le prove cos' contrassegnate a fianco del risultato, non sono Accreditate da ACCREDIA / The evidence thus marked by side with the result, are not accredited by ACCREDIA

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Continuation of Test Report n°: **2110858-001**

Tests	U.O.M.	Method	Result		Uncertainty	Recovery	L.Min.	L.Max.
Simazina *Simazine*	µg/l	APAT CNR IRSA 5060 Man 29 2003	< 0,01					
Tributilstagno *tributyltin*	µg/l	UNI EN ISO 17353:2006	< 0,01	(*)				
Triclorobenzene *Trichlorobenzene*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001					
1,2,4-Triclorobenzene *1,2,4-Trichlorobenzene*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,01					
Triclorometano *Trichloromethane*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01					
Trifluralin *Trifluralin*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Pentabromodifeniletere	µg/l	EPA 3545:2007 + EPA 1614:2007	< 0,0000001					
Chlorpyrifos-methyl *Chlorpyrifos-methyl*	µg/l	APAT CNR IRSA 5100 Man 29 2003	< 0,01					
DDT *DDT*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001					
p,p'-DDT *p,p'-DDT*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001					
Aldrin *Aldrin*	µg/l	EPA 3510C 1996 – EPA 8270D 2007	< 0,001					
Dieldrin *Dieldrin*	µg/l	EPA 3510C 1996 - EPA 8270D 2007	< 0,001					
Endrin *Endrin*	µg/l	EPA 3510C 1996 – EPA 8270D 2007	< 0,001					
Isodrin *Isodrin*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001					
Tetracloroetilene *Tetrachloroethylene*	µg/l	EPA 5030C 2003 - EPA 8260C 2006	< 0,01					
Tricloroetilene *Trichloroethylene*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01					
Tetracloruro di carbonio *Carbon tetrachloride*	µg/l	EPA 5030C 2003 + EPA 8260C 2006	< 0,01					
Dicofol	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Acido *Perfluorooctanoic (PFOS)*	µg/l	APAT CNR IRSA 5050 Man 29 2003	< 1	(*)				
Quinoxifen	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Sommatoria Policlorobifenili (PCB) DIOXIN LIKE WHO-TEQ	ng/Kg	EPA 3545 A 2007 + EPA 1668 B 2008 + UNEP/POPS/COP.3/INF/27 11/04/2007 WHO 2006 TEF	0					

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Continuation of Test Report n°: **2110858-001**

Tests	U.O.M.	Method	Result		Uncertainty	Recovery	L.Min.	L.Max.
Aclonifen	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Bifenox	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Cibutrine	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Cipermetrina	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Diclorvos *Diclorvos*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Esabromociclododecane (HBCDD)	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001	(*)				
Eptacloro epossido *Heptachlor epoxide*	µg/l	EPA 3510C 1996 + EPA 8270D 2007	< 0,001					
Terbutrina	µg/l	APAT CNR IRSA 5060 Man 29 2003	< 0,05					
Diclofenac	µg/l	EPA 1694:2007	< 0,1	(*)				
Ethinylestradiol	µg/l	EPA 1698:2007	< 0,1	(*)				
Estradiol	µg/l	EPA 1698:2007	< 0,1	(*)				

< Not Detectable because lower than detection limit of the method.
The sample is stored for two weeks unless particular disposition of the law
When indicated the uncertainty of the measure, it is expressed in the same unit of measurement of the test performed:
- At probability of the measure of 95% and a coverage factor K=2 for the chemical tests ;
- At Reproducibility Deviation SR, with uncertainty U equal to SR and a coverage factor K=2 for the microbiological tests on food.
- At confidence interval with probability of the measure of 95% and a coverage factor K=2 for the microbiological tests on water.
This Test report is relative to the sample subordinate to test and it cannot be reproduced without written approval from of the C.A.D.A. s.n.c.
The records of testing of this sample are kept for a minimum period of 4 years.

Il Responsabile Analisi Chimiche
(dott. Giuseppe Rocca)

Il Direttore della Divisione Analitica
(dott.ssa Margherita Augello)

(*) = Le prove così contrassegnate a fianco del risultato, non sono Accreditate da ACCREDIA / The evidence thus marked by side with the result, are not accredited by ACCREDIA

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Opinions and interpretations - are not subject to accreditation from ACCREDIA

Groundwater (Bi-annual)			**28.05.12**	**29.05.12**		**23.11.12**	**10.12.12**	**10.12.12**	**10.12.12**		**Mean**	**Mean**	**Mean**	**Mean**
			Saliba	Dalli		Saliba	Dalli	Blank	Vella		**Saliba**	**Dalli**	**Blank**	**Vella**
pH			7.8	7.8		7.9	7.5	7.7	7.5		**7.85**	**7.65**	**7.7**	**7.5**
SETTLEABLE SOLID	mg/l		n/d	n/d		n/d	n/d	n/d	n/d		**n/d**	**n/a**	**n/a**	**n/a**
SUSPENDED SOLIDS	mg/l		n/d	n/d		n/d	66	11	66		**n/d**	**33**	**11**	**66**
TOTAL KJELDAHL NITROGEN	mg/l		50.3	51.4		0.9	172	120	172		**25.6**	**111.7**	**120**	**172**
AMMONIUM NITROGEN	mg/l		<0.05	<0.05		<0.05	<0.05	<0.05	<0.05		**n/a**	**n/a**	**n/a**	**n/a**
SULPHIDES and COMPOUNDS	mg/l		<1	<1		<1	<1	<1	<1		**n/a**	**n/a**	**n/a**	**n/a**
HYDROCYANIC ACID AND COMPOUND	mg/l as CN		<0.005	<0.005		<0.005	<0.005	<0.005	<0.005		**n/a**	**n/a**	**n/a**	**n/a**
TOTAL SULPHATES	mg/l		240.40	403.9		249	569	1537	569		**244.7**	**486.45**	**1537**	**569**
FREE AND EMULSIFIED GREASE	mg/l		8	<0.05		<0.05	21	27	21		**4**	**10.5**	**27**	**21**
FREE CHLORINE	mg/l		<0.03	<0.03		<0.03	<0.03	<0.03	<0.03		**n/a**	**n/a**	**n/a**	**n/a**
CHLORIDE	mg/l		1642	2880		1713	13583	9137	13583		**1677.5**	**8231.5**	**9137**	**13583**
TOTAL CHROMIUM	mg/l		<0.005	<0.005		<0.005	0.01	0.009	0.01		**n/a**	**0.005**	**0.009**	**0.01**
TOTAL SILVER	mg/l		<0.0005	<0.0005		<0.0005	<0.0005	<0.0005	<0.0005		**n/a**	**n/a**	**n/a**	**n/a**
TOTAL NICKEL	mg/l		<0.002	<0.002		<0.002	0.007	0.005	0.007		**n/a**	**0.0035**	**0.005**	**0.007**
TOTAL COPPER	mg/l		<0.005	<0.005		0.025	0.032	0.029	0.032		**0.0125**	**0.016**	**0.029**	**0.032**
TOTAL LEAD	mg/l		<0.002	<0.002		<0.002	0.007	0.006	0.007		**n/a**	**0.0035**	**0.006**	**0.007**
TOTAL ZINC	mg/l		0.009	0.015		0.026	0.51	0.32	0.51		**0.0175**	**0.2625**	**0.32**	**0.51**
TOTAL NON-FERROUS METALS	mg/l		0.049	0.059		0.96	4.22	1.52	4.22		**0.5045**	**2.1395**	**1.52**	**4.22**
TOTAL SOLUBLE NON-FERROUS METALS	mg/l		0.017	0.015		0.47	1.15	0.77	1.15		**0.2435**	**0.5825**	**0.77**	**1.15**
TOTAL ARSENIC	mg/l		<0.005	<0.005		<0.005	<0.005	<0.005	<0.005		**n/a**	**n/a**	**n/a**	**n/a**
TOTAL FLUORIDE	mg/l		<0.2	<0.2		<0.2	<0.2	<0.2	<0.2		**n/a**	**n/a**	**n/a**	**n/a**
TOTAL BORON	mg/l		0.34	0.045		0.66	0.92	0.5	0.92		**0.5**	**0.4825**	**0.5**	**0.92**
CHEMICAL OXYGEN DEMAND	mg/l		<15	20		33	<15	<15	<15		**16.5**	**10**	**n/a**	**n/a**
BIOLOGICAL OXYGEN DEMAND	mg/lO2		2.2	8		9	2	2	2		**5.6**	**2.5**	**2**	**2**

Process Water (After Dewatering) Monthly			06.01.12	11.01.12	19.01.12	26.01.12	01.02.12	18.04.12	28.05.12	27.06.12	01.08.12	23.11.12	14.12.12		Mean
pH			6.5	6.8	6.4	6.9	6.8	7	7.6	7.6	7.7	7.4	7.5		**7.1**
SETTLEABLE SOLID	mg/l		n/d	n/d	0.8	0.4	1	n/d	n/d	n/d	n/d	n/d	n/d		**0.2**
SUSPENDED SOLIDS	mg/l		320	160	625	220	240	295	n/d	395	n/d	5144	8012		**1401**
TOTAL KJELDAHL NITROGEN	mg/l		885	770	880	720	610	538.1	780.8	552.6	1850	1058	10.4		**786.8**
AMMONIUM NITROGEN	mg/l		208	285	322	262.39	225.54	40.8	844.2	498.6	1250	1360	<0.05		**481.5**
SULPHIDES and COMPOUNDS	mg/l		5	<0.1	1	1.1	<0.1	<0.1	<1	<0.1	<1	<1	<1		**0.645**
HYDROCYANIC ACID AND COMPOUND	mg/l as CN		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		**n/a**
TOTAL SULPHATES	mg/l		667	725	605	624.2	467.5	633.4	793.1	185.6	3108	603	260		**788**
FREE AND EMULSIFIED GREASE	mg/l		33	37	25	20	35	18	186	45	75	14	56		**49.45**
FREE CHLORINE	mg/l		10	26	48	48	10.2	0.3	7.5	<0.03	0.51	<0.03	<0.03		**13.68**
CHLORIDE	mg/l		985	5016.2	4864.4	4962.4	3666.3	6651	6709	9136	38007	10312	8190.1		**8954.5**
TOTAL CHROMIUM	mg/l		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.113	1.13	0.66		**0.173**
TOTAL SILVER	mg/l		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		**n/a**
TOTAL NICKEL	mg/l		0.044	0.036	<0.002	0.046	0.047	0.067	0.048	0.048	0.129	0.37	0.54		**0.125**
TOTAL COPPER	mg/l		0.077	<0.005	0.006	<0.005	0.008	0.008	0.012	0.059	0.484	5.21	2.06		**0.72**
TOTAL LEAD	mg/l		0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.12	0.934	2.51	2.68		**0.57**
TOTAL ZINC	mg/l		0.17	0.2	1.11	0.137	0.168	0.132	0.045	0.107	1.79	24.2	10.7		**3.52**
TOTAL NON-FERROUS METALS	mg/l		0.33	0.27	1.15	0.184	0.21	0.17	0.058	0.27	15.11	111	68.5		**17.932**
TOTAL SOLUBLE NON-FERROUS METALS	mg/l		0.26	0.15	1.02	0.151	0.17	0.12	0.021	0.15	13.7	81.5	12.5		**9.98**
TOTAL ARSENIC	mg/l		<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	0.013	0.015	<0.005	0.086		**0.011**
TOTAL FLUORIDE	mg/l		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		**n/a**
TOTAL BORON	mg/l		2.3	1.58	0.086	1.78	1.6	1.8	1.05	1.37	0.117	3.82	0.14		**1.42**
CHEMICAL OXYGEN DEMAND	mg/l		965	1080	840	1020	152	630	600	1780	11380	2020	164.7		**1875.6**
BIOLOGICAL OXYGEN DEMAND	mg/lO2		462	416	325	390	57	242	322	650	4376	248	64		**686.55**

Appendix C

S1 - Inspire	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	98	87	90	71	**86.5**
Ozone *Max.* (µg/Nm³)	108	115	97	80	**100**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Total VOC's (µg/Nm³)	*ND*	*ND*	*ND*	*1.3*	-
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Methane (% v/V)	0.00022	0.00017	0.00011	0.00008	**0.000145**
Dioxins and Furans (pg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide (mg/Nm³)	0.6	0.4	0.5	1	**0.625**
Arsenic (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Cadmium (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercury (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Nickel (ng/Nm³)	*ND*	6	*ND*	*ND*	-
Lead (ng/Nm³)	*ND*	16	8	*ND*	**12**
PM10 (µg/Nm³)	38	37	42	15	**33**
PM 2.5 (µg/Nm³)	11	20	19	2	**13**
Total Particulates (µg/Nm³)	46	67	51	29	**48.25**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	4	3	3	6	**4**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	250	80	210	270	**202.5**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	58.6	48.1	58.6	59.9	**56.3**
Vibrations (mm/s)	20.22	0.45	0.23	0.28	**0.32**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	0.1	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*ND*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

S2 - Chef Choice	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	88	93	98	75	**88.5**
Ozone *Max.* (µg/Nm³)	101	102	99	79	**95.25**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Total VOC's (µg/Nm³)	232	*ND*	*ND*	*13.9*	**245.9**
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Methane (% v/V)	0.00021	0.00017	0.0001	0.00008	**0.00014**
Dioxins and Furans (pg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide (mg/Nm³)	0.3	0.5	0.3	0.6	**0.425**
Arsenic (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Cadmium (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercury (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Nickel (ng/Nm³)	*ND*	8	*ND*	*ND*	-
Lead (ng/Nm³)	*ND*	14	8	25	**15.666**
PM10 (µg/Nm³)	33	21	34	22	**27.5**
PM 2.5 (µg/Nm³)	10	19	11	6	**11.5**
Total Particulates (µg/Nm³)	45	63	45	30	**45.75**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	4	2	2	6	**3.5**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	380	820	500	520	**555**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	53.3	54	54	61.6	**55.725**
Vibrations (mm/s)	0.21	0.21	0.23	0.27	**0.23**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	0.1	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*ND*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

S3 - Bellavista	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	99	111	88	70	**91**
Ozone *Max.* (µg/Nm³)	104	118	88	74	**96**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*1.7*	-
Total VOC's (µg/Nm³)	*ND*	8	*ND*	*ND*	-
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*0.4*	-
Methane (% v/V)	0.00019	0.00016	0.00009	0.00007	**0.0001275**
Dioxins and Furans (pg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide (mg/Nm³)	0.4	0.3	0.5	0.7	**0.475**
Arsenic (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Cadmium (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercury (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Nickel (ng/Nm³)	*ND*	14	*ND*	*ND*	-
Lead (ng/Nm³)	*ND*	*ND*	4	*ND*	-
PM10 (µg/Nm³)	31	14	41	18	**26**
PM 2.5 (µg/Nm³)	11	13	11	3	**9.5**
Total Particulates (µg/Nm³)	52	35	52	22	**40.25**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	3	2	2	4	**2.75**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	90	20	420	230	**190**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	56.5	55.1	53	59.6	**56.05**
Vibrations (mm/s)	0.24	0.24	0.27	0.27	**0.255**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*ND*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

S4 - Torri Mamo	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	94	113	68	75	**87.5**
Ozone *Max.* (µg/Nm³)	99	120	86	77	**95.5**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Total VOC's (µg/Nm³)	*ND*	8	*ND*	*ND*	-
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Methane (% v/V)	0.0002	0.00016	0.0001	0.00008	**0.000135**
Dioxins and Furans (pg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide (mg/Nm³)	0.3	0.5	0.5	0.7	**0.5**
Arsenic (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Cadmium (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercury (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Nickel (ng/Nm³)	*ND*	8	*ND*	*ND*	-
Lead (ng/Nm³)	*ND*	*ND*	5	4	**4.5**
PM10 (µg/Nm³)	25	28	42	10	**26.25**
PM 2.5 (µg/Nm³)	14	23	12	3	**13**
Total Particulates (µg/Nm³)	32	57	51	22	**40.5**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	7	2	3	6	**4.5**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	290	30	200	190	**177.5**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	61.3	51.7	58.3	58.7	**57.5**
Vibrations (mm/s)	0.2	0.34	0.24	0.24	**0.255**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*ND*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

S5 - Ta' Grabiel	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	94	103	100	76	**93.25**
Ozone *Max.* (µg/Nm³)	103	113	115	81	**103**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Total VOC's (µg/Nm³)	*ND*	12	*ND*	*ND*	-
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Methane (% v/V)	0.00018	0.00018	0.00029	0.00008	**0.0001825**
Dioxins and Furans (pg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide (mg/Nm³)	0.4	0.3	0.5	1.1	**0.575**
Arsenic (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Cadmium (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercury (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Nickel (ng/Nm³)	*ND*	7	*ND*	*ND*	-
Lead (ng/Nm³)	*ND*	*ND*	7	*5*	**6**
PM10 (µg/Nm³)	34	16	44	13	**26.75**
PM 2.5 (µg/Nm³)	4	13	13	1	**7.75**
Total Particulates (µg/Nm³)	47	35	47	21	**37.5**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	6	2	3	7	**4.5**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	290	20	290	610	**302.5**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	60.5	56.4	53.1	61.5	**57.875**
Vibrations (mm/s)	5.72	0.24	0.19	0.24	**0.223333**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	0.2	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*0.1*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

S6 - Family Park	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	91	105	90	61	**86.75**
Ozone *Max.* (µg/Nm³)	84	116	101	75	**94**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*6.1*	-
Total VOC's (µg/Nm³)	*ND*	*ND*	*ND*	*14.4*	-
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*1.6*	-
Methane (% v/V)	0.00019	0.00016	0.00011	0.00009	**0.0001375**
Dioxins and Furans (pg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide (mg/Nm³)	0.4	0.4	0.5	0.5	**0.45**
Arsenic (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Cadmium (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercury (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Nickel (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Lead (ng/Nm³)	*ND*	*ND*	6	*7*	**6.5**
PM10 (µg/Nm³)	36	18	45	26	**31.25**
PM 2.5 (µg/Nm³)	9	13	15	6	**10.75**
Total Particulates (µg/Nm³)	119	21	50	35	**56.25**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	4	2	3	4	**3.25**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	40	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	190	50	290	630	**290**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	57.1	57.8	51.7	58.3	**56.225**
Vibrations (mm/s)	0.29	0.24	0.22	0.28	**0.2575**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	0.2	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*ND*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

S7 - Zejtun	Quarter1	Quarter2	Quarter3	Quarter4	MEAN
Ozone *Average* (µg/Nm³)	89	104	81	74	**87**
Ozone *Max.* (µg/Nm³)	106	106	85	78	**93.75**
Total Hydrocarbons (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Total VOC's (µg/Nm³)	2.4	*ND*	*ND*	*ND*	-
Benzene (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Methane	0.00021	0.00016	0.00027	0.00009	**0.0001825**
Dioxins and Furans	*ND*	*ND*	*ND*	*ND*	-
Carbon Monoxide	0.4	0.7	0.4	1	**0.625**
Arsenic	*ND*	*ND*	*ND*	*ND*	-
Cadmium	*ND*	*ND*	*ND*	*ND*	-
Mercury	*ND*	*ND*	*ND*	*ND*	-
Nickel	*ND*	11	*ND*	*ND*	-
Lead	*ND*	21	11	25	**19**
PM10 (µg/Nm³)	47	37	*ND*	*27*	**37**
PM 2.5 (µg/Nm³)	14	23	16	7	**15**
Total Particulates (µg/Nm³)	76	64	54	48	**60.5**
Hydrogen Sulphide (ppb)	*ND*	*ND*	*ND*	*ND*	-
Sulphur Dioxide (µg/Nm³)	3	2	2	6	**3.25**
Ammonia (ng/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Esters (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Mercaptans (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Indoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Skatoles (µg/Nm³)	*ND*	*ND*	*ND*	*ND*	-
Aspergillus (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Ecoli (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Yeasts (cfu/m³)	170	230	370	450	**305**
Total Coliforms (cfu/m³)	*ND*	*ND*	*ND*	*ND*	-
Noise (dBA)	59.6	54	54.6	59.4	**56.9**
Vibrations (mm/s)	0.19	0.36	0.23	0.27	**0.2625**
PAHs *Total* (µg/Nm³)	*ND*	*ND*	*ND*	0.2	-
Acenaphthene	*ND*	*ND*	*ND*	*ND*	-
Acenaphthylene	*ND*	*ND*	*ND*	*ND*	-
Anthracene	*ND*	*ND*	*ND*	*ND*	-
Benz(a)anthracene	*ND*	*ND*	*ND*	*ND*	-
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(e)pyrene	*ND*	*ND*	*ND*	*ND*	-
Benzo(b)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(ghi)perylene	*ND*	*ND*	*ND*	*ND*	-
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Chrysene	*ND*	*ND*	*ND*	*ND*	-
Coronene	*ND*	*ND*	*ND*	*ND*	-
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	*ND*	-
Fluoranthene	*ND*	*ND*	*ND*	*ND*	-
Fluorene	*ND*	*ND*	*ND*	*0.1*	-
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	*ND*	-
Phenanthrene	*ND*	*ND*	*ND*	*ND*	-
Pyrene	*ND*	*ND*	*ND*	*ND*	-

Appendix D

Monthly (inside halls)	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**MEAN**	Limits
Ammonia (mg/m³)	0.2932	0.27439	2.52	0.29351	0.24043	0.24077	0.20723	na	0.22499	0.279525	0.24147	**0.482**	18
Hydrogen sulfide (mg/m³)	0.00198	0.00346	0.013	0.0051	0.0174	0.0216	0.0191	na	0.017	ND	0.19393	**0.033**	7
Mercaptans (mg/m³)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	35
Skatoles (µg/m³)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Indoles (µg/m³)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Methane (ppm)	100	ND	ND	ND	18	ND	ND	ND	ND	ND	ND	-	-
Polyamines (µg/m³)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-	-
Aspergillus (CFU/t)	ND	ND	16	16	64	*	*	ND	200	ND	21		-
Yeasts (CFU/t)	ND	*	250	250	360	ND	500	*	260	>100	>100	**260**	-
Noise (dBA)	80.4	78.4	76	76.3	76	79.1	68	78.5	81.3	77.9	83	**77.718**	87
PM10 (µg/Nm³)	**310.51**	**539.64**	**1110.2**	**1377.2**	**866.01**	**1452.54**	**599.96**	**1142.37**	**386.65**	**242.19**	**424.02**	**768.299**	50
Total Col. Counts (CFU/t)	ND	ND	*	*	300	250	ND	108	180	94	6	**156.333**	-

* blanket growth

Quarterly (outside halls)	Q1	Q2	Q3	Q4	**MEAN**	Limits
Ammonia (mg/m³)	0.02121	0.03421	0.0437	0.03247	**0.033**	18
Hydrogen sulfide (mg/m³)	0.01754	0.0349	0.011	0.01429	**0.019**	7
Mercaptans (mg/m³)	ND	ND	ND	ND	**-**	35
Skatoles (µg/m³)	ND	ND	ND	ND	**-**	-
Indoles (µg/m³)	ND	ND	ND	ND	**-**	-
Methane (ppm)	ND	12	ND	ND	**-**	-
Polyamines (µg/m³)	ND	ND	ND	ND	**-**	-
Aspergillus (CFU/t)	ND	ND	ND	40	**-**	-
Yeasts (CFU/t)	ND	ND	28	96	**62**	-
Noise (dBA)	71.6	67.6	70.4	72.7	**70.575**	87
PM10 (µg/Nm³)	**111.33**	**166.9**	35.25	46.48	**89.99**	50
Total Col. Counts (CFU/t)	ND	ND	ND	ND	**-**	-

* blanket growth

Quarterly (inside halls)	Q1	Q2	Q3	Q4	**MEAN**	Limits
Benzene (µg/m³)	2.5	2.3	2.9	3.2	**2.725**	5
Carbon Monoxide (mg/m³)	ND	4.582	1.26	0.55	**2.1306**	10
NM VOCs (mg/m³)	3900	3500	6	3.9	**-**	-
Nitrogen dioxide (µg/m³)	**160**	**70**	**590**	**520**	**335**	40
Sulfur dioxide (µg/m³)	5.4	2.5	7.2	8.8	**5.975**	125

Quarterly (outside halls)	Q1	Q2	Q3	Q4	**MEAN**	Limits
Benzene (µg/m³)	ND	ND	ND	ND	**-**	5
Carbon Monoxide (mg/m³)	ND	0.733	0.687	0.447	**0.622**	10
NM VOCs (mg/m³)	170	230	0.21	0.17	**-**	-
Nitrogen dioxide (µg/m³)	8.6	ND	16	20	**14.866**	40
Sulfur dioxide (µg/m³)	4.6	3.3	1.6	1.3	**2.7**	125

Monthly (inside halls)	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**MEAN**	Limits
Ammonia (mg/m³)	0.08946	0.11273	0.10088	0.0931	0.1493	0.16617	0.15664	0.16453	0.12829	0.07739	0.06557	**0.119**	18
Hydrogen sulfide (mg/m³)	0.00207	0.00354	0.00216	0.00338	0.0095	0.0106	0.0136	0.0125	0.0061	*ND*	0.00569	**0.007**	7
Mercaptans (mg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	35
Skatoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	-
Indoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	-
Methane (ppm)	24	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	-
Aspergillus (CFU/t)	*ND*	*ND*	*	*	*	400	*ND*	*<1*	64	5	5	**-**	-
Yeasts (CFU/t)	*ND*	*ND*	*	*	*	*<1*	*ND*	250	180	67	55	**-**	-
PM10 (µg/Nm³)	**338.18**	**478.5**	**238.68**	**973.4**	**591.78**	**764.52**	**772.97**	**677.36**	**870.41**	**358.53**	**333.4**	**581.612**	50
Noise (dBA)	82.6	77.8	77.1	79.9	78.9	77.7	73.4	77.3	78.1	82.2	80	**78.636**	87
Vibrations (mm/s)	0.55	0.41	0.19	0.19	0.2	0.23	0.19	0.24	0.24	0.27	0.24	**0.268**	254
Total Col. Counts (CFU/t)	*ND*	*ND*	*	*	*<1*	52	*ND*	48	32	29	3	**-**	-

Quarterly (outside halls)	Q1	Q2	Q3	Q4	**MEAN**	Limits
Ammonia (mg/m³)	0.11273	0.00876	0.01466	0.00372	**0.035**	18
Hydrogen sulfide (mg/m³)	0.00354	0.01	0.0153	0.00661	**0.009**	7
Mercaptans (mg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	35
Skatoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	-
Indoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	-
Methane (ppm)	*ND*	*ND*	*ND*	*ND*	**-**	-
Aspergillus (CFU/t)	*na*	*<1*	*<1*	3	**-**	-
Yeasts (CFU/t)	*na*	*<1*	18	19	**18.5**	-
PM10 (µg/Nm³)	**478.5**	43.67	**55.8**	30.44	**43.303**	50
Noise (dBA)	77.8	78.7	84.1	83.7	**81.075**	87
Vibrations (mm/s)	0.41	0.24	0.27	0.24	**0.29**	254
Total Col. Counts (CFU/t)	*na*	*<1*	47	*<1*	**-**	-

Quarterly (inside halls)	Q1	Q2	Q3	Q4	**MEAN**	Limits
Arsenic(ng/m³)	12	*ND*	*ND*	*ND*	**-**	6
NM VOCs(mg/m³)	0.98	1.4	0.59	1.4	**1.093**	-
PM 2.5(µg/m³)	**435.72**	**401.75**	**67.36**	**201.89**	**276.5**	25
Asbestos(f/ml)	*<0.01*	*<0.01*	*<0.01*	*<0.01*	**-**	0.01
Nickel(ng/m³)	**59**	*ND*	*ND*	*ND*	**-**	20
Dioxins & Furans(pg/Nm³)	0.08	0.023	0.14	0.021	**0.066**	-
Mercury(mg/m³)	0.0000039	0.0000012	0.0000093	0.0000012	**0.0000039**	0.1
Cadmium(ng/m³)	*ND*	*ND*	**21**	*ND*	**-**	5
Lead(µg/m³)	**0.5**	**0.56**	0.31	0.11	**0.37**	0.5
Polyamines(mg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	-
PAHs(ng/Nm³)	*18*	*55*	51	83	**51.75**	-
PCBs(pg/m³)	*410*	*330*	400	100	**310**	-
PAHs(ng/Nm³)						
Acenaphthene	0.28	1.7	5.4	0.61	**1.9975**	
Acenaphthylene	0.28	*ND*	*ND*	0.53	**0.405**	
Anthracene	1.4	3.3	4.4	1.1	**2.55**	

Benz(a)anthracene	0.55	0.83	*ND*	0.58	**0.6533**	
Benzo(a)pyrene	0.55	0.55	*ND*	0.61	**0.57**	
Benzo(e)pyrene	*ND*	0.83	*ND*	0.47	**0.65**	
Benzo(b)fluoranthene	0.55	1.1	*ND*	0.5	**0.7166**	
Benzo(ghi)perylene	0.55	*ND*	*ND*	1	**0.775**	
Benzo(j)fluoranthene	*ND*	0.55	*ND*	*ND*	**-**	
Benzo(k)fluoranthene	*ND*	0.28	*ND*	0.41	**0.345**	
Chrysene	1.1	1.4	*ND*	0.91	**1.1366**	
Coronene	*ND*	*ND*	*ND*	0.61	**-**	
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	0.61	**-**	
Fluoranthene	3	9.9	6.4	1.2	**5.125**	
Fluorene	2.5	11	5.8	3.8	**5.775**	
Indeno(1,2,3-cd)pyrene	0.28	*ND*	*ND*	83	**-**	
Phenanthrene	18	55	51	5.9	**32.475**	
Pyrene	5	9.1	7.9	2.3	**6.075**	
PCBs(pg/m³)						
28	410	330	400	100	**310**	
52	140	130	110	58	**109.5**	
77	2.8	*ND*	*ND*	*ND*	**-**	
81	*ND*	*ND*	*ND*	*ND*	**-**	
101	17	23	19	19	**19.5**	
105	4.1	3	2.8	2.8	**3.175**	
114	*ND*	*ND*	*ND*	*ND*	**-**	
118	9.9	8.3	8.6	7.7	**8.625**	
123	*ND*	*ND*	*ND*	*ND*	**-**	
126	*ND*	*ND*	*ND*	*ND*	**-**	
138	8.3	6.6	8.3	6.4	**7.4**	
153	8.8	6.9	8.8	6.6	**7.775**	
156	*ND*	*ND*	*ND*	*ND*	**-**	
157	*ND*	*ND*	*ND*	*ND*	**-**	
167	*ND*	*ND*	*ND*	*ND*	**-**	
169	*ND*	*ND*	*ND*	*ND*	**-**	
180	3.3	25	4.7	2.1	**8.775**	
189	*ND*	*ND*	*ND*	*ND*	**-**	

Quarterly (outside halls)	Q1	Q2	Q3	Q4	**MEAN**	Limits
Arsenic(ng/m³)	*ND*	*ND*	*ND*	*ND*	**-**	6
NM VOCs(mg/m³)	0.014	0.0054	0.0032	0.017	**0.0099**	-
PM 2.5(µg/m³)	**28.37**	**31.74**	*ND*	**32.79**	**30.966**	25
Asbestos(f/ml)	*<0.01*	*<0.01*	*<0.01*	*<0.01*	**-**	0.01
Nickel(ng/m³)	*ND*	*ND*	*ND*	*ND*	**-**	20
Dioxins & Furans(pg/Nm³)	0.047	0.021	0.029	0.024	**0.03025**	-
Mercury(mg/m³)	0.00000058	0.00000054	0.00000075	0.00000039	**0.0000056.5**	0.1
Cadmium(ng/m³)	*ND*	*ND*	**21**	*ND*	**-**	5
Lead(µg/m³)	0.021	*ND*	0.15	*ND*	**0.0855**	0.5

Polyamines(mg/m³)	*ND*	*ND*	*ND*	*ND*	-	-
PAHs(ng/Nm³)	4.4	2.5	6.6	83	**24.125**	-
PCBs(pg/m³)	25	15	25	12	**19.25**	-
PAHs(ng/Nm³)						
Acenaphthene	*ND*	2.5	*ND*	0.61	**1.555**	
Acenaphthylene	*ND*	0.28	*ND*	0.53	**0.405**	
Anthracene	0.28	0.28	0.41	1.1	**0.5175**	
Benz(a)anthracene	0.28	0.28	*ND*	0.58	**0.38**	
Benzo(a)pyrene	*ND*	0.55	*ND*	0.61	**0.58**	
Benzo(e)pyrene	*ND*	0.28	*ND*	0.47	**0.375**	
Benzo(b)fluoranthene	*ND*	0.55	*ND*	0.5	**0.525**	
Benzo(ghi)perylene	*ND*	*ND*	*ND*	1	-	
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	-	
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	0.41	-	
Chrysene	*ND*	0.55	*ND*	0.91	**0.73**	
Coronene	*ND*	*ND*	*ND*	0.61	-	
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	0.61	-	
Fluoranthene	1.4	1.4	2.6	1.2	**1.65**	
Fluorene	0.55	1.4	*ND*	3.8	**0.9166**	
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	83	-	
Phenanthrene	4.4	2.2	6.6	5.9	**4.775**	
Pyrene	1.7	1.7	2.6	2.3	**2.075**	
PCBs(pg/m³)						
28	25	15	25	12	**19.25**	
52	14	12	11	7.5	**11.125**	
77	*ND*	*ND*	*ND*	*ND*	-	
81	*ND*	*ND*	*ND*	*ND*	-	
101	4.7	6.3	5.8	3.6	**5.1**	
105	*ND*	*ND*	*ND*	*ND*	-	
114	*ND*	*ND*	*ND*	*ND*	-	
118	2.7	2.8	2.8	*ND*	**2.766**	
123	*ND*	*ND*	*ND*	*ND*	-	
126	*ND*	*ND*	*ND*	*ND*	-	
138	2.6	3	4.1	*ND*	**3.2333**	
153	3	3.6	4.7	*ND*	**3.7666**	
156	*ND*	*ND*	*ND*	*ND*	-	
157	*ND*	*ND*	*ND*	*ND*	-	
167	*ND*	*ND*	*ND*	*ND*	-	
169	*ND*	*ND*	*ND*	*ND*	-	
180	*ND*	*ND*	2.2	*ND*	-	
189	*ND*	*ND*	*ND*	*ND*	-	

Monthly (inside halls)	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	**MEAN**	**Limits**
Ammonia (mg/m³)	0.26298	0.27737	0.242	0.2731	0.25371	0.23422	0.23201	0.27195	0.19577	0.26268	0.19393	**0.25**	**18**
Arsenic (ng/m³)	*ND*	**47**	*ND*	*ND*	*ND*	*ND*	**18**	**13**	**12**	*ND*	*ND*	**-**	**6**
Asbestos (f/ml)	*<0.01*	*<0.01*	**	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	**	**	*<0.01*	**-**	**0.01**
Cadmium (ng/m³)	**18**	*ND*	*ND*	**18**	*ND*	*ND*	**23**	*ND*	*ND*	*ND*	*ND*	**-**	**5**
Hydrogen sulfide (mg/m³)	0.00378	0.00524	0.01481	0.00605	0.0764	0.0428	0.0318	0.028	0.0532	*ND*	0.0233	**0.03**	**7**
Lead (µg/m³)	0.34	0.41	0.025	0.2	**0.81**	**0.55**	0.49	0.44	0.3	0.25	*ND*	**0.38**	**0.5**
Mercaptans (mg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	**35**
Skatoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	**-**
Indoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	**-**
Mercury (mg/m³)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*ND*	**0.000009**	**0.1**
Methane (ppm)	130	*ND*	*ND*	*ND*	180	ND	190	ND	*ND*	*ND*	*ND*	**-**	**-**
Polyamines (µg/m³)	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	**-**	**-**
Aspergillus (CFU/t)	*ND*	*ND*	*	7	*	*ND*	*	*ND*	100	42	19	**-**	**-**
Yeasts (CFU/t)	*ND*	*	*	600	*ND*	*ND*	150	*	400	*>100*	*>100*	**-**	**-**
PM10 (µg/Nm³)	**895.91**	**229.78**	**384.09**	**694.79**	**236**	**574.94**	**627.73**	**846.71**	**668.82**	**941.45**	**365.21**	**587.766**	**50**
PM2.5 (µg/Nm³)	**326.33**	**215.03**	**241.64**	**709.75**	**438.52**	**250.85**	**340.41**	**220.38**	**202.9**	**218.72**	**145.67**	**300.927**	**25**
Total Col. Counts (CFU/t)	*ND*	*ND*	*	*	*	*ND*	*ND*	120	67	96	10	**-**	**-**
Nickel (ng/m³)	**24**	*ND*	*ND*	**39**	*ND*	*ND*	**45**	*ND*	14	*ND*	*ND*	**-**	**20**

** blanket growth*

*** occluded*

Quarterly (outside halls)	Q1	Q2	Q3	Q4	**MEAN**	**Limits**
Ammonia (mg/m³)	0.01712	0.05686	0.0809	0.02877	**0.046**	**18**
Arsenic (ng/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**6**
Asbestos (f/ml)	*<0.01*	*<0.01*	*<0.01*	*<0.01*	**-**	**0.01**
Cadmium (ng/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**5**
Hydrogen sulfide (mg/m³)	0.01785	0.0331	0.0106	0.01826	**0.02**	**7**
Lead (µg/m³)	0.029	*ND*	0.034	*ND*	**-**	**0.5**
Mercaptans (mg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**35**
Skatoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**-**
Indoles (µg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**-**
Mercury (mg/m³)	0.0000004	0.0000013	0.00000055	*ND*	**0.000007**	**0.1**
Methane (ppm)	*ND*	24	*ND*	*ND*	**-**	**-**
Polyamines (µg/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**-**
Aspergillus (CFU/t)	*ND*	*ND*	*ND*	16	**-**	**-**
Yeasts (CFU/t)	*ND*	*ND*	*	18	**-**	**-**
PM10 (µg/Nm³)	**60.85**	**65.69**	**70.5**	**60.86**	**64.475**	**50**
PM2.5 (µg/Nm³)	**29.23**	**41.84**	16.86	11.64	**24.893**	**25**
Total Col. Counts (CFU/t)	*ND*	*ND*	120	*ND*	**-**	**-**
Nickel (ng/m³)	*ND*	*ND*	*ND*	*ND*	**-**	**20**

Quarterly (inside halls)	Q1	Q2	Q3	Q4	**MEAN**	**Limits**
Ozone (µg/m³)	**6700**	6.8	4.6	4.9	**5.433**	120
NM VOCs(mg/m³)	9600	2900	4.4	2.1	**-**	-
Benzene (µg/m³)	**6**	1.5	*ND*	*ND*	**-**	5
Dioxins & Furans(pg/m³)	0.011	0.02	0.028	0.021	**0.02**	-
Sulfur Dioxide(µg/m³)	24	*ND*	4	1.3	**9.767**	125

Esters(µg/m³)	890	350	580	250	**517.5**	-
CO(mg/m³)	*<10*	0.481	0.619	0.447	**1.547**	10
PAHs (ng/Nm³)	8.6	97	220	120	**-**	-
PCBs (pg/m³)	30	30	0.18	19	**26.333**	-
PAHs(ng/Nm³)						
Acenaphthene	1.4	1.9	11	12	**6.575**	
Acenaphthylene	*ND*	0.55	*ND*	2.8	**1.675**	
Anthracene	5.2	5.5	22	18	**12.675**	
Benz(a)anthracene	0.83	0.83	*ND*	*ND*	**0.83**	
Benzo(a)pyrene	0.28	1.4	*ND*	0.55	**0.743**	
Benzo(e)pyrene	*ND*	3.3	*ND*	*ND*	**3.3**	
Benzo(b)fluoranthene	0.28	2.8	*ND*	0.83	**1.303**	
Benzo(ghi)perylene	0.28	2.2	*ND*	1.9	**1.46**	
Benzo(j)fluoranthene	*ND*	1.1	*ND*	*ND*	**1.1**	
Benzo(k)fluoranthene	0.28	0.83	*ND*	0.55	**0.553**	
Chrysene	1.1	2.2	*ND*	0.83	**1.377**	
Coronene	*ND*	1.7	*ND*	0.83	**1.265**	
Dibenz(a,h)anthracene	*ND*	0.28	*ND*	1.1	**0.69**	
Fluoranthene	11	11	35	9.4	**16.6**	
Fluorene	3.9	8.3	24	62	**24.55**	
Indeno(1,2,3-cd)pyrene	0.28	0.83	*ND*	1.7	**0.937**	
Phenanthrene	39	97	220	120	**119**	
Pyrene	8.6	13	23	7.7	**13.075**	
PCBs(pg/m³)						
28	30	30	0.18	19	**26.333**	
52	27	16	0.05	9.1	**17.367**	
77	*ND*	*ND*	*ND*	*ND*	**-**	
81	*ND*	*ND*	*ND*	*ND*	**-**	
101	9.1	5.8	0.01	5	**6.633**	
105	1.7	*ND*	0.002	*ND*	**-**	
114	*ND*	*ND*	*ND*	*ND*	**-**	
118	4.4	2.6	0.0061	1.7	**2.9**	
123	*ND*	*ND*	*ND*	*ND*	**-**	
126	*ND*	*ND*	*ND*	*ND*	**-**	
138	5	3.3	0.0061	3	**3.767**	
153	7.2	3.9	0.0072	3	**4.7**	
156	*ND*	*ND*	*ND*	*ND*	**-**	
157	*ND*	*ND*	*ND*	*ND*	**-**	
167	*ND*	*ND*	*ND*	*ND*	**-**	
169	*ND*	*ND*	*ND*	*ND*	**-**	
180	2.3	2.5	0.0027	1.9	**6.7**	
189	*ND*	*ND*	*ND*	*ND*	**-**	

Quarterly (outside halls)	Q1	Q2	Q3	Q4	**MEAN**	**Limits**
Ozone(µg/m³)	*<1*	39	42	53	**44.667**	120
Non methane VOCs(mg/m³)	160	160	0.53	0.068	**-**	-
Benzene(µg/m³)	*<5*	*ND*	*ND*	*ND*	**-**	5

Dioxins & Furans(pg/m³)	0.078	0.024	0.026	0.033	**0.04**	-
Sulfur Dioxide(µg/m³)	24	1.7	*ND*	*ND*	**12.85**	125
Esters(µg/m³)	16	25	20	0.73	**20.33**	-
CO(mg/m³)	*<10*	0.848	1.604	0.218	**0.89**	10
PAHs(ng/Nm³)	2.8	9.6	5.2	3.6	**5.3**	-
PCBs(pg/m³)	17	12	0.025	7.5	**12.167**	-
PAHs(ng/Nm³)						
Acenaphthene	*ND*	0.55	*ND*	0.83	**0.69**	
Acenaphthylene	*ND*	*ND*	*ND*	0.55	**0.55**	
Anthracene	*ND*	0.83	3.2	1.1	**1.71**	
Benz(a)anthracene	1.4	0.55	*ND*	*ND*	**0.975**	
Benzo(a)pyrene	*ND*	*ND*	*ND*	*ND*	**-**	
Benzo(e)pyrene	*ND*	*ND*	*ND*	0.55	**0.55**	
Benzo(b)fluoranthene	0.28	*ND*	*ND*	0.55	**0.415**	
Benzo(ghi)perylene	*ND*	*ND*	*ND*	1.4	**1.4**	
Benzo(j)fluoranthene	*ND*	*ND*	*ND*	*ND*	**-**	
Benzo(k)fluoranthene	*ND*	*ND*	*ND*	0.55	**0.55**	
Chrysene	0.28	0.55	*ND*	0.28	**0.37**	
Coronene	*ND*	*ND*	*ND*	0.55	**0.55**	
Dibenz(a,h)anthracene	*ND*	*ND*	*ND*	0.83	**0.83**	
Fluoranthene	0.83	1.9	5.2	2.2	**2.533**	
Fluorene	0.83	1.1	4.5	3.6	**2.508**	
Indeno(1,2,3-cd)pyrene	*ND*	*ND*	*ND*	1.1	**1.1**	
Phenanthrene	2.8	9.6	21	1.6	**8.75**	
Pyrene	1.1	2.2	4.1	2.8	**2.55**	
PCBs(pg/m³)						
28	17	12	0.025	7.5	**12.167**	
52	9.7	8.8	0.0099	4.1	**7.533**	
77	*ND*	*ND*	*ND*	*ND*	**-**	
81	*ND*	*ND*	*ND*	*ND*	**-**	
101	5.2	5	0.0044	3	**4.4**	
105	1.4	*ND*	*ND*	*ND*	**-**	
114	*ND*	*ND*	*ND*	*ND*	**-**	
118	3.6	2.4	0.0027	1.4	**2.467**	
123	*ND*	*ND*	*ND*	*ND*	**-**	
126	*ND*	*ND*	*ND*	*ND*	**-**	
138	3.3	2.8	0.0036	2.2	**2.767**	
153	3.9	3.6	0.0041	2.5	**3.333**	
156	*ND*	*ND*	*ND*	*ND*	**-**	
157	*ND*	*ND*	*ND*	*ND*	**-**	
167	*ND*	*ND*	*ND*	*ND*	**-**	
169	*ND*	*ND*	*ND*	*ND*	**-**	
180	*ND*	*ND*	0.0014	*ND*	**0.0014**	
189	*ND*	*ND*	*ND*	*ND*	**-**	

Appendix E

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier:

- **Product name** : Gulf Harmony 68
- **Viscosity Grade** : ISO VG 68

1.2. Relevant identified uses of the substance or mixture and uses advised against:

- **Relevant identified uses** : Hydraulic oil.
- **Uses advised against** : This oil should not be used for any other purpose than the intended use as an hydraulic oil without expert advice.

1.3. Details of the supplier of the Safety Data Sheet:

- **Supplier** : Gulf Oil Nederland B.V.
  Ambachtsweg 31 -
  1785 AJ - Den Helder - Nederland
  Tel: +31 223 634567
  E-mail: technicalsupport@gulf.nl
  Internet: www.gulf.nl

1.4. Emergency telephone number:

- **Phone number(s)** : +31 223 634567

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture:

- **Classification according to Directive 1999/45/EC** : This product does not meet the classification requirements of the current European legislation.

2.2. Label elements:

- **Safety advices** : Do not empty into drains ; dispose of this material and its container in a safe way.

2.3. Other hazards : Injection under the skin can occur when using high pressure equipment.
Overexposure to oil mist may cause respiratory irritations.
Spillage of lubricating oils will make surfaces slippery.

SECTION 3: Composition/information on ingredients

3.2. Mixtures:

- **Description of the mixture** : Mixture of highly refined mineral oils (PCA-content < 3% - IP 346) and additives.
  Product is not considered to be hazardous but contains hazardous components.

- **Composition of the mixture:**

Substance name		Contents	CAS No	EC No	Annex No	Ref REACH	Classification
Lubricating oils(petroleum), C20-C50, hydrotreated neutral oil-based, high-viscosity.	:	70 - 80 %	72623-85-9	276-736-3	649-481-00-4	-----	Not classified (DSD/DPD)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	:	20 - 30 %	72623-87-1	276-738-4	649-483-00-5	-----	Not classified (DSD/DPD)
Alkyl phenol	:	0,1 - 1 %	128-39-2	204-884-0	-----	-----	Xi; R36/37/38 N; R51-53

3.3. Other information : For full text of all R-phrases: see SECTION 16.

SECTION 4: First aid measures

General advice : In case of accident or if you feel unwell, seek medical advice immediately (show the label when possible).

4.1. Description of first aid measures:

- **After inhalation** : Assure fresh air breathing. If you feel unwell, seek medical advice.
- **After contact with skin** : Remove contaminated clothing and shoes. Wash skin thoroughly with mild soap and water. Never use kerosine or gasoline for cleaning the skin.
- **After contact with the eyes** : Rinse immediately with plenty of water. Seek medical attention if irritation develops.
- **After ingestion** : Do not induce vomiting. Seek medical attention immediately.

4.2. Most important symptoms and effects, both acute and delayed:

- **After exposure** : No acute or delayed symptoms or effects are anticipated if first aid treatment is applied and is effective.

4.3. Indication of any immediate medical attention and special treatment needed:

- **After exposure** : If injected under the skin when using high pressure equipment, send casualty immediately to a hospital, even when there are few or no symptoms.

SECTION 5: Fire-fighting measures

5.1. Extinguishing media:

- **Suitable extinguishing media** : Water fog. Carbon dioxide. Foam. Dry chemical product.
- **Unsuitable extinguishing media** : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture:

- **In the event of a fire** : Under fire conditions, hazardous fumes will be present.

5.3. Advice for firefighters:

- **Protective actions** : Avoid fire-fighting water to enter environment.
- **Special protective equipment for fire-fighters** : Do not enter fire area without proper protective equipment, including respiratory protection. Wear self-contained breathing apparatus, rubber boots and thick rubber gloves.
- **Surrounding fires** : Use water spray or fog for cooling exposed containers.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures:

- **For non-emergency personnel** : Evacuate unnecessary personnel.
- **For emergency responders** : Equip cleanup crew with proper protection. Wear suitable protective clothing, gloves and eye or face protection. Eliminate every possible source of ignition.

6.2. Environmental precautions:

- **In case of accidental spills** : Avoid release to the environment. Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up:

- **Appropriate containment techniques** : Clean up any spills as soon as possible, using an absorbent material to collect it.
- **Appropriate clean-up procedures** : Clean up even minor leaks or spills and spread granular absorbent promptly. Collect spills and put it into appropriated container.

SECTION 6: Accidental release measures (continued)

6.4. Reference to other sections : See also sections 8 & 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling:

- **Measures to prevent fire, aerosol and dust generation** : Keep away from sources of ignition. No naked lights. No smoking. Proper grounding procedures to avoid static electricity should be followed.
- **Measures to protect the environment** : Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams.
- **Advice on general occupational hygiene** : When using, do not eat, drink or smoke. Wash hands and other exposed areas with soap and water before leaving work.

7.2. Conditions for safe storage, including any incompatibilities:

- **Technical protective measures** : Local exhaust and general ventilation must be adequate to meet exposure standards.
- **Conditions of storage** : Store this product in a dry location where it can be protected from the elements. Do not store near oxidizing agents or acidic material. Store at temperatures not exceeding 50°C/122°F.
- **Specific designs for storage rooms or vessels** : Store in tightly closed, properly ventilated containers away from heat, sparks, open flame, strong oxidizers, radiations, and other initiators.

7.3. Specific end use(s):

- **Recommendations** : See Product Data Sheet for detailed information.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters:

- **Occupational exposure limit values** : United Kingdom: Occupational Exposure Standard (OES) of 5 mg/m³, 8-hour time-weighted average reference period for oil mist.
  The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned mineral oil mist a threshold limit value (TLV) of 5 mg/m³ as a Time Weighted Average (TWA) for a normal 8-hour workday and a 40-hour workweek and a short-term exposure limit (STEL) of 10 mg/m³ for periods not to exceed 15 minutes. Exposures at the STEL concentration should not be repeated more than four times a day and should be separated by intervals of at least 60 minutes. [ACGIH 1994, p. 28]
- **Biological limit values** : No data available.

8.2. Exposure controls:

8.2.1 Appropriate engineering controls:

- **Technical measures to prevent exposure** : Use adequate ventilation to keep oil mist below applicable standard.

8.2.2 Individual protection measures, such as personal protective equipment:

- **Eye / face protection** : Chemical goggles or safety glasses.(EN 166)
- **Skin protection** : Wear suitable protective clothing. (EN 465, EN 466 or EN 467).
- **Hand protection** : Wear suitable gloves resistant to chemical penetration. (EN 374)
  Use neoprene or rubber gloves.

SECTION 8: Exposure controls/personal protection (continued)

- **Respiratory protection** : The use of Filtertype A (EN 141) is recommended If exceeding the Occupational Exposure Limit.
- **Other** : Do not wear leather soled shoes.

8.2.3 Environmental exposure controls:

- **Measures to prevent exposure** : Avoid release to the environment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties:

• Appearance:

- **Physical state** : Oily liquid.
- **Colour (ASTM-D1500)** : <1.0
- **Odour** : Light odour of petroleum.
- **Flash point (ASTM-D92)** : >185°C
- **Density @ 15°C (ASTM-D4052)** : 884 kg/m^3
- **Solubility(ies)** : Insoluble.
- **Viscosity @ 40°C (ASTM-D445)** : 61.2-74.8 cSt

9.2. Other information:

- **Pour point (ASTM-D97)** : <-15°C

SECTION 10: Stability and reactivity

- **10.1 Reactivity** : No data available.
- **10.2 Chemical stability** : Stable under normal conditions.
- **10.3 Possibility of hazardous reactions** : None under normal conditions.
- **10.4 Conditions to avoid** : Extremely high or low temperatures.
- **10.5 Incompatible materials** : Strong oxidizing agents.
- **10.6 Hazardous decomposition products** : None under normal conditions.

SECTION 11: Toxicological information

11.1. Information on toxicological effects:

- **Acute toxicity** : No specific toxicity data on this product available.
- **Irritation** : Not expected to be irritant.
- **Corrosivity** : No adverse health effects were noted.
- **Sensitisation** : No sensitization effects known.
- **Repeated dose toxicity** : Not applicable.
- **Carcinogenicity** : This product contains mineral oils which are considered to be severely refined and not considered to be carcinogenic under IARC. All of the oils in this product have been demonstrated to contain less than 3% extractables by the IP 346 test.

SECTION 11: Toxicological information (continued)

- **Mutagenicity** : Not expected to be mutagenetic.
- **Toxicity for reproduction** : Not expected to be toxic.

11.2. Information on likely routes of exposure:

- **After ingestion** : Ingestion may cause nausea, vomiting and diarrhoea.
- **After inhalation** : Not expected to present a significant inhalation hazard under anticipated conditions of normal use.
- **After skincontact** : Not expected to present a significant skin hazard under anticipated conditions of normal use.
- **After eyecontact** : Slight eye irritant upon direct contact.

11.3. Symptoms related to the physical, chemical and toxicological characteristics:

- **General** : No adverse symptoms/effects were noted.

11.4. Delayed and immediate effects as well as chronic effects from short and long-term exposure:

- **General** : No adverse symptoms/effects were noted.

11.5. Other toxicological information : No data available.

SECTION 12: Ecological information

12.1. Toxicity:

- **Acute toxicity** : No specific toxicity data on this product available.
- **Chronic toxicity** : No specific toxicity data on this product available.

12.2. Persistence and degradability:

- **Biodegradation** : No data available.

12.3. Bioaccumulative potential:

- **Partition coefficient: n-octanol/water** : Not determined.
- **Bioconcentration factor (BCF)** : Not determined.
- **Bioaccumulation** : Not determined.

12.4. Mobility in soil:

- **Mobility** : It is to be expected small mobility in soil. Some or a few components may get into the soil and may cause pollution of ground water.

12.5 Results of PBT and vPvB assessment : Not applicable.

12.6 Other adverse effects : Spills may contaminate water supplies / pollute public waters.

SECTION 13: Disposal considerations

13.1. Waste treatment methods:

- **Waste disposal** : Dispose of this material and its container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation. Recover waste liquids for recycling/re-use. See Directive 2001/118/EC.
- **Waste Code European Waste List** : 13 02 05 - mineral-based non-chlorinated engine, gear and lubricating oils.
  15 01 10 - packaging containing residues of or contaminated by dangerous substances.

SECTION 14: Transport information

Not regulated.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture:

15.1.1 National regulations:

- **Germany** : Water Hazard Class: 1 - slightly hazardous to water
- **Netherlands** : Water pollution effect indication {11}: Slightly harmful to aquatic organisms. Abatement effort: B

15.1.2 International Regulations:

- **European Inventory of Existing Commercial Chemical Substances (EINECS)** : All components listed.
- **Australian Inventory of Chemical Substances (AICS)** : All components are in compliance with chemical notification requirements in Australia.
- **Canadian Environmental Protection Act (CEPA)** : All components are in compliance with the Canadian Environmental Protection Act and are present on the Domestic Substances List (DSL).
- **USA Toxic Substances Control Act (TSCA)** : All components of this material are on the US TSCA Inventory or are exempt.

15.2. Chemical safety assessment : Not applicable.

SECTION 16: Other information

- **Indication of changes** : Revision according to Regulation (EU) No 453/2010 amending Regulation (EC) No 1907/2006.
- **Abbreviations and acronyms** : ACGIH = American Conference of Industrial Hygienists
  CLP = Classification and Labelling of Substances and Preparations
  DOT = Department of Transport
  EC = European Commission. EN = European Norm
  IARC= International Agency for Research on Cancer
  IP = Institute of Petroleum. ISO = International Organization for Standardization
  NLGI = National Lubricating Grease Institute
  PCA = Polycyclic Aromatics
  SAE = Society of Automotive Engineers
  TLV = Threshold Limit Value. TWA = Time Weighted Average
  VG = Viscosity Grade
- **Key literature references and sources for data** : Concawe Report 01/53, Concawe Report 01/54, Concawe Report 05/87. Regulations (EC) No 1907/2006, 1272/2008 & 453/2010 of the European Parliament and of the Council.
- **List of relevant R-phrases** : R36/37/38 : Irritating to eyes, respiratory system and skin.
  R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
- **Training advice** : See Product Data Sheet for detailed information.

The contents and format of this SDS are in accordance with COMMISSION REGULATION (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

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Ambachtsweg 31 - 1785 AJ - Den Helder - Nederland
Tel: +31 223 634567
E-mail: technicalsupport@gulf.nl
Internet: www.gulf.nl

DISCLAIMER OF LIABILITY The information in this SDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use or disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This SDS was prepared and is to be used only for this product. If the product is used as a component in another product, this SDS information may not be applicable.

End of document

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1. Identification of the substance/preparation and company/undertaking

Product name	**Castrol Tection Global 15W-40**
SDS no. -	464410
Use of the substance/preparation	Diesel engine oil. For specific application advice see appropriate Technical Data Sheet or consult our company representative.
Supplier -	Castrol (UK) Ltd Wakefield House Pipers Way Swindon Wiltshire SN3 1RE
EMERGENCY TELEPHONE NUMBER	Carechem: +44 (0) 208 762 8322 (24 hours)
E-mail address -	MSDSadvice@bp.com

2. Hazards identification

This preparation is not classified as dangerous according to Directive 1999/45/EC as amended and adapted.

Additional hazards - USED ENGINE OILS
Used engine oil may contain hazardous components which have the potential to cause skin cancer.
See Toxicological Information, section 11 of this Safety Data Sheet.

See sections 11 and 12 for more detailed information on health effects and symptoms and environmental hazards.

3. Composition/information on ingredients

Highly refined base oil (IP 346 DMSO extract < 3%). Proprietary performance additives.

Chemical name	CAS no.	% -	EINECS / ELINCS.	Classification	
Zinc alkyl dithiophosphate	68649-42-3	1 - 5	272-028-3 -	Xi; R41, R38 N; R51/53	[1]

See section 16 for the full text of the R-phrases declared above

[1] Substance classified with a health or environmental hazard

[2] Substance with a workplace exposure limit

[3] PBT-substance

[4] vPvB substance -

Occupational exposure limits, if available, are listed in section 8. -

4. First-aid measures

Eye contact -	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.
Skin contact -	In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if irritation develops.
Inhalation -	If inhaled, remove to fresh air. Get medical attention if symptoms appear.
Ingestion -	Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If potentially dangerous quantities of this material have been swallowed, call a physician immediately.
Notes to physician -	Treatment should in general be symptomatic and directed to relieving any effects.

5. Fire-fighting measures

Extinguishing media

Suitable	In case of fire, use foam, dry chemical or carbon dioxide extinguisher or spray
Not suitable	Do not use water jet.

Hazardous decomposition products	Decomposition products may include the following materials: carbon dioxide carbon monoxide sulfur oxides phosphorus oxides metal oxide/oxides
Special fire-fighting procedures	None identified.
Protection of fire-fighters	Fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear.

6 . Accidental release measures

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Large spill	Stop leak if without risk. Move containers from spill area. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Dispose of via a licensed waste disposal contractor. Note: see section 1 for emergency contact information and section 13 for waste disposal.
Small spill	Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

7 . Handling and storage

Handling	Wash thoroughly after handling.
Storage	Keep container tightly closed. Keep container in a cool, well-ventilated area.
Not suitable	Prolonged exposure to elevated temperature.

8 . Exposure controls/personal protection

Ingredient name -	Occupational exposure limits
Base oil - unspecified	EH40-OES (United Kingdom (UK)). STEL: 10 mg/m³ 15 minute(s). Form: Oil mist, mineral TWA: 5 mg/m³ 8 hour(s). Form: Oil mist, mineral
ACGIH TLVs	
Base oil - unspecified	ACGIH (United States). STEL: 10 mg/m³ 15 minute(s). Form: Mineral oil, mist TWA: 5 mg/m³ 8 hour(s). Form: Mineral oil, mist

For information and guidance, the ACGIH values are included. For further information on these please consult your supplier.

Whilst specific OELs for certain components may be shown in this section, other components may be present in any mist, vapour or dust produced. Therefore, the specific OELs may not be applicable to the product as a whole and are provided for guidance only.

Exposure controls

Occupational exposure controls	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective occupational exposure limits. Ensure that eyewash stations and safety showers are close to the workstation location. All chemicals should be assessed for their risks to health and appropriate control measures put in place to prevent or adequately control exposure. A hierarchy of control measures exists (e.g. elimination, substitution, general ventilation, containment, systems of work, changing the process or activity) that must be considered before use of personal protective equipment. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained. Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards. The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.
Hygiene measures -	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period.

Personal protective equipment

Respiratory protection -	Respiratory protective equipment is not normally required where there is adequate natural or local exhaust ventilation to control exposure. In case of insufficient ventilation, wear suitable respiratory equipment. Respiratory protective equipment must be checked to ensure it fits correctly each time it is worn. Air-filtering respirators, also called air-purifying respirators, will not be adequate under conditions of oxygen deficiency (i.e. low oxygen concentration), and would not be considered suitable where airborne concentrations of chemicals with a significant hazard are present. In these cases air-supplied breathing

	apparatus will be required. Provided an air-filtering/air-purifying respirator is suitable, a filter for particulates can be used for mist or fume. Use filter type P or comparable standard. A combination filter for particles and organic gases and vapours (boiling point >65°C) may be required if vapour or abnormal odour is also present due to high product temperature. Use filter type AP or comparable standard.
Hand protection	Wear protective gloves if prolonged or repeated contact is likely. Wear chemical resistant gloves. Recommended: nitrile gloves Protective gloves will deteriorate over time due to physical and chemical damage. Inspect and replace gloves on a regular basis. The frequency of replacement will depend upon the circumstances of use.
Eye protection	Safety glasses with side shields.
Skin and body	Use of protective clothing is good industrial practice. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required.

9 . Physical and chemical properties

General information

Appearance

Physical state	Liquid.
Colour	Amber.
Odour	Oily.

Important health, safety and environmental information

Flash point	Closed cup: 224°C (435.2°F) [Pensky-Martens.]
Viscosity	Kinematic: 106.4 mm^2/s (106.4 cSt) at 40°C Kinematic: 14.4 mm^2/s (14.4 cSt) at 100°C
Pour point	-42 °C
Density	885 kg/m^3 (0.885 g/cm^3) at 15°C
Solubility	insoluble in water.
Partition coefficient (LogKow)	>3

10 . Stability and reactivity

Stability	The product is stable.
Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	Avoid all possible sources of ignition (spark or flame).
Materials to avoid	Reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	Combustion products may include the following: carbon oxides sulfur oxides phosphorus oxides metal oxide/oxides Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11 . Toxicological information

Acute toxicity -

Unlikely to cause more than transient stinging or redness if accidental eye contact occurs.

Unlikely to cause harm to the skin on brief or occasional contact but prolonged or repeated exposure may lead to dermatitis.

Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea.

At normal ambient temperatures this product will be unlikely to present an inhalation hazard because of its low volatility. May be harmful by inhalation if exposure to vapour, mists or fumes resulting from thermal decomposition products occurs.

Chronic toxicity

Other chronic toxicity data -

USED ENGINE OILS
Combustion products resulting from the operation of internal combustion engines contaminate engine oils during use. Used engine oil may contain hazardous components which have the potential to cause skin cancer. Frequent or prolonged contact with all types and makes of used engine oil must therefore be avoided and a high standard of personal hygiene maintained.

Effects and symptoms

Eyes	No significant health hazards identified.
Skin	No significant health hazards identified.
Inhalation	No significant health hazards identified.
Ingestion	No significant health hazards identified.

12 . Ecological information

Persistence/degradability	Inherently biodegradable .
Mobility	Spillages may penetrate the soil causing ground water contamination. -
Bioaccumulative potential -	This product may bioaccumulate through food chains in the environment. -
Environmental hazards -	Not classified as dangerous. Based on data available for this or related materials
Other ecological information -	Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

13 . Disposal considerations

Disposal considerations / - Waste information -	The generation of waste should be avoided or minimised wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Unused product

European waste catalogue (EWC)	13 02 05* mineral-based non-chlorinated engine, gear and lubricating oils However, deviation from the intended use and/or the presence of any potential contaminants may require an alternative waste disposal code to be assigned by the end user.

14 . Transport information

Not classified as hazardous for transport (ADR/RID, ADNR, IMDG, ICAO/IATA)

15 . Regulatory information

Classification and labelling have been performed according to EU directives 1999/45/EC and 67/548/EEC as amended and adapted.

Label requirements

Risk phrases	This product is not classified according to EU legislation.
Additional warning phrases	Safety data sheet available for professional user on request.

Other regulations

Europe inventory	At least one component is not listed in EINECS but all such components are listed in ELINCS. Please contact your supplier for information on the inventory status of this material.
United States inventory (TSCA 8b) -	All components are listed or exempted.
Australia inventory (AICS)	All components are listed or exempted. -
Canada inventory	All components are listed or exempted. -
China inventory (IECSC)	All components are listed or exempted. -
Japan inventory (ENCS)	All components are listed or exempted. -
Korea inventory (KECI)	All components are listed or exempted. -
Philippines inventory (PICCS)	All components are listed or exempted. -

16 . Other information

Full text of R-phrases referred to in sections 2 and 3	R41- Risk of serious damage to eyes. R38- Irritating to skin. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
History	
Date of issue/ Date of revision	05/11/2009.
Date of previous issue	05/10/2009.
Prepared by	Product Stewardship

Notice to reader

∇ Indicates information that has changed from previously issued version.

All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

	SAFETY DATA SHEET	Page : 1 Revised edition no : 0 Date : 2 / 8 / 2011 Supersedes : C / 0 / 0
	Gulf Coolant XLL	**PRODUCT CODE 6939**

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 **Product identifier** : Gulf Coolant XLL

1.2 **Relevant identified uses of the substance or mixture and uses advised against:**

1.2.1 **Relevant identified uses** : Cooling fluid (antifreeze)
Ready to use

1.2.2 **Uses advised against** : Use only as antifreeze.

1.3 **Details of the supplier of the safety data sheet** : Gulf Oil Nederland B.V.
Ambachtsweg 31
1785 AJ - Den Helder - Nederland
Tel: +31 223 634567
E-mail: technicalsupport@gulf.nl

1.4 **Emergency telephone number** : +31 223 634567

SECTION 2: Hazards identification

2.1 **Classification of the substance or mixture:**

2.1.1 **Classification according to Directive 1999/45/EC** : Classified as dangerous under EC criteria.
Xn; R22

2.1.2 **Most important adverse physicochemical effects** : None under normal conditions.

2.1.3 **Most important adverse human health effects** : Harmful if swallowed.

2.1.4 **Most important adverse environmental effects** : No specific risk for the environment.

2.2 **Label elements:**

2.2.1 **Hazard symbols**

2.2.2 **Indications of danger** : Xn: Harmful.

2.2.3 **Risk phrases** : R22 : Harmful if swallowed.

2.2.4 **Safety advices** : S2 : Keep out of the reach of children. - S13 : Keep away from food, drink and animal feedingstuffs. - S35 : This material and its container must be disposed of in a safe way. - S46 : If swallowed seek medical advice immediately and show this container or label. - S51 : Use only in well-ventilated areas. - S56 : Dispose of this material and its container to hazardous or special waste collection point. - S59 : Refer to manufacturer/supplier for information on recovery/recycling.

2.3 **Other hazards** : None under normal conditions.

SECTION 3: Composition/information on ingredients

3.1 **Description of the mixture** : Mixture of ethylene glycol, additives and water.

3.2 **Composition of the mixture:**

Substance name		Contents	CAS No	EC No	Annex No	Ref REACH	Classification
Ethylene glycol	:	40 - 60 %	107-21-1	203-473-3	603-027-00-1	-----	Xn; R22

SECTION 3: Composition/information on ingredients (continued)

Substance name		Contents	CAS No	EC No	Annex No	Ref REACH	Classification
Water	:	40 - 60 %	7732-18-5	231-791-2	---	----	Not classified (DSD/DPD)
Sodium-2-ethylhexanoate	:	1 - 5 %	19766-89-3	243-283-5	---	----	Xn;R63

3.3 **Other information** : See § 16 for full text of all R- phrases.

SECTION 4: First aid measures

General Advice : In case of accident or if you feel unwell, seek medical advice immediately (show the label when possible).

4.1 Description of first aid measures:

- After inhalation : Remove the casualty to fresh air. Allow the victim to rest. In case of respiratory arrest, administer artificial respiration. If you feel unwell, seek medical advice.

- After contact with skin : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse. Seek medical attention if ill effect or irritation develops.

- After contact with the eyes : In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

- After Ingestion : Rinse mouth. Do not induce vomiting. Seek medical attention immediately.

4.2 Most important symptoms and effects, both acute and delayed : Symptoms of ingestion include drowsiness, weakness, headache, dizziness, nausea, vomiting.

4.3 Indication of any immediate medical attention and special treatment needed : If swallowed, seek medical advice immediately and show this container or label.

SECTION 5: Fire-fighting measures

5.1 Extinguishing media:

5.1.1 Suitable extinguishing media : Water spray. Carbon dioxide. Alcohol resistant foam. Dry chemical product.

5.1.2 Unsuitable extinguishing media : Do not use a heavy water stream.

5.2 Special hazards arising from the substance or mixture : Under fire conditions, hazardous fumes will be present.

5.3 Advice for firefighters:

5.3.1 Protective actions : Evacuate unnecessary personnel.
Avoid fire-fighting water to enter environment.

5.3.2 Special protective equipment for fire-fighters : Do not enter fire area without proper protective equipment, including respiratory protection. Wear self-contained breathing apparatus, rubber boots and thick rubber gloves.

5.3.3 Surrounding fires : Use water spray or fog for cooling exposed containers.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

6.1.1 For non-emergency personnel : Evacuate unnecessary personnel.

6.1.2 For emergency responders : Equip cleanup crew with proper protection. Avoid contact with skin and eyes. Wear suitable protective clothing and gloves.

SECTION 6: Accidental release measures (continued)

6.2 Environmental precautions : Prevent entry to sewers and public waters. Notify authorities if product enters sewers or public waters.

6.3 Methods and material for containment and cleaning up:

6.3.1 Appropriate containment techniques : Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams.

6.3.2 Appropriate clean-up procedures : Clean up any spills as soon as possible, using an absorbent material to collect it. Collect spills and put it into appropriated container.

6.4 Reference to other sections : See also headings 8 & 13 for additional information.

SECTION 7: Handling and storage

7.1 Precautions for safe handling:

7.1.1 Measures to prevent fire, aerosol and dust generation : Provide local exhaust or general room ventilation.

7.1.2 Measures required to protect the environment : Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams.

7.1.3 Advice on general occupational hygiene : When using, do not eat, drink or smoke. Where contact with eyes or skin is likely, wear suitable protection.

7.2 Conditions for safe storage, including any incompatibilities:

7.2.1 Technical protective measures : Local exhaust and general ventilation must be adequate to meet exposure standards.

7.2.2 Conditions of storage : Store in tightly closed, properly ventilated areas away from heat, sparks, open flame. Keep at temperature not exceeding 50°C. Keep away from food, drink and animal feeding stuffs.

7.2.3 Specific designs for storage rooms or vessels : Store in accordance with local, regional, national or international regulation.

7.3 Specific end use(s) : See Product Data Sheet for detailed information.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters:

8.1.1 Occupational exposure limit values:

- EU : EH40 Workplace exposure limit.
Long-term exposure limit (8-hour TWA reference period)
Ethane-1,2-diol, vapour; 20 ppm - 52 mg/m³ (skin)

- USA : The American Conference of Governmental Industrial hygienists (ACGIH) assigns ethylene glycol a ceiling limit value of 50 ppm (127 mg/m³), which should not be exceeded during any part of the working exposure. [ACGIH 1993].

8.1.2 Biological limit values : No data available.

8.2 Exposure controls:

8.2.1 Appropriate engineering controls : Provide adequate ventilation to minimize dust and/or vapour concentrations.

8.2.2 Individual protection measures, such as personal protective equipment:

SECTION 8: Exposure controls/personal protection (continued)

- Eye / face protection	: Safety glasses.
- Skin protection	: Wear suitable protective clothing. (EN 465, EN 466 or EN 467).
- Hand protection	: Wear suitable gloves resistant to chemical penetration. (EN 374)
- Respiratory protection	: In case of insufficient ventilation, wear suitable respiratory equipment.
8.2.3 Environmental exposure controls	: Avoid release to the environment.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties:

- Appearance	: Aqueous solution.
- Physical state	: Liquid.
- Colour	: Red.
- Odour	: Characteristic
- pH value	: 8.2 (50% in water)
- Melting point / Freezing point	: -40°C@50% dilution
- Density @ 15°C	: 1070 kg/m³
- Solubility in water	: Miscible.

SECTION 10: Stability and reactivity

10.1 Reactivity	: Stable under normal conditions.
10.2 Chemical stability	: Stable under normal conditions.
10.3 Possibility of hazardous reactions	: Reacts with: Strong oxidizing agents. Strong bases.
10.4 Conditions to avoid	: Extremely high or low temperatures.
10.5 Incompatible materials	: Flammable materials. Acids.
10.6 Hazardous decomposition products	: Toxic gases.

SECTION 11: Toxicological information

11.1 Information on toxicological effects:

- Acute toxicity	: No specific toxicity data on this product available.
- Irritation	: Irritating to eyes and respiratory system.
- Corrosivity	: No adverse health effects were noted.
- Sensitisation	: No sensitization effects known.
- Carcinogenicity	: This material or its emissions may cause damage to kidney and liver and/or aggravate existing disorders.
- Mutagenicity	: Not expected to be mutagenetic.
- Toxicity for reproduction	: Not expected to be toxic.

11.2 Information on likely routes of exposure:

- After ingestion	: Ingestion may cause nausea, vomiting and diarrhoea.

SECTION 11: Toxicological information (continued)

- After inhalation	: Inhalation of vapours may cause respiratory irritation.
- After skincontact	: Not expected to present a significant skin hazard under anticipated conditions of normal use.
- After eyecontact	: Contact with the eyes is likely to be irritating.
11.3 Symptoms related to the physical, chemical and toxicological characteristics	: No adverse symptoms/effects were noted.
11.4 Delayed and immediate effects as well as chronic effects from short and long-term exposure	: Substance may have effects on the central nervous system, resulting in abnormal eye movements(nystagmus). Substance may cause effects on the kidneys and central nervous system, resulting in renal failure and brain injury. Exposure could cause lowering of consciousness.
11.5 Other toxicological information	: No data available.

SECTION 12: Ecological information

12.1 Toxicity	: No specific ecotoxicity data on this product available.
12.2 Persistence and degradability	: Biodegradable.
12.3 Bioaccumulative potential	: There are no indications for appearence of bioaccumulation.
12.4 Mobility in soil	: Not determined.
12.5 Results of PBT and vPvB assessment	: Not applicable.
12.6 Other adverse effects	: No data available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods	: Dispose in a safe manner in accordance with local/national regulations. See Directive 2001/118/EC
13.2 Waste Code European Waste List	: 16 01 14 - antifreeze fluids containing dangerous substances. 15 01 10 packaging containing residues of or contaminated by dangerous substances.

SECTION 14: Transport information

Not classified.

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

National regulations:

- Germany	: Water Hazard Class: 1 - slightly hazardous to water
- Netherlands	: Water pollution effect indication (11): Slightly harmful to aquatic organisms. Abatement effort: B

International Regulations:

- European Inventory of Existing Commercial Chemical Substances (EINECS)	: All components listed.

SECTION 15: Regulatory information (continued)

15.2 Chemical safety assessment : Not applicable.

SECTION 16: Other information

16.1 Revision indicators : None.

16.2 Abbreviations and acronyms : EC = European Community
EN = European Norm
TWA = Time Weighted Average

16.3 Key literature references and sources for data : Concawe Report 01/53, Concawe Report 01/54, Concawe Report 03/87. Regulations (EC) No 1907/2006, 1272/2008 & 453/2010 of the European Parliament and of the Council.

16.4 List of relevant R phrases : R22 : Harmful if swallowed.
R63 : Possible risk of harm to the unborn child.

16.5 Training advice : See Product Data Sheet for detailed information.

The contents and format of this SDS are in accordance with COMMISSION REGULATION (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

DISCLAIMER OF LIABILITY The information in this SDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use or disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This SDS was prepared and is to be used only for this product. If the product is used as a component in another product, this SDS information may not be applicable.

End of document

Gulf Oil Nederland B.V.
Ambachtsweg 31 1785 AJ - Den Helder - Nederland
Tel: +31 223 634567
E-mail: technicalsupport@gulf.nl

SAFETY DATA SHEET

Revised edition no : 2

Date : 21 / 6 / 2012

Supersedes : 2 / 11 / 2012

Gulf Superfleet Supreme 15W-40

PRODUCT CODE 1540

SECTION 1. Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier:

- **Product name** : Gulf Superfleet Supreme 15W-40
- **Viscosity Grade** : SAE 15W-40

1.2. Relevant identified uses of the substance or mixture and uses advised against:

- **Relevant identified uses** : Engine oil (lubricant)
- **Uses advised against** : This oil should not be used for any other purpose than the intended use as an engine oil without expert advice.

1.3. Details of the supplier of the Safety Data Sheet:

- **Supplier** : Gulf Oil Nederland B.V.
  Ambachtsweg 31
  1785 AJ - Den Helder - Nederland
  Tel: +31 (0)223 634567
  E-mail: technicalsupport@gulf.nl
  Internet: www.gulf.nl

1.4. Emergency telephone number:

- **Phone number(s)** : +31 (0)223 634567

SECTION 2. Hazards identification

2.1. Classification of the substance or mixture:

- **Classification according to Directive 1999/45/EC** : This product does not meet the classification requirements of the current European egislation.

2.2. Label elements:

- **Safety advices** : Contains Calcium long chain alkaryl sulphonate. May produce an allergic reaction. Do not empty into drains ; dispose of this material and its container in a safe way.

2.3. **Other hazards** : Flammable liquid. Prolonged or repeated skin contact with the material will remove natural oils and could lead to a dermatitis. Spills of this product present a serious slipping hazard. Overexposure to oil mist may cause respiratory irritations. This mixture does not meet the criteria for PBT or vPvB according to Regulation (EC) No 1907/2006, Annex XIII.

SECTION 3. Composition/information on ingredients

3.2. Mixtures:

- **Description of the mixture** : Product is not considered to be hazardous but contains hazardous components. Mixture of mineral base oils (PCA-content < 3 % - IP 346) and additives.

- **Composition of the mixture:**

Substance name	Contents	CAS No	EC No	Annex No	Ref REACH	Classification
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	85 - 90 %	72623-87-1	276-738-4	649-483-00-5	---	Not classified (1999/45/EC)
Lubricating oils(petroleum), C20-C50, hydrotreated neutral oil-based, high-viscosity.	5 - 10 %	72623-85-9	276-736-3	649-481-00-4	---	Not classified (1999/45/EC)
Polyolefine polyamine succinimide, Polyol	1 - 5 %	---	---	---	---	R53

SECTION 3. Composition/information on ingredients (continued)

Substance name		Contents	CAS No	EC No	Annex No	Reg REACH	Classification
calcium long chain alkaryl sulphonate	:	1 - 2 %	---	---	---	---	R43
Zinc alkyl dithiophosphate	:	1 - 3 %	68649-42-3	272-028-3	---	---	Xn; R22 N; R51-53
Calcium long chain alkaryl sulphonate	:	0,1 - 1 %	68610-34-4	271-877-7	---	---	R43 R53

SECTION 4. First aid measures

General advice : In case of accident or if you feel unwell, seek medical advice immediately (show the label when possible).

4.1. Description of first aid measures:

- **After inhalation** : Assure fresh air breathing. If you feel unwell, seek medical advice.
- **After contact with skin** : Remove contaminated clothing and shoes. Wash skin thoroughly with mild soap and water. Never use kerosine or gasoline for cleaning the skin.
- **After contact with the eyes** : Rinse immediately with plenty of water. Seek medical attention if irritation develops.
- **After ingestion** : Do not induce vomiting. Seek medical attention immediately.

4.2. Most important symptoms and effects, both acute and delayed:

- **After exposure** : No acute or delayed symptoms or effects are anticipated if first aid treatment is applied and is effective.

4.3. Indication of any immediate medical attention and special treatment needed:

- **After exposure** : If injected under the skin when using high pressure equipment, send casualty immediately to a hospital, even when there are few or no symptoms.

SECTION 5. Firefighting measures

5.1. Extinguishing media:

- **Suitable extinguishing media** : Water fog. Carbon dioxide. Foam. Dry chemical product.
- **Unsuitable extinguishing media** : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture:

- **In the event of a fire** : Under fire conditions, hazardous fumes will be present.

5.3. Advice for firefighters:

- **Protective actions** : Avoid fire-fighting water to enter environment.
- **Special protective equipment for fire-fighters** : Do not enter fire area without proper protective equipment, including respiratory protection. Wear self-contained breathing apparatus, rubber boots and thick rubber gloves.
- **Surrounding fires** : Use water spray or fog for cooling exposed containers.

SECTION 6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures:

- **For non-emergency personnel** : Evacuate unnecessary personnel.
- **For emergency responders** : Equip cleanup crew with proper protection. Wear suitable protective clothing, gloves and eye or face protection. Eliminate every possible source of ignition.

SECTION 6. Accidental release measures (continued)

6.2. Environmental precautions:

- **In case of accidental spills** : Avoid release to the environment. Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up:

- **Appropriate containment techniques** : Clean up any spills as soon as possible, using an absorbent material to collect it. Take up large spills with pump or vacuum and finish with dry chemical absorbent.
- **Appropriate clean-up procedures** : Clean up even minor leaks or spills and spread granular absorbent promptly. Collect spills and put it into appropriated container.

6.4. Reference to other sections : See also sections 8 & 13.

SECTION 7. Handling and storage

7.1. Precautions for safe handling:

- **Measures to prevent fire, aerosol and dust generation** : Keep away from sources of ignition. No naked lights. No smoking. Proper grounding procedures to avoid static electricity should be followed.
- **Measures to protect the environment** : Contain any spills with dikes or absorbents to prevent migration and entry into sewers or streams.
- **Advice on general occupational hygiene** : When using, do not eat, drink or smoke. Wash hands and other exposed areas with soap and water before leaving work.

7.2. Conditions for safe storage, including any incompatibilities:

- **Technical protective measures** : Local exhaust and general ventilation must be adequate to meet exposure standards.
- **Conditions of storage** : Store this product in a dry location where it can be protected from the elements. Do not store near oxidizing agents or acidic material. Keep at temperature not exceeding 50°C.
- **Specific designs for storage rooms or vessels** : Store in tightly closed, properly ventilated containers away from heat, sparks, open flame, strong oxidizers, radiations, and other initiators.

7.3. Specific end use(s):

- **Recommendations** : See Product Data Sheet for detailed information.

SECTION 8. Exposure controls/personal protection

8.1. Control parameters:

- **Occupational exposure limit values:** : United Kingdom: Occupational Exposure Standard (OES) of 5 mg/m³, 8-hour time-weighted average reference period for oil mist.
  The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned mineral oil mist a threshold limit value (TLV) of 5 mg/m³ as a Time Weighted Average (TWA) for a normal 8-hour workday and a 40-hour workweek and a short-term exposure limit (STEL) of 10 mg/m³ for periods not to exceed 15 minutes. Exposures at the STEL concentration should not be repeated more than four times a day and should be separated by intervals of at least 60 minutes. [ACGIH 1994, p. 28]
- **Biological limit values** : No data available.

8.2. Exposure controls:

SECTION 8. Exposure controls/personal protection (continued)

8.2.1 Appropriate engineering controls:

• Technical measures to prevent exposure	: Use adequate ventilation to keep oil mist below applicable standard.

8.2.2 Individual protection measures, such as personal protective equipment:

• Eye / face protection	: Chemical goggles or safety glasses.(EN 166)
• Skin protection	: Wear suitable protective clothing. (EN 465, EN 466 or EN 467).
• Hand protection	: Wear suitable gloves resistant to chemical penetration. (EN 374) Use neoprene or rubber gloves.
• Respiratory protection	: The use of Filtertype A (EN 141) is recommended if exceeding the Occupational Exposure Limit.
• Other	: Do not wear leather soled shoes.

8.2.3 Environmental exposure controls:

• Measures to prevent exposure	: Avoid release to the environment. See Heading 6.

SECTION 9. Physical and chemical properties

9.1. Information on basic physical and chemical properties:

• Appearance:

- Physical state	: Oily liquid.
- Colour	: Yellow-brown.
• Odour	: Characteristic
• Pour point (ASTM-D97)	: <-24 °C
• Flash point (ASTM-D92)	: >215 °C
• Density @ 15 °C (ASTM-D4052)	: 881 kg/m³
• Solubility(ies)	: Insoluble.
• Viscosity @ 40 °C (ASTM-D445)	: 106 mm²/s
9.2. Other information	: See Product Data Sheet for detailed information.

SECTION 10. Stability and reactivity

10.1 Reactivity	: No data available.
10.2 Chemical stability	: Stable under normal conditions.
10.3 Possibility of hazardous reactions	: None under normal conditions.
10.4 Conditions to avoid	: Extremely high or low temperatures.
10.5 Incompatible materials	: Strong oxidizing agents.
10.6 Hazardous decomposition products	: None under normal conditions.

SECTION 11. Toxicological information

11.1. Information on toxicological effects:

SECTION 11. Toxicological information (continued)

- **Acute toxicity** : No specific toxicity data on this product available.
- **Irritation** : Not expected to be irritant.
- **Corrosivity** : No adverse health effects were noted.
- **Sensitisation** : Experimental data has shown that the concentration of potentially sensitizing components present in this product does not induce skin sensitization.
- **Repeated dose toxicity** : Not applicable.
- **Carcinogenicity** : This product contains mineral oils which are considered to be severely refined and not considered to be carcinogenic under IARC. All of the oils in this product have been demonstrated to contain less than 3% extractables by the IP 346 test.
- **Mutagenicity** : Not expected to be mutagenetic.
- **Toxicity for reproduction** : Not expected to be toxic.

11.2. Information on likely routes of exposure:

- **After ingestion** : Ingestion may cause nausea, vomiting and diarrhoea.
- **After inhalation** : Not expected to present a significant inhalation hazard under anticipated conditions of normal use.
- **After skincontact** : Repeated or prolonged skin contact may cause irritation.
- **After eyecontact** : Slight eye irritant upon direct contact.

11.3. Symptoms related to the physical, chemical and toxicological characteristics:

- **General** : No adverse symptoms/effects were noted.

11.4. Delayed and immediate effects as well as chronic effects from short and long-term exposure:

- **General** : No acute or delayed symptoms or effects are anticipated if first aid treatment is applied and is effective.

11.5. Other toxicological information : During use in engines, contamination of oil with low levels of cancer-causing combustion products occurs. Used motor oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used motor oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water. Avoid prolonged contact with used motor oil.

SECTION 12. Ecological information

12.1. Toxicity:

- **Acute (short-term) toxicity:** : No specific toxicity data on this product available.
- **Chronic (long-term) toxicity:** : No specific toxicity data on this product available.

12.2. Persistence and degradability : No data available.

12.3. Bioaccumulative potential : No data available.

12.4. Mobility in soil : It is to be expected small mobility in soil. Some or a few components may get into the soil and may cause pollution of ground water.

12.5. Results of PBT and vPvB assessment : This mixture does not contain any substances that are assessed to be a PBT or a vPvB.

12.6 Other adverse effects : None known.

SECTION 13. Disposal considerations

13.1. Waste treatment methods:

- **Waste disposal** : Dispose of this material and its container to hazardous or special waste collection point, in accordance with local, regional, national and/or international regulation. Recover waste liquids for recycling/re-use. See Directive 2001/118/EC.
- **Waste Code European Waste List** : 13 02 05 - mineral-based non-chlorinated engine, gear and lubricating oils.
  15 01 10 - packaging containing residues of or contaminated by dangerous substances.

SECTION 14. Transport information

Not regulated.

SECTION 15. Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture:

15.1.1 National regulations:

- **Germany** : Water Hazard Class: 1 - slightly hazardous to water
- **Netherlands** : Water pollution effect indication (11): Slightly harmful to aquatic organisms. Abatement effort: B

15.1.2 International Regulations:

- **Europe** : All components listed in the European Inventory of Existing Commercial Chemical Substances (EINECS)
- **Australia** : All components are in compliance with chemical notification requirements in Australia. (AICS)
- **Canada** : All components are in compliance with the Canadian Environmental Protection Act (CEPA) and are present on the Domestic Substances List.
- **USA** : All components of this material are on the US Toxic Substances Control Act (TSCA) inventory or are exempt.

15.2. Chemical safety assessment : No chemical safety assessment has been carried out for this mixture.

SECTION 16. Other information

- **Indication of changes** : Revision according to Regulation (EU) No 453/2010 amending Regulation (EC) No 1907/2006.
- **Abbreviations and acronyms** : ACGIH = American Conference of Industrial Hygienists
  CLP = Classification and Labelling of Substances and Preparations
  DOT = Department of Transport
  EC = European Commission. EN = European Norm
  IARC= International Agency for Research on Cancer
  IP = Institute of Petroleum
  ISO = International Organization for Standardization
  NLGI = National Lubricating Grease Institute
  PBT = Persistent Bioaccumulative and Toxic
  PCA = Polycyclic Aromatics
  SAE = Society of Automotive Engineers
  TLV = Threshold Limit Value. TWA = Time Weighted Average
  vPvB = very Persistent and very Bioaccumulative
  VG = Viscosity Grade

SECTION 16. Other information (continued)

· Key literature references and sources for data	: Concawe Report 01/53, Concawe Report 01/54, Concawe Report 05/87, Regulations (EC) No 1907/2006, 1272/2008 & 453/2010 of the European Parliament and of the Council.
· List of relevant **R-phrases**	: R41 : Risk of serious damage to eyes. R43 : May cause sensitization by skin contact. R51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R53 : May cause long-term adverse effects in the aquatic environment.
· Training advice	: See Product Data Sheet for detailed information.

The contents and format of this SDS are in accordance with COMMISSION REGULATION (EU) No 453/2010 of 20 May 2010 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

DISCLAIMER OF LIABILITY The information in this SDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use or disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This SDS was prepared and is to be used only for this product. If the product is used as a component in another product, this SDS information may not be applicable.

End of document

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SAFETY DATA SHEET
HYDRO TECH HVI 100

Prepared according to Annex II of EC regulation 1907/2006

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

PRODUCT NAME HYDRO TECH HVI 100

SUPPLIER
OMV PETROL OFİSİ A.Ş.
Ayazağa Eski Büyükdere Cad.
No:33-37 B Blok 34398
Maslak-Istanbul/TURKEY
Tel: +90 212 329 1500
Fax: +90 212 329 1896
www.poas.com.tr
info@poas.com.tr

PRODUCT NO. 22146

APPLICATION Industrial oil

EMERGENCY TELEPHONE POAŞ: +90 212 329 1845 (office hours)

2 HAZARDS IDENTIFICATION

Not regarded as a health or environmental hazard under current legislation.

ENVIRONMENT

The product is not expected to be hazardous to the environment.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Name	EC No.	CAS-No.	Content	Classification (67/548)
Alkyl phenol			< 1%	N;R50/53.
Calcium alkaryl sulfonate			< 1%	Xi;R36/38.
Calcium long chain alkylphenate sulfide			< 1%	R53.
HYDROCARBONS, C20-50, SOLVENT DEWAXED HEAVY PARAFFINIC, HYDROTREATE (DMSO<3% by IP 346)	292-617-9	90640-95-2	85-95%	-
Phenol 4-dodecyl			< 1%	Repr. Cat. 3;R62. Xi;R38.
Zinc alkyldithiophosphate	272-028-3	68649-42-3	< 1%	Xi;R38,R41. N;R51/53.

The Full Text for all R-Phrases are Displayed in Section 16

COMPOSITION COMMENTS

Some substances are not classified by legistlation.They are self classified by the manufacturer. The DMSO extract by IP 346 of the oil is less than 3%

4 FIRST-AID MEASURES

INHALATION

Move the exposed person to fresh air at once. Rinse nose and mouth with water. Get medical attention if any discomfort continues.

INGESTION

NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! Rinse mouth thoroughly. Get medical attention if any discomfort continues.

SKIN CONTACT

Remove affected person from source of contamination. Remove contaminated clothing. Wash the skin immediately with soap and water. Get medical attention if any discomfort continues.

HYDRO TECH HVI 100

EYE CONTACT

Make sure to remove any contact lenses from the eyes before rinsing. Promptly wash eyes with plenty of water while lifting the eye lids. Continue to rinse for at least 15 minutes. Get medical attention if any discomfort continues.

5 FIRE-FIGHTING MEASURES

EXTINGUISHING MEDIA

This product is not flammable. Use fire-extinguishing media appropriate for surrounding materials.

SPECIAL FIRE FIGHTING PROCEDURES

Avoid breathing fire vapours.

PROTECTIVE MEASURES IN FIRE

Self contained breathing apparatus and full protective clothing must be worn in case of fire.

6 ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS

Wear protective clothing as described in Section 8 of this safety data sheet.

ENVIRONMENTAL PRECAUTIONS

Avoid discharge into drains, water courses or onto the ground.

SPILL CLEAN UP METHODS

Stop leak if possible without risk. Absorb in vermiculite, dry sand or earth and place into containers. Flush with plenty of water to clean spillage area. Do not contaminate water sources or sewer.

7 HANDLING AND STORAGE

USAGE PRECAUTIONS

Avoid spilling, skin and eye contact.

STORAGE PRECAUTIONS

Store in tightly closed original container in a dry and cool place. Keep in original container.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

PROTECTIVE EQUIPMENT

ENGINEERING MEASURES

Provide adequate ventilation. Observe occupational exposure limits and minimize the risk of inhalation of vapours.

RESPIRATORY EQUIPMENT

No specific recommendation made, but respiratory protection may still be required under exceptional circumstances when excessive air contamination exists.

HAND PROTECTION

Use suitable protective gloves if risk of skin contact.

EYE PROTECTION

If risk of splashing, wear safety goggles or face shield.

OTHER PROTECTION

Wear appropriate clothing to prevent any possibility of skin contact.

HYGIENE MEASURES

DO NOT SMOKE IN WORK AREA! Wash at the end of each work shift and before eating, smoking and using the toilet. Wash promptly if skin becomes wet or contaminated. Promptly remove any clothing that becomes contaminated. Use appropriate skin cream to prevent drying of skin. When using do not eat, drink or smoke.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Liquid		
COLOUR	Yellow		
ODOUR	Characteristic.		
RELATIVE DENSITY	0,88 g/ml 15	**VISCOSITY**	90-110 cSt 40
FLASH POINT (°C)	238 OC (Open cup).		

HYDRO TECH HVI 100

10 STABILITY AND REACTIVITY

STABILITY

Stable under normal temperature conditions.

CONDITIONS TO AVOID

Avoid excessive heat for prolonged periods of time. Avoid contact with strong oxidisers.

MATERIALS TO AVOID

Strong oxidising substances.

HAZARDOUS DECOMPOSITION PRODUCTS

Fire creates: Carbon monoxide (CO). Carbon dioxide (CO_2).

11 TOXICOLOGICAL INFORMATION

INHALATION

In high concentrations, vapours may irritate throat and respiratory system and cause coughing.

INGESTION

May cause discomfort if swallowed.

SKIN CONTACT

Liquid may irritate skin.

EYE CONTACT

Spray and vapour in the eyes may cause irritation and smarting.

12 ECOLOGICAL INFORMATION

ECOTOXICITY

Not regarded as dangerous for the environment.

MOBILITY

The product is miscible with water. May spread in water systems.

13 DISPOSAL CONSIDERATIONS

DISPOSAL METHODS

Dispose of waste and residues in accordance with local authority requirements.

14 TRANSPORT INFORMATION

GENERAL	The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID). No transport warning sign required.
ROAD TRANSPORT NOTES	Not Classified
RAIL TRANSPORT NOTES	Not classified.
SEA TRANSPORT NOTES	Not classified.
AIR TRANSPORT NOTES	Not classified.

15 REGULATORY INFORMATION

RISK PHRASES

NC	Not classified.

SAFETY PHRASES

NC	Not classified.

STATUTORY INSTRUMENTS

Chemicals (Hazard Information and Packaging) Regulations.

APPROVED CODE OF PRACTICE

Classification and Labelling of Substances and Preparations Dangerous for Supply. Safety Data Sheets for Substances and Preparations.

GUIDANCE NOTES

Workplace Exposure Limits EH40. CHIP for everyone HSG(108).

16 OTHER INFORMATION

HYDRO TECH HVI 100

REVISION COMMENTS

Company name changed

ISSUED BY

Certificated from the Turkish Standards Institute (TSE) to prepare Safety Data Sheet (Certificate no: SDS - 0397)

REVISION DATE	17.06.2011
DATE	14.09.2010

RISK PHRASES IN FULL

NC	Not classified.
R36/38	Irritating to eyes and skin.
R38	Irritating to skin.
R41	Risk of serious damage to eyes.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R53	May cause long-term adverse effects in the aquatic environment.
R62	Possible risk of impaired fertility.

DELTREX CHEMICALS

A Division of Campbell Brothers Limited
ABN 92 009 657 489
7-11 Burr Court
Laverton North
3026
Postal Address:
P.O Box 118, Newport
Victoria 3015
AUSTRALIA
Telephone: 61/3/9250-1000

FERRIC CHLORIDE SOLUTION 42%

ISSUED: OCTOBER , 1999

Hazardous according to criteria of Worksafe Australia.

IDENTIFICATION

TRADE NAME :	Ferric Chloride Solution 42%
OTHER NAMES :	Ferric Chloride Solution
U.N. NO. :	2582
DG CLASS :	8
HAZCHEM :	2Z
PACKING GROUP :	III
POISON SCHEDULE :	None Allocated
USES :	Water treatment. General Chemical

PHYSICAL DESCRIPTION/ PROPERTIES

Appearance, odour : Reddish liquid with faint odour of hydrogen chloride.

Melting Point : Not available.

Boiling Point : 105 -110°C

Vapour Pressure (20°C) : Not available.

Specific Gravity (20°C) : 1.45

Flash Point : >160°C

Flammability Limits (%) : Not available.

Vapour Density (air=1) : 1.5kg/m3

%Volatile by volume : 58

Solubility : Completely soluble in water.

OTHER PROPERTIES

Autoignition Temp (°C) : Not available.

pH : 1 - 2

Viscosity : 13 mPa.s

Bulk Density : 1440 kg/m3

Reactivity : Highly corrosive to most metals liberating flammable hydrogen gas. Hydrogen Chloride is produced on hydrolysis. Reactive with oxidising agents and strong bases.

INGREDIENTS

Chemical Name CAS Number Proportion

Ferric Chloride 7705-08-0 42%

Hydrogen Chloride 7647-01-0 <1%

Water 7732-18-5 to 100%

HEALTH HAZARD INFORMATION

HEALTH EFFECTS

No adverse health effects expected if the product is handled in accordance with this Safety Data Sheet and the product label where applicable. Symptoms that may arise if the product is mishandled are:

ACUTE EFFECTS

SWALLOWED: Swallowing large amounts may cause nausea, vomiting, diarrhoea, abdominal pain, irritation of the gastrointestinal tract and circulatory collapse.

EYE: Liquid or vapour may cause severe eye irritation. Corrosive to eyes. Contamination can result in permanent injury. Contact can cause corneal burns.

SKIN: Contact with skin may cause irritation. May cause staining of the skin.

INHALED: Exposure to vapour may cause irritation to mucous membrane and respiratory tract.

CHRONIC EFFECTS

No information available.

FIRST AID

SWALLOWED: Wash out mouth with plenty of water and give water to drink. DO NOT INDUCE VOMITING. Seek immediate medical assistance.

EYE: Immediately irrigate with copious quantities of water for at least 15 minutes. Eyelids to be held open. Seek immediate medical assistance.

SKIN: Wash contaminated skin with plenty of soap and water. Remove contaminated clothing and wash before re-use. If swelling, redness, blistering or irritation occurs seek medical advice.

INHALED: Remove victim from exposure - avoid becoming a casualty. Remove contaminated clothing and loosen remaining clothing. Allow patient to assume most comfortable position and keep warm. Keep at rest until fully recovered. For all but the most minor symptoms, arrange for victim to be seen by doctor as soon as possible.

ADVICE TO DOCTOR

Treat symptomatically as for acidic material and iron salts. Can cause corneal burns and conjunctival ulceration.

PRECAUTIONS FOR USE

EXPOSURE STANDARDS

None established for this material. Exposure standard for constituents are:

Iron salts, soluble as Fe: TWA: 1mg/m3

Hydrogen Chloride, hydrolysis product: TWA : 7.5 mg/m3 (5ppm)

As published by the National Occupational Health & Safety Commission (Worksafe Australia).

ENGINEERING CONTROLS

Ensure ventilation is adequate to maintain air concentrations below recommended exposure standard. Avoid generating and inhaling mists. Use with local exhaust ventilation or while wearing acid mist respirator or air supplied mask. Keep containers closed when not in use.

PERSONAL PROTECTION

Avoid skin and eye contact and inhalation of vapour. Wear overalls, chemical goggles and impervious gloves. Use with adequate ventilation. Respiratory protection is required if concentration exceeds exposure standard. Wear acid mist respirator. Always wash hands before smoking, eating, drinking or using the toilet.

FLAMMABILITY

Non combustible material.

SAFE HANDLING INFORMATION

STORAGE AND TRANSPORT

Store in cool dry, well-ventilated place. Keep containers closed when not in use. Do not store with incompatible products such as oxidising agents, cyanides, metals, strong bases and foodstuffs. Classified as a Class 8 Dangerous Good according to the Australian Code for the Transport of Dangerous Goods by Road or Rail.

SPILLS

Increase ventilation. Wear protective equipment to prevent skin and eye contamination and inhalation of vapours. Contain using sand or soil - prevent run off into drains and waterways. Use absorbent (soil, sand, vermiculite or other inert material). Neutralise with lime or soda ash. Collect and seal in properly labelled drums for disposal. Wash down area with large quantities of water. If contamination of sewers or waterways has occurred advise the local emergency services.

DISPOSAL

Refer to State Land Waste Management Authority.

FIRE/EXPLOSION HAZARDS

Not flammable. Can liberate flammable hydrogen gas upon contact with most metals. On burning will emit toxic fumes such as hydrogen chloride. Keep containers cool with water spray. Fire fighters to wear self-contained breathing apparatus if risk of exposure to vapour or products of combustion.

EXTINGUISHING MEDIA: Water, foam, dry agent (carbon dioxide, dry chemical powder).

OTHER INFORMATION AND REFERENCES

ENVIRONMENTAL IMPACT

Product has low potential for bioaccumulation.

Harmful to fish and aquatic invertebrates.

TOXICITY

Oral LD50 (rat): 2900 mg/kg

Hazard Category: Irritant

RISK PHRASES

R41: Risk of serious damage to eyes

SAFETY PHRASES

S25: Avoid contact with eyes.

S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S28: After contact with skin, wash immediately with plenty of water.

S39: Wear eye/face protection.

PRINCIPAL REFERENCE

Safety Data Sheet - Ferric Chloride Liquor 42%

Orica Australia Pty Ltd

Issued March 98

CONTACT POINT

Phone: (03) 9250 1000
Phone: 1 800 628 724 (24hr - Emergency Contact)

This MSDS has been prepared from current technical data and summarises at the date of issue our best knowledge of the health and safety information of the product, and in particular how to safely handle and use the product in the workplace. Each user should read this MSDS and consider the information in the context of how the product will be handled and used in the workplace.

If clarification or further information is needed to ensure that an appropriate assessment can be made, the user should contact this company. Our responsibility for products sold is subject to our standard terms and conditions, a copy of which is sent to our customers and is also available upon request

END OF MSDS NO 080

Safety Data Sheet

TILLFLOCK serie 1xx-9xx / serie 5xxx-9xxx polvere cationica

Safety Data Sheet dated 24/11/2008, version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Trade name: TILLFLOCK serie 1xx-9xx / serie 5xxx-9xxx polvere cationica
Trade code: 0212545
Product type and use: flocculant
Supplier:
SPA TILLMANNS Via B. Crespi 10/a 20159 MILANO
Emergency telephone number of the company and/or of an authorised advisory centre:
SPA TILLMANNS MILANO TEL +39 (0)2 6940.1
Competent person responsible for the safety data sheet:
D.ssa Daniela Marciano
D.ssa Daniela Marciano sds@tillmanns.it

2. HAZARDS IDENTIFICATION

No specific hazards are encountered under normal product use.
The product is an organic powder. Danger of explosion in presence of airborne dust and electrostatic discharge or sparks.
Warning: spilled product is slippery if wet or moisted.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Cationic poliacrylamide
CAS Number: 69418-26-4 Ethanaminium, N,N,N-trimethyl-2-[(1-oxo-2-propen-1-yl)oxy]-, chloride (1:1), polymer with 2-propenamide
Hazardous components within the meaning of EEC directive 67/548 and corresponding classification:
None

4. FIRST AID MEASURES

In case of skin contact:
Wash with plenty of water and soap.
In case of eyes contact:
Wash immediately with water for at least 15 minutes.
If irritation persists, obtain medical examination.
In case of Ingestion:
Drink slowly about 750 ml of water; then 250 ml every 10 minutes. Obtain medical examination immediately, showing the safety data sheet.
Do not give anything to drink if the patient is unconscious. Do not induce vomiting.
In case of Inhalation:
Ventilate the premises. The patient is to be removed immediately from the premises contaminated and made to rest in a well ventilated area. Should the patient feel unwell, consult a physician.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media:
Water.
Extinguishers not to be used:
Full spray jet: the product is very slippery when wet.
Risks arising from combustion:
Avoid inhaling the fumes.
Protective equipment:
Use protection for the respiratory tract.

6. ACCIDENTAL RELEASE MEASURES

Measures for personal safety:

Do not inhale dust.
Danger: very slippery when wet.
Use gloves and protective clothing.

Environmental measures:

Avoid airborne dust formation: danger of explosion in case of electrostatic dischages or sparks occur.
Limit leakages with earth or sand.
If the product has escaped into a water course, into the drainage system, or has contaminated the ground or vegetation, notify the competent authorities.

Cleaning methods:

Recover the product with a vacuum cleaner or a damp cloth. Do not sweep up to avoid creation of airborne dust.
Recover the product for re-use if possible, or for elimination. The product might, where appropriate, be absorbed by inert material.
After the product has been recovered, rinse the area and materials involved with water.

7. HANDLING AND STORAGE

Handling precautions:

Avoid contact and inhalation of the dust. See, too, paragraph 8 below.
Do not smoke while working.
Do not eat or drink while working.

Storage conditions:

Keep away from water or from damp surroundings.
Do not use iron, copper or alluminium containers, piping or devices because the solution can corrode them.

Instructions as regards storage premises:

Adequately ventilated premises.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Precautionary measures:

Give adequate ventilation to the premises where the product is stored and/or handled.

Respiratory protection:

Ensure a good ventilation on the working place. If the dust concentration is high anyway, use adequate protection devices (EN 149 FFP2S).

Protection for hands:

Use protective gloves, rubber or PVC.

Eye protection:

Safety goggles.

Protection for skin:

No special precaution must be adopted for normal use.

Exposure limit(s) (ACGIH):

None

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and colour:	white powder
Odour:	tipical
pH:	n.a.
Melting point:	n.a.
Boiling point:	n.a.
Solid/gas flammability:	n.a.

Explosive properties:	n.a.
Oxidizing properties:	N.A.
Solubility in water:	soluble

Bulk density: 600 - 900 g/L

10. STABILITY AND REACTIVITY

Conditions to avoid:

Stable under normal conditions.
The product is an organic powder. Danger of explosion in presence of airborne dust and electrostatic discharge or sparks.

Substances to avoid:

Avoid contact with reactive chemicals.

Hazardous decomposition products:

Burning may produce carbon monoxide and/or carbon dioxide.

11. TOXICOLOGICAL INFORMATION

There is no toxicological data available on the mixture. Consider the individual concentration of each component to assess toxicological effects resulting from exposure to the mixture.
Set out below is the toxicological information relating to the main substances in the preparation.
Acute toxicity:
LD50 oral, rat > 5000 mg/Kg

12. ECOLOGICAL INFORMATION

Adopt sound working practices, so that the product is not released into the environment.
The product is strongly bonded to sludges.
Toxicity, fishes:
LC50 >100 mg/l
Daphnia magna, 48 h

13. DISPOSAL CONSIDERATIONS

Recover if possible. In so doing, comply with the local and national regulations currently in force.
Where applicable, refer to the following regulatory provisions : 91/156/EEC, 91/689/EEC, 94/62/EC and subsequent amendments.

14. TRANSPORT INFORMATION

Not regulated.

15. REGULATORY INFORMATION

Council Directive 67/548/EEC (Classification, packaging and labelling of dangerous substances) and subsequent amendments. Commmission Directive 1999/45/EC (Classification, packaging and labelling of dangerous preparation) and subsequent amendments. Commission Directive 98/24/EC (Protection of the health and safety of workers from the risk related to chemical agent). Commission Directive 2000/39/EC (Occupational exposure limit values). Regulation (EC) No 1907/2006 (REACH).
The preparation should not be considered as dangerous accordingly to dir. 1999/45/EC.

Where applicable, refer to the following regulatory provisions :

Ministerial circulars 46 e 61 (Aromatic amines).
Regulation (EC) nr 648/2004 (Detergents).
Directive 2003/105/CE ('Activities linked to risks of serious accidents').
Presidential Decree D.P.R. 250/89 (Labelling of detergents).

16. OTHER INFORMATION

Paragraphs modified from the previous revision:

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING
2. HAZARDS IDENTIFICATION
3. COMPOSITION/INFORMATION ON INGREDIENTS
4. FIRST AID MEASURES
5. FIRE-FIGHTING MEASURES
6. ACCIDENTAL RELEASE MEASURES
7. HANDLING AND STORAGE
8. EXPOSURE CONTROLS/PERSONAL PROTECTION
9. PHYSICAL AND CHEMICAL PROPERTIES
10. STABILITY AND REACTIVITY
11. TOXICOLOGICAL INFORMATION
12. ECOLOGICAL INFORMATION
13. DISPOSAL CONSIDERATIONS
15. REGULATORY INFORMATION

Main bibliographic sources:

NIOSH - Registry of toxic effects of chemical substances (1983)
I.N.R.S. - Fiche Toxicologique
ACGIH - Threshold Limit Values - 2004 edition
ADR 2007 (ECE/TRANS/185, Vol I and II, and any corrigenda or amendment later published).

The information contained herein is based on our state of knowledge at the above-specified date. It refers solely to the product indicated and constitutes no guarantee of particular quality.
It is the duty of the user to ensure that this information is appropriate and complete with respect to the specific use intended.
This MSDS cancels and replaces any preceding release.