

**WasteServ Malta Ltd**

# **IPPC APPLICATION FOR THE INSTALLATION OF A HAZARDOUS WASTE INCINERATOR**

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## **IPPC APPLICATION**



**VERSION 6: 20<sup>TH</sup> SEPTEMBER 2007**



**WasteServ Malta Ltd**

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ASSOCIATES  
ENVIRONMENTAL  
CONSULTANTS

**Installation for the Incineration of  
Hazardous Waste**

**IPPC Application**

**Prepared for WasteServ Malta Ltd  
by**

**Adi Associates  
Environmental Consultants Ltd**

**September 2007**

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## QUALITY ASSURANCE

**WasteServ Malta Ltd  
Installation for the Incineration of  
Hazardous Waste  
IPPC Application**

**VERSION 6**

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**Report for:**

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## I. INTRODUCTION

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- I.1. This chapter briefly introduces the Installation of the Thermal Treatment Facility at Marsa and the history to the development of this Facility. Further details on the installation can be found in subsequent chapters particularly Chapter 4.
- I.2. Through this IPPC Application, WasteServ Malta Ltd (“WasteServ”) is seeking to obtain a permit to operate the new incinerator located at the Civil Abattoir in Marsa (approved by MEPA development permit PA 2201/01)<sup>1</sup> to thermally treat abattoir and hazardous (including clinical) waste.
- I.3. WasteServ Malta Ltd will be responsible for the Plant’s daily operation and its management with the assistance of an experienced Plant Manager who is competent in managing such a facility and to fulfil all the IPPC conditions imposed by MEPA.
- I.4. The Facility that is subject of this IPPC Application<sup>2</sup> comprises the incinerator that was approved to treat abattoir waste under PA 2201/01 with the modifications and additions subsequently made to allow the Facility to treat hazardous and clinical waste.
- I.5. This Report provides the full responses in support of the IPPC Application.

### BACKGROUND

- I.6. This section provides a background to the IPPC Application. This is important because it provides an explanation to the changes being made to the Incinerator (approved by PA 2201/01).
- I.7. The Facility was originally designed by the Veterinary Services to incinerate 12,910 tonnes of animal and food derived waste only<sup>3</sup>. This volume of waste was necessary to ensure that the incinerator would operate all year round stopping only for routine maintenance. Due to the low calorific value of these waste streams, a large amount of diesel fuel would need to be used on a daily basis to operate the incinerator.
- I.8. The Facility that was approved under PA 2201/01 to treat abattoir waste comprises the following:
  - A reception facility where waste is received in purpose built bins or is loaded into them;
  - A climate controlled bin storage facility for 240 bins;

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<sup>1</sup> The original application was submitted by the Veterinary Services Division.

<sup>2</sup> Integrated Pollution Prevention and Control Regulations, 2002 (Legal Notice 234 of 2002).

<sup>3</sup> AIS Environmental / SLR Consulting, 2006, Incinerator at the Public Abattoir, Environmental Planning Statement

- A loading facility where waste from the bins is emptied into a shredder and passed by way of an auger through a chute that feeds the primary combustion chamber;
- A shredder;
- A bin washing facility;
- A blood storage tank which accepts blood directly from the abattoir;
- A hopper to receive shredded waste;
- A rotary kiln primary combustion chamber;
- A post-furnace chamber;
- A secondary combustion chamber;
- An emergency stack;
- A boiler and economiser;
- Dissipater-condenser;
- Condensate recovery tank;
- Degasser;
- Blow-down tank;
- A flue gas treatment system;
- Ash dumping and transfer system<sup>4</sup>;
- A hopper for the collection of combined bottom ash and fly ash;
- Silos for the storage of reagents and reagent metering control units; and
- An emissions stack.

I.9. **Appendices 1** and 2 show the layout of the plant permitted under PA 2201/01 and the process flow respectively.

I.10. The installation that is subject of this IPPC Application is described in further detail in subsequent sections.

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<sup>4</sup> As currently designed, this system does not separate fly and bottom ash. The upgraded plant will include such a separation system.

### **Rationale behind the Change from an Incinerator to Treat Abattoir Waste Only to one that also Treats Clinical and Hazardous Waste**

- I.11. Since the planning application for the incinerator was submitted in 2001 but the planning permission only granted in 2006, the figures of animal waste generated in the Maltese Islands have changed significantly in the intervening period (AIS Environmental, 2006<sup>5</sup>).
- I.12. In view of this, various studies were commissioned to establish the exact quantities of animal waste that are currently being produced locally. As described above, the original design was based on a waste production figure of 12,910 tonnes per annum that needs to be incinerated. A Study carried out by the Management Efficiency Unit (MEU)<sup>6</sup> concluded that as at September 2006 the amount of abattoir waste was 9,850 tonnes of which 3,460 tonnes per annum may be considered as contaminated and therefore must be thermally treated.
- I.13. The MEU Study also showed that with some modifications (described elsewhere in this IPPC document) the plant could incinerate clinical, pharmaceutical, and industrial (hazardous) waste. The MEU Study states that this mix of waste could be supplemented by Refuse Derived Fuel (RDF) when there is not enough waste to maintain operation; this would secure the thermal capacity of the plant (average of 5.29 MW). This would allow the plant to operate 24 hours a day, 7 days a week, for 310 days (7,446 hours) a year; the remaining days in the year being when the plant is shut down during routine maintenance and in emergencies. This view is also supported by WasteServ who have been entrusted with overseeing the upgrade of the plant.

### **INSTALLATION DEFINITION**

- I.14. This Section seeks to define the “most apt description” of the process as well as the extent of the IPPC Installation based upon a Limb (i) (Stationary Technical Unit) and Limb (ii) (Directly Associated Activities) analysis carried out in line with the guidance in UK Environment Agency IPPC Regulatory Guidance Series Number 5<sup>7</sup>.
- I.15. In defining the extent of the IPPC Installation the first step is to define the “most apt description” of the process in terms of the most appropriate section of Schedule I of the (local) IPPC Regulations, 2002.
- I.16. According to Malta’s IPPC Regulations the installation falls under Section 5.1 of Schedule I, “Installations for the disposal or recovery of hazardous waste as defined in Schedule 4 and Schedule 6 (operations R1, R5, R6, R8, and R9) of the Waste Management (Permit and Control) Regulations, with a capacity exceeding 10 tonnes a day”.

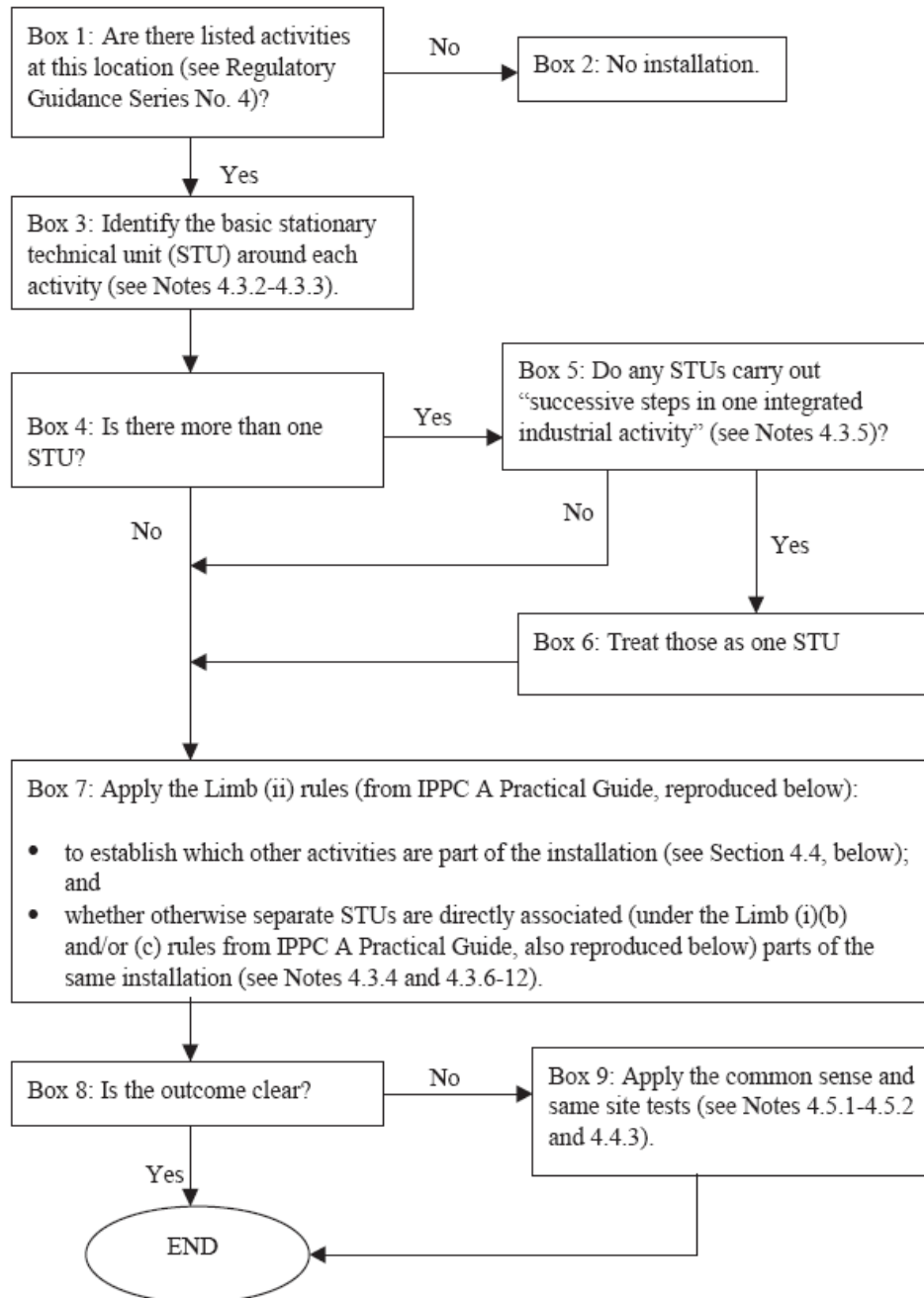
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<sup>5</sup> AIS Environmental, 2006, Proposal for a Modification to the Public Abattoir, Project Description Statement.

<sup>6</sup> Management Efficiency Unit, 2006, Assessing the Feasibility of an Upgraded Abattoir Thermal Treatment Facility.

<sup>7</sup> Environment Agency, 2004, IPPC Regulatory Guidance Series, No. 5, Interpretation of “Installation” in the PPC Regulations.

I.17. In the absence of local guidelines on the interpretation of the Regulations, the UK IPPC Regulatory Guidance Note No. 5 identifies a “common sense” methodology for defining the extent of the IPPC Installation by first identifying the Stationary Technical Unit [Limb (i)] and then all other Directly Associated Activities [Limb (ii)]. It is illustrated by the following flow sheet:



- I.18. The above methodology has been used to define the installation for this IPPC Application. The UK guidance is used because the definition in the local regulations is the same as the UK one.

*“Installation” means a stationary technical unit where one or more activities listed in Part 1 of Schedule 1 are carried out; and any other location on the same site where any other directly associated activities are carried out which have a technical connection with the activities carried out in the stationary technical unit and which could have an effect on pollution.”*

- I.19. In this context, the “Stationary Technical Unit” comprises any unit that can carry out the function (incineration) on its own in a controlled manner and for a sufficient period of time for it to reach its designed or intended use.
- I.20. The “Directly Associated Activities” are defined as those that are connected to the stationary unit they are directly associated with, and must have the potential for an effect on the environment<sup>8</sup>.
- I.21. The Installation that is the subject of this IPPC Application comprises the units described in the following paragraphs. **Appendix 14** contains a description of all these parts.

### **Stationary Technical Unit**

- I.22. The Stationary Technical Unit (STU) comprises the following components:
- Waste reception facility including storage for all waste types ;
  - Bin lifting systems;
  - Shredder;
  - Feeding equipment including injection lances and feed hopper;
  - Primary Combustion Chamber;
  - Post-furnace chamber;
  - Secondary Combustion Chamber
  - Emergency flue;
  - Energy recovery system; and
  - Flue Gas Treatment Plant including injection for urea, boiler, economiser, dry reagent storage tank, bag house filter, and emissions stack.

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<sup>8</sup> Department for Environment, Food and Rural Affairs, 2005, Integrated Pollution Prevention and Control: A Practical Guide, Edition 4.

## **Directly Associated Activities**

I.23. The Directly Associated Activities include:

- Laboratory;
- Flue Gas Reagents storage;
- Sludge pumping station;
- Plant control room;
- SCADA Control system;
- Fuel Storage tanks;
- Emergency generator;
- Bin washer;
- Bottom ash and fly ash storage facilities;
- Emissions monitoring equipment;
- Water treatment plant;
- Boiler Treatment Chemicals – Reactant Dosage Control Unit;
- Blow-down vessel; and
- Water reservoirs.

I.24. **Appendix 3** shows the layout of the Facility. The various components of the plant and the installation operation are discussed in subsequent Sections of this Application. **Appendix 14** contains a description of the Installation.

I.25. The Plant has been guaranteed by the plant manufacturer to operate 24 hours a day 310 days a year (the rest of the 55 days will be taken up for maintenance, if these are required). The maximum thermal capacity of the plant is 5.7 MW and the minimum capacity is 4.3 MW.

I.26. The various components of the plant are described hereunder.

## **STATIONARY TECHNICAL UNIT**

### **Waste Reception Area**

I.27. This consists of the reception area for abattoir waste, clinical waste, Refuse Derived Fuel (RDF) and spent solvents and sludges. Abattoir and clinical waste and RDF will be received in the area adjacent to the refrigerated room whereas hazardous

solvents and sludges will be received in a separate area to the south of the main incinerator building in appropriately built refrigerated rooms.

### ***Bin insertion bay***

- I.28. This is the area where identification, weighing, and classification of the type of waste contained in the bins (abattoir, clinical and RDF) are carried out before they are inserted into the storage room. Information about their characteristics is automatically recorded into the computerised system through loading cells for reading the weight and the use of an operator keyboard for assigning the type of waste contained in the bin. The bin insertion bay comprises:
- Lifting platform with electro-hydraulic controls for lifting the bin to the height necessary for insertion into the first level of the storage room;
  - Equipment for identifying the bin; and
  - Equipment for measuring the weight of the bin.
- I.29. The bin insertion comprises a forward movement chain system for transferring the bin to the station for pick-up by the travelling elevator positioned inside the refrigerator room together with a series of guards to guarantee operator safety.
- I.30. The travelling elevator is used to perform bin loading and unloading operations inside the refrigerator. It has a maximum lifting capacity of 1,000 kg and an installed electrical power of 7 kW. Detailed specifications of the operation of this device are found in **Appendix I4**.

### ***Refrigerated room***

- I.31. The refrigerated room is located at the eastern boundary of the incineration building. It is the room into which bins are loaded from the bin insertion bay. The structure comprises a metal framework that has a storage capacity of 240 bins; these bins are inserted into the refrigerator at different levels. For each level there are 6 sliding channels with a capacity of 10 bins per channel, giving a total of 240. The forward movement of the bins in the various channels is provided by the presence of a transport system with a driving bar, driven by an electro-mechanical chain system with alternative linear movement. The application of this particular transport system allows a bin to be inserted in the channel required at any time, with the possibility to remove bins from the other side. A series of safety devices are fitted to prevent accidental falling of bins from the high levels.

### ***Temporary storage of solvents and sludges***

- I.32. Solvents and sludges delivered on site will be unloaded and secured in a purposely-built refrigerated facility to be located to the south of the incinerator building. This Facility will only store solvents and sludges until the necessary tests are conducted to determine the composition and acceptability for thermal treatment of these materials. Following testing, sludges are transferred by fork lift to the sludge pump

room (described below) and solvents are stored in the solvent tanks described below.

### **Spent solvents storage tanks**

- I.33. The spent solvents storage tanks area has been designed according to ATEX<sup>9</sup> standards. The tanks are protected against the sun by a purposely-built shed. Each tank is contained in a bunded area with a capacity of 110% of the volume of each tank. The area is equipped with heat detectors and a fixed fire extinguisher system that uses foam. There are three cylindrical vertical stainless steel tanks (2 tanks with a capacity of 10 m<sup>3</sup> and 1 tank of 2 m<sup>3</sup>). The tanks are double walled and made of steel. The tanks are refrigerated and externally insulated; they are prearranged to store solvents under a nitrogen atmosphere and are equipped with a double conservation vent, double relief valves, and a level control and measurement system. Every tank has a dedicated ring pipeline and pneumatic pump to the feeding unit of the solvent burner. Solvents are transferred from the drums to the storage tanks via corrosion-proof pneumatic transfer pumps. The pipeline that transfers solvents from the tanks to the solvent burner is specifically designed for the conveyance of flammable liquids. It is double walled and comprises a corrugated primary pipe, surveillance space and a containment pipe. A double layer of bitumen and a polyethylene jacket protect the outermost part of the pipe.

### **Sludge Pumping Station**

- I.34. The sludge pumping station is located in the ancillary building to the main incinerator building. It is adjacent to the workshop. Sludge will be delivered in proper feeding tanks (maximum weight 2000 kg) that will be transported by forklift from the temporary storage area (where they will be stored until they are tested) to the sludge pumping station. The station comprises a metering pump with a maximum capacity of 350 kg per hour and a piping line to the incinerator.

### **Bin Lifting Systems**

- I.35. From the refrigerated room, abattoir waste and RDF will be transported to a shredder via a bin lifting mechanism. Clinical waste will by-pass the shredder as explained below. The bin lifter / tipper is designed to lift waste bins to the level of the grinding unit's feeding hopper with simultaneous automatic tipping so that the contents of the bin are completely emptied into the hopper. This bin lifter has a maximum lifting capacity of 800 kg and can lift bins up to 7.5 metres. An accident-prevention safety barrier secures the area.
- I.36. Whole animal carcasses will not pass through the shredder but will be loaded onto a separate animal carcass lifter that is designed to lift a whole animal carcass from the road surface to the level of the grinding unit's feed hopper with simultaneous automatic transfer of the carcasses into the hopper. The lifting device has a

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<sup>9</sup> ATEX Directive 94/9/EC - Equipment and protective systems intended for use in potentially explosive atmospheres

maximum lifting capacity of 1,200 kg and can lift bins to 7.5 metres. The loading surface on which carcasses are deposited can, with a few simple mechanical operations, be removed and replaced with a lifting car similar to the one provided inside the lifter, thus making it possible to handle roadside containers in the event of temporary non-operation of the lifter.

- I.37. Clinical waste will not pass through the shredder. When clinical waste is stored in the refrigerator, following a call command by the operator for that bin, the clinical waste bin will automatically by-pass the shredding area and will go outside to be received by the operator. The bin will be brought to the bins elevator specifically designed for clinical waste. This bins elevator is located within the incineration building and is at ground floor level adjacent to the feeding hopper (which is at a higher level, located directly in front of the Primary Combustion Chamber as explained below). At floor level, next to the bins elevator there is a weighing and data recording station which sends data to the SCADA system. After emptying into the feed hopper, clinical waste bins will pass through the refrigerated room on a dedicated railway and will be sent automatically to the bin washing machine. Alternatively the bins can be manually wheeled to the bin washing area.

### **Shredder**

- I.38. The shredder or grinding unit has a capacity of 2,000 kg per hour. This is an industrial grinder that has a grinding surface of 760 x 1060 mm with 19 grinding stones. The grinder comprises a loading hopper, a grinding unit with two contra-rotating shafts and relative drive unit, an unloading unit, and an electric drive system interlocked with a reverse system in case of overloading. The hopper, made entirely of AISI 304 stainless steel, consists of four slanted panels connected to each other via seam welding. Its entrance dimensions are approximately 3700 x 2500 mm. The grinder will only shred abattoir waste and RDF.

### **Feeding Equipment**

- I.39. This comprises a system to feed abattoir waste, RDF, clinical waste, spent solvents and sludges into the rotary kiln.

### **Solid waste transfer**

- I.40. The solid waste transfer section comprises:
- First collection tank for the ground product;
  - Screw bed extractor;
  - Transfer screw unit; and
  - Metered feed unit.

- I.41. The useful capacity of the first collection tank is 1.7 m<sup>3</sup>. It is made from stainless steel. The tank body is provided with a visible sight glass and with minimum and maximum level sensors aimed at the automatic crosscheck of the functionality of both the grinder unit and extractor.
- I.42. The screw bed extractor, with a 5° tilted bottom, is specifically designed for extraction of slaughter by-products from the deposit tanks. It consists of four 250 mm diameter coils placed side by side and driven, two at a time, by means of a chain transmission. The extractor's operation is interlocked with that of the transfer screws, so that if any of them is blocked, it is stopped.
- I.43. Transfer screws, are 6.2 metres in length, have a trough channel and a very thick, 250 mm diameter propeller in stainless steel. These types of screws have been chosen to prevent as far as possible the obstructions which afflict traditional screws. Each screw is equipped with its own drive unit whose operation is interlocked with the operation of the transport systems positioned further downstream, so that if one of the screws closer to the furnace stops, this will cause the feeding system before it to stop automatically.
- I.44. The metered feed unit is composed of a compensation manifold in stainless steel and a screw conveyor without intermediate supports; there is a cooling jacket to prevent overheating.

#### ***Blood transfer***

- I.45. The section for refrigerated storage and transfer of blood produced from the civil abattoir and from the grinding process comprises the following:
- Storage tank;
  - Cooling liquid refrigerator; and
  - Feeding system.
- I.46. The blood storage tank has a capacity of 15 m<sup>3</sup> with a transfer pump of maximum delivery of 350 litres per hour. The storage tank is vertical, cylindrical, and made from stainless steel. It is equipped with an upper hatch with two partial and total discharge gates; a double acting valve for bleeding during the filling phase and air intake during the discharge phase; dial thermometer; fixed washing ball in stainless steel; multi-blade vertical motorised mixer; cooling liquid circulation space; and external insulation.
- I.47. The blood storage tank is cooled by a closed circuit refrigerating unit with glycol water at a temperature of 0°C with a thermal head of 5°C.
- I.48. The feeder system for blood from the refrigerated tank is composed of a group of two single-screw type positive-displacement pumps, one of which is for normal operation and the other for stand-by. The single-screw pump is the most suitable equipment for the transport of thick liquids containing solids in suspension. The

pump's operation is managed by a control system which receives signals from both the level probe installed in the storage tank and the temperature control system in the combustion chamber. In the case of the level probe, the pump is automatically stopped to prevent it from operating unnecessarily should the level of the liquid inside the tank drop to below the minimum; the temperature control in the combustion chamber, causes the pump to stop in the event that an excessive inflow of liquids causes the temperature to drop abnormally compared to the normal operating value.

### ***Injection lances***

- I.49. Liquid sludge is injected into the system via a purposely-built injection lance. A sludge atomising lance is installed near the primary burner; it can only operate if the temperature in the primary combustion chamber is at the current combustion temperature (850°C) and the primary burner is in operation. It is made from stainless steel; the atomizing medium is compressed air with a maximum pressure of 6 bar. Sludge pressure is adjustable and the adjustable sludge rate and can reach a maximum of 350 kg/hour.
- I.50. There is an atomizing lance for organic wastewater that is installed near the primary burner. This lance transports wastewater from the washing of the shredder and the blood vessel only. This is enabled only if there is the correct temperature in the primary combustion chamber and if the primary burner is in operation. It is made from stainless steel and the atomizing medium is compressed air at a maximum pressure of 6 bar.

### ***Feed hopper***

- I.51. The feed hopper installed directly in front of the Primary Combustion Chamber (PCC) receives all the waste prior to discharge into the PCC. The feed hopper system includes a chute, the hopper itself, a compacting lid, a hydraulic ram, a double fire door, and a water cooling system. The hopper has an internal capacity of approximately 1 m<sup>3</sup> and its dimensions are 700 x 830 x 1750 mm. Clinical waste is fed into the hopper under negative pressure. The hopper lid is able to compact waste with a hydraulic activator. The guillotine fire door has a hydraulic activator that is equipped with a shield against thermal radiance when the primary combustion chamber inlet is opened and the waste is rammed in. The feeding rate is 12 cycles per hour equivalent to 12 m<sup>3</sup> per hour. There is also a safety water spraying system operating into the hopper.

### ***Primary Combustion Chamber***

- I.52. The primary combustion chamber is the first chamber that receives waste to be burnt from the feeding hopper. It consists of a rotating drum tilted by about 2° in relation to the horizontal plane. The shell is composed of very thick carbon sheet steel. The useful internal diameter is 1.9 metres and the internal length is 11 metres. The useful volume is 31 m<sup>3</sup> and the average rotation speed is 0.2 rpm. The entire cylinder is lined internally with a total thickness of 300 mm consisting of insulating

materials positioned in contact with the shell; for the inner layer a vibrated jet of refractory concrete with a high alumina content, low cement content and high abrasion resistance. The refractory material can resist continuous working temperatures of up to 1600°C (please refer to **Appendix 14** for further technical details).

### ***Modulating burner***

I.53. The primary burner is used to heat the primary combustion chamber. It is designed for functioning in the following ways:

- Only with diesel; or
- Diesel and solvents mixed together in a variable way; however for safety reasons, it cannot function only on solvents – it requires a minimum of 49 kg/hr of diesel as a baseline.

I.54. The specifications of the burner are:

- Range (max / min) of modulating power: 100% / 12.5%
- Modulating range in mass on diesel only: 390 / 49 Kg/h (4.62 / 0.58 Mw)
- Range in volume for the diesel + solvents mix: 480 / 60 ltrs/hr

(Reference is made to the volume rather than mass; power is not referred to because the specific weight of the solvents and its calorific value are variable and different from those of diesel).

I.55. The primary chamber will be pre-heated using fuel; when the temperature is over 850°C solvent can be used. **Appendix 19** contains the technical specifications of the burner.

### **Post-furnace Chamber**

I.56. This is the connecting element between the primary combustion chamber's rotating drum and the fumes' post-combustion chamber. In the post-furnace, which actually makes up the first part of the secondary combustion chamber, the solid products and gases resulting from the combustion of waste are separated. Structurally similar to the other two combustion chambers it has an external structure in arc-welded carbon steel framework and an internal lining with an overall thickness of 270-300mm, made of two layers of material, acting as thermal insulation and as a refractory covering with high thermal resistance. At the point where the combustion chamber joins the post-furnace, a sealing element is positioned while a suitably sized hatch permits access, when the furnace is cold. The lower part of the post-furnace has a frustum of pyramid connection, again made from refractory material, to the slide system for evacuation of ashes.

## Secondary Combustion Chamber

I.57. The secondary combustion chamber (SCC), also referred to as the post-combustion chamber, is the unit inside which fumes coming from the PCC are completely oxidised and deodorised. The chamber is sized so as to guarantee a stay time of at least two seconds at a temperature of 850°C and in the presence of free oxygen content of more than 6%. It has a useful volume of 35m<sup>3</sup>. It is placed horizontally and in line with the primary combustion chamber. It comprises flanged sections with support structure and shell made from carbon steel, and the entire cylinder is internally lined with a total thickness of 300 mm of insulating and refractory material made partly from insulating bricks positioned in contact with the shell and partly (the inner layer) from a vibrating jet of refractory concrete with about 60% alumina, low cement content and highly resistant to temperature (maximum operating temperature of 1,650°C). Suitable expansion joints are provided both lengthwise and cross-wise, to guarantee the necessary structural stability of the shell. The auxiliary post-combustion burner can use both methane gas or diesel oil with an automatic fuel switching system. It is a modulating burner with a flame regulator and the maximum thermal power supplied is 6,175 kW.

I.58. The following calculations prove that the residence time in the afterburner is according to the EU Directive. The internal dimensions of the cylindrical part of the afterburner are:

$$\begin{aligned} \text{Internal diameter} &= 1.900 \text{ m} & \text{Internal length} &= 12.380 \text{ m} \\ \text{Volume} &= 35.10 \text{ m}^3 \end{aligned}$$

Maximum admissible peak gas flow  $V = 14,000 \text{ Nm}^3/\text{h}$  (wet)<sup>10</sup> with O<sub>2</sub> > 6% (in SCC)

Design temperature 950° > 850°C – which is the temperature level required by EU WID 2000/76/EC

Flow transformation coefficient  $C_t = (950+273)/273=4.479$  to obtain the effective load

$$\text{Residence time (sec.)} = (V \times 3600) / (C_t \times V)$$

$$\text{Residence time (sec.)} = (35.10 \times 3600) / (4.479 \times 14000) = 2.015 > 2 \text{ sec as required by EU WID 2000/76/EC.}$$

I.59. There is also an additional, safety-orientated, useful post-combustion volume not included in the calculation above, formed by the upright, descending square-section connection component, placed between the cylindrical SCC chamber and the boiler inlet, designed to increase the effective residence time.

<sup>10</sup> The contribution of water (24kg/hr) contained in the Urea solution (total of 36kg/hr), (urea amounts to 12kg/hr as described in Appendix 6), for the eventual use of deNO<sub>x</sub>, is minimal (equivalent to 30 Nm<sup>3</sup>/h of steam) when compared to the total amount of flue gas generated.

- I.60. The volume of the vertical connecting chamber between the SCC and the boiler, whose main function is to contribute to the reduction of dust in the boiler, can be considered useful to increase the residence time.

Added Volume of the connected element:

First horizontal section: 1,200 × 1,200 mm

Second vertical section: 1,200 × 1,150 mm

Total additional volume at the end of the post-combustion chamber: 4.70m<sup>3</sup>

New total volume useful for post-combustion: 35.10 + 4.70 = 39.8m<sup>3</sup>

If we assume:

Working temperature of 950°C (superior to the minimum requested temp of 850°);

Maximum wet design flow: 14000Nm<sup>3</sup>/h;

Transformation coefficient delivered from 0°C to 950° : 4.479

Effective flow: 4.479 × 14,000 = 62,706 m<sup>3</sup>/h

New residence time:  $(39.8 \times 3,600) / (4.479 \times 14,000) = 2.285 > 2.000$  sec (as requested from the EU WID 2000/76/EC) is superior by 14.25% of the minimum value requested.

- I.61. The manufacturers state that, for certain solutions adopted at the Installation such as the low velocity of the fumes at the exit of the PCC and with a rational control of the combustion, the phenomenon of ash accumulation in the secondary combustion chamber will be limited.
- I.62. Accumulation of ashes can increase with the drastic increase of RDF respective to the hypothetical value and simultaneously a substantial decrease in the liquids and materials that are very humid. In this hypothesised circumstance, suitable solutions to minimize the negative impacts must be adopted as described hereunder. For this reason incineration of RDF will be kept to a minimum and if possible avoided.
- I.63. To prevent the fusion of ashes on the refractory and to avoid their adhesion to the bottom part of the SCC, it may be required to use, only after testing, a layer of stones. This layer would cover the cylindrical bottom part of the SCC and would have a thickness of 4 cm. This layer would be removed together with the ash every 2.5-3 months during programmed maintenance works. This layer would give a reduction in volume of the SCC of 0.56 m<sup>3</sup>. Since, as shown above, there already is an excess in utilisable volume (4.7 m<sup>3</sup>), this gives the Plant an adequate margin of safety to operate normally between one maintenance period and the next in case that there is a problem with the temporary reduction of the useful volume due to dust deposition. Residence time will not go below 2 seconds. Another issue that

contributes to the margin of safety is the temperature that has been assumed at 950°C but with respect to normal operation can also be reduced so long as the temperature remains above 850°C (in accordance with the WID). A reduction in temperature means a reduction in the effective flow rate and therefore an increase in residence time as compared with the volume of the SCC.

- I.64. Considering a reduced temperature in the SCC of 900°C, the coefficient of transformation of the normalised flow of 14,000 Nm<sup>3</sup>/hr is  $(900+273)/273 = 4.297$ . Effective flow at 900° is  $4.297 \times 14,000 = 60,154$  m<sup>3</sup>/hr. Residence time is  $(39.8 \times 3,600) / (4.297 \times 14,000) = 2.382$  seconds. This is 19.1% greater than the minimum 2 seconds required by the WID. Using the same calculations to estimate residence time with the layer of stones, the residence time would be 2.35 seconds  $((39.8-0.56) \times 3,600) / (4.297 \times 14,000) = 2.348$  seconds).
- I.65. The eventual accumulation of ashes on the bottom of the chamber can be monitored through visual inspection from the outside through the inspection hole in the SCC during maintenance periods.

### Emergency Flue

- I.66. The emergency flue is inserted near the end section of the secondary chamber. Its function is to discharge fumes directly into the atmosphere, only and exclusively in emergency conditions when for safety reasons they cannot be transferred through the recovery boiler and the bag filter. The emissions emerging from the Emergency Stack are described in **Appendix 6 – Raw Flue Gas**.
- I.67. The Stack is made from carbon sheet steel externally protected by a protective cycle with paint for marine atmospheres; internally it is lined with 100 mm of light refractory concrete. It has an inner diameter of 1.3 metres and a height of 18 metres.
- I.68. At the outlet there is a refractory counterbalance valve with proper sealing system against smokes, normally open when the plant is at a standstill and held closed by means of a pneumatic cylinder during its regular operation. This check valve opens automatically thanks to the discharge of compressed air present in the supply circuit, which is also equipped with a manually opened safety blow-down valve.

### Energy Recovery System

- I.69. The fumes from the Secondary Combustion Chamber then pass through a boiler and economiser that reduce the temperature from a maximum of 950°C to approximately 180°C.
- I.70. The recovery boiler has an exchange surface of 262 m<sup>2</sup> with tubes arranged vertically in a  $\Omega$  shape (vertical pipes connected at the top to the main cylindrical body and at the bottom to two cylindrical bodies)– the configuration is such that it guarantees a high ratio of circulation between delivery tubes. The gases in transit run through the exchanger in a single passage without interposition of deviating septa; the latter

would encourage accumulation of ashes or residues that are not easy to remove. The tube used is in carbon steel without welding. The manufacturer guarantees the use of the boiler through water tubes for operating with intake gas with an operating temperature of 950°. The tubes used are those indicated by European regulations for these applications.

- I.71. The front fume chamber is vertical, equipped with a top inlet positioned immediately above the upper cylindrical body. It is internally insulated with a double layer of insulating and refractory concrete in order to limit its heat dispersion and it is provided with a bolted inspection hatch. The volume of this chamber (internal dimensions 1,000 x 1,150 mm) is such that the ashes and slag carried by the fumes can be separated, encouraging down flow in an orthogonal direction to the boiler axis and creating a chamber with the dual function of improving the gas flow distribution over the entire front area of the pipe bundle and, at the same time, encouraging the slag to drop into the collection hopper. The hopper is positioned in the lower part of the chamber and is equipped with a double discharge slide gate to prevent air from infiltrating. The rear fume chamber (internal crosswise dimensions 500 x 1,000 mm) allows the fumes to escape at the top towards the economiser; it is provided with a bolted inspection hatch.
- I.72. The chamber has two points: a downstream drawing point at the economizer and an upstream introduction point for a partial gas circulation system; this is to cool the gas before it enters the boiler. This plant engineering solution is designed to prevent the adhesion of fly ash to the tube bundle.
- I.73. This recirculation of flue gas has been installed in case it is required to reduce the temperature of the flue gas prior to the boiler. This will only affect the flow through the boiler and the economizer. The re-circulating gas will be extracted from the outlet of the economizer while the introduction of this air will be injected in the area between the boiler and the SCC. The air flow will not affect the PCC or the SCC, consequently it will not increase the flue gas flow and therefore it will not reduce the residence time inside the SCC.
- I.74. The purpose of the economiser is to further reduce the temperature of the fumes by heating the feedwater and or the condensate by a further 100 to 120°C. It comprises a fume /water heat exchanger with only one duct. It has a heat exchange area of 55 m<sup>2</sup> and the fumes enter it at 300°C and leave at 180°C. The tubes are positioned vertically.
- I.75. A dissipater / condenser is used to condense and cool the steam (at 10 bar) generated by the boiler to 80°C if this is not utilised. Cooling is achieved by force feeding air at ambient temperature into the pipes of the condenser and making the air circulate from bottom to top by a helical fan. A condensate recovery tank, of capacity 8m<sup>3</sup> collects the condensate. A degasser is positioned directly above the condensation tank.

## Flue Gas Treatment Plant

- I.76. The FGT system located downstream of the energy recovery / fume cooling system is of the “dry” type and includes a section for neutralisation of the acid components contained in the fumes and guarantees an average emissions concentration of the main pollutants in the emissions that is compatible with the limits laid down in Directive 76/2000/ EC. The reduction of NO<sub>x</sub> is however carried out in the secondary combustion chamber by direct injection of urea or a water-ammonia solution (please see P&I diagram in **Appendix 10**).
- I.77. The FGT system comprises the following components:
- Reagent silos, reagent metering, and an injection unit for activated carbon and sodium bicarbonate that will be used to neutralise acid gases in the fumes and to absorb toxic materials, in particular heavy metals;
  - A suction unit;
  - A reactor for the mixing of fumes and reagents;
  - A direct injection lance for the introduction of atomised urea solution to control NO<sub>x</sub> emissions;
  - A bag filter unit;
  - A fly ash recirculation system from the bag house filter to the reactor; and
  - A process stack.
- I.78. The flue-gas cleaning technology capacity for individual pollutant removal determines what wastes can be accepted at the installation.
- I.79. The current installation operates at a maximum total fume (wet) flow rate of 14,700Nm<sup>3</sup>/h at 180°C after the economiser (see table below to show difference in values at filter outlet and SCC).
- I.80. Activated carbon will be used to remove toxic products in the flue gas emitted, particularly heavy metals. Activated carbon will be introduced after the Boiler and Economiser.
- I.81. The current acid neutralization reagent, calcium hydroxide, will be replaced by sodium bicarbonate (NEUTREC process), in order to increase the efficiency of abatement of acid emissions. The reagent dosing system will also be modified to a micro-feeding screw regulated by an inverter.
- I.82. Sodium bicarbonate will need to be crushed prior to being introduced into the system. Extraction and crushing equipment will be installed inside the plant. This consists of a receiving hopper where the big-bags are emptied using a fork lifter. A feeding screw mechanism transfers the material to a crushing mill to achieve the optimal grain size for the neutralising reaction.

I.83. The neutralising reagents (activated carbon and sodium bicarbonate) are stored in 2m<sup>3</sup> silos. The reagents are injected pneumatically into the connecting tubes between the economiser and the reactor. Fumes are mixed with activated carbon and sodium bicarbonate in these tubes and subsequently in the reactor. The operating dosage of the reagents (sodium bicarbonate and activated carbon) will be estimated during commissioning, starting from concentrations determined by theoretical calculations based on the expected concentration of pollutants.

I.84. The fumes then pass into the bag house filter. The bag house technical specifications are the following:

- Maximum filter inlet temperature: 180°C
- Effective flow rate at 180°C 24,400 E<sup>11</sup>m<sup>3</sup>/hour
- Filtering surface 475m<sup>3</sup>
- Number of bags 408
- Maximum filtration rate 0.85/minute
- Bag fabric Polyphenylene sulphide
- Bag Weight 550g/m<sup>2</sup>
- Compressed air consumption at 7 bar 1000NI<sup>12</sup>/minute
- Flow transformation coefficient  $(180+273)/273 = 1.659$
- Filter speed (w=m/min') 0.63 (min); 0.74 (average); 0.85 (max)

I.85. These speed levels guarantee optimum filtration efficiency.

I.86. The gas flow rate at the SCC exit and the filter inlet may vary according to the type of waste mixture, in the following range:

	Minimum wet flow rate	In normal operation	Maximum wet flow rate
SCC exit (V=Nm <sup>3</sup> /h)	10,500	12,250	14,000
Filter inlet (V= Nm <sup>3</sup> /h)	10,900	12,700	14,700

I.87. The temperature of the filter inlet gases, compatible with the bags manufactured in RYTON tissue, is 180°C.

I.88. The dust and the spent reagents are collected from the surface of the fabric filters and are removed by rapidly expanding the bags with air at timed intervals. The dust

<sup>11</sup> Effective

<sup>12</sup> Normal litres

and spent reagent are then collected in the hopper at the base of the filters. Part of this fly ash is re-circulated to the reactor while the other part is conveyed to the ash dumping system.

- I.89. A centrifugal fan (Induced Draft Fan [ID Fan]) located at the clean end of the bag house, prior to the stack, is used to ensure that clean exhaust gases are emitted to the atmosphere via the stack at a minimum velocity of 15 metres per second. The ID Fan ensures a negative pressure throughout the flue gas path.
- I.90. The differential pressure across the filter is used to monitor the need of cleaning. Periodic replacement is required when the residual lifetime is achieved or in the case of irreversible damage (e.g. an increasing loss of pressure may be caused by irreversible deposit of fine dust in the filter material).

## **DIRECTLY ASSOCIATED ACTIVITIES**

### **Laboratory**

- I.91. The laboratory is located in the second floor in the building ancillary to the incinerator as shown in the block plan in **Appendix I2**. The laboratory will be used to test basic waste parameters such as calorific value, flash point, waste compatibility and reactivity.

### **Flue Gas Reagents Storage**

- I.92. The neutralising reagents are activated carbon and sodium bicarbonate. These chemicals are delivered in 1 tonne jumbo bags to the powder room located in the building ancillary to the incinerator building. A fork lifter will transport the bags to a feeding hopper and the contents of the bag discharged gradually into the feeding hopper. A dosing pump equipped with a blower discharges the reagents into the flue gas.

### **Plant Control Room**

- I.93. The plant control room is located within the incinerator building. It is the central area where the operation of the incinerator is controlled and observed.

### **SCADA Control System**

- I.94. The SCADA system is a comprehensive computerised system that regulates the functioning of the entire installation and allows the operator to view the operation inside the incinerator at different stages (see **Figure 8.1** and **Appendix I1**: SCADA system).

### **Fuel Storage Tanks**

- I.95. Fuel is stored in six tanks that are installed on the periphery of the incinerator plant. They are elevated from the ground and at a lower level than the plant itself. Although they are close to the installation and there is direct access to them via a

staircase, they are physically separated from the plant because of the change in level and the high wall between the tanks and the open area in front of the incinerator. The tanks are also located away from residential areas.

- I.96. The tanks are fenced off and are contained in a secure area that is locked (see **Figure I.1**). The location of the fuel storage tanks, away from residential areas and the fact that they are in a contained secure area makes them less susceptible to damage from vehicle collision and vandalism. This is consistent with the requirements of the recommendations contained in the Institute of Petroleum's Code of Practice for Design, Construction, and Operation of Petrol Filling stations (1996)<sup>13</sup>.
- I.97. The horizontal tanks have double chambers with a volume of 15m<sup>3</sup> each for a total storage of 90m<sup>3</sup> that provides one week's self-sufficiency. They are also positioned such that the space in between them allows passage for inspection of the individual tanks.
- I.98. The tanks are filled through a pumping system that is a fixed component of the tank. The fill connection point is located such that there is clear visibility of the tanks during delivery. This is in accordance with recommendations contained in the Code of Practice.
- I.99. The Code of Practice recognises that the risk of fire or explosion is greater at above ground tank sites than at underground tank sites. At such installations there needs to be room for fire fighters to work. Fire protection provisions, such as fire extinguishers and prominently displayed instructions for their use are also required. The site of the fuel storage tanks will require these fire extinguishers together with the necessary instruction.

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<sup>13</sup> Institute of Petroleum, 1996, Code of Practice for Design, Construction, and Operation of Petrol Filling Stations

**Figure I.1: Fuel tanks**



- I.100. The Code of Practice explains that careful inspection of visible surfaces of above ground tanks provides an effective method of leak detection, particularly when the tank is full. Visual inspections are especially effective for horizontal tanks which have few concealed surfaces. Signs of leakage may include the presence of fuel, staining on outer surfaces, or evidence of contaminated ground. Regular inspections will be carried out at the installation to detect leakages.
- I.101. Leaks in aboveground storage systems can result from loose fittings, corrosion, thermal stress, structural failure, or collision. Spills may occur when delivery hoses are disconnected, when tanks are overfilled, or when vandalism occurs. The Code of Practice recommends that the minimum volumetric capacity of the bund area should be at least equivalent to the greatest amount of liquid that can be released from the largest full tanks plus 10%. The bund walls and bottom should be impervious to diesel. There should be no outlet directly connecting the bund to any drain, sewer or watercourse, or discharging to the ground. Rainwater that does not evaporate naturally should be removed by a pump and discharged through an oil separator. Drainage of water from bunded areas should be controlled to prevent contamination.
- I.102. The fuel tank area must include adequate containment to collect any diesel spillages. The bunded area should be at least 17 m<sup>3</sup> and will be constructed of impervious concrete. The bunded area will be inspected prior to commissioning of the plant and

regularly thereafter and any joints that may exist in the concrete surface will be adequately sealed with sealants that are resistant to attack from fuel and oil products.

- I.103. Surface water drainage from the bunded area will discharge through a full retention oil/petrol separator (see **Figure 1.2**). The uncontaminated water from the separator will be discharged to the sewer. The separator filters need to be changed twice a year unless there is a major spillage, in which case the filters would need to be changed immediately. Filters will be considered as hazardous waste and disposed at the Ghallis Hazardous Waste Facility.
- I.104. The plans of the fuel storage tanks are shown in **Appendix 5**.

**Figure 1.2: Diagram of a typical Fuel Separator**



### **Emergency Generator**

I.105. The Diesel Emergency Generator provides a back-up electric supply to the following items:

- The Burner group of the secondary burner;
- Fan of the secondary air (secondary-burner);
- Boiler feeding pump;
- Diesel blow-by pump; and
- All the electric control boards.

I.106. It is located inside the main incinerator building at the south end of the plant.

I.107. For the other cooling components of the Facility, a contractor, who operates a 24-hour service, will supply an emergency generator on demand.

### **Bin Washer**

I.108. The bin washing machine is a cleaning and sanitizing machine that automatically handles 1,110 litre bins. The washing chamber is 2700 x 2000 x 1700 mm in size. There is a bin lifting and tilting machine that loads bins inside the washing chamber with automatic self-centering handle arms. A high pressure system removes dry residues adherent to bin walls. The mechanical action of the water, which is at 120 bar pressure, provides an efficient system for bin cleaning. Water consumption is estimated at 30 litres per bin.

### **Bottom Ash and Fly Ash Storage Facilities**

I.109. Bottom ash is produced from combustion of waste in the PCC. The ash evacuation device is located at the bottom of the post-furnace. It consists of a rigid box structure in carbon steel partly covered with insulating and refractory cement, inside of which is a self-propelled sliding device. It slides on a very thick steel lining. The lining is cooled by a continuous flow of air to prevent deformation caused by contact with the hot ashes.

I.110. The open-bottomed sliding device is driven by a hydraulic cylinder and transfers ash, at a programmable rate, arriving from the post-furnace from the initial falling position to the shuttle conveyor's connecting hopper. At the same time as the ashes fall into the hopper a small quantity of water is sprayed in order to cool them and to impede raising dust caused by their falling into the shuttle below. The ashes discharged into the shuttle are transferred at regular intervals to the collecting point, consisting of a bin, by means of a chain conveyor alternating with forwards-backwards movement. The inside of the conveyor is kept under a slight, constant depression.

I.111. Fly ash and spent reagents from the baghouse filter are collected separately from the bottom ash. This dust from the baghouse filter will be collected in a big bag attached

to the end of the archimedial screw transferring system with a capacity of 1 m<sup>3</sup> (the screw is located beneath the hopper of the baghouse filter).

- I.112. Fly ash from the boiler is also collected separately from the baghouse dust and the bottom ash; it is collected in suitable big bags that are temperature resistant (120-130°C). The bags are connected to the terminal archimedial screw located beneath the boiler hopper and the economiser as shown in the drawings in **Appendix 10**.

### **Emissions Monitoring Equipment**

- I.113. The incinerator is fitted with a System for Continuous Emission Monitoring and Management aimed at emission control and comprises the following devices:
- Thermocouples for measuring the temperature in the combustion and post-combustion chambers (for operation and for safety) at the boiler outlet and in the filter's intake section;
  - A system for the measurement of free oxygen in wet fumes in the last quarter of the post-combustion chamber that includes a solid state probe for detecting the oxygen content with a zirconium oxide cell, a diaphragm pump for supplying sample air, and a flow meter for measuring the flow rate of the sample air;
  - An instrument for the measurement of dust; the system utilises an Opacity meter model LAND 4500nMKII;
  - An instrument for the measurement of the concentration of pollutants in the flue including hydrochloric acid (HCl), carbon monoxide (CO), sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>) and total organic carbon (TOC). The system is of the infrared multi-parameter type with a long optical path and includes sample collection and a preliminary treatment system, connecting tubes, a final sample treatment system and calibration unit and a multi-parameter analyser with infrared beams for the measurement of the various parameters;
  - Fume pressure and water vapour are also measured by transducers, sensitive to each of the two parameters. Both instruments provide a current signal that is sent to a central processing unit and used to record the data monitored;
  - Computerised system for acquisition, supervision, and recording of the plant's process parameters. The SCADA system is a comprehensive computerised system that regulates the functioning of the entire installation and allows the operator to view the operation inside the incinerator at different stages (see **Figure 8.1** and **Appendix 11: SCADA system**).
- I.114. MIR 9000 will be used to monitor emissions continuously. The point of sampling is in accordance with Italian Standard UNI 10169/2001.

### **Water Treatment Plant**

- I.115. The pre-treatment plant for boiler water boiler is designed to treat 2,000 litres per hour of water from the mains network. The plant comprises three units:
- A WSI 200 DUPLEX water softener, with two resin beds with automatic regeneration to remove calcium and magnesium ions from the water;
  - A WP 2400 dechlorinator with one multilayered filter stage, automatic regeneration, which assists the reverse osmosis unit; and
  - BW 80-2500 reverse osmosis unit for the elimination of dissolved mineral salts, bacteria, micro organisms and all solid substances in suspension.
- I.116. Reverse osmosis does not require treatment plants for the depuration of waste waters since it does not use sodium hydroxide and hydrochloric acid, as used by traditional plants.

### **Boiler Treatment Chemicals – Reactant Dosage Control Unit**

- I.117. Boiler water is treated with anti-corrosion and anti-scaling reagent (BT1040) as described in Chapter 3. The reagent dosage control unit comprises a preparation tank with a capacity of 100litres and a dosage pump. Reagents are mixed in the additive / mixing tank and dosed to the boiler through a metered pump.

### **Blow-down vessel**

- I.118. This tank collects the discharges from the boiler. It has a capacity of 3m<sup>3</sup> and operates at atmospheric pressure. It collects the boiler's bottom discharges from the line discharge units.

### **Water Reservoirs**

- I.119. At the Facility there are 4 reservoirs and one contaminated wastewater sump (please refer to **Appendix 12** showing location of reservoirs). The 3 reservoirs located to north of the Site, are used to hold mains water, fire fighting water, uncontaminated surface water. Clean roof water will be collected in the reservoir located in the south western corner of the site. The sump at the entrance to the facility will be used to store contaminated waste.

## 2. SITE HISTORY REPORT

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- 2.1. This Section addresses section **BI.3** of the IPPC Application Form.
- 2.2. The incinerator is sited at the Civil Abattoir in Albert Town, Marsa. The abattoir was established in 1897 and since then it has been upgraded several times, most notably over the last 35 years (see **Figure 2.1**). In 1974, some buildings within the abattoir were demolished and rebuilt. Others were restored since they were recognized as being of importance from an industrial archaeology perspective. Further upgrades to the site were carried out in 1985 and in 1987. In 2004 a mobile incinerator was added to the abattoir. The mobile incinerator was not located at the site of the current incinerator. In addition to these modifications, the use of the buildings themselves has changed frequently.
- 2.3. The Abattoir includes two market halls (both kept at a temperature of 12°C), numerous chillers, including a blast freezer and a storage freezer capable of holding 300 tonnes of packed meat or 150 tonnes of carcass, and an emergency lab. Also on site are offices, a substation, general stores, cattle and pig lairage, a workshop / store and the slaughter halls. The slaughter halls include separate cattle and pig slaughter halls and rooms for casings and tripe (see **Figure 2.2**).
- 2.4. The site currently occupied by the incinerator was not entirely within the curtailage of the public abattoir. Part of the incinerator site consisted of disturbed land and another comprised a small building at the northwest corner; the building can be seen in the 1942 aerial photos. This building was the Old Royal Navy Abattoir which was eventually used as a general storage area. (See **Figure 2.3**).
- 2.5. The 1978 aerial photo shows that the disturbed land previously outside the boundary of the abattoir was being used as an open-air storage area by the abattoir. This tract of land is located within the site of the incinerator. According to a survey of the abattoir carried out in 1968, the storage area was divided into two: one was a scrap metal yard and the other was as a storage yard used by the Civil Abattoir itself (see **Figure 2.3**). The nature of the material stored in the latter yard is not known, however it is likely to be electric cables. Post-1988 aerial photographs show that this area was no longer used for storage; it appears to be vacant / disturbed land. Since then all equipment has been removed and the area re-surfaced.
- 2.6. The land site history and land uses described above indicate that the land should be used for industrial purposes.
- 2.7. The underlying rock comprises Lower Globigerina Limestone overlying Lower Coralline Limestone, the latter being below sea level. In the absence of excavations in the area that would expose the stratigraphy, it is not possible to specify the particular Lower Globigerina bed that is exposed or the degree of fissuring or faulting. However, the Geological Map for the Maltese Islands indicates that there are no faults in the area. The Mean Sea Level Aquifer, which lies in the Lower Coralline Limestone, is not likely to be present beneath the site because of its

proximity to the sea; in 1957 the coastline was on the seaward side of Triq il-Moll. The possibility that Triq il-Moll is on reclaimed land, which extends as far as the seaward side of the shipyard Heavy Plant Maintenance facility (see below) is not discounted.

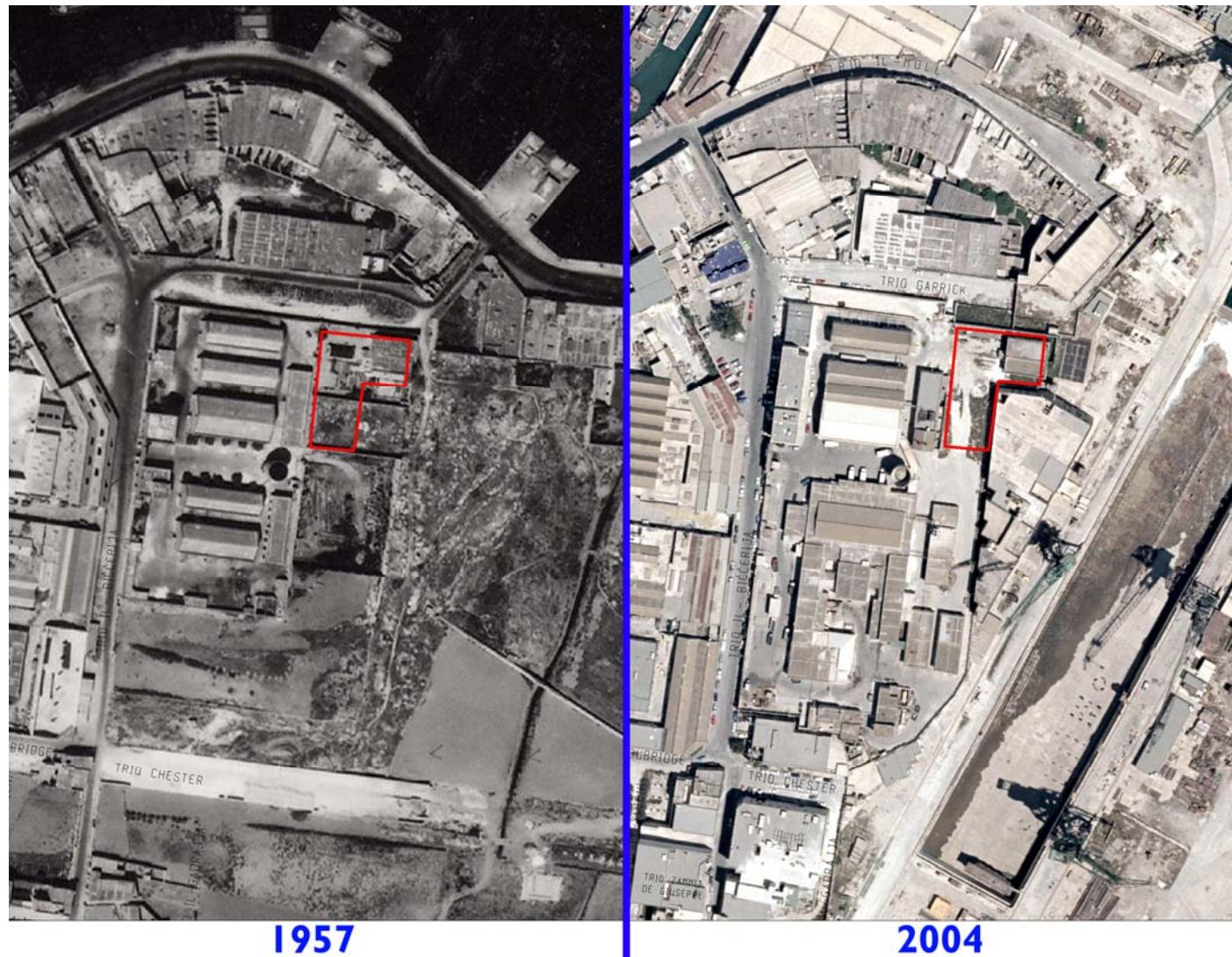
- 2.8. Much of the surrounding area was used for agriculture up to the 1960s. In the 1970s, the construction of the Malta Shipbuilding facilities together with a new reclamation along the seaward side of Triq il-Moll not only changed the shoreline but also initiated the gradual industrialisation of the area. Triq il-Moll, which used to lead to the Kordin and Paola roundabout, was truncated and diverted to Triq Garrick (see **Figure 2.1**).
- 2.9. Between the late 1980s and the early 1990s, the buildings located along the road joining Triq Garrick and Triq il-Moll were occupied by the shipyards. The road connecting Triq Garrick and Triq il-Moll was subsequently closed by *franka* stone walls.

### Land Use

- 2.10. The area surrounding the incinerator site is characterised by land uses related to the Civil Abattoir, port activities, residences, and government departments. A large number of buildings are vacant and falling into disrepair. These include dwellings and garages / warehouses. The land use is described in **Figure 2.4**.
- 2.11. Most buildings on site are two to three storeys high. Several large sites, such as the abattoir and the Public Works site have buildings of varying heights, as shown in **Figure 2.4**.
- 2.12. A brackish water reverse osmosis plant abuts the southern border of the abattoir (see **Figure 2.5**); it was commissioned in 1983. Along Triq il-Princep Bertu are some abandoned dwellings as well as a number of facilities used by meat importers, including cold stores and warehousing facilities together with the related offices and sales areas. Further to the south there is a Church and Convent.
- 2.13. The residential area is confined to the area along Triq il-Princep Bertu and Triq Dr Guzeppi Zammit (see **Figure 2.6**), some 250m south of the incinerator. Dumping of various material including inert waste and wooden pallets occurs behind the Church and in Triq il-Gardalja. Buildings in the latter area are in a neglected state, some of which have been abandoned.
- 2.14. Approximately 270 metres south of the incinerator, along Triq ix-Xwieni, are a number of large garages, one of which is used by a panel beater. All the other garages were closed with no indication of their usage. Two recently built buildings (one extending to Triq il-Princep Bertu) comprising a large garage and two overlying floors are vacant.
- 2.15. Land uses along Triq Troubridge, south of the site, include a large informal parking area, a bar, some abandoned dwellings, and an abandoned construction site. A confectionary lies over two large garages used by a transport services provider.

- 2.16. To the west of the abattoir there are two large government-owned sites. One is used as offices and workshops by the Works Division and the other is the Marsa Open Centre, which houses over 600 illegal immigrants. The Open Centre, situated 180 metres west of the site, was previously used as a trade school. Further west, abutting the Marsa Open Centre, is an old stormwater channel, part of the island's industrial heritage.
- 2.17. The buildings to the north of the site, between Triq il-Moll and Triq Garrick, are mostly abandoned (see **Figure 2.7**). Those buildings still in use on Triq Garrick include a cold store, an ice vendor, and a substation. A carpenter, a sales office, and an importer of timber and building materials are located in Triq il-Moll. Along Triq il-Moll are several identical buildings that are locked; their use is not apparent. Closer to Xatt il-Mollijiet are a bar, two large garages, and a vacant building belonging to a food manufacturing and trading company.
- 2.18. The Malta Shipyard is located to the north and east of the abattoir. The site is mainly used for ship construction and includes related facilities such as a dock, a paint shop, and several stores, as well as a welding school. The site also includes vacant stores and offices. The buildings opposite the northern boundary of the incinerator site form part of the shipyards; they currently house a heavy plant servicing facility on the ground floor with a rock wool store above it. The vacant building next to these was formerly used for offices.

**Figure 2.1: Orthophoto comparison of the Site: 1957 - 2004**



**Figure 2.2: Block plan of the Public Abattoir**

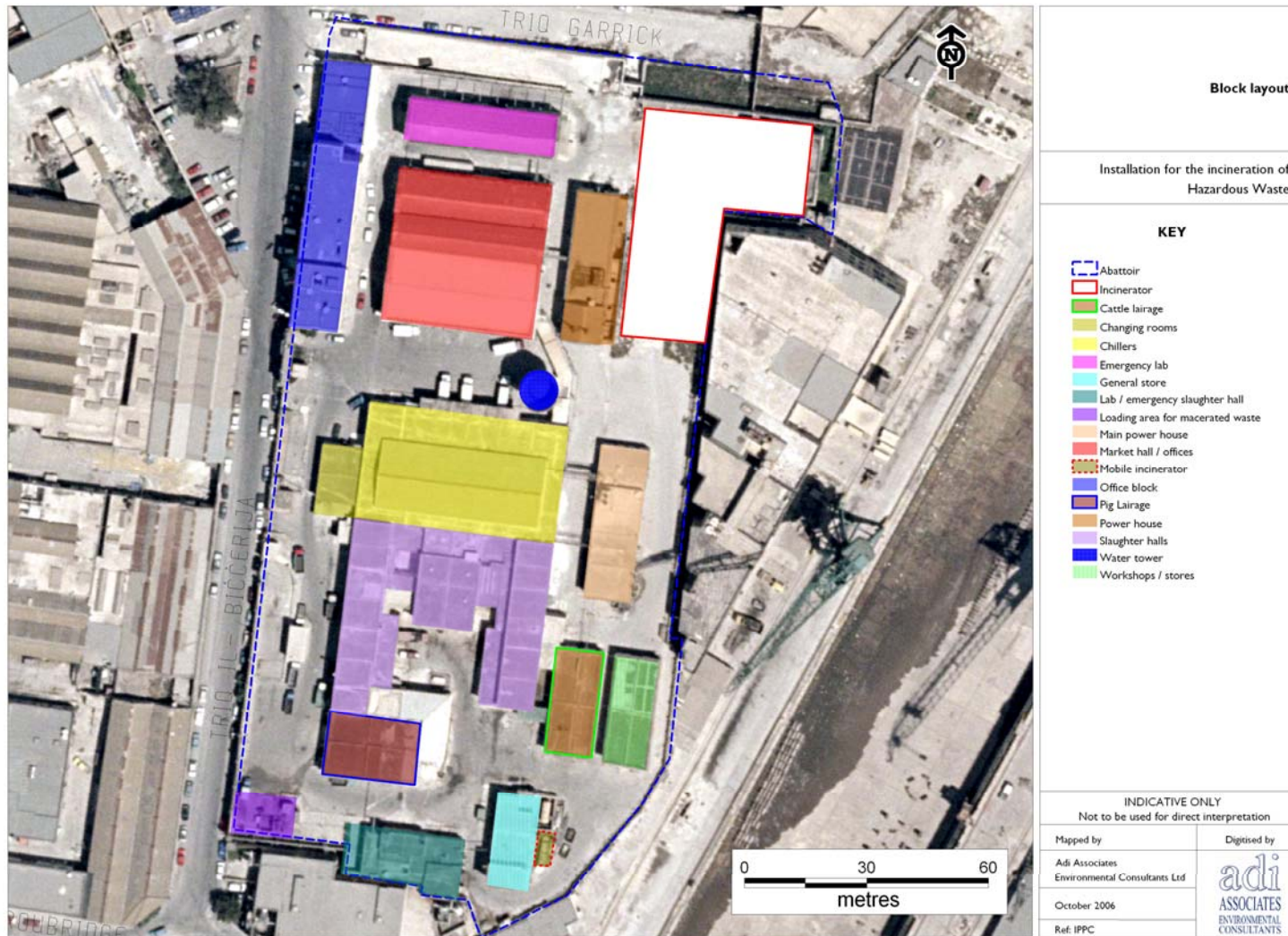


Figure 2.3: Extract from survey plan of the abattoir in 1968

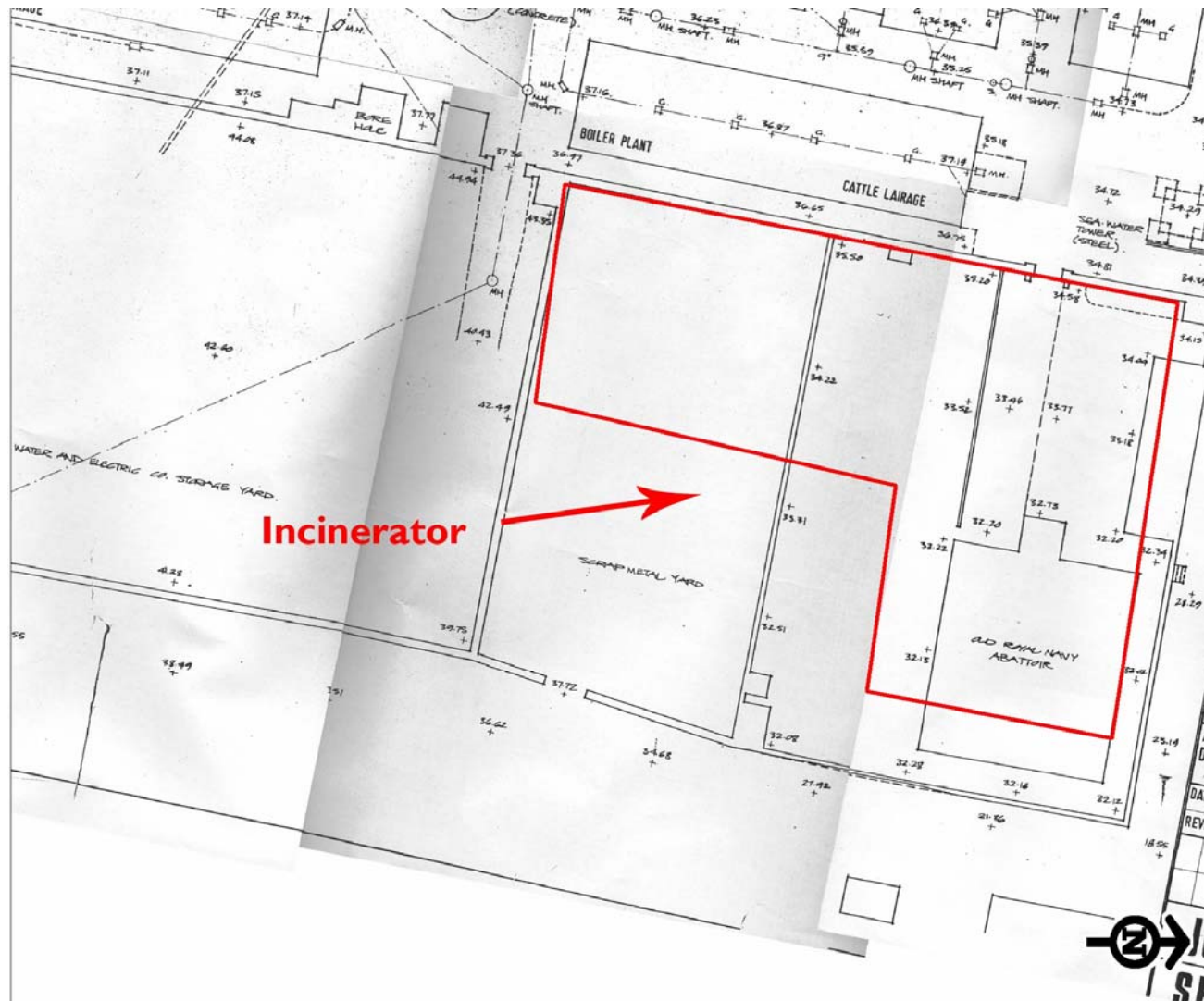
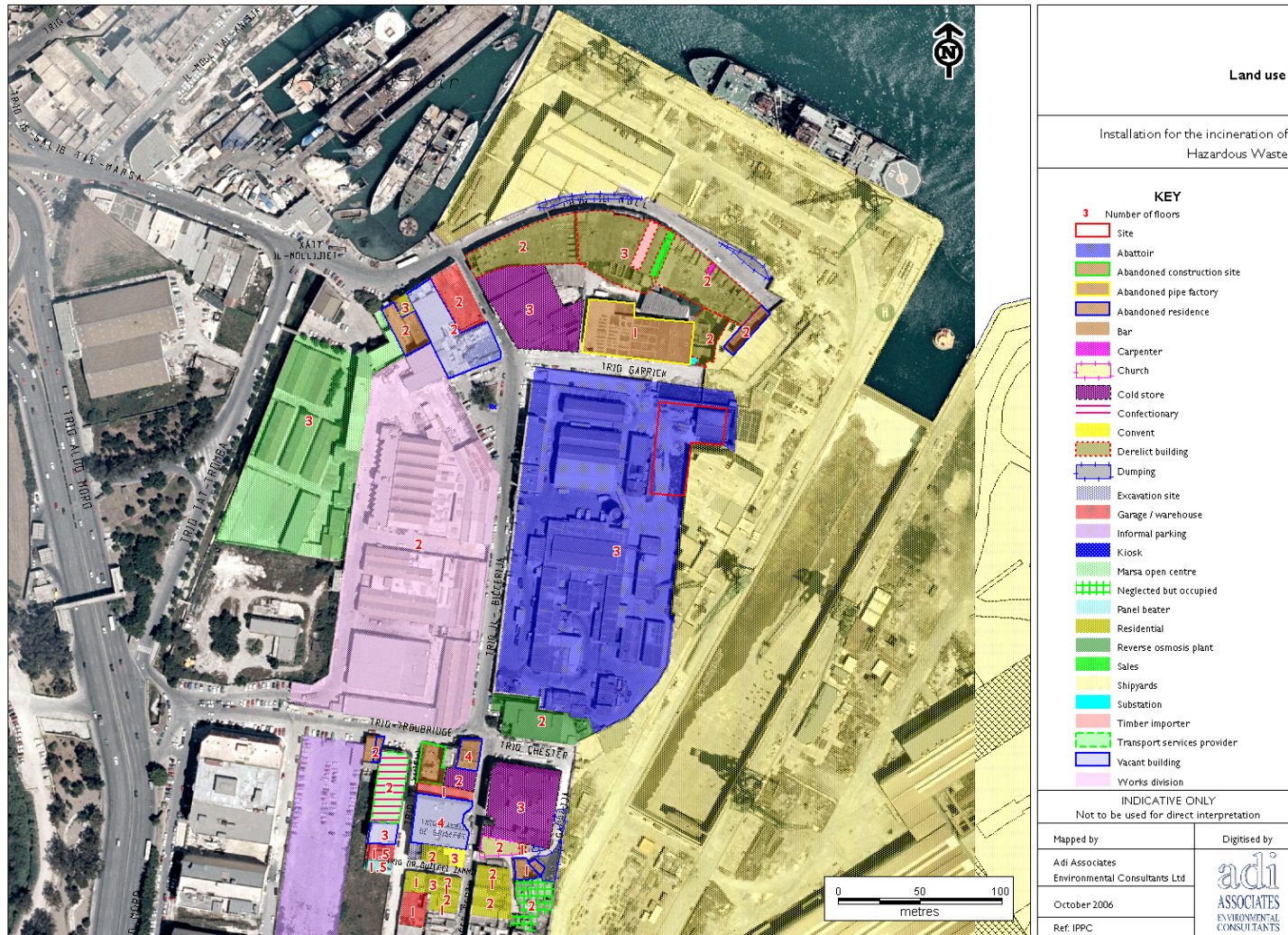


Figure 2.4: Land use



**Figure 2.5: Marsa Reverse Osmosis Plant**



**Figure 2.6: The residential area**



**Figure 2.7: Abandoned buildings on Triq il-Moll**



## 3. RAW AND AUXILIARY MATERIALS

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### RAW AND AUXILIARY MATERIALS CONSUMPTION

- 3.1. This Section addresses section **B2.2** of the IPPC Application Form.
- 3.2. Operation of the installation will involve the use of different materials during various parts of the operation. Inputs into the installation are the various waste streams to be combusted (see **Table 3.1**). In order to operate, the installation will also require fuel input. The flue gas treatment system uses a number of chemicals to neutralise toxic fumes. The following is a list of the raw and auxiliary materials:
- Water;
  - Fuel:
    - Diesel; or
    - LPG (gas).
  - Reagents:
    - Activated carbon and sodium bicarbonate mix;
    - Urea or Ammonia with water; and
    - Demineralising system reagent (boiler water treatment chemicals and additives - BT 1040 consisting of potassium hydroxide and sodium sulphite. Please refer to **Appendix 4** for material safety data sheet).
  - Refrigeration gas:
    - Glycolate water; and
    - R404A for refrigeration room.
  - Chemicals for bin washing<sup>14</sup>.

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<sup>14</sup> Bins will normally be washed with water and sterilised with steam. If, however, the Plant Manager receives a request from a specific client, for example, that require bins to be washed with a specific chemical then the Manager would decide whether or not this can be done, especially considering the quality of wastewater generated. At this stage these chemicals are not known because normal day-to-day operation will not utilise such chemicals.

**Table 3.1: Consumption of raw materials<sup>15</sup>**

Raw material	Physical state	Quantity per annum	Storage	Waste minimization options
Water	Liquid	5,068 m <sup>3</sup>	Mains.	Wash water cannot be recycled because of hygiene reasons
Fuel	Liquid	Between 893 and 1,452 tonnes	Six oil tanks are installed at a lower level on the periphery of the incinerator plant. The tanks have double chambers with a volume of 15m <sup>3</sup> each for a total storage of 90m <sup>3</sup> that provides one week's self-sufficiency. The area is contained to collect any diesel spillages.	Use of liquid hazardous waste as a replacement to fuel and solid and sludge waste with higher calorific value will be mixed with low calorific value waste to improve efficiency of the plant.
Sodium bicarbonate	Solid	186-447 tonnes	Silo inside the installation.	Use of sodium bicarbonate instead of lime
Activated Carbon	Solid	37 tonnes	Silo inside the installation.	N/A
Aqueous Urea	Liquid	268 tonnes aqueous urea solution (33%)	Tank outside the incinerator building.	N/A
Boiler water treatment chemicals – BT1040	Liquid	52.5 kg per year	Tank inside the installation.	N/A
Refrigerant – R404A	Liquid	As required	Maintenance of the refrigeration system will be sub-contracted to specialized firms. Refrigerant will not be stored on site.	N/A
Glycolate water	Liquid	As required	Will be consumed as required and not stored on site.	N/A

<sup>15</sup> Waste streams to be incinerated are listed in subsequent paragraphs.

## WASTE STREAMS TO BE INCINERATED

- 3.3. The Facility has been designed in a modular way to treat different quantities and types / mixes of waste, as long as the maximum thermal capacity of 5.7MW is not exceeded and the chlorine content of the mixed waste fraction is not greater than 1%.
- 3.4. The Facility's maximum thermal capacity is 5.7MW and a minimum capacity of 4.3MW. To illustrate the principle of the modular type of plant the following example is provided: if only abattoir waste is to be incinerated having an average calorific value of 4.2MJ/kg, the maximum quantity of abattoir waste that can be treated per hour is 2,000kg/hr, generating 2.3MW. Hence the other 3MW will be generated by burning diesel. If clinical waste is to be co-incinerated, having an average calorific value of 18MJ/kg, burning 100kg/hr, 0.5MW can be generated; hence replacing some diesel. If liquid hazardous waste is available, having an average calorific value of 20MJ/kg, 450kg/hr can be co-incinerated, generating 2.5MW<sup>16</sup>. Co-incinerating 2,000kg/hr of abattoir waste together with 450kg/hr liquid hazardous waste and 100kg/hr of clinical waste will require very little diesel because these 3 waste streams co-incinerated together will produce the 5.3MW required. If liquid hazardous waste or other type of waste is not available, then diesel or RDF will have to be burned to maintain the 5.3 MW necessary.
- 3.5. Using a modulating burner (see specifications in **Appendix 19**), liquid hazardous waste will be used as necessary when the quantity of the solid waste streams varies or the calorific value of the solid waste fluctuates. Diesel will be used as a back-up source.
- 3.6. **Appendix 6** describes the three scenarios – operation with representative waste mix and the worse case scenario (high water content and high ash content) – together with all the inputs such as diesel and chemicals and outputs including raw flue gas composition, clean flue gas, and ash and steam production.

### European Waste Catalogue Codes

- 3.7. The following is a list of wastes that will be accepted at the incineration facility. The list of wastes should be read in conjunction with the Waste Acceptance Criteria (WAC) described in **Section 5, Management Techniques**. This waste list is based on the results of the MEPA Twinning Project that was carried out in 2007 to collect data on hazardous waste generated in Malta (see **Appendix 7** for results). **Appendix 6** also provides a typical sample of waste mixes that can be incinerated. It is noted that the maximum chlorine and fluorine content in the waste is < 1%. Polychlorinated biphenyl (PCBS) and Polychlorinated triphenyl (PCTs) composites and very stable polychlorinates will not be accepted as the temperature of the post-

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<sup>16</sup> (450kg/hr × 20MJ/kg)/3600 = 2.5MW

combustion chamber required for their dissociation (1200°C) is not compatible with that of the plant

**Non-Hazardous Waste**

**02 01 Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing**

02 01 02 animal-tissue waste

**02 02 wastes from the preparation and processing of meat, fish and other foods of animal origin**

02 02 02 animal-tissue waste

02 02 03 materials unsuitable for consumption or processing

**03 01 Wastes from wood processing and the production of panels and furniture**

03 01 05 sawdust, shavings, cutting, wood, particle board and veneer other than those mentioned in 03 01 04

**04 02 wastes from the textile industry**

04 02 15 waste from finishing other than those mentioned in 04 02 14

04 02 17 dyestuffs and pigments other than those mentioned in 04 02 16

04 02 20 sludges from on-site effluent treatment other than those mentioned in 04 02 19

**06 05 sludges from on-site effluent treatment**

06 05 03 sludges from on-site effluent treatment other than those mentioned in 06 05 02

**07 01 wastes from the MFSU of basic organic chemicals**

07 01 12 sludges from on-site effluent treatment other than those mentioned in 07 01 11

**07 02 wastes from the MFSU of plastics, synthetic rubber and man-made fibres**

07 02 12 sludges from on-site effluent treatment other than those mentioned in 07 02 11

07 02 15 wastes from additives other than those mentioned in 07 02 14

07 02 17 waste containing silicones other than those mentioned in 07 02 16

**07 03 wastes from the MFSU of organic dyes and pigments (except 06 11)**

07 03 12 sludges from on-site effluent treatment other than those mentioned in 07 03 11

**07 04 wastes from the MFSU of organic plant protection products (except 02 01 08 and 02 01 09), wood preserving agents (except 03 02) and other biocides**

07 04 12 sludges from on-site effluent treatment other than those mentioned in 07 04 11

**07 05 wastes from the MFSU of pharmaceuticals**

07 05 12 sludges from on-site effluent treatment other than those mentioned in 07 05 11

07 05 14 solid wastes other than those mentioned in 07 05 13

**07 06 wastes from the MFSU of fats, grease, soaps, detergents, disinfectants and cosmetics**

07 06 12 sludges from on-site effluent treatment other than those mentioned in 07 06 11

**07 07 wastes from the MFSU of fine chemicals and chemical products not otherwise specified**

07 07 12 sludges from on-site effluent treatment other than those mentioned in 07 07 11

**08 01 wastes from MFSU and removal of paint and varnish**

08 01 12 waste paint and varnish other than those mentioned in 08 01 11

08 01 14 sludges from paint or varnish other than those mentioned in 08 01 13

08 01 16 aqueous sludges containing paint or varnish other than those mentioned in 08 01 15

08 01 18 waste from paint or varnish removal other than those mentioned in 08 01 17

08 01 20 aqueous suspensions containing paint or varnish other than those mentioned in 08 01 19

**08 03 wastes from MFSU of printing inks**

08 03 07 aqueous sludges containing ink

08 03 13 waste ink other than those mentioned in 08 03 12

08 03 15 ink sludges other than those mentioned in 08 03 14

08 03 18 waste printing toner other than those mentioned in 08 03 17

**08 04 wastes from MFSU of adhesives and sealants (including waterproofing products)**

08 04 10 waste adhesives and sealants other than those mentioned in 08 04 09

08 04 12 adhesive and sealant sludges other than those mentioned in 08 04 11

08 04 14 aqueous sludges containing adhesives or sealants other than those mentioned in 08 04 13

08 04 16 aqueous liquid waste containing adhesives or sealants other than those mentioned in 08 04 15

**12 01 wastes from shaping and physical and mechanical surface treatment of metals and plastics**

12 01 15 machining sludges other than those mentioned in 12 01 14

12 01 17 waste blasting material other than those mentioned in 12 01 16

12 01 21 spent grinding bodies and grinding materials other than those mentioned in 12 01 20

**15 01 packaging (including separately collected municipal packaging waste)**

15 01 01 paper and cardboard packaging

15 01 03 wooden packaging

**15 02 absorbents, filter materials, wiping cloths and protective clothing**

15 02 03 absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing other than those mentioned in 15 02 02

**16 01 end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**

16 01 15 antifreeze fluids other than those mentioned in 16 01 14

**16 03 off-specification batches and unused products**

16 03 06 organic wastes other than those mentioned in 16 03 05

**16 10 aqueous liquid wastes destined for off-site treatment**

16 10 02 aqueous liquid wastes other than those mentioned in 16 10 01

16 10 04 aqueous concentrates other than those mentioned in 16 10 03

**16 11 waste linings and refractories**

16 11 02 carbon-based linings and refractories from metallurgical processes other than those mentioned in 16 11 01

**17 02 wood, glass and plastic**

17 02 01 wood

**18 01 wastes from natal care, diagnosis, treatment or prevention of disease in humans**

18 01 01 sharps (except 18 01 03)

18 01 02 body parts and organs including blood bags and blood preserves (except 18 01 03)

18 01 04 waste whose collection and disposal is not subject to special requirements in order to prevent infection (e.g. dressings, plaster casts, linen, disposable clothing, diapers)

18 01 07 chemicals other than those mentioned in 18 01 06

18 01 09 medicines other than those mentioned in 18 01 08

**18 02 wastes from research, diagnosis, treatment or prevention of disease involving animals**

18 02 01 sharps (except 18 02 02)

18 02 03 waste whose collection and disposal is not subject to special requirements in order to prevent infection

**18 02 06 chemicals other than those mentioned in 18 02 05**

18 02 08 medicines other than those mentioned in 18 02 07

**19 08 wastes from waste water treatment plants not otherwise specified**

19 08 05 sludges from treatment of urban waste water

19 08 12 sludges from biological treatment of industrial waste water other than those mentioned in 19 08 11

19 08 14 sludges from other treatment of industrial waste water other than those mentioned in 19 08 13

**19 09 wastes from the preparation of drinking water or water for human consumption or water for industrial use**

19 09 04 spent activated carbon

### **19 11 wastes from oil regeneration**

19 11 06 sludges from on-site effluent treatment other than those mentioned in 19 11 05

### **19 12 wastes from the mechanical treatment of waste (e.g. sorting, crushing, compacting, pelletising) not otherwise specified**

19 12 01 paper and cardboard

19 12 07 wood other than that mentioned in 19 12 06

19 12 10 combustible waste (refuse derived fuel)

19 12 12 other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11

### **19 13 wastes from soil and groundwater remediation**

19 13 04 sludges from soil remediation other than those mentioned in 19 13 03

19 13 06 sludges from groundwater remediation other than those mentioned in 19 13 05

19 13 08 aqueous liquid wastes and aqueous concentrates from groundwater remediation other than those mentioned in 19 13 07

## ***Hazardous waste***

### **03 01 Wastes from wood processing and the production of panels and furniture**

03 01 04\* sawdust, shavings, cutting, wood, particle board and veneer containing dangerous substances

### **03 02 wood preservation wastes**

03 02 01\* non-halogenated organic wood preservatives

03 02 03\* organometallic wood preservatives

03 02 05\* other wood preservatives containing dangerous substances

### **04 02 Wastes from the textile industry**

04 02 14\* waste from finishing containing organic solvents

04 02 16\* dyestuffs and pigments containing dangerous substances

04 02 19\* sludges from on-site effluent treatment containing dangerous substances

**06 05 sludges from on-site effluent treatment**

06 05 02\* sludges from on-site effluent treatment containing dangerous substances

**06 08 waste from the MFSU of silicon and silicon derivatives**

06 08 02\* waste containing dangerous silicones

**06 13 wastes from inorganic chemical processes**

06 13 02\* spent activated carbon (except 06 07 02

06 10 05\* soot

**07 01 wastes from the manufacture, formulation, supply and use (MFSU) of basic organic chemicals**

07 01 01\* aqueous washing liquids and mother liquors

07 01 04\* other organic solvents, washing liquids and mother liquors

07 01 08\* other still bottoms and reaction residues

07 01 10\* other filter cakes and spent absorbents

07 01 11\* sludges from on-site effluent treatment containing dangerous substances

**07 02 wastes from the MFSU of plastics, synthetic rubber and man-made fibres**

07 02 01\* aqueous washing liquids and mother liquors

07 02 04\* other organic solvents, washing liquids and mother liquors

07 02 08\* other still bottoms and reaction residues

07 02 10\* other filter cakes and spent absorbents

07 02 11\* sludges from on-site effluent treatment containing dangerous substances

07 02 14\* wastes from additives other than those containing dangerous substances

07 02 16\* waste containing dangerous silicones

**07 03 wastes from the MFSU of organic dyes and pigments (except 06 11)**

07 03 01\* aqueous washing liquids and mother liquors

07 03 04\* other organic solvents, washing liquids and mother liquors

07 03 08\* other still bottoms and reaction residues

07 03 10\* other filter cakes, spent absorbents

07 03 11\* sludges from on-site effluent treatment containing dangerous substances

**07 04 wastes from the MFSU of organic plant protection products (except 02 01 08 and 02 01 09), wood preserving agents (except 03 02) and other biocides**

07 04 01\* aqueous washing liquids and mother liquors

07 04 04\* other organic solvents, washing liquids and mother liquors

07 04 08\* other still bottoms and reaction residues

07 04 10\* other filter cakes and spent absorbents

07 04 11\* sludges from on-site effluent treatment containing dangerous substances

07 04 13\* solid wastes containing dangerous substances

**07 05 wastes from the MFSU of pharmaceuticals**

07 05 01\* aqueous washing liquids and mother liquors

07 05 04\* other organic solvents, washing liquids and mother liquors

07 05 08\* other still bottoms and reaction residues

07 05 10\* other filter cakes and spent absorbents

07 05 11\* sludges from on-site effluent treatment containing dangerous substances

07 05 13\* solid wastes containing dangerous substances

**07 06 wastes from the MFSU of fats, grease, soaps, detergents, disinfectants and cosmetics**

07 06 01\* aqueous washing liquids and mother liquors

07 06 04\* other organic solvents, washing liquids and mother liquors

07 06 08\* other still bottoms and reaction residues

07 06 10\* other filter cakes and spent absorbents

07 06 11\* sludges from on-site effluent treatment containing dangerous substances

**07 07 wastes from the MFSU of fine chemicals and chemical products not otherwise specified**

07 07 01\* aqueous washing liquids and mother liquors

07 07 04\* other organic solvents, washing liquids and mother liquors

07 07 08\* other still bottoms and reaction residues

07 07 10\* other filter cakes and spent absorbents

07 07 11\* sludges from on-site effluent treatment containing dangerous substances

**08 01 wastes from MFSU and removal of paint and varnish**

08 01 11\* waste paint and varnish containing organic solvents or other dangerous substances

08 01 13\* sludges from paint or varnish containing organic solvents or other dangerous substances

08 01 15\* aqueous sludges containing paint or varnish containing organic solvents or other dangerous substances

08 01 17\* waste from paint or varnish removal containing organic solvents or other dangerous substances

08 01 19\* aqueous suspensions containing paint or varnish containing organic solvents or other dangerous substances

08 01 21\* waste paint or varnish remover

**08 03 wastes from MFSU of printing inks**

08 03 12\* waste ink containing dangerous substances

08 03 14\* ink sludges containing dangerous substances

08 03 16\* waste etching solutions

08 03 17\* waste printing toner containing dangerous substances

08 03 19\* disperse oil

**08 04 wastes from MFSU of adhesives and sealants (including waterproofing products)**

08 04 09\* waste adhesives and sealants containing organic solvents or other dangerous substances

08 04 11\* adhesive and sealant sludges containing organic solvents or other dangerous substances

08 04 13\* aqueous sludges containing adhesives or sealants containing organic solvents or other dangerous substances

08 04 15\* aqueous liquid waste containing adhesives or sealants with organic solvents or other dangerous substances

08 04 17\* rosin oil

**08 05 wastes not otherwise specified in 08**

08 05 01\* waste isocyanates

**12 01 wastes from shaping and physical and mechanical surface treatment of metals and plastics**

12 01 07\* mineral-based machining oils free of halogens (except emulsions and solutions)

12 01 09\* machining emulsions and solutions free of halogens

12 01 10\* synthetic machining oils

12 01 12\* spent waxes and fats

12 01 14\* machining sludges containing dangerous substances

12 01 16\* waste blasting material containing dangerous substances

12 01 18\* metal sludge (grinding, honing and lapping solution) containing oil

12 01 19\* readily biodegradable machining oil

12 01 20\* spent grinding bodies and grinding materials containing oil

**13 01 waste hydraulic oils**

13 01 01\* hydraulic oils, containing PCBs

13 01 10\* mineral-based non-chlorinated hydraulic oils

13 01 11\* synthetic hydraulic oils

13 01 12\* readily biodegradable hydraulic oils

13 01 13\* other hydraulic oils

**13 02 waste engine, gear and lubricating oils**

13 02 05\* mineral-based non-chlorinated engine, gear and lubricating oils

13 02 06\* synthetic engine, gear and lubricating oils

13 02 07\* readily biodegradable insulating and heat transmission oils

13 02 08\* other engine, gear and lubricating oils

**13 03 waste insulating and heat transmission oils and other liquids**

13 03 01\* insulating or heat transmission oils containing PCBs

13 02 07\* mineral-based non-chlorinated insulating and heat transmission oils

13 02 08\* synthetic insulating and heat transmission oils

13 02 09\* readily biodegradable insulating and heat transmission oils

13 02 10\* other engine, gear and lubricating oils

**13 04 bilge oils**

13 04 01\* bilge oils from inland navigation

13 04 02\* bilge oils from jetty sewers

13 04 03\* bilge oils from other navigation

**13 05 oil/water separator contents**

13 05 01\* solids from grit chambers and oil/water separators

13 05 02\* sludges from oil/water separators

13 05 03\* interceptor sludges

13 05 06\* oil from oil / water separators

13 05 07\* oily water from oil / water separators

13 05 08\* mixtures of wastes from grit chambers and oil / water separators

**13 07 wastes of liquid fuels**

13 07 01\* fuel oil and diesel

13 07 02\* petrol

13 07 03\* other fuels (including mixtures)

**13 08 oil wastes not otherwise specified**

13 06 01\* desalter sludges or emulsions

13 08 02\* other emulsions

13 08 99\* wastes not otherwise specified

**15 01 packaging (including separately collected municipal packaging waste)**

15 01 10\* packaging containing residues of or contaminated by dangerous substances

**15 02 absorbents, filter materials, wiping cloths and protective clothing**

15 02 02\* absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances

**16 01 end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)**

16 01 07\* oil filters

16 01 13\* brake fluids

16 01 14\* antifreeze fluids containing dangerous substances

16 01 21\* hazardous components other than those mentioned in 16 01 07 to 16 01 11 and 16 01 13 and 16 01 14

**16 03 off-specification batches and unused products**

16 03 05\* organic wastes containing dangerous substances

**16 07 wastes from transport tank, storage tank and barrel cleaning (except 05 and 13)**

16 07 08\* wastes containing oil

16 07 09\* waste containing other dangerous substances

**16 10 aqueous liquid wastes destined for off-site treatment**

16 10 01\* aqueous liquid wastes containing dangerous substances

16 10 03\* aqueous concentrates containing dangerous substances

**18 01 wastes from natal care, diagnosis, treatment or prevention of disease in humans**

18 01 03\* waste whose collection and disposal is subject to special requirements in order to prevent infection

18 01 06\* chemicals consisting of or containing dangerous substances

**18 02 wastes from research, diagnosis, treatment or prevention of disease involving animals**

18 02 02\* waste whose collection and disposal is subject to special requirements in order to prevent infection

18 02 05\* chemicals consisting of or containing dangerous substances

**19 02 wastes from physico/chemical treatments of industrial waste (including dechromatation, decyanidation and neutralisation)**

19 02 04\* premixed wastes composed of at least one hazardous waste

19 02 07\* oil and concentrates from separation

19 02 11\* other wastes containing dangerous substances

**19 08 wastes from waste water treatment plants not otherwise specified**

19 08 07\* solutions and sludges from regeneration of ion exchangers

19 08 09\* grease and oil mixture from oil/water separation containing only edible oil and fats (not hazardous)

19 08 10\* grease and oil mixture from oil/water separation other than those mentioned in 19 08 09

19 08 11\* sludges containing dangerous substances from biological treatment of industrial waste water

19 08 13\* sludges containing dangerous substances from other treatment of industrial waste water

**19 11 wastes from oil regeneration**

19 11 01\* spent filter clays

19 11 02\* acid tars

19 11 03\* aqueous liquid wastes

19 11 04\* wastes from cleaning of fuel with bases

19 11 05\* sludges from on-site effluent treatment containing dangerous substances

**19 12 wastes from the mechanical treatment of waste (e.g. sorting, crushing, compacting, pelletising) not otherwise specified**

19 12 06\* wood containing dangerous substances

19 12 11\* other wastes (including mixtures of materials) from mechanical treatment of waste containing dangerous substances

**19 13 wastes from soil and groundwater remediation**

19 13 03\* sludges from soil remediation containing dangerous substances

19 13 05\* sludges from groundwater remediation containing dangerous substances

19 13 07\* aqueous liquid wastes and aqueous concentrates from groundwater remediation containing dangerous substances

**19 01 wastes from incineration or pyrolysis of waste**

19 01 10\* spent activated carbon from flue-gas treatment

19 01 15\* boiler dust containing dangerous substances

## ENERGY CONSUMPTION

- 3.8. This Section addresses part of section **B2.7.1** of the IPPC Application.
- 3.9. Common sources of significant process energy consumption are:
- Induced and forced draught fan to overcome pressure drops and for combustion air;
  - Waste transfer/loading equipment (e.g. pumps/cranes and grabs/screw feeders);
  - Air-cooled condensers;
  - Waste pre-treatment (shredders, etc.);
  - Flue-gas heating for specific air pollution control devices;
  - Fuels for combustion support and start-up/shut-down; and
  - Electricity demand from other devices.
- 3.10. **Table 3.4** indicates the electrical power installed for each component of the facility, as provided by the supplier. The main electricity consumers can be found in **Appendix 20** that shows the plant together with electricity consumption of the various parts.

**Table 3.4: Expected average electrical consumption**

Component	Power utilised in kW
Bins storage system	50
Refrigeration system	110
Bin and carcass lifting mechanism	5.2
Crushing unit (shredder)	52
Waste storage, transfer and furnace feed unit	29
Primary combustion chamber, secondary chamber, and post-combustion chamber	47
Ash dumping and transfer system	32
Boiler, condenser, water treatment, water pumping	55
Reagent injection, fabric filter, final gases discharge	80
Auxiliary systems	10
Cold storage for liquid wastes	3
Liquid injection system	1.5 per screw
Dechlorinator filter	5
Softener	5
Reverse Osmosis System	7
Suction unit of depuration plant	55 Power absorbed at 20 °C: 45 Power absorbed at 160 °C: 34

## 4. INSTALLATION ACTIVITIES

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### INTRODUCTION

- 4.1. This Section addresses section **B2.3** of the IPPC Application.
- 4.2. The maximum thermal capacity of the plant is 5.7 MW and the minimum capacity is 4.3 MW. This thermal load will be used to determine the waste streams that will be combusted. In order to reduce fuel consumption and to control emissions, the waste will be mixed (abattoir waste, clinical waste, hazardous waste and Refuse-Derived Fuel (RDF)) so that this load will be maintained.
- 4.3. The plant is guaranteed, by the supplier, to operate for 7,446 hours a year. Although the plant will be operating 24 hours a day, 7 days a week it will be shutdown 8 times a year for at least 5 days for general scheduled maintenance. The remaining shut down time is for unscheduled maintenance which will not exceed 5 days per maintenance period. The incinerator will need 48 hours to cool down and another 48 hours to heat up gradually to the working temperature.
- 4.4. During the shutdown period, abattoir and clinical waste will be stored in the cold storage area on site; the latter has a volume of 240 skips of 1,100 litres each giving a total storage capacity of abattoir waste of 108,000 kg. Non-infected carcasses can be incinerated at the mobile incinerator operated by the Veterinary Services in the Civil Abattoir and outside the scope of this IPPC Application<sup>17</sup>. It is noted that the mobile incinerator will be re-located to another site.
- 4.5. No other waste will be stored on site during shutdown / maintenance periods. Clients will be advised beforehand of the scheduled shut down periods of the plant. During this period, hazardous liquid and sludge waste will not be accepted. Clients will have to keep their hazardous waste on site until the maintenance period is over. If the client is unable to store waste onsite, then this material will be temporarily transferred to the Ghallis Hazardous Waste Facility storage area.
- 4.6. Waste will be delivered on site by licensed waste carriers whose vehicle is registered with Wasteserv. MEPA's consignment note procedure will apply to the delivery of waste. If these conditions are satisfied and all the necessary information is provided to the operator of the Facility including detailed chemical analyses of the waste (see below for information required), then waste will be accepted at the Facility. Samples of waste will be taken by the Facility for checking (see below).

### WASTE RECEPTION AND STORAGE

- 4.7. While in general waste will only be accepted at the facility if it can be incinerated within the next 48 hours, there is an exception for abattoir and clinical waste. This

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<sup>17</sup> Please note that the mobile incinerator is a back-up solution for the destruction of large animals (such as horse and cows) that need to be destroyed during the shut down period.

waste will be stored in a refrigerated bin room with a capacity of 240 bins arranged on 4 floors (please see **Appendix 14** for technical details of the refrigeration room). It is noted that during regular maintenance the refrigeration room will still be operational.

- 4.8. In the event that the refrigeration system malfunctions or there is a power-cut, abattoir waste will not be accepted until the system is repaired. Any waste already present in the facility will be incinerated within 48 hours. In the case of an emergency where both the refrigeration system<sup>18</sup> and the combustion plant are not working, prior to commencement of operations, WasteServ will sign an agreement with a company that furnishes Industrial Generators, based on a 24hrs service. In such cases the company brings over a diesel generator. On site they have an industrial plug to which the generator can be connected to furnish the power required within one hour of the power failure. This event is highly unlikely because extended periods with no electricity are a rare occurrence. It is noted that the refrigeration room is equipped with two chillers; each chillers is capable of reaching 4°C on its own. Consequently, if one chiller fails the other unit will still do the job.
- 4.9. It is noted that from data provided by Enemalta Corporation, over the past 6 years (2002-2007) the blackout periods at the Civil Abattoir sub-station were as follows:
- 2002 – 1.65 hours;
  - 2003 – none;
  - 2004 – 16.7 hours;
  - 2005 – none;
  - 2006 – 40.2 hours; and
  - 2007 – 3 hours.
- 4.10. The longest single blackout period was of 15 hours; this happened only once in 2006.
- 4.11. Each of the 240 bins has an electronic tag with a unique bin identification code so that the operator can trace the waste producer. An identification system reads the unique bin identification code by means of radio frequency technology. The operator has to look into each bin to confirm the type of waste it contains. The SCADA system<sup>19</sup> will automatically capture the weight of each bin<sup>20</sup> and the system will combine this data with the information inserted manually by the operator, i.e. the type of waste and the time limit by which that waste has to be incinerated (if this varies from the default time). In summary, upon loading a bin of waste material, the system knows the weight (by means of the weighing system), the bin identification (by

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<sup>18</sup> The refrigeration system is not connected to the emergency diesel generator.

<sup>19</sup> The SCADA system is the computerised system that will be used to store waste data. See **Appendix 1** for details.

<sup>20</sup> Since the weight of the bins is known (the 240 bins are identical), the system will automatically deduct the weight of the bin and the net weight of the waste entered into the system.

means of the afore-mentioned electronic tag system), and the contents of the bin (by means of operator entry). These bins will be utilised to store abattoir waste, clinical waste, and RDF. The SCADA system will be used to input data for all waste types. Bins will be distinguished by their colour and labelling. Labelling of bins will be at the producers end with specifications given by Wasteserv, and then upon arrival at the facility by the Operator to show properties of that waste.

- 4.12. With regards to the other waste streams namely, industrial sludges and spent solvents a Just-in-Time (JIT) system will be adopted. The producers of these waste streams will have to contact the installation operator and provide details on the quantity and type of waste they need to dispose of (refer to Waste acceptance Procedure in the Environmental Management System (EMS) – Operational Procedure 15 in **Appendix 8**). The operator will include this waste in the quantities of waste scheduled for incineration in the following days and will give the waste producer a specific day and time when this material will be accepted at the facility. If any such waste needs to be stored by the incinerator operator prior to treatment, this will be stored at the Ghallis Hazardous Waste Facility. The JIT system implies that no waste will be stored on site for more than 48 hours; this means that the following **maximum** quantities of waste<sup>21</sup> will be stored on site at any one time:
- Abattoir waste: 72 tonnes;
  - Clinical waste: 12 tonnes;
  - Spent solvents: 15,000 litres;
  - Industrial sludges: 5 m<sup>3</sup>; and
  - RDF: 0 tonnes<sup>22</sup>.
- 4.13. A written and agreed procedure between waste producers and the operator of the installation will be required in order to ensure that clinical waste is brought on site when required (please refer to sample letter from Wasteserv to prospective customers found in Operational Procedure 15 of the EMS in **Appendix 8**).
- 4.14. Clinical waste is placed in sealed plastic bags; these bags are placed in 1,100 litre bins (please refer to **Appendix 9** for details on clinical waste containers and plastic bags) and then transferred to the incinerator on a daily basis by means of a licensed operator. Any leaks from the plastic bags will be contained in the 1,110 litre bin that has been certified to be resistant to puncture and are purposely designed to contain clinical waste. In the case of leakage, the leaked contents of the bag will be contained in the 1,100 litre bin and will be discharged into the hopper.

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<sup>21</sup> For complete list of wastes that can be treated at the Facility, please refer to Chapter 3.

<sup>22</sup> RDF will not be stored on site. In case of malfunction RDF will be sent back to Sant'Antnin Waste Facility – as this is operated by the Wasteserv (the same operator as the Facility).

- 4.15. Clinical waste bins and abattoir waste bins will be differentiated by colour – the clinical waste bins will be yellow and the abattoir waste blue. The labelling will also be different.
- 4.16. Upon arrival on site, these bins are placed in the cold room to reduce odours due to normal high temperatures in Malta. The computer (SCADA System) knowing how much clinical waste is in the freezer (as data is inputted upon arrival) will find the optimum time to treat this waste. The computer will select a bin and send it out of the cold store automatically, bypassing the shredding cycle and the bin washing cycle. An alarm will alert the operator to notice the bin, and wheel it to the bin lifting mechanism. The operator will unlock the bin and place the bin on the bin lifting mechanism platform, which is also a weighing device. The bin will automatically be unloaded in the hopper and returned back empty. The operator will take the bin to the bin washer to be automatically washed and sterilized. From the hopper the waste will be transferred to the Primary Combustion Chamber using a ram. A double door system will ensure that waste does not catch fire before it enters the PCC. It is noted that the operator will never handle the plastic bags as these will be contained in the 1100 L skips.
- 4.17. Sharps will be contained in High Density Polyethylene (HDPE) sharp boxes and placed into skips and transferred to the incinerator as described above. Sharp boxes will also be incinerated.
- 4.18. Liquid hazardous waste will be delivered, unloaded, and stored in the waste reception room, in the refrigerated containers located to south of the main Facility building (see **Appendix 12**). The waste will be kept here until the waste is tested. Once a sample of the sludge or liquid waste is chemically analysed, the chemist will determine if the liquid or sludge can be treated in the incinerator or not and if the waste is reactive or not. Close to the storage containers is a platform containing three reservoirs for solvents. Liquid waste delivered in drums or Intermediate Bulk Containers (IBCs) will be transported by a forklifter to the large reservoirs and emptied into either of these 2 drums each connected to the Incinerator modulating burner. If the liquid waste is reactive, it will be emptied in the 3<sup>rd</sup> reservoir and fed directly in the kiln. Therefore, the chemist will determine if the liquid can be emptied in drum A or B. If the liquid is considered as reactive and cannot be mixed with any other substance then the liquid will be pumped directly into the rotary kiln through an injection lance. Sludge will be transferred by fork lift to the sludge pump room located in the ancillary building then it will be pumped directly into the rotary kiln. The reception area and containers will be bunded in case of accidental spillages. This is congruent with Best Available Technique Reference 5 (BAT 5)<sup>23</sup> (see below).
- 4.19. Consignments of solvents will be accompanied by an information sheet containing the chemical composition of the solvent (see EMS Operational Procedure 15 – **Appendix 8**). The waste producer will have to notify MEPA and the Incinerator operator that hazardous has to be disposed of. When MEPA approves the disposal, a

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<sup>23</sup> European Commission, 2006, IPPC Reference Document on the Best Available Techniques for Waste Incineration.

code shall be given. When the operator gives the preliminary acceptance of the waste, a code will be given. The waste producer prints a sticker showing any relevant information about the waste, including the confirmation code issued by MEPA and the confirmation code issued by the Incinerator operator. Once the material is delivered to the incinerator and analysed, the chemist will fix a second sticker with relevant data including instructions to the operator of how to dispose of this material and properties of the waste. A sample of this waste will be tested in the laboratory for calorific value, flash point, waste compatibility and reactivity and radioactivity, to ensure compatibility before mixing (please refer to Operational Procedure 16 for laboratory testing procedures in the EMS in **Appendix 8**). The temperature of the storage container can be automatically controlled to ensure that the waste is kept at a safe temperature. The liquid wastes will be pumped directly into the burner of the Primary Combustion Chamber as a secondary fuel replacing diesel. Liquid hazardous waste that cannot be mixed due to reactivity problems will be pumped directly into a dedicated solvent lance in the Primary Combustion Chamber. Combustion of solvents will be the main fuel driving the incinerator (please refer to drawings for all components on the installation found in **Appendix 10**).

- 4.20. Hazardous liquid wastes will be transported to the incinerator by licensed waste carriers as and when instructed by the plant operator after receiving the consignment note from MEPA. This will facilitate general housekeeping since relatively little waste will be retained on site. A written and agreed procedure will need to be established between the operators of the incinerator and the waste producers in order to ensure that hazardous waste is brought on site when required (please refer to sample letter from Wasteserv to prospective customers found in Operational Procedure 15 of the EMS in **Appendix 8**).
- 4.21. Empty solvent and sludge containers will be sent back to the waste producers for re-use.
- 4.22. Abattoir waste will also be transported by authorised waste carriers, unloaded at the waste reception area, and immediately loaded into the cold storage area.
- 4.23. Refuse Derived Fuel will be transported from the Sant Antnin Waste Treatment Plant (SAWTP) and other waste facilities if it is needed. Since RDF is normally baled, it will have to be unbaled at the SAWTP and transported to the incinerator in 1,100 litre bins. Again a JIT system will be adopted and no material will be stored on site for longer than 24 hours.
- 4.24. Abattoir waste will be visually checked by the operator. Sludge and solvents will be analysed as explained above (see EMS). Clinical waste cannot be analysed. However, the radioactivity of the waste may be tested using a Geiger sensor. RDF will be analysed regularly for calorific value (please refer to **Chapter 5 – Waste Acceptance Criteria and Quality Control of Waste Input** for more details).

- 4.25. The separate storage of abattoir waste, hazardous sludges, clinical waste, and spent solvents ensures that there is no risk posed by storing different waste streams together. This is in line with BAT for storage of such wastes (see BAT boxes below).
- 4.26. As described above, during maintenance no waste will be accepted on site; waste producers will be notified in advance so that they can plan for such events. In the event of a malfunction of the incinerator waste producers scheduled to take waste in the day of the malfunction and following days will be advised not to take any waste. Waste that is stored on site will be kept on site in the cooled areas (kept at 4°C) if the plant is not operational. Since a JIT system will be operated quantities of hazardous waste kept on site will be minimal. In the case of emergency breakdown the refrigerated areas will be connected to a back-up generator provided by a Contractor to WasteServ. The Contractor will supply Industrial Generators on a 24-hour service.
- 4.27. The waste handling procedure can therefore be summarised as follows. Process & Instrumentation (P&I) diagrams depicting the various components of the plant are given in **Appendix I0**:
- Trucks delivering abattoir and clinical waste will unload the 1,100 litre containers in the reception area adjacent to the refrigeration room;
  - These bins are then loaded onto a lifting mechanism that transfers the bins from the waste reception area to the cold storage area;
  - Carcasses can also be directly transferred to the shredder by means of a carcass elevator;
  - Clinical waste will be unloaded directly to the feeding hopper (it will by-pass the shredder);
  - Just before the abattoir waste containers are inserted in the cold storage area, the operator identifies the waste inside the container and manually places the bin on a weighing mechanism;
  - The SCADA system<sup>24</sup> will automatically take the weight of the material inside the bin. Due to the fact that all the bins are identical, the computer will deduct the weight of the bin from the gross weight and calculate the net weight of the waste inside each bin. In the case of wastes not placed in one of the 240 identical bins (i.e. hazardous liquid wastes, sharps), the net weight will be calculated by weighing the container when full and following emptying. The operator will manually type into the computerised SCADA system the waste code using the touch screen near the weighing mechanism. The chip on the bin facilitates the traceability of the waste producer; as soon as all the information is inserted, the SCADA system accepts the material and automatically transfers the bin from the weighing mechanism into the cold storage area;

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<sup>24</sup> Please see **Appendix I2** for details on SCADA system

- Sludge will be delivered in IBCs or drums. The composition of the sludge will be known in advance since the waste producer needs the permission of the incinerator operator to deliver this waste to the facility. The permission is granted when all the information relevant to that material is known<sup>25</sup>;
- The waste hauler unloads the sludge containers into the reception area. The bin is placed on a weighing mechanism and the permit number is inserted manually by the operator<sup>26</sup>;
- The SCADA system will capture the weight of the waste in each bin and associate the information related with that waste from the permit number, which would have been stored in the database when the permit was issued. (The Operator issues the permit for delivery when all the information related with the waste is known. The operator stores this waste data with the permit number.);
- When the SCADA system has all the necessary information, the waste will be tipped into the hopper and the empty containers are given to the waste hauler;
- Sludge that is liquid enough to be transferred to the PCC via an injection lance will be pumped to the lance; sludge that is almost solid will be fed into the PCC via the hopper;
- Solvents are delivered in special containers as required by each type of solvent. A permit number is also required prior to delivery. The containers are unloaded in the reception area. There will be specific delivery time frames for each waste stream. For example, abattoir waste will be delivered between 07:00 and 12:00, clinical waste between 06:00 and 07:00, liquid hazardous waste between 14:00 and 18:00, and sludges between 18:00 and 21:00. This will avoid different waste arriving on site at the same time. The solvents are then transferred to the reception area where they will be weighed;
- Solvents will arrive at the installation accompanied by a laboratory analysis of the composition of the waste. This analysis will be used by the operator to determine if this solvent can be mixed with other solvents and hence pumped in one of the liquid storage tanks, or if it has to be injected independently into the liquid lance;
- All the information is loaded in the SCADA system; the SCADA system will choose when to incinerate the waste and the best mixture, depending on the

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<sup>25</sup> The waste producer must provide the incinerator operator with a number of samples of the sludge intended for treatment in advance of delivery. These samples will be accompanied by a chemical analysis of the sludge. The incinerator operator may carry out further analysis and will determine if the particular sludge can be incinerated or not (see EMS – Operating Procedure 16 in **Appendix 9**). Once all the data is known, the waste producer will be given the green light to delivery the sludge for treatment, including the day of delivery and the maximum quantity that the facility can take. Unless the sludge generating process changes, and depending on the reactivity and the nature (hazardous content) of the sludge, the operator will decide whether or not the sludge will be analysed for each consignment brought for treatment or alternatively restrict analysis to occasional random samples.

<sup>26</sup> Should RDF be used, the system used for sludges will be adopted.

calorific demand at each instance, taking into consideration all the other waste available, i.e. abattoir waste, clinical waste, sludges, and liquid waste; and

- Depending on the waste type, the system will calculate the expected calorific value and expected emission values. Hence, the dosing rate of each waste stream per hour will be based on these calculations in order to keep the emissions as low as possible and the thermal value as constant as possible.

4.28. The system can store the following information for each bin:

- Input order;
- Identification number, information contained in a microchip on each bin that is read by the automatic control system;
- Date/time of input;
- Position of abattoir waste inside cold storage area;
- Type of waste;
- Net weight of waste;
- Expected calorific value;
- Thermal load of each bin (CV x net weight); and
- Expected emission value (HCl and SO<sub>x</sub>) of each bin.

4.29. The control system, according to special algorithms (please refer to **Appendix I I** for details on SCADA system), determines the hourly load (number of bins and type of content to be transferred in an hour to the crusher, meaning the hourly load capacity) as well as the best waste composition. This calculation is made on the basis of the parameters acquired during the in-feed phase of the wastes into the refrigerated storage area or previously assigned and therefore entered as a 'datum' in the calculation programme.

4.30. After choosing the bins representing the hourly load, the computer determines their transfer to the shredder at a speed that depends on the number of bins.

4.31. The system updates the database every time one of the bins leaves the refrigerated storage area for incineration.

4.32. From the cold storage area, the abattoir waste will be unloaded into the shredder from where it is transferred into the PCC. The empty bin is then transferred to the automatic bin washer. Waste water generated from the washing of the bins, estimated at 300 litres per hour, is directed to drainage. A system of valves will be installed in the drains to prevent any contaminated waste water from entering the drainage system in the event of a spill or fire. A waste water sump will be built at the entrance of the site, with a capacity of 100 m<sup>3</sup> from where waste water can then be removed and disposed of appropriately (please refer to **Appendix I 2** for drawings of reservoirs). It is estimated that the tank will need to be emptied once every week.

Water used to regularly flush out the shredder and the blood vessel will be incinerated. Waste water treatment is discussed in detail in Chapter 5 – waste management.

- 4.33. The waste reception area will be a contained area so that any spillages or contaminated runoff water can be easily captured in a sump on site (see **Appendix 12** and **Appendix 10** for process flows) or incinerated.
- 4.34. The incinerator will have its own entrance and exit gate to the waste reception area (see traffic management, below).
- 4.35. The following are references taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration<sup>27</sup> (referred to as BREF) that are relevant to waste storage and reception. As explained above, the installation is in line with these requirements as wastes will be stored separately and will be stored in sealed containers. Clinical waste containers are manufactured in accordance with certain standards, as explained above, and containers will be labelled. Halogenated and radioactive waste will not be accepted on site and waste testing procedures have been described in the EMS.

#### **BAT BOX**

##### **Reference 5:**

**The storage of wastes according to a risk assessment of their properties, such that the risk of potentially polluting releases is minimised. In general, it is BAT to store waste in areas that have sealed and resistant surfaces with controlled and separated drainage as described in 4.1.1.1.**

#### **BAT BOX**

##### **Reference 8:**

**The segregation of the storage of wastes according to a risk assessment of their chemical and physical characteristics to allow safe storage and processing, as described in 4.1.4.5.**

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<sup>27</sup> European Commission, 2006, IPPC Reference Document on the Best Available Techniques for Waste Incineration

**BAT BOX**

**Reference 79:**

**The receipt and storage of clinical wastes in closed containers that are suitably resistant to leaks and punctures.**

**BAT BOX**

**Reference 9:**

**The clear labelling of wastes that are stored in containers such that they may continually be identified, as described in 4.1.4.6.**

## **BAT BOX**

### **Reference 69:**

**In addition to the quality controls outlined in BAT 4, at Hazardous Waste Incinerators to use specific systems and procedures, using a risk based approach according to the source of the waste, for the labelling, checking, sampling and testing of waste to be stored/treated (see 4.1.3.4).**

**Analytical procedures should be managed by suitable qualified personnel and using appropriate procedures. In general, equipment is required to test:**

- The calorific value;**
- The flashpoint;**
- PCBs;**
- Halogens (e.g. Cl, Br, F) and sulphur;**
- Heavy metals;**
- Waste compatibility and reactivity; and**
- Radioactivity (if not already covered by BAT 3 through fixed detectors at the plant entrance).**

**Knowledge of the process or origin of the waste is important as certain hazardous characteristics (for example toxicity or infectiousness) are difficult to determine analytically.**

## WASTE TRANSFER INTO THE ROTARY KILN

### Abattoir Waste

- 4.36. The waste feed system for abattoir / slaughterhouse waste is composed of two distinct sections with the following functions:
- Transfer and feeding of solid waste from the lower discharge hatch of the crushing unit; and
  - Cooled storage, transfer, and feeding of blood and liquid resulting from the crushing process to the inlet on the load hopper.
- 4.37. The current waste feed mechanism includes a bin lifter/tilter and an animal carcass lifter, both of which will transport abattoir waste to the shredder, or crushing unit, for processing prior to injection into the PCC. Only abattoir waste and RDF will be shredded.
- 4.38. The bin lifter/tilter is designed to lift bins containing waste from street level to the level of the feed hopper of the crushing unit. It has a maximum lifting capacity of 750kg. This will be used to transfer animal waste (other than carcasses) and RDF. For a more detailed description please see **Appendix 14** – Waste Feeding Plant.
- 4.39. The animal carcass lifter is designed to lift whole animal carcasses of different sizes to a maximum size of an adult bovine from street level to the level of the feed hopper of the crushing unit with simultaneous automatic transfer of the carcasses into the hopper. The system uses a trolley onto which the carcass is placed: this trolley is equipped with wheels so that the carcass can be moved into the crushing area and placed and attached onto the elevator. In addition, to meet the requirements for continuous operation, a slide can be fitted on the lifting carriage so that it can be used similarly to the bin lifter, thus making it possible to move the bins also in the event of temporary fault of the lifter. The lift has a maximum lifting capacity of 1,200kg.
- 4.40. The material transport system that passes through the shredder constitutes 3 conveyor systems: the first conveyor extracts from the shredder, another intermediate conveyor screw and the third screw which is the feeding screw into the loading hopper. The three conveyor screws are controlled by an inverter, they have a time function related to the quantity of waste that needs to be unloaded into the loading hopper for each load which may vary between 40-50kg in the case of organic and humid waste. They are dimensioned in a way that they are 50-60% filled. They are of the shaftless type (open archimedian spiral). The conveying screws have an automatic system whereby in case of a jam they can rotate in the opposite direction for a number of cycles until the blockage is cleared.
- 4.41. The crushing unit supports two crushers, which operate in series so as to obtain a final crushed waste size of no larger than 50 x 50 mm pieces. This specification ensures that the waste is of a suitable size to be transferred to the PCC via a screw conveying system.

- 4.42. The extraction screw extracts the crushed waste from the hopper and conveys it via the screws to the load hopper located in proximity to the fore furnace. Its operation is interlocked with that of the transfer screws in such a way that if one of the latter locks it is automatically stopped together with the crushers.
- 4.43. The metered feed unit is composed of a hydraulic pushing mechanism of which the part that enters the furnace is tubular with a water-cooled sleeve and the remaining part is a trough. The load hopper is flange-mounted on this part of the feed screw and has a capacity of about 1m<sup>3</sup> and is shaped so as to prevent the waste from clogging. The entire feed unit is supported by a steel framework on wheels supported on a rail system that allows the screw to eject from the furnace if necessary. The screws are driven by a coupled joint to coaxial gears equipped with an electric motor that is controlled by a frequency drive.

**Figure 4.1: Incinerator plant: carcass bin lifter and blood storage vessel**



- 4.44. The storage and transfer of blood and liquid (non-hazardous) resulting from the crushing process is made up of the following components:
- Drained liquid collection tank and transfer system to cooled tank;
  - Cooled storage tank;

- Coolant cooler; and
  - Furnace feed system.
- 4.45. The liquid collection tank has a capacity of approximately 0.7 m<sup>3</sup>. It collects the drained liquids coming from the screws. For this reason, it is located below the crusher support structure.
- 4.46. The furnace feed system feeds the blood and liquid from the cooled tank to the coupling point on the load hopper. The temperature control in the combustion chamber stops the pump in the event that excessive liquid flow causes the temperature to go down to below the normal operating value.

### **Solvents and Sludges**

- 4.47. Depending on their properties, spent solvents will either be burnt in the primary combustion chamber through an atomisation lance or through a purposely built solvent burner. A modulating burner will be installed through which solvents can be incinerated. The burner can operate on 2 fuels, one being diesel while the other being solvents or liquid hazardous waste (Please see **Appendix 19** for detailed specifications of the modulating burner). The operator will decide how to burn the solvents depending on the chemical composition of the solvent.
- 4.48. Reactive sludges will be injected directly into the primary combustion chamber through a dedicated injection lance that will be added to the fixed part of the PCC. The injection will also be water cooled. The other solid sludges will be transported using 1,100 litre bins that will be unloaded into the hopper preceding the PCC using a new skip loader and bin tilting mechanism.

### **Clinical Waste**

- 4.49. Clinical waste will be transferred directly to the hopper preceding the PCC. The clinical waste bins will be emptied into the hopper via a skip loader and tilting mechanism. The bins are automatically opened and the content is automatically tipped in the hopper, at regular instances. Bins are returned to the bin washing area, where they are sterilised and returned back to the client (see process flow in **Appendix 13**). It is noted that clinical waste bins will only be unlocked by the operator but never opened. When the bin is lifted to be unloaded in the feeding hopper, it will open automatically within the unloading hopper and emptied. The hopper is an enclosed chamber and it has a negative pressure to ensure that no aerosols escape in the surrounding environment. The bin will then be sent for sterilizing (using steam) in the bin washer. The infectious controller of the Mater Dei Hospital found no objections to this procedure (Personal communication, Ing Mary Grace Micallef, WasteServ Malta Ltd). Similarly the Veterinary Affairs and Fisheries within the Ministry for Rural Affairs and the Environment confirmed that the bin-washing mechanism is considered adequate for the washing and sterilisation of abattoir waste bins<sup>28</sup>. In case of leaks, which are highly unlikely, bins will be washed in

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<sup>28</sup> E-mail from MRAE (Mr Paul Fenech Gonzi) to WasteServ (Ing. Mary Grace Micallef) dated 23<sup>rd</sup> August 2007

a separate area and the wastewater collected in the sump for contaminated water at the entrance to the facility.

- 4.50. The bags containing clinical waste will not be manually opened for inspection due to risk of disease transmission. This is in accordance with BAT that requires the use of non-manual waste handling and loading systems (see below). In the hopper, clinical waste is “mixed” with the abattoir waste and non-reactive sludge, and fed together into the PCC through a ram.
- 4.51. The pre-treatment of abattoir waste by passing it through a shredder or crushing unit, the direct injection of liquid wastes, and the non-manual feed for clinical waste are BAT (see BAT boxes below).

### **Other**

- 4.52. RDF will be brought on site only when required; it will be transported in 1,110 litre bins and loaded to the hopper as described above. Data will be inputted into the SCADA System as per other waste streams. Pre-treatment of such waste (such as shredding) will be done off-site prior to receipt of waste.
- 4.53. In summary waste in the hopper will be rammed into the PCC as required to maintain constant temperature. Liquid hazardous waste will be pumped directly into the burner to maintain the flame required in the PCC. Any reactive liquids or sludges that cannot be mixed with any other substance will be fed directly in a separate dedicated injection lance. There will be two injection lances, an atomised injection lance for liquids and another one for sludges. In the event that no liquid hazardous waste is available, diesel will have to be used to maintain a flame.
- 4.54. The proposed systems are adequate for the waste streams to be handled by the facility. It is good practice to shred waste to homogenise it. Direct injection is the simplest way to feed liquids. Direct feed of clinical waste ensures that operators have as little contact with clinical waste as possible, especially if cytotoxic waste is present.
- 4.55. The following are references taken from the European Commission’s IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to waste transfer. The manufacturers of the plant, Barbieri & Tarozzi (B&T) of Modena, Italy confirm that the installation is consistent with these requirements.

### **BAT BOX**

#### **Reference 11:**

**Mixing (e.g. using bunker crane mixing) or further pre-treatment (e.g. the blending of some liquid and pasty wastes, or the shredding of some solid wastes) of heterogeneous wastes to the degree required to meet the design specifications of the receiving installation (4.1.5.1).**

**BAT BOX**

**Reference 72:**

**The direct injection of liquid and gaseous hazardous wastes, where those wastes require specific reduction of exposure, releases, or odour risk, as described in 4.1.6.3.**

**BAT BOX**

**Reference 78:**

**The use of non-manual waste handling and loading systems.**

## COMBUSTION OF WASTE

### Combustion Technology and BAT

- 4.56. The PCC comprises a rotary kiln. The European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration considers that the rotary kiln is BAT for the types of wastes being processed in the installation (see BAT Reference I below). Air distribution in the PCC is facilitated by the rotating kiln which can be rotated both clockwise and anticlockwise. The use of a rotary kiln primary combustion chamber also allows the operator to control the residence time of the waste within the chamber. This ensures that all types of waste injected into the combustion chamber can be completely incinerated, thus reducing the volume of bottom ash.
- 4.57. The manual for the incinerator plant "ROTOMAX 2000" (See **Appendix I4**) states that the reason for choosing a system with a rotary chamber is based on the fact that, compared to conventional static furnaces or furnaces with movable grilles, this solution provides the following advantages:
- More efficient waste remixing with resultant better exposure of those fractions richer in moisture to the action of the flame and a consequently lower risk of the presence of unburnt substances; and
  - Lower thermal inertia because of the smaller volume in the combustion chamber and consequently the assurance that the operating temperature will be reached in a shorter time leading also to lower fuel consumption.
- 4.58. Although the original designs for the waste incinerator were for the destruction of animal waste only, the plant has been upgraded to cater for the destruction of hazardous waste, including clinical waste. The combustion technology originally designed for the incineration of animal waste is flexible enough to cater for the destruction of the proposed new waste streams (including hazardous waste).
- 4.59. Given that the nature of the waste to be incinerated is very broad and includes hazardous waste, rotary kiln technology is considered to meet the requirements of BAT.

### Waste Combustion

- 4.60. Abattoir waste, clinical waste, RDF, sludges, and hazardous wastes are all burnt in the PCC.
- 4.61. The products of combustion pass from the rotary kiln to the secondary combustion chamber via a transition or post-furnace chamber. The solid and gas (products resulting from waste combustion) are separated in the post-furnace chamber. The lower part of the post-furnace chamber is fitted with an ash transfer and remixing device. This area allows completion of ash combustion. To this end a two-stage burner is installed with a fan that assures air in-feed. The afterburner was originally

designed for a plant that almost exclusively had to treat organic waste from animal slaughter, at a high level of humidity and with a low ash content (10%) compared to the initial weight<sup>29</sup>.

- 4.62. The ash is collected in a hopper that is kept under negative pressure to reduce dust emissions. While the ash is being dumped into the hopper, a small amount of water is sprayed on the ashes to cool them and to further mitigate against the possibility that the dust is kicked up into the air as the ashes drop into the hopper. The ashes are collected in the hopper and they are then periodically transferred to the dumping bin by means of a chain conveyor with alternate forward and backward movement.
- 4.63. Oxidation and deodorisation of the fumes coming from the primary chamber are completed in the secondary chamber. The chamber is sized to guarantee a stay time of at least two seconds at a temperature of 850°C and in the presence of a free oxygen content of >6%. This is in accordance with Legal Notice 336 of 2001 that requires a temperature of 850°C for hazardous waste with a chlorine content of <1%. This design ensures that CO and VOC emissions are kept within acceptable limits (see section I).
- 4.64. The manufacturers of the installation state that the horizontal position of the SCC, adopted by many manufacturers in Europe and the US, was used because it has construction advantages and it resolves many functional problems. Although different waste streams are being incinerated at the facility, B&T believe<sup>30</sup> that the accumulation of ash will never be such that it will block the system or cause unexpected shutdown. However if this situation does arise it can be resolved with adequate operating systems and with the normal maintenance programme. The contract between WasteServ and B&T stipulates that the plant is to operate in accordance with the Directive for at least 7,446 hours a year. B&T are therefore responsible to ensure that the horizontal SCC does meet the requirements of the Directive.
- 4.65. The horizontal shape allows the burner to be comfortably and appropriately positioned with a flame that can reach 3.5-4.0m in length and with a maximum diameter of 0.8m.
- 4.66. Experience has also shown that this solution produces a good turbulence with positive effects on the oxidation of unburned gases from the PCC. The ash build-up is not significant and causes no unusual fusion given the low operating temperature (850-950°C), low transport speed (5-6 m/sec) and given that sedimentation, if it were to manifest, would do so away from the radiation of the flame.

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<sup>29</sup> The burner inside the de-ashing chamber was important for the original version of the Plant that was designed for the incineration of 1650kg/hr of abattoir waste. In the modified Installation it is foreseen that the maximum incineration capacity of abattoir waste is 600kg/hr. These estimates imply that the de-ashing chamber burner (a 2-stage burner where the power varies between 20-40 kg/hr diesel, producing between 270-540 Nm<sup>3</sup>/h flue gas directly in the SCC) may not be required and therefore after the first operating tests, it will be uninstalled (please see Appendix 6 showing 0 consumption for BC burner).

<sup>30</sup> E-mail from B&T dated 4<sup>th</sup> January 2007

- 4.67. The flame from the burner itself can produce a propulsive force in front of the ashes.
- 4.68. For inspection and maintenance procedures, the afterburner can be accessed through one of three walkways, and has an easily accessible door at the end.
- 4.69. There can never be enough ash build-up for it to have a negative influence on combustion and the flow of gas through that section.
- 4.70. The plant is designed for the installation of the deNO<sub>x</sub> SNCR system which uses the reagent urea adapted for use in a temperature window of 850°-950°C, exactly like that introduced at the end of the afterburner on the plant in question, where injection occurs. The anticipated efficiency, with the proper atomisation of the urea solution through a pneumatic jet, is around 60%. An adjustable capacity volumetric dosing pump feeds the injection jets, withdrawing the solution from a 1,500 litre stock tank connected to a preparation tank.
- 4.71. The system is effectively installed only if the NO<sub>x</sub> emissions in the first 60 days of operation are greater, on at least one day, than the level indicated by EU WID 2000/76/EC or if, after the final calibration of the plant, the daily average exceeds 200 mg/Nm<sup>3</sup> in standard conditions. For the tests conducted on rotating kilns, which operate within a temperature range lower than that at the Malta Civil Abattoir, B&T believe this limit will not be exceeded.
- 4.72. If it is not necessary to install the system after simplifying conduction, this is advantageous in preventing ammonia slips from 5-15 mg/Nm<sup>3</sup>, which represent the negative effect of the chemical reduction of NO<sub>x</sub>.
- 4.73. Fly ash is collected by a system of tubular screws connected to each other, which at one end receive the ashes coming from the discharge valves of the boiler and the economiser, and at the other end discharge the exhausted sodium bicarbonate from the rotary cell of the filter. They then connect to a last screw which discharges everything into a second dumping bin.
- 4.74. The following are references taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to combustion. B&T confirm that the secondary combustion chamber meets the Directive's requirements. Continuous operation of the plant will be maintained by ensuring, amongst other things, that ash generation is controlled. When the plant manager prepares the work schedule showing what waste will be incinerated, waste generating high quantities of ash such as RDF will be maintained to the minimum possible. The preferred waste streams for this rotary kiln are solvents and liquid hazardous waste because the ash generated from such waste is minimal. The SCC will be cleaned as often as required to ensure that the residence time of the flue gas remains of 2 seconds.

### **Plant Maintenance**

- 4.75. A set of 6 maintenance procedures have been prepared covering a 5-day period (once every 2 months), as well as a further two periods of 5 days for extraordinary

maintenance following an emergency shutdown. The large capacity of the cold store containing 240 bins, each with a 1100lt volume and a load of 450kg, satisfies the requirements for stockpiling irremissible temporary waste coming in during down time; it is in fact possible to stockpile a nominal volume of 264 m<sup>3</sup> and a nominal mass of 108,000kg of waste, which must be kept in a cooled atmosphere.

- 4.76. The remaining 15 days from the 55 days' total down time constitute reserve time, to be used only if absolutely necessary. These additional days could be used when it is necessary to increase the 5 day stops so as to complete more complex works, such as maintenance on the refractory lining.
- 4.77. The SCC will be cleaned during scheduled maintenance. This will be undertaken when the Plant Manager notices that the boiler efficiency is reducing because the temperature at the exit is more than the normal expected temperature, then it is clear that the SCC and boiler needs cleaning. It is expected that the cleaning should take place every 8 weeks. The Incinerator manager will start the shutdown procedure. Basically, waste feed is stopped and the waste already in the rotary kiln will be totally incinerated. When all the waste in the kiln is combusted, the burners are switched off and the kiln is allowed to cool slowly for two days. The operators responsible for the cleaning the secondary chamber will be equipped with all the necessary Personal Protective Equipment (PPE) according to the Health and Safety regulations in Malta. The operators will need to enter the SCC and with the help of mechanical equipment, they will shovel the ash out of the chamber. The fly ash in the SCC will be disposed of in the container specifically installed for this waste stream which will then be emptied in the hazardous waste landfill. The SCC, which is horizontal, has a vertical chute at each end. Dust can be pushed to either end of the SCC into the chutes. The chute at one end is the de-ashing chamber of the PCC while at the other side there is a chute specifically designed to capture the dust prior to the boiler. Dust will be captured into the containers without dust emissions into the atmosphere. Further cleaning of the SCC can be carried out with an industrial vacuum cleaner specifically used for these type of dusts.
- 4.78. Prior to such maintenance waste producers will be notified that no waste will be received on site within a specified period.

**BAT BOX**

**Reference 19:**

**In general it is BAT to use those operating conditions (i.e. temperatures, residence times and turbulence) as specified in Article 6 of Directive 2000/76. The use of operating conditions in excess of those that are required for efficient destruction of the waste should generally be avoided. The use of other operating conditions may also be BAT – if they provide for a similar or better level of overall environmental performance.**

**BAT BOX**

**Reference 23:**

**Use of furnace (including secondary combustion chambers etc.) dimensions that are large enough to provide for an effective combination of gas residence time and temperature such that combustion reactions may approach completion and result in low and stable CO and VOC emissions, as described in 4.2.23-24.**

## HEAT RECOVERY

- 4.79. The fumes from the Secondary Combustion Chamber then pass through a boiler which reduces the temperature from a maximum of 950°C to approximately 180°C. The cooling of the flue gas to 180°C is confirmed by the manufacturers.
- 4.80. The recovery boiler is a steam generator with vertical pipes connected at the top to the main cylindrical body and at the bottom to two cylindrical bodies. The gases in transit flow through the exchanger in a single pass without interposition of deviating septa; the latter would encourage accumulation of ashes or residues that are not easy to remove.
- 4.81. The volume of this chamber is such that the ashes and slag carried by the fumes can be separated, encouraging down flow in an orthogonal direction to the boiler axis and creating a chamber with the dual function of improving the gas flow distribution over the entire front area of the pipe bundle and, at the same time, encouraging the slag to drop into the collection hopper. The hopper is positioned in the lower part of the chamber and is equipped with a double discharge slide gate to prevent air from infiltrating. The rear fume chamber allows the fumes to escape at the top towards the economiser.
- 4.82. The purpose of the economiser is to further reduce the temperature of the fumes by heating the feedwater and or the condensate by a further 100 to 120°C. It comprises a fume /water heat exchanger with only one duct. The ashes coming from the boiler are dumped into the screw system.
- 4.83. A dissipater / condenser is used to condense and cool the steam (at 10 bar) generated by the boiler to 80°C if this is not utilised. Cooling is achieved by force feeding air at ambient temperature into the pipes of the condenser and making the air circulate from bottom to top by a helical fan. A condensate recovery tank collects the condensate.
- 4.84. Boiler water is treated with anti-corrosion and anti-scaling reagents as described in Chapter 3. Reagents are mixed in the additive / mixing tank and dosed to the boiler through a metered pump.
- 4.85. A blowdown tank is used for the collection of the discharges from the bottom of the boiler.

## FLUE GAS TREATMENT SYSTEM (FGT)

- 4.86. The FGT system located downstream of the energy recovery / fume cooling system is of the “dry” type and includes a section for neutralisation of the acid components contained in the fumes and guarantees an average emissions concentration of the main pollutants in the emissions that is compatible with the limits laid down in Directive 76/2000/ EC. The reduction of NO<sub>x</sub> is however carried out in the secondary combustion chamber by direct injection of urea or a water-ammonia solution (please see P&l diagram in **Appendix 10**).
- 4.87. The FGT system comprises the following components:
- Reagent silos, reagent metering, and an injection unit for activated carbon and sodium bicarbonate that will be used to neutralise acid gases in the fumes and to absorb toxic materials, in particular heavy metals;
  - A suction unit;
  - A reactor for the mixing of fumes and reagents;
  - A direct injection lance for the introduction of atomised urea solution to control NO<sub>x</sub> emissions;
  - A bag filter unit;
  - A fly ash recirculation system from the bag house filter to the reactor; and
  - A process stack.
- 4.88. The flue-gas cleaning technology capacity for individual pollutant removal determines what wastes can be accepted at the installation.
- 4.89. The current installation operates at a maximum total fume (wet) flow rate of 14,700Nm<sup>3</sup>/h at 180°C after the economiser (see table below to show difference in values at filter outlet and SCC).
- 4.90. Activated carbon will be used to remove toxic products in the flue gas emitted, particularly heavy metals. Activated carbon will be introduced after the Boiler and Economiser.
- 4.91. The current acid neutralization reagent, calcium hydroxide, will be replaced by sodium bicarbonate (NEUTREC process), in order to increase the efficiency of abatement of acid emissions. The reagent dosing system will also be modified to a micro-feeding screw regulated by an inverter.
- 4.92. Sodium bicarbonate will need to be crushed prior to being introduced into the system. Extraction and crushing equipment will be installed inside the plant. This consists of a receiving hopper where the big-bags are emptied using a fork lifter. A feeding screw mechanism transfers the material to a crushing mill to achieve the optimal grain size for the neutralising reaction.

4.93. The neutralising reagents (activated carbon and sodium bicarbonate) are stored in 2m<sup>3</sup> silos. The reagents are injected pneumatically into the connecting tubes between the economiser and the reactor. Fumes are mixed with activated carbon and sodium bicarbonate in these tubes and subsequently in the reactor. The operating dosage of the reagents (sodium bicarbonate and activated carbon) will be estimated during commissioning, starting from concentrations determined by theoretical calculations based on the expected concentration of pollutants.

4.94. The fumes then pass into the bag house filter. The bag house technical specifications are the following:

- Maximum filter inlet temperature: 180°C
- Effective flow rate at 180°C 24,400 E<sup>31</sup>m<sup>3</sup>/hour
- Filtering surface 475m<sup>3</sup>
- Number of bags 408
- Maximum filtration rate 0.85/minute
- Bag fabric Polyphenylene sulphide
- Bag Weight 550g/m<sup>2</sup>
- Compressed air consumption at 7 bar 1000NI<sup>32</sup>/minute
- Flow transformation coefficient  $(180+273)/273 = 1.659$
- Filter speed (w=m/min') 0.63 (min); 0.74 (average); 0.85 (max)

4.95. These speed levels guarantee optimum filtration efficiency.

4.96. After the upgrade, the gas flow rate at the SCC exit and the filter inlet may vary according to the type of waste mixture, in the following range:

	Minimum wet flow rate	In normal operation	Maximum wet flow rate
SCC exit (V=Nm <sup>3</sup> /h)	10,500	12, 250	14,000
Filter inlet (V= Nm <sup>3</sup> /h)	10,900	12,700	14,700

4.97. The temperature of the filter inlet gases, compatible with the bags manufactured in RYTON tissue, is 180°C

4.98. The dust and the spent reagents are collected from the surface of the fabric filters and are removed by rapidly expanding the bags with air at timed intervals. The dust

<sup>31</sup> Effective

<sup>32</sup> Normal litres

and spent reagent are then collected in the hopper at the base of the filters. Part of this fly ash is re-circulated to the reactor while the other part is conveyed to the ash dumping system.

- 4.99. A centrifugal fan (Induced Draft Fan [ID Fan]) located at the clean end of the bag house, prior to the stack, is used to ensure that clean exhaust gases are emitted to the atmosphere via the stack at a minimum velocity of 15 metres per second. The ID Fan ensures a negative pressure throughout the flue gas path.
- 4.100. The differential pressure across the filter is used to monitor the need of cleaning. Periodic replacement is required when the residual lifetime is achieved or in the case of irreversible damage (e.g. an increasing loss of pressure may be caused by irreversible deposit of fine dust in the filter material).
- 4.101. The choice of the FGT systems depends on a number of factors including:
- Type of waste: composition and variation;
  - Type of combustion process;
  - Flue gas flow and temperature;
  - Flue gas content, size and rate of fluctuations in composition;
  - Target emission limit values;
  - Restrictions on discharge aqueous effluents;
  - Plume visibility requirements;
  - Land and space availability;
  - Availability and cost of water and other reagents-;
  - Energy supply possibilities;
  - Availability of subsidies for exported energy;
  - Tolerable disposal charge for incoming waste;
  - Reduction of emissions by primary methods; and
  - Noise emissions.
- 4.102. The type of waste to be treated was originally animal waste. The FGT system that was considered most appropriate to treat the flue gases resulting from the incineration of this (abattoir) waste to comply with Legal Notice 336 of 2001 (and the Waste Incineration Directive) comprised a system of injecting the flue gas with lime or sodium bicarbonate (dry) and passing the resultant gas through a bag house filter (see **Appendix 14**).

- 4.103. Primary techniques will be used to control emissions of oxides of nitrogen. These include:
- Preventing an over supply of air by having a system in the PCC and SCC that avoids uneven temperature gradients; this is done by taking continuous measurement of oxygen in the PCC and SCC. If the oxygen levels decrease, the feeding rate of combustion air is increased to ensure proper combustion of waste; and
  - Preventing the use of unnecessarily high furnace temperatures (including local hot spots). The SCADA system makes sure that the proper waste quantities are fed in the rotary kiln depending on the calorific value of the material.
- 4.104. Secondary techniques will be used to control high NO<sub>x</sub> emissions: the injection of urea solution into the SCC reduces nitrogen oxides to nitrogen and N<sub>2</sub>O – the process is known as Selective Non Catalytic Reduction (SNCR).
- 4.105. Since the installation is required to treat a broad spectrum of waste, including hazardous solvents and clinical waste, the FGT also includes an injection lance in the SCC for the introduction of atomised urea and the injection of activated carbon to control heavy metals.
- 4.106. The European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration requires that the carbon injection be upstream of the bag house filter. It is possible to mix activated carbon with sodium bicarbonate in order to avoid hot spots inside the bag house filter. Reagents are added to the flue gas stream prior to the reactor and not inside the bag house filter. However, the flue gas enters the bag house filter from the lower part and flows upstream. The incinerator is in line with this requirement because the activated carbon will be injected prior to the reactor. When the flue gas enters the reactor, activated carbon and sodium bicarbonate will be well mixed with the flue gas. The mixture and flue gas and reagent will then enter the bag house filter in an upstream position, i.e. from the lower part of the bag house filter upwards.
- 4.107. The new design of the FGT system is in line with BAT for overall optimisation and the “whole system” approach in particular the following elements:
- The Bag-House Filter (BF) is used downstream of the reagent injection: this gives it the advantage of acting as a complementary reactor in addition to its de-dusting effect. The pressure drop through the fabric material distributes the flue-gas on the adhered cake which contains some deposited reagent and, due to low velocity of the gases, the residence time is long. The BF can, therefore contribute to the treatment of acid gases, gaseous metals such as mercury and cadmium, and Persistent Organic Pollutants (POPS) such as PAH, PCB, dioxins, and furans; and
  - Activated carbon shows a high adsorption efficiency for mercury as well as for polychlorinated dibenzodioxin (PCDD) and polychlorinated dibenzofuran (PCDF), (collectively referred to as “PCDD / F”).

- 4.108. Land space and availability was also a factor to be considered in the design of the whole installation. Space is extremely limited and was therefore a key issue in the design. Energy efficiency was also a consideration – the dry system chosen is the most energy efficient system.
- 4.109. The FGT system ensures that the fumes comply with the maximum emission levels laid down in Directive 2000/76/EC of the European Parliament and the Council of 4 December 2000 on the incineration of waste (hereafter referred to as the “Waste Incineration Directive or WID”). The following table provides the atmospheric pollution levels that will be the maximum from the installation. The manufacturers confirm the limit values for atmospheric emissions to be those indicated in Attachment V of EU WID (2000/76/EC).

**Table 4.2: Atmospheric emission values**

Pollutant	Average daily values Mg/Nm <sup>3</sup>	Average half-hourly values Mg/Nm <sup>3</sup>
NO <sub>x</sub>	200	400
SO <sub>2</sub>	50	200
PM <sub>10</sub>	10	30
CO	50	100
HCL	10	60
HF	1	4
Hg	-	0.05
Total Metals	-	0.5
Dioxins and Furans (ng/m <sup>3</sup> )	-	0.1
Cd and Tl	-	0.05
TOC	10	20

- 4.110. Bottom ash from the PCC and SCC will be transferred from the incinerator de-ashing chamber to a large container. This material will be disposed of in the hazardous waste landfill or non-hazardous landfill depending on the chemical and physical parameters of the ash. Dust from the boiler will be separated and disposed separately in another smaller steel container which will then be unloaded in the hazardous waste landfill since the contamination of this dust is expected to be more concentrated. Dust from the bag house filter will be unloaded in a big bag and disposed of in the hazardous waste landfill. Storage on site of the slags and dust/ashes is improbable due to lack of space available. For further details on waste management please refer to **Chapter 5**.
- 4.111. In summary, dry systems perform better than wet systems in terms of water consumption, effluent production, energy consumption, plume visibility, and capital as well as operational costs. Thus, in order to reduce resource consumption, the dry system was chosen for the incinerator.
- 4.112. The system is therefore congruent with BAT References 35, 36, and 37 that are described hereunder.

### **BAT BOX**

#### **Reference 35:**

**Use of an overall flue-gas treatment (FGT) system that, when combined with the installation as a whole, generally provides for the operational emission levels listed in Table 5.2 for releases to air associated with the use of BAT.**

### **BAT BOX**

#### **Reference 36:**

**When selecting the overall FGT system, take into account:**

- a. The general factors described in 4.4.1.1 and 4.4.1.3;**
- b. The potential impacts on energy consumption of the installation, as described in section 4.4.1.2; and**
- c. The additional overall-system compatibility issues that may arise when retrofitting existing installations (see 4.4.1.4).**

### **BAT BOX**

#### **Reference 37:**

**When selecting between wet/ semi-wet/ and dry FGT systems, to take into account the (non-exhaustive) general selection criteria given as an example in Table 5.3.**

### **The Stack**

- 4.113. The stack is 26 metres high with a terminal section diameter of 630 mm (please see **Appendix 15** for coordinates of the stack and stack drawings).
- 4.114. The emergency relief stack is only used in case of emergency when for reasons of safety it is not possible to have fumes flow through the recovery boiler and the bag house filter. It is installed at the terminal part of the secondary chamber; it has an inside diameter of 1.3 metres and a height of 18 metres. A refractory flap valve is positioned at the outlet and is fitted with suitable fume seals. It is normally open when the system is off and kept closed by means of a pneumatic cylinder during regular operation. The flap valve opens automatically through release of the

compressed air in the feed circuit, which is equipped with a safety discharge valve with manual opening.

- 4.115. During the combustion of material inside the main chamber, the emergency stack must only be opened under exceptional circumstances and only in the case of impending risk to people or to the plant itself. The stack is opened to bring the plant into safe conditions from a thermal point of view, when there is no possibility or time for operators to carry out other interventions to resolve the situation with an adequate margin of safety.
- 4.116. An immediate consequence of the automatic emergency stack opening is that it disables the load process so as to not allow any waste into the chamber other than that already present, which must be completely burned. To reduce the environmental impact of this delicate transitory and relatively short phase, the plant is fitted with a BR3 secondary burner which, together with the secondary chamber combustion air feed system, continues to function even in the event of a blackout by means of a motor generator. This prevents unburned gases from escaping into the flue and the consequent emission of plumes of black smoke. Burn off time is programmable; the reference time is 2.5 hours which is adjustable following operating experience.
- 4.117. By opening the stack the thermal energy that develops in the PCC and the SCC is prevented from transiting through the boiler and the filter or spreading through the facility together with the fumes.
- 4.118. An immediate result of opening the emergency stack is that loading is disabled so that no other waste is brought into the chamber other than that already present and whose combustion must necessarily be brought to an end.
- 4.119. To reduce the environmental impact of this transitory phase of relatively short duration, the secondary burner and combustion air intake system of the SCC continue operation by means of a generator even in the case of a black-out. In this way, unburnt gas is prevented from escaping from the stack.
- 4.120. The causes that may lead to the automatic opening of the emergency stack are:
  - Activation of the emergency stop button;
  - Very high / very low SCC temperature;
  - Very high / very low PCC temperature;
  - Failure of Programmable Logic Cotrollers (PLC) watchdogs;
  - Very high / very low pressure change n the filter;
  - Very low oxygen levels;
  - Automatic ashes discharge and transfer system block;

- Very high pressure in the boiler;
- Very low water level in the boiler;
- Very high condensate temperature at the steam condenser outlet;
- Very low treated water level in the reservoir;
- Very high temperature of the combustion gases at the inlet of the bag filter;
- Very low temperature of the combustion gases at the inlet of the bag filter;
- Very high /low pressure change on the filter;
- Very low suction pressure on the combustion section (PCC and SCC); and
- Rotary kiln is not running as programmed.

4.121. These events are discussed in detail in **Appendix I8**.

4.122. For safety purposes, automatic discharge of the pneumatic piston that holds the flap valve of the emergency stack closed is guaranteed by a system made up of two parallel discharge valves. In the event that both solenoid valves do not function (normally open if there is no power), it is possible to discharge the air using a special manually-operated emergency ball valve located in proximity of the stack.

4.123. The stack height and its implications on air quality are further discussed in **Section 6** of the IPPC Application.

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## 5. MANAGEMENT TECHNIQUES

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- 5.1. The Section addresses section **B2.1** of the IPPC Application.
- 5.2. WasteServ will employ quality management systems and technically competent staff to ensure the operation of the plant is executed to the highest environmental standards and improved throughout the life of the installation. The application of an accredited environmental management system provides safeguards for legal compliance and demonstrates a commitment to continuous improvement in environmental performance, which fits well with IPPC.
- 5.3. The planning stage of the EMS has already begun through the IPPC application and EIA. The identification and assessment of the operation's aspects and impacts, as well as an evaluation of the relevant legal and regulatory requirements provided as part of the IPPC and EIA is information that will be used directly to set up the EMS. The IPPC and EIA also include an overview of operations. The Environmental Management Programme, which will be drawn up as part of the EMS, will include a documented list of procedures required for operational control together with assigned key responsibilities.
- 5.4. Aside from operational procedures necessary for the continued operation of the incinerator, the EMS will include documented procedures for maintenance, quality control, training requirements, emergency response procedures, and monitoring.
- 5.5. The full EMS will be established once operations commence and an operator has been appointed. WasteServ have appointed an experienced (Austrian) operator who will be responsible for the implementation of the EMS. The operator will also be responsible for training WasteServ personnel in the setting up, implementation, and maintenance of an EMS and in the operation of the incinerator. B&T will also be involved in training personnel during commissioning. During operation of the plant, key plant operating parameters will be directly linked to B&T so that they can assist if there are any malfunctions/abnormal operation of the plant.
- 5.6. It is envisaged that local operators will be trained on the EMS in accordance with the requirements of BAT 56, described hereunder. The documentation prepared to date contains the basic structure for the EMS; it is based on ISO 14 001 requirements. The EMS together with the operating procedures are found in **Appendix 8**.

### **BAT BOX**

#### **Reference 56:**

**Apply environmental management. A number of environmental management techniques are determined as BAT. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale, and complexity of the installation, and the range of environmental impacts it may have. BAT**

is to implement and adhere to an **Environmental Management System (EMS)** that incorporates, as appropriate to individual circumstances, the following features: (see Chapter 4.8):

- **Definition of an environmental policy for the installation by top management (commitment of the top management is regarded as a precondition for a successful application of other features of the EMS);**
- **Planning and establishing the necessary procedures;**
- **Implementation of the procedures, paying particular attention to:**
  - **Structure and responsibility;**
  - **Training, awareness, and competence;**
  - **Communication;**
  - **Employee involvement;**
  - **Documentation;**
  - **Efficient process control;**
  - **Maintenance programme;**
  - **Emergency preparedness and response; and**
  - **Safeguarding compliance with environmental legislation.**
- **Checking performance and taking corrective action, paying particular attention to:**
  - **Monitoring and measurement (see also the Reference document on Monitoring of Emissions);**
  - **Corrective and preventive action;**
  - **Maintenance of records; and**
  - **Independent (where practicable) internal auditing in order to determine whether or not the environmental management system conforms to planned arrangements and has been properly implemented and maintained.**
- **Review by top management.**

**Three further features, which can complement the above, are considered as supporting measures. However, their absence is generally not inconsistent with BAT. These three additional steps are:**

- Having the management system and audit procedure examined and validated by an accredited certification body or an external EMS verifier;**
- Preparation and publication (and possibly external validation) of a regular environmental statement describing all the significant environmental aspects of the installation, allowing for year-by-year comparison against environmental objectives and targets as well as with sector benchmarks as appropriate; and**
- Implementation and adherence to an internationally accepted voluntary system such as EMAS and EN ISO 14001:1996. This voluntary step could give higher credibility to the EMS. In particular EMAS, which embodies all the above-mentioned features, gives higher credibility. However, non-standardised systems can in principle be equally effective provided that they are properly designed and implemented.**

**Specifically for this industry sector, it is also important to consider the following potential features of the EMS:**

- Giving consideration to the environmental impact from the eventual decommissioning of the unit at the stage of designing a new plant; and**
- Giving consideration to the development of cleaner technologies.**

**Where practicable, sectoral benchmarking on a regular basis, including energy efficiency and energy conservation activities, choice of input materials, emissions to air, discharges to water, consumption of water, and generation of waste.**

**The development and use of procedures for the commissioning stages of new installations, generally including:**

- The prior preparation of a detailed programme of works describing the commissioning programme; and**
- An initial gap analysis of training requirements to identify pre-commissioning training needs.**

**Health & safety needs which meet European and local requirements:**

**The availability of sufficient and up to date documentation regarding the installation**

**Emergency and accident prevention planning, generally including procedures for:**

- **Serious fire;**
  - **Major explosion;**
  - **Sabotage/bomb;**
  - **Site intruders;**
  - **Major injury/death of employee/visitor/contractor;**
  - **Traffic accident;**
  - **Theft;**
  - **Environmental incident; or**
  - **Power interruption.**
- **Where the plant commissioning and tuning period may give rise to emissions outside the normal regulatory controls.**
  - **All incineration installations, and in particular for those receiving hazardous wastes, personnel training programs are considered an important part of all safety management systems, especially training for:**
- **Explosion and fire prevention;**
  - **Fire extinguishing;**
  - **Knowledge of chemical risks (labelling, carcinogenic substances, toxicity, corrosion, fire); and**
  - **Transportation.**

## **QUALITY CONTROLS OVER THE WASTE INPUT**

- 5.7. In determining the type of waste that will be incinerated at the plant, the following factors are to be considered:
- Design of the waste incineration plant;
  - Design of waste feed mechanism and the physical suitability of the waste received;
  - Maximum thermal capacity of the Incinerator and the thermal calorific value of the particular waste stream. This will affect the waste flow rate;
  - Emission limit values required to be reached (i.e. % pollutant reduction required); and
  - Flue-gas cleaning technology capacity for individual pollutant removal (e.g. limit on flue-gas flow rate, pollutant loading, etc.).
- 5.8. The permitted installation is designed to accept abattoir waste, hazardous waste including clinical waste, pharmaceutical waste, solvents, and sludges as described above.

### **Waste Acceptance Criteria**

- 5.9. The following are examples of potential key risks of certain waste streams and their implications:
- High mercury input, leading to high raw flue-gas concentrations;
  - High iodine or bromine input, leading to high raw flue-gas concentrations;
  - High variability in moisture content or calorific value (CV), leading to combustion irregularities;
  - High chlorine loading exceeding flue-gas treatment (FGT) capacity;
  - High sulphur loading exceeding FGT capacity;
  - Rapid change in flue-gas chemistry that affects FGT function;
  - High ash content;
  - Ash melting behaviour;
  - Physically large items blocking feed systems – leading to an interruption of regular operation; and
  - Excessive slagging / fouling of boiler components when certain types of waste are being fed, e.g. high Zn concentration sources (contaminated wood waste) have been reported to cause abnormal slagging in the first boiler pass.

- 5.10. The incinerator technology already in place has been designed to be flexible in terms of the waste that can be burnt. This facilitates management of the installation to operate at optimum specifications ensuring that emissions do not exceed Emission Limit Values (ELVs) as outlined by the Waste Incineration Directive (WID) (transposed to local legislation through LN 336 of 2001).
- 5.11. Notwithstanding the above, certain wastes cannot be accepted into the plant. The following considerations will limit what waste streams can be accepted:
- The chlorine concentration of the waste mix will be less than 1% in the half-hourly feed rate and the PVC quantity will not exceed 1.9%;
  - The sulphur concentration in the half-hourly feed rate will have to be compatible with the typical efficiency of neutralization of the chosen reagent and with the emissions fixed by the Waste Incineration Directive 2000/76/EC;
  - The hourly feed rate of the new waste added to the hour quantity of organic wet waste must comply with the hour thermal load in normal running condition for the rotary combustion chamber;
  - A number of additional wastes will not be treated alone so as to ensure a mix of waste having the required calorific value;
  - Clinical waste will have to be packed into plastic bags and taken to the incineration plant in 1,100 litre skips, as is the current practice at St Luke's Hospital;
  - A steady supply of material with a high calorific value is required to ensure optimum performance;
  - Moisture content of waste arriving (a high moisture content requires more energy for incineration); and
  - Large quantities of metal in the animal waste stream cannot be accepted as this could damage the shredder.
- 5.12. Prior to the acceptance of waste at the installation, the following waste acceptance procedures will be followed as appropriate. Please refer to **Appendix 8** - the EMS Operational Procedures 15 and 16 for waste acceptance procedures and laboratory testing. These procedures will be further elaborated and standards included once the plant is operational and the appropriate staff (such as the chemist) will be employed.
- 5.13. To ensure traceability of material each waste container will have a label containing information on the type of waste present inside, the permit issued by MEPA, and the permit number issued by the Plant manager. Waste that is not properly labelled will not be accepted at the plant.
- 5.14. Other than in the prescribed circumstances outlined below, all wastes accepted at the installation will undergo basic characterisation testing by, or on behalf of, the

waste holder prior to delivery. Basic characterisation testing will be used to determine the following:

- Source and origin of the waste;
- Information on the process producing the waste (description and characteristics of raw materials and products);
- Description of waste treatment applied to the waste or reasons why treatment is not considered necessary;
- Data on composition of the waste;
- Appearance of the waste (smell, colour, and physical form); and
- The European Waste Catalogue code for the waste being received.

5.15. All wastes being accepted at the installation will be subject to basic characterisation and compliance testing, except in the following circumstances:

- Where testing is not considered necessary due to the nature of the waste (e.g. RDF, etc.). This exclusion would not apply where there is the possibility that the waste has been contaminated during previous use, production, storage, or transport;
- Where all necessary information required for the basic characterisation is already known (this will usually only apply to wastes that are regularly generated by a consistent process at the same installation); or
- Where testing is impractical or where appropriate testing procedures are unavailable.

5.16. Compliance testing constitutes periodical testing by simpler standardised analysis methods to determine whether the waste complies with the results of the basic characterisation and the installation specific conditions of the permit. This test will focus on key variables and will be carried out at least once a year for each waste stream.

5.17. The relevant parameters to be checked will be determined from the results of the basic characterisation. The parameters, and reasons for their selection, will be documented, and the results of the tests will be kept at the installation.

5.18. The reasons for not carrying out compliance testing will be justified and documented and regular checks will be carried out to ensure that the waste complies with its description and documentation.

5.19. The requirements for basic characterisation and compliance testing depend upon the type of waste. For wastes that are regularly generated in the same process, where the input materials, and the process are well defined, and changes to the process are notified to the incinerator operator, initial analyses may show that there is little

variability in the waste, and there may be no further requirement for characterisation testing. Further deliveries may then only be subject to compliance testing. For wastes that are not regularly generated in the same process and installation, each batch may require the basic characterisation testing and consequently no compliance testing is needed.

- 5.20. On-site verification constitutes rapid check methods to confirm that a waste is the same as that which has been subjected to compliance testing and that which is described in the documentation accompanying the waste. It may consist merely of a visual inspection of the waste before and/or after unloading.
- 5.21. A visual inspection to satisfy the on-site verification requirements will be carried out on all wastes received at the installation. Preliminary verification, including checking of the paperwork and a visual inspection if possible, will take place before vehicles carrying waste are allowed to proceed to the unloading bay and final checking is carried out at the point of discharge.
- 5.22. This visual inspection will have two purposes:
- To confirm that the waste being accepted is permitted for treatment at the installation; and
  - To confirm that the waste in the container is as described in the accompanying documentation.
- 5.23. In this respect, the person inspecting the waste will be looking for visual evidence of contaminants within the waste, which are either not declared on the consignment note, and/or are not permitted under the terms of the permit.
- 5.24. In cases where basic characterisation has identified that a waste may vary outside the limits applicable to the installation, and the variation cannot be detected by visual means, it will be necessary to supplement the visual testing by additional tests. If the necessary tests cannot be carried out at the installation, the tests will be undertaken prior to delivery, and the necessary results provided in advance of the delivery of the waste to the installation.

### **Communication with Waste Suppliers to Improve Incoming Waste Quality Control**

- 5.25. The operators of the installation have indicated that the person responsible for the plant will be training personnel in the operation and management of the plant. The training will include ensuring that the operators have a good knowledge of process limitations that will allow them to assess and select procedures to control input and hence the overall process performance.
- 5.26. Waste producers will be required to notify the operator at least two weeks in advance that they have waste for incineration. Waste producers will be required to give details about the waste they will be incinerating including volumes, type, chemical composition, and calorific values. This will ensure that operators will be able to plan

the waste mix for the incinerator well in advance of receipt of the waste, thus ensuring that the incinerator will be operating with a more or less constant thermal load (see **Appendix 8** – EMS and Operating Procedure 15).

- 5.27. Producers of clinical waste are Mater Dei Hospital and other Governmental Hospitals and Clinics, private hospitals and clinics. Producers of abattoir waste are the Civil Abattoir at Marsa and Gozo and other private slaughter houses and food processors. Airport waste is generated by Air Malta in-flight catering and other airlines that unload their waste in Malta and port food waste unloaded by ships and cruise liners. Hazardous waste is generated by Maltese industry including Malta Shipyards Ltd, the pharmaceutical industry, paint industry, and other manufacturing industries. RDF, if used, will be generated from facilities installed at the Sant'Antnin Waste Treatment Plant in Marsaskala.
- 5.28. Operators will develop a feed mix that is prepared to ensure that the incinerator operates at a constant calorific value whatever the waste mixture being inputted. This in turn ensures that emission values are also consistent.
- 5.29. When the operator has all the necessary data about the waste that needs to be treated and it is suitable for the incinerator, the waste will be inserted in the work schedule and a permit will be granted to the waste producer. This permit reference has to be clearly shown on the waste container. In addition to this, the waste has to be accompanied by a consignment note issued by MEPA.
- 5.30. Waste that does not conform to the waste acceptance criteria will not be accepted at the facility.
- 5.31. In order to ensure that the waste received at the facility complies with the conditions listed above, waste producers must complete a form, supplied by the incinerator operator, prior to sending their waste for incineration.
- 5.32. The incinerator operator will analyse each form to determine whether (i) the waste can be incinerated at the facility; and (ii) when each waste consignment should be delivered to the incinerator site in accordance with the waste incineration burn schedule.
- 5.33. Waste that cannot be accepted at the incinerator will be diverted to the Ghallis Hazardous Waste Facility and treated there.
- 5.34. The waste feed mix will be such that it will ensure that compliance with ELVs is continuously achieved. An Environmental Management System will be developed once the operator has been contracted. The EMS will facilitate compliance.
- 5.35. The EC's BAT BREF identifies the following key substances/properties that will usually require particular procedures to be put in place for their management in terms of concentration and distribution in the waste:
  - Mercury, alkali metals, and heavy metals;

- Iodine and bromine;
- Chlorine and sulphur;
- Variations in heat values/moisture content;
- Critical organic pollutants;
- Physical consistency of waste, e.g. sewage sludge; and
- “Mixability” of different kinds of waste.

### Checking, Sampling, and Testing Incoming Wastes

- 5.36. Refuse Derived Fuel (RDF) will be verified through visual inspection.
- 5.37. Sampling of clinical waste is not advisable because of health risks. Clinical wastes can, however, be assessed through:
- Control and comparison of data in the declaration list in comparison with the delivered waste; there are different codes for each clinical waste category and each bag should have the code showing the type of clinical waste within the bag; and
  - Manual screening for radioactivity by means of a Geiger counter.
- 5.38. Animal by-products will be assessed through visual control and comparison of data in the declaration list in comparison with the delivered waste.
- 5.39. The exact on site procedures for verifying incoming waste will be developed as experience is gained on the nature and composition of incoming waste, known difficulties with certain waste streams (of a certain type or from a certain source), specific sensitivities of the installation concerned (e.g. certain substances known to cause operational difficulties), existence or absence of a quality controlled specification for the waste, and whether the waste has been dealt with before and experiences with it. An operating procedure will be prepared.
- 5.40. Checking of hazardous waste will be carried out using various techniques, such as:
- Visual inspection;
  - Control and comparison of data in the declaration list with the delivered waste;
  - Sampling/analysis of bulk tankers;
  - Random checking of drummed loads;
  - Unpacking and checking of packaged loads;
  - Assessment of combustion parameters;
  - Reactivity of hazardous liquids; and
  - Flash point of the liquid hazardous waste and liquid sludge.
- 5.41. It is WasteServ's intention to sub-contract any specialised testing that needs to be carried out. The laboratory contracted to carry out any testing for WasteServ and the methods employed for testing will be made known to MEPA once details are available. A small on-site laboratory will be used to confirm the chemical composition of waste to be incinerated and will test calorific value, reactivity, and some minor chemical analysis including chlorides of the waste (see **Appendix 12** showing location of laboratory).

***Detectors for radioactive materials***

- 5.42. Waste producers will be informed that radioactive materials cannot and will not be treated in the incinerator. Random waste analysis will be carried out. It is anticipated that such waste is generated from the hospital. In order to ensure that no waste is transported to the Facility, the licensed waste carrier, prior to loading waste from the hospital onto the vehicle, will test the waste with a Geiger-Muller counter. If any radioactive waste is found the waste will not be loaded onto the vehicle. As a further precaution, the security personnel at the gate of the Facility will also have a Geiger counter where they will test the clinical waste; should radioactivity be found the consignment will be refused entry into the Facility.
- 5.43. The following are references taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to quality controls over waste input. As explained above, the installation is consistent with these requirements.

**BAT BOX**

**Reference 4:**

**To establish and maintain quality controls over the waste input, according to the types of waste that may be received at the installation, as described in:**

**4.1.3.1 Establishing installation input limitations and identifying key risks, and**

**4.1.3.2 Communication with waste suppliers to improve incoming waste quality control, and**

**4.1.3.3 Controlling waste feed quality on the incinerator site, and**

**4.1.3.4 Checking, sampling and testing incoming wastes, and**

**4.1.3.5 Detectors for radioactive materials.**

## **BAT BOX**

### **Reference 6:**

**To use techniques and procedures to restrict and manage wastes storage times, as described in 4.1.4.2, in order to generally reduce the risk of releases from storage of waste/container deterioration, and of processing difficulties that may arise. In general it is BAT to:**

- Prevent the volumes of wastes stored from becoming too large for the storage provided; and**
- In so far as is practicable, control and manage deliveries by communication with waste suppliers, etc.**

## **MAINTENANCE OF A TIDY SITE**

- 5.44. The facility will adopt a JIT management system. The facility will only retain abattoir waste intended for incineration within 72 hours. This waste will be refrigerated at a temperature of not higher than 4°C. Clinical waste will be delivered on a daily basis and burned during that same day. Notwithstanding the plant can still hold waste in the refrigerated room for 5 days (during plant maintenance). The plant operator will have to establish contracts with the different waste producers so that waste will be delivered to the plant just before it will be treated. This will avoid having to transform the incinerator facility into a hazardous waste storage area of all the waste produced in Malta.
- 5.45. Spent solvents will be stored in a purpose built container; the temperature in the container can be automatically controlled to ensure that the waste is kept at a low temperature, further reducing odour impacts. The liquid wastes will be pumped directly into the Primary Combustion Chamber or the burner, depending on the chemical properties, thus reducing the risk of spillages.
- 5.46. Hazardous waste to be incinerated will be delivered to the facility by licensed waste carriers not more than two days prior to its scheduled incineration. This will facilitate general housekeeping since relatively little waste will be retained on site.
- 5.47. Abattoir waste will also be transported by authorised waste carriers, unloaded at the waste reception area, and immediately loaded into the cold storage area.
- 5.48. Refuse Derived Fuel (RDF) will be transported from the Sant' Antnin Waste Treatment Plant, if and when required.
- 5.49. A full EMS based on the submitted EMS for the facility will be developed. The EMS will facilitate site management and help to ensure that it is managed in accordance with good housekeeping practices.

- 5.50. Waste water will be generated from the washing of the bins that contain abattoir waste. Waste water from this process goes to drainage and will not be incinerated (see **Appendix 12**). An Operating Procedure has been prepared for the testing of bin washing wastewater to ensure that it complies with the requirements of Legal Notice 139 of 2002 – see EMS OP 18 – **Appendix 8**. A system of valves will be installed to prevent any contaminated waste water from entering the drainage system in the event of a spill or fire. A waste water reservoir will be built with a capacity of 60m<sup>3</sup> from where waste water can then be removed from site and disposed of appropriately. Water used to regularly flush out the shredder and the blood vessel will be incinerated. Discussions between the Drainage Department of the Water Services Corporation and Wasteserv Malta Ltd are underway in order to chart out the best way for the Installation to obtain a discharge permit. It is noted that discharges that are compliant with Legal Notice 139 of 2002 will be allowed to go to drainage. The Drainage Department is the competent authority that authorises discharges. A meeting between Wasteserv and the discharge permit representative of the Drainage Department was held and the requirements of the Installation were discussed (see section below Waste Management).
- 5.51. The installation contains a detailed “Operator’s and Maintenance Manual” that describes the maintenance interventions programme for each part of the installation. The frequency of maintenance is also described. Although most of the routine checks are carried out monthly, certain inspections on, for example, the elevator trolley (bin elevator), should be carried out weekly for the first three months. The manual also contains a “Lubrication Programme” that describes the frequency of lubrication for different parts of the installation as well as the type of lubricant to be used.
- 5.52. The maintenance programme is detailed for all parts of the installation. The manual must be followed by the operator and a log sheet kept describing what maintenance has been carried out, when, and by whom. This should be checked by the responsible person. The maintenance programme, relevant training, and record keeping will be maintained and facilitated through the EMS.
- 5.53. A power wash hose will be available on site to clean vehicles should a spill occur. The contaminated water will be contained in the bunded area. Wastewater will be collected in a reservoir and tested prior to discharge. Discharge of effluent will be as required by the Competent Authority.
- 5.54. The following are references taken from the European Commission’s IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to site maintenance. As explained above, the installation is congruent with these requirements.

**BAT BOX**

**Reference 2:**

**Maintenance of the site in a generally tidy and clean state, as described in 4.1.2.**

**BAT BOX**

**Reference 3:**

**Maintain all equipment in good working order, and to carry out maintenance inspections and preventative maintenance in order to achieve this.**

## FLUE GAS TREATMENT

- 5.55. As described in Section 4 of the IPPC Application, a dry FGT system will be used at the incinerator. A mixture of activated carbon and sodium bicarbonate will be used to treat the flue gases. In addition, a urea solution will be injected into the secondary combustion chamber in order to reduce NO<sub>x</sub> emissions.
- 5.56. Dry systems perform better than wet systems in terms of water consumption, effluent production, energy consumption, plume visibility, and capital as well as operational costs. Thus, in order to reduce resource consumption, the dry system was chosen for this incinerator.
- 5.57. The proposed system is also the least complex to operate (according to **Table 5.3** of the EC's Waste incineration BAT BREF). These are important factors considering that this is Malta's first hazardous waste incinerator.
- 5.58. The dosing equipment for each reagent is connected to the SCADA system that controls the quantity of activated carbon, sodium bicarbonate, and urea solution to be released in the flue gas according to the flue gas flow rate and the chemical constituents expected to be generated during the combustion process. The flue gas chemical constituents depend on the waste mixture as well as on the flue gas readings throughout its path, such as oxygen readings.
- 5.59. The operator should try to keep the waste mix as constant as possible. The operator should be familiar with the type of waste that is being incinerated and the emission levels likely to be produced, in order to reduce or increase the dosing rate of the chemical additives.
- 5.60. Measurements from the PCC and the SCC will give an indication if the chemical dosing should be increased or decreased. This system will be an automatic procedure.
- 5.61. The manufacturers confirm that the FGT system complies with the maximum emission levels laid down in the Incineration Directive and is in accordance with the requirements of BAT Reference 35, described hereunder.
- 5.62. The operation of the Facility has been described in detail in Chapter 4 and detailed calculations have been provided to demonstrate compliance of the Plant with the requirements of the Waste Incineration Directive. The Contract between the manufacturers and the Government also stipulates that the Facility is to operate within the parameters of the WID.

### **BAT BOX**

#### **Reference 16:**

**In order to reduce overall emissions, to adopt operational regimes, and implement procedures (e.g. continuous rather than batch operation,**

**preventative maintenance systems) in order to minimise as far as practicable planned and unplanned shutdown and start-up operations, as described in 4.2.5.**

**Reference 35:**

**Use of an overall flue-gas treatment (FGT) system that, when combined with the installation as a whole, generally provides for the operational emission levels listed in Table 5.2 for releases to air associated with the use of BAT.**

## **BAT BOX**

### **Reference 41:**

**For the reduction of overall PCDD/F emissions to all environmental media, the use of:**

- a. techniques for improving knowledge of and control of the waste, including in particular its combustion characteristics, using a suitable selection of techniques described in 4.1, and**
- b. primary (combustion related) techniques (summarised in 4.4.5.1) to destroy PCDD/F in the waste and possible PCDD/F precursors, and**
- c. the use of installation designs and operational controls that avoid those conditions (see 4.4.5.2) that may give rise to PCDD/F reformation or generation, in particular to avoid the abatement of dust in the temperature range of 250 – 400°C. Some additional reduction of *de-novo* synthesis is reported where the dust abatement operational temperature has been further lowered from 250 to below 200°C, and**
- d. the use of a suitable combination of one or more of the following additional PCDD/F abatement measures:**
  - i. adsorption by the injection of activated carbon or other reagents at a suitable reagent dose rate, with bag filtration, as described in 4.4.5.6, or**
  - ii. adsorption using fixed beds with a suitable adsorbent replenishment rate, as described in 4.4.5.7, or**
  - iii. multi layer SCR, adequately sized to provide for PCDD/F control, as described in 4.4.5.3, or**
  - iv. the use of catalytic bag filters (but only where other provision is made for effective metallic and elemental Hg control), as described in 4.4.5.4.**

## **BAT BOX**

### **Reference 45:**

**For the control of Hg emissions where semi-wet and dry FGT systems are applied, the use of activated carbon or other effective adsorptive reagents for the adsorption of PCDD/F and Hg, as described in 4.4.6.2, with the reagent dose rate controlled so that final air emissions are within the BAT emission ranges given for Hg.**

## ENERGY MANAGEMENT

- 5.63. This Section addresses part of section **B2.7** of the IPPC Application.
- 5.64. Energy consumption has been discussed in Section I above. It varies depending on the calorific value of the waste that is combusted: waste with a higher calorific value is preferable because less fuel is consumed.
- 5.65. The heat recovery plant (including both the boiler and the economiser) is designed taking into account an incoming maximum fume temperature of 950°C and a maximum outgoing temperature of 180°C.
- 5.66. The recovery boiler consists of a steam generator with vertical pipes connected at the top to the main cylindrical body and at the bottom to two cylindrical bodies. The gases in transit flow through the exchanger in a single pass without interposition of deviating septa; the latter would encourage accumulation of ashes or residues that would not be easy to remove. This configuration guarantees a high ratio of circulation between gravity pipes.
- 5.67. The volume of this chamber is such that the ashes and slag carried by the fumes can be separated, encouraging down flow in an orthogonal direction to the boiler axis and creating a chamber with the dual function of improving the gas flow distribution over the entire front area of the pipe bundle and, at the same time, encouraging the slag to drop into the collection hopper. The hopper is positioned in the lower part of the chamber and is equipped with a double discharge slide gate to prevent air from infiltrating. The rear fume chamber allows the fumes to escape at the top towards the economiser.
- 5.68. The plant has been designed with features that reduce heat losses and therefore have a positive impact on energy consumption; these are discussed below.
- 5.69. The chosen incinerator system is a rotary kiln design. One of the reasons that this model was chosen was because of the relatively low thermal inertia arising from the use of this type of chamber. This arises as a result of the smaller volume in the combustion chamber and consequently the assurance that the operating temperature is reached more quickly and the fuel consumption lowered.
- 5.70. Heat losses are reduced in the rotary kiln, the post-furnace chamber, and secondary or post-combustion chamber because they are lagged with insulating material.
- 5.71. The heat recovery plant ensures that the energy and heat arising from incineration is transferred to the flue-gases. Cooling these gases through the boiler sequesters the heat energy to produce steam.
- 5.72. The economiser further reduces the temperature of the fumes that heat the feed water and/or condensate by a further 100-120°C.
- 5.73. The condenser condenses and cools the saturated steam to 80°C and 10 bar if the steam is not used by the abattoir.

5.74. The plant is designed to recover approximately 30% of the steam generated and will supply the abattoir their daily cleaning operations. There is also the possibility that steam can be sold to Malta Shipyards for use when certain types of vessels are being maintained. WasteServ is also exploring the possibility of using steam to produce cooling with adsorption/absorption chillers for the cold storage area at the thermal treatment facility and also at the Civil Abattoir itself in order to reduce electricity consumption. This option is preferred since it is a closed loop system and water will not be wasted in the atmosphere.

### **Energy Loss Reduction**

5.75. Some heat is lost through the flue-gas leaving the plant. The actual loss depends on the flue-gas flow and on its temperature (enthalpy).

5.76. Possibilities for reducing these losses are:

- Reduce the flue-gas flow – to achieve this several options are possible:
  - Reduce excess air e.g. improve primary and/or secondary air distribution;
  - Recycle flue-gas, i.e. replace a part of the secondary air by flue-gas;
- Enrich the combustion air in O<sub>2</sub>, i.e. increase the proportion of O<sub>2</sub> and decrease the one of N<sub>2</sub> by O<sub>2</sub> injection (only in special cases is this carried out – see Section 4.2.13);
- Reduce the flue-gas temperature, e.g. by using flue-gas condensation or by decreasing the temperature at the boiler exit; and
- Selecting FGT facilities with decreasing temperatures from the boiler to the stack as far as possible.

5.77. Air distribution in the primary combustion chamber is facilitated by the rotating kiln which can be rotated both clockwise and anticlockwise.

5.78. The gases from the primary combustion chamber create turbulence in the secondary combustion chamber.

5.79. Flue gas flow is dependant on the quantity of waste being burnt, the ID fan speed, and the temperature of incineration. Since the boiler has a fixed  $\Delta T$ , if the temperature is higher than the normal working temperature of 950°C, then the flow of flue gas has to decrease. This procedure is included in the automatic control procedure of the plant. If the temperature of the plant starts increasing, the plant will automatically take measures to reduce the temperature to the normal working safe temperature. The plant ensures that the temperature after the boiler is 180°C. If the temperature is high, irrelevant of all the automatic procedures programmed by the computer system (SCADA), the plant will go into automatic shutdown and open the emergency chimney to avoid fire in the bag house filter.

5.80. **Table 5.1** summarises the techniques that are listed in the Waste Incineration BAT BREF to reduce energy loss together with the corresponding measures adopted at the installation.

5.81. **Appendix 16** shows the mass and energy Sankey diagrams for the installation.

**Table 5.1: BAT for reduction in energy loss at the installation**

<b>BAT</b>	<b>Technique applied at plant</b>
<p>Heat radiation and convection arising mainly from the furnace and boiler can be reduced through:</p> <ul style="list-style-type: none"> <li>• Lagging; and</li> <li>• Building the plant inside an enclosed building.</li> </ul>	<p>The entire furnace cylinder is lined with a 300mm thick skirt composed of several layers of insulating material in contact with the skirt. The innermost layer consists of a vibrated jet of refractory concrete with high alumina content, low cement content and high resistance to abrasion. The transition, or post-furnace chamber, is also made up of layers of thermal insulation and refractory material with high thermal resistance. The secondary combustion chamber is lined with insulating and refractory material with a total thickness of 300mm, partially made with insulating panels in contact with the skirt and partially (for the innermost layer) with a vibrated jet of refractory concrete containing approximately 60% alumina, low cement content, and high resistance to temperature (max. operating temperature 1650 0C). Suitable expansion joints are fitted in both a longitudinal and transverse direction in order to ensure the necessary structural stability of the skirt. The front fume chamber of the boiler is entirely insulated with a double layer of insulating and refractory concrete.</p> <p>The plant is entirely enclosed within a building.</p>
<p>Losses with solid residues (bottom and fly ashes) can be reduced through:</p> <ul style="list-style-type: none"> <li>• Good waste burnout; and</li> <li>• Using heat from the slag bath.</li> </ul>	<p>The rotary cylinder is inclined at an angle of 2° and the average rotation speed is 0.2 rpm. The rotation speed of the chamber can be changed by use of an inverter. This allows the operator to ensure adequate residence time in the combustion chamber for the different types of material being incinerated.</p>
<p>Losses from boiler blowdowns and effluent can be reduced by re-using the energy in the water for heating the building at the plant.</p>	<p>This is not considered appropriate for Malta as it is unlikely that heating the building at the plant will be required (considering Malta's climate).</p>
<p>Fouling of the boiler reduces heat transfer efficiency. This can be addressed by:</p> <ul style="list-style-type: none"> <li>• Designing the boiler to ensure a lower fouling rate; and</li> <li>• Ensuring effective boiler cleaning – see Section 4.3.12</li> </ul>	<p>The volume of the front fume chamber of the boiler is such that the ashes carried by the fumes can be separated, encouraging downflow in an orthogonal direction to the boiler axis and creating, in correspondence to the intake area, a 'calming' chamber that improves the gas flow distribution over the entire front area of the pipe bundle.</p> <p>The boiler is equipped with an automatic system with timed and sequential cleaning cycle of the exchanging surfaces by means of steam blowers.</p>
<p>Avoid start-up and shutdown procedures, developing procedures for continuous operation and good maintenance.</p>	<p>Start up and shutdown procedures will be reduced by having full control of the plant. WasteServ will employ an overseas operator who is very experienced in the management of similar installations. This person will ensure the smooth running of the plant while training local operator/s.</p>

	The fact that the plant is designed to combust a range of wastes ensures that waste is always available for burning.
Losses from fast changes in waste characteristics or heat demand can be reduced through: <ul style="list-style-type: none"> <li>Waste mixing and quality assurance/control; and</li> <li>Supply heat to buffer storage network.</li> </ul>	Procedures for waste mixing and quality control will be applied as described in previous paragraphs.
Maintenance procedures to prevent plant failures/outage.	Detailed maintenance procedures are available in the operating manual of the plant. The operator will be responsible for following these procedures and maintaining a log.
Use of measuring systems with low pressure drop and precise results reduces losses from these instruments.	<p>The following devices are part of the plant:</p> <p>At the sampling point on the process stack:</p> <ul style="list-style-type: none"> <li>SEC sampling probe with pressure, temperature, and flow rate sensor; and</li> <li>Sample/span/air transfer line.</li> </ul> <p>In the air-conditioned cabinet in the control room:</p> <ul style="list-style-type: none"> <li>Analyser model MIR 9000 with which HCl, SO<sub>2</sub>, NO<sub>x</sub>, CO, O<sub>2</sub>, and TOC are measured using the infrared absorption method;</li> <li>Opacity meter model LAND 4500nMKII with which dust is measured;</li> <li>Air dehumidification panel – MDS; and</li> <li>Automatic calibration panel model T.I.G. which performs the calibration, zero, and countercurrent washing functions of the sampling probe.</li> </ul> <p>In addition, there is equipment that: (1) takes oxygen readings in the PCC and SCC that will control the combustion air; (2) measures pressure drop in the bag house filter; (3) measures pressure and temperature of the boiler. There are also pressure and temperature probes along the plant.</p>

- 5.82. The following are references taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to energy efficiency. As explained above, WasteServ will be exploring options of reusing the steam generated by the installation.

### **BAT BOX**

#### **Reference 26:**

**The overall optimisation of installation energy efficiency and energy recovery, taking into account the techno-economic feasibility (with particular reference to the high corrosivity of the flue-gases that results from the incineration of many wastes, e.g. chlorinated wastes), and the availability of users for the energy so recovered, as described in 4.3.1, and in general:**

**(a) To reduce energy losses with flue-gases, using a combination of the techniques described in 4.3.2 and 4.3.5;**

**(b) The use of a boiler to transfer the flue-gas energy for the production of electricity and/or supply of steam/heat with a thermal conversion efficiency of:**

**(i) For mixed municipal waste at least 80% (ref. Table 3.46);**

**(ii) For pre-treated municipal wastes (or similar waste) reared in fluidised bed furnaces, 80 to 90%;**

**(iii) For hazardous wastes giving rise to increased boiler corrosion risks (typically from chlorine/sulphur content), above 60 to 70%; and**

**(iv) For other wastes conversion efficiency should generally be increased in the range 60 to 90%.**

### **BAT BOX**

#### **Reference 27:**

**To secure where practicable, long-term base-load heat/steam supply contracts to large heat/steam users (see 4.3.1) so that a more regular demand for the recovered energy exists and therefore a larger proportion of the energy value for the incinerated waste may be used.**

**BAT BOX**

**Reference 28:**

**The location of new installations so that the use of the heat and/or steam generated in the boiler can be maximised through any combination of:**

**Electricity generation with heat or steam supply for use (i.e. use CHP);**

**The supply of heat or steam for use in district heating distribution networks;**

**The supply of process steam for various, mainly industrial, uses (see examples in 4.3.18); and**

**The supply of heat or steam for use as the driving force for cooling/air conditioning systems.**

## WASTE MANAGEMENT

5.83. This Section addresses Section **B2.3**, **B2.4**, **B2.5**, and **B2.6** of the IPPC Application

### Waste Streams

5.84. The waste generated by the operation of the Scheme falls into the following categories:

- Bottom ash;
- Fly ash from bag house filter including spent reagents;
- Dust from the boiler;
- Waste material from maintenance operations;
- Waste water from washing floors / cleaning of spillages;
- Water from the disinfection / cleaning of the shredder and blood vessel;
- Water from the bin washer;
- Brine from the Reverse Osmosis Plant; and
- Wastewater from ablution facilities.

5.85. The amount of waste generated and its disposal is discussed hereunder. **Table 5.2** summarises waste generation and disposal data and provides the ECW codes.

5.86. Waste streams from construction of the plant have been dealt with in the certified EPS for the Incinerator at the Public Abattoir as the plant is already built. The Environmental Impact Assessment for the modifications to the incinerator to treat hazardous waste states that construction waste is minimal because the modifications include installation of equipment and bunding a concrete yard.

5.87. The new infrastructure to be installed on site consists mainly of pre-fabricated equipment including the storage containers for solvents and clinical waste. Bunding of the area may result in very small quantities of inert waste that will be disposed of by the contractor in line with legal requirements.

### Bottom Ash

5.88. Bottom ash will be generated from the primary combustion chamber. The ash will be unloaded in the deashing chamber where a smaller diesel burner is installed to reduce the TOC of the ash.

5.89. Bottom ash will be collected separately from the fly ash and will be disposed to the hazardous waste landfill. The bottom ash collecting system is designed to operate under negative pressure so that no dust escapes and it is not exposed to the outside.

The bottom ash is therefore not expected to mature on site and will be transported off site before leachate can be produced.

- 5.90. Depending on the waste mix incinerated, the incinerator will generate between 685 and 1,057 tonnes of slag from the rotary kiln (as per data in **Appendix 6**). The ash will be hazardous and will be sent to the Ghallis Hazardous Waste Facility for final disposal.
- 5.91. Ferrous material in the bottom ash will be minimal, most of which will be the metal parts of sharps. Although BAT Reference 12 states that ferrous materials should be separated where practicably and economically viable, in this case, metal from the bottom ash will not be removed because it is present in such low quantities that it is not considered to be economically viable to remove the metal.

### ***Fly Ash***

- 5.92. The amount of fly ash to be produced annually is expected to be 320 to 506 tonnes including the spent reagents. This estimate is based on the data given in **Appendix 6**.
- 5.93. Fly ash will contain residues of sodium salts, chlorides, sulphites/sulphates, unreacted reagent chemicals, and some dust from the flue gas treatment. It will be collected separately from bottom ash. Since it is hazardous it will be disposed at the Ghallis Hazardous Waste Facility<sup>33</sup>. The consignment note system adopted by MEPA will be used to ensure that national waste management procedures and regulations are adhered to.
- 5.94. Samples of bottom ash and fly ash will be taken and analysed regularly at an accredited laboratory<sup>34</sup>.

### ***Dust from boiler***

- 5.95. Dust generated from the boiler is approximately 37 to 89 tonnes.

### ***Maintenance Material***

- 5.96. Maintenance of the plant will obviously generate waste. This will be treated as hazardous waste and removed from the site by licensed water carriers and sent to the hazardous waste landfill. Skips will be used to collect material deposited in the rotary kiln. They will be taken to the Ghallis Landfill by a licensed waste carrier.

### ***Waste Water from Washing Floors***

- 5.97. Waste water from washing of floors will go directly to the sewerage system. Fire water will not be allowed to go to drains because valves will be fitted to the drainage

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<sup>33</sup> It is noted that although the Ghallis Hazardous Waste Facility is not yet operational (at the time of writing, January 2007) WasteServ have confirmed that it will be by the time the incinerator is permitted and operating.

<sup>34</sup> Such as the Malta National Laboratory.

system so that fire water is collected in a sump specifically built to receive such waters. The water will be disposed off site as instructed by the Competent Authority; the necessary permits will be obtained. Similarly wastewater from spills and from cleaning of trucks<sup>35</sup> will be collected in the same sump and tested prior to discharge (see **Appendix 8** - EMS).

- 5.98. Rain water that falls on the waste reception area will go to the sump prior to disposal or reuse for washing of the plant. However, valves will be installed to the sewerage system in case of hazardous waste spillages, in order to capture and treat water that may fall on this area. Separate systems are in accordance with BAT 47.

#### ***Water from Bin Washer***

- 5.99. Effluent from the bin washer will be discharged to the sewerage system. A sewerage discharge permit will be obtained from the Competent Authority. No substances listed in Legal Notice 139 of 2002 will be found in the wastewater because the latter will only contain wash water from bins containing animal and clinical waste. It is unlikely that the abattoir waste will be contaminated with substances listed in Schedules A and B of the Legal Notice. It is also unlikely that clinical waste skips will be contaminated as clinical waste is contained in appropriate plastic bags. Notwithstanding a Standard Operating Procedure has been prepared as part of the EMS to test wastewaters. Please refer to **Appendix 8**.
- 5.100. The manufacturers of the plant are not in a position to provide estimates of potential contamination of wastewater because of the variable nature of the waste that may be left behind in the bins. In addition, they confirmed that only appropriate bags can be used for the transport of waste.
- 5.101. Discussions between the Drainage Department of the Water Services Corporation and Wasteserv Malta Ltd are underway in order to chart out the best way for the Installation to obtain a discharge permit. It is noted that discharges that are compliant with Legal Notice 139 of 2002 will be allowed to go to drainage. The Drainage Department is the competent authority that authorises discharges. A meeting between Wasteserv and the discharge permit representative of the Drainage Department was held and the requirements of the Installation were discussed. In summary the following points emerged:
- The issue of the drainage system of the incinerator and that of the public abattoir was discussed. It was discussed that the best approach would be for Wasteserv to ensure that the sewerage network of the incinerator premises is not in any way connected to the sewerage system of the public abattoir. Should any prohibited wastewater enter the incinerator premises, WSC will hold Wasteserv responsible and may retract the discharge permit. It is also advisable to discuss a separate sewerage connection for the incinerator premises since the sewerage connection of the public abattoir is prone to blockages.

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<sup>35</sup> Trucks will only be washed if there is a spill and they are soiled.

- Wasteserv should investigate the use of the shorewell just beneath the incinerator premises as a means of RO/water softener brine disposal. A discharge permit from MRA would be required in order to use the shorewell.
  - Wasteserv is to compile a list of the clinical waste that will be received at the incinerator, with particular emphasis on any radioactive wastes, hazardous wastes, and laboratory wastes (including details of containers and packaging). The Drainage Department would review the list with a view to identify potential “problematic” wastes from a discharge point of view. Once these wastes are identified the hospital will be required to dispose of similar waste types in the same 1,110 L bin. There should be a procedure that the bin-washing operator checks the empty bins containing identified clinical waste for spillages. If there is evidence of a spillage the bin should be cleaned in a separate bin cleaning area, and the wastewater arising thereof contained (and not discharged into the sewerage system). This would be tested to determine its nature.
  - A 'conditional discharge permit' may be granted which effectively would allow Wasteserv to carry some BOD/COD/other analyses of the bin washing wastewater during the first few months of operation to confirm that the wastewater arising from the washing of bins is suitable to be discharged to the sewerage system. Only once the plant starts to operate can Wasteserv provide test results to the Drainage Department – this would correspond to the initial trial period of the Incinerator.
  - Wasteserv are to install an effective hydrocarbon-water separator at the diesel tanks storage depot. The discharge of even trace amounts of hydrocarbons into the sewerage system is prohibited.
- 5.102. Contaminated animal waste (such as diseased carcasses) will not be fed into the automated bin system but will be manually loaded onto the lift and transferred to the shredder. The bins used to load the contaminated carcasses will be washed in the bunded yard and waste water collected in the sump (used to collect firewater). Prior to disposal wastewater will be tested. If wastewater is unsuitable to be discharged into the sewerage system, it will be transferred by a bowser to a sewage treatment plant or to the Ghallis Hazardous Waste Facility. Please see drawings in **Appendix 12** for drainage system.

***Water from the disinfection of the shredder***

- 5.103. Water from the disinfection of the shredder will go to the blood storage vessel for incineration; this is in line with the requirements of BAT 80. The shredder will be washed via a steam lance when a work stop is foreseen or whenever it is necessary.
- 5.104. The quantity of water necessary for the washing and sterilizing the shredder and the screw conveying with steam (158°C – 183°C) is estimated in the range of 300 Kg per cycle of washing. The blood tank is equipped with an internal system of nozzles for the washing with water that will be activated by the operator for each tank emptying. Medium consumption for each washing cycle is 180Kg.

### ***Reject from the Reverse Osmosis Plant***

- 5.105. The pre-treatment plant for boiler water boiler is designed to treat 2000 litres per hour of water from the mains network. The plant comprises three units:
- A WSI 200 DUPLEX water softener, with two resin beds with automatic regeneration to remove calcium and magnesium ions from the water;
  - A WP 2400 dechlorinator with one multilayered filter stage, automatic regeneration, which assists the reverse osmosis unit; and
  - BWV 80-2500 reverse osmosis unit for the elimination of dissolved mineral salts, bacteria, micro organisms and all solid substances in suspension.
- 5.106. Reverse osmosis does not require treatment plants for the depuration of waste waters since it does not use sodium hydroxide and hydrochloric acid, as used by traditional plants.
- 5.107. Brine from reverse osmosis will be reused at the Facility. Reuse will depend on the salinity of the water that then must be disposed to the sewerage system in accordance with the requirements of Legal Notice 139 of 2002. Alternatively a permit from the Malta Resources Authority will be sought to discharge the brine into a shorewell that is in close proximity to the facility.

### ***Wastewater from ablution facilities***

- 5.108. This wastewater is ordinary domestic sewage and will therefore be disposed in the sewerage system.

### **Measures to Prevent and Reduce Waste Arisings**

- 5.109. This Section addresses part of section **B2.3** of the IPPC Application.
- 5.110. Although it is BAT to recycle or reduce bottom ash or fly ash, in Malta this is not possible. Since both waste streams are considered to be hazardous they cannot be reused. Furthermore there exists no other treatment plant in Malta that is capable of further treating these waste streams. Export is not economically feasible.
- 5.111. The techniques used in the installation to improve waste burn out have been discussed in the relevant sections. The primary combustion chamber comprises a rotary kiln which has been shown to be BAT for the types of wastes being processed in the installation.
- 5.112. With regards to the amount of waste generated from maintenance of the installation this would depend on the proper functioning of the installation. It is expected that after a few months of operation, operators would be familiar with the set up, leading to less waste generated from maintenance of the plant.
- 5.113. The use of sodium bicarbonate instead of lime will lead to less waste arisings because a lesser amount of reagent is required to neutralise the same amount of gases.

5.114. WasteServ will adopt a systematic approach to the reduction of waste at source, by understanding and changing processes and activities to prevent and reduce waste. The objective will be to use raw materials efficiently and consequently to reduce gaseous, liquid, and solid emissions. The systematic approach will involve staff at all levels in the ongoing identification and implementation of waste prevention opportunities, monitoring of the use of materials, and checking against key performance measures. This will be included in the EMS.

**Table 5.2: Hazardous waste generation and EWC Codes**

<b>Waste Description</b>	<b>Internal handling, disposal &amp; storage</b>	<b>Treatment by waste contractor</b>	<b>Quantity projected</b>	<b>Frequency &amp; Method of transport to disposal site</b>	<b>Current Disposal Site / Waste Management Company</b>	<b>European Waste Catalogue Codes</b>
<b>Hazardous waste</b>						
Fly ash from baghouse filter including spent reagents	The fly ash collection system is described above.	Removal by a licensed waste carrier	320-506 tonnes/annum	Once a week	A licensed waste carrier will take the waste to the hazardous waste landfill at Ghallis	19 01 13* fly ash containing dangerous substances
Bottom ash and slag	The bottom ash collection system is described above.	Removal by a licensed waste carrier	685-1,057 tonnes per annum	4 times a week	A licensed waste carrier will take the waste to the hazardous waste landfill at Ghallis	19 01 11* bottom ash and slag containing dangerous substances
Boiler dust	Will be managed with the fly ash.	Removal by a licensed waste carrier	37-89 tonnes	With fly ash	A licensed waste carrier will take the waste to the hazardous waste landfill at Ghallis	19 01 15* boiler dust containing dangerous substances
Maintenance material	Stored in secure containers in workshop.	Removal by a licensed waste carrier	Minimal	As required	A licensed waste carrier will take the waste to the hazardous waste landfill at Ghallis	13 01 Waste hydraulic oils 13 02 Waste engine, gear and lubricating oils 13 05 Oil / water separator contents 14 06 Refrigerants 15 02 02 Absorbents, filter materials, wiping cloths, protective clothing contaminated by dangerous substances

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Contaminated wastewater	Collection in sump prior to disposal	Removal to Ghallis Hazardous Facility or treatment plant	To be established	As required	To be established	16 10 01* Aqueous liquid waste containing dangerous substances
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5.115. The following are references taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to waste management. As explained above, the installation is congruent with these requirements.

**BAT BOX**

**Reference 12:**

**Use of the techniques described in 4.1.5.5 or 4.6.4 to, as far as practicably and economically viable, remove ferrous and non-ferrous recyclable metals for their recovery either (a) after incineration from the bottom ash residues, or (b) where the waste is shredded (e.g. when used for certain combustion systems) from the shredded wastes before the incineration stage.**

**BAT BOX**

**Reference 47:**

**The use of separate systems for the drainage, treatment and discharge of rainwater that falls on the site, including roof water, so that it does not mix with potential or actual contaminated waste water streams, as described in 4.5.9. Some such waste water streams may require only little or no treatment prior to their discharge, depending on contamination risk and local discharge factors.**

**BAT BOX**

**Reference 49:**

**The use of a suitable combination of the techniques and principles described in 4.6.1 for improving waste burnout to the extent that is required so as to achieve a TOC value in the ash residues of below 3 wt % and typically between 1 and 2 wt %, including in particular:**

- a. The use of a combination of furnace design (see combustion technology selection in 4.2.1), furnace operation (see 4.2.17), and waste throughput rate (see 4.2.18) that provides sufficient agitation and residence time of the waste in the furnace at sufficiently high temperatures, including any ash burn-out areas;**
- b. The use of furnace designs that, as far as possible, physically retain the waste within the combustion chamber (e.g. narrow grate bar spacings for grates, rotary or static kilns for appreciably liquid wastes)**

to allow its combustion. The return of early grate riddlings to the combustion chamber for re-burn may provide a means to improve overall burn out where they contribute significantly to the deterioration of burnout (see 4.2.21);

c. The use of techniques for mixing and pre-treatment of the waste, as described in BAT 11, according to the type(s) of waste received at the installation; and

d. The optimisation and control of combustion conditions, including air (oxygen) supply and distribution, as described in BAT 18.

#### **BAT BOX**

**Reference 50:**

The separate management of bottom ash from fly ash and other FGT residues, so as to avoid contamination of the bottom ash and thereby improve the potential for bottom ash recovery, as described in 4.6.2. Boiler ash may exhibit similar or very different levels of contamination to that seen in bottom ash (according to local operational, design, and waste specific factors) – it is therefore also **BAT** to assess the levels of contaminants in the boiler ash, and to assess whether separation or mixing with bottom ash is appropriate. It is **BAT** to assess each separate solid waste stream that arises for its potential for recovery either alone or in combination.

#### **BAT BOX**

**Reference 52:**

The separation of remaining ferrous and non-ferrous metals from bottom ash (see 4.6.4), as far as practicably and economically viable, for their recovery.

#### **BAT BOX**

**Reference 54:**

The treatment of FGT residues (on or off-site) to the extent required to meet the acceptance requirements for the waste management

**option selected for them, including consideration of the use of the FGT residue treatment techniques described in 4.6.11.**

**BAT BOX**

**Reference 80:**

**The washing out of waste containers that are to be re-used in a specifically designed, designated washing facility, with disinfection as required, and the feeding of any accumulated solids to the waste incinerator.**

## **FIRE PREVENTION AND CONTROL**

- 5.116. Given the critical importance of safety to operations on-site, extensive fire prevention and detection measures will reduce the risk of fire occurring initially. Measures to reduce the risk include minimising quantities of storage volumes on-site, staff training, and an automatic fire detection and alarm system.
- 5.117. The installation is equipped with a sensor and alarm system in the event of a fire. Optic-acoustic sensors are present within all areas of the plant, i.e. the cold storage area, the shredder room, and the room that houses the incinerator. The shredder room also includes a smoke detector, external siren, and manual alarm activation point.
- 5.118. The central fireproof system is housed in the incinerator room. Manual alarm activators are also present.
- 5.119. The hazardous waste temporary storage container has a separate fire detection system.
- 5.120. Water deluge and foam systems are present to provide immediate response in the event of a fire. Other fire-fighting measures provided include fire hydrants, portable fire-fighting appliances, and hand-held extinguishers.
- 5.121. In the event of a fire the potential exists for contaminated firewater to be generated, especially next to the hazardous waste storage container and the fuel storage tanks. The greatest potential for contaminated firewater run-off arises from firewater combining with solvents or diesel stored in tanks. Within the installation a closed drains system and areas of hard standing will assist in preventing contamination of surface water or ground under these circumstances.
- 5.122. Ongoing reviews will ensure that drains and hard standing where potentially contaminated run-off can pass over or collect, are in a good state of repair, free of fractures and impervious. The potential for firewater to reach controlled waters including groundwater is considered to be low.
- 5.123. The HAZOP report discusses fire detection and risks in greater detail.
- 5.124. The Civil Protection Department representative has visited the facility and provided a number of suggestions and requirements that they are envisaging should be included. Further to this, they will be providing fire-fighting courses to the facility operators. The fire sensing system will be connected real-time with the Civil Protection Department in case of fire or any emergency situation. An operating procedure for fire-fighting an emergency break down has been prepared as part of the EMS in **Appendix 8**.
- 5.125. The following are reference taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration is relevant to fire prevention. As explained above, the installation is consistent with this requirement.

**BAT BOX**

**Reference 10:**

**The development of a plan for the prevention, detection and control (described in 4.1.4.7) of fire hazards at the installation, in particular for waste storage and pre-treatment areas, furnace loading areas, electrical control systems, bag house filters and static bed filters.**

## **SECURITY AT THE PLANT**

- 5.126. It is good practice to have operators with a good view of waste storage and loading areas and their mechanisms to monitor them. The preferred option<sup>36</sup> is opposite the control room with a view of the combustor loading areas.
- 5.127. The position of the control room is such that it allows the operator to view the primary combustion chamber and the hopper into which waste is fed as well as the shredder room.
- 5.128. A number of cameras are installed from which the operator can look at the top part of the shredder and points inside the incinerator room, including the PCC flame.
- 5.129. The following reference is taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration; it is relevant to plant security. As explained above, the installation is congruent with this requirement.

### **BAT BOX**

#### **Reference 13:**

**Provision of operators with a means to visually monitor, directly or using television screens or similar, waste storage and loading areas, as described in 4.1.6.1.**

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<sup>36</sup> European Commission, 2006, IPPC Reference Document on the Best Available Techniques for Waste Incineration

## TRAFFIC MANAGEMENT

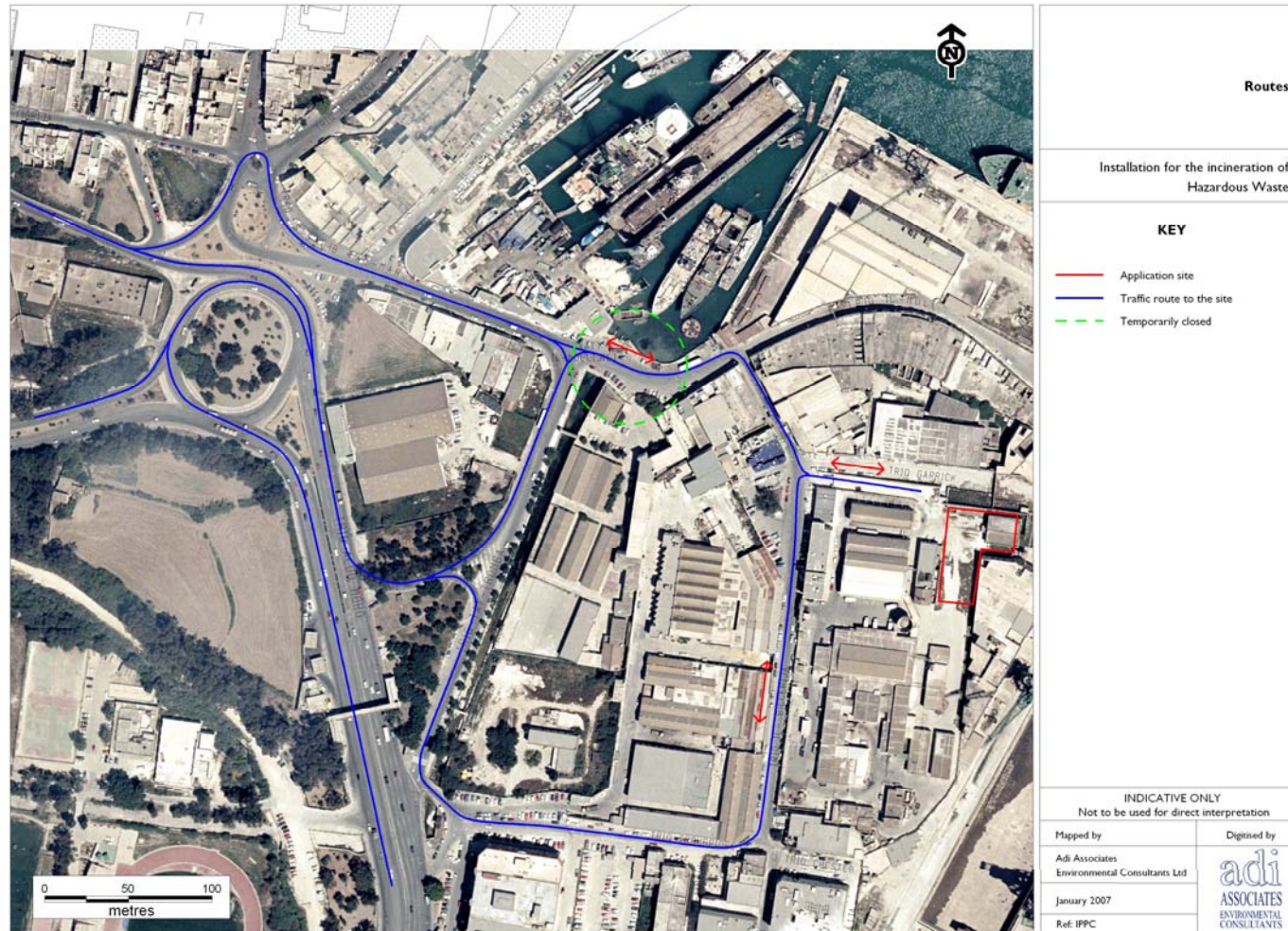
- 5.130. Licensed waste carriers will transport all waste to be processed by the Incinerator. Site egress will be via the controlled main gate of the facility on Triq il-Biccerija. The local routing of the vehicles is described on **Figure 5.1**.
- 5.131. WasteServ Malta Ltd anticipates a daily average of 15 waste deliveries comprising 10 flat loaders transporting abattoir waste in 1,100 litre secured bins. The remaining 5 deliveries will comprise hazardous waste<sup>37</sup> or RDF.
- 5.132. Such vehicle movements are not considered to have any impact on the arterial / distributor network or the roads in the vicinity of the Incinerator.
- 5.133. **Figure 5.2** shows swept path analysis<sup>38</sup> of the turning movements of an HGV the size of a refuse truck. No manoeuvring difficulties are anticipated.
- 5.134. All trucks will unload the waste in the bunded area; no activity will be allowed outside the bunded area. If there is a mishap, e.g. spilling of waste, the contaminated part of the truck will be pressure washed and the effluent washed into the drainage system leading to the waste water storage reservoir. Considering the volume of trucks entering and leaving the site, this is considered the best way to keep the site and the vehicles clean; a wheel wash would not be useful in cleaning up areas that have been contaminated in case of an accident. The power hose can also be used to clean wheels to keep surrounding roads clean.

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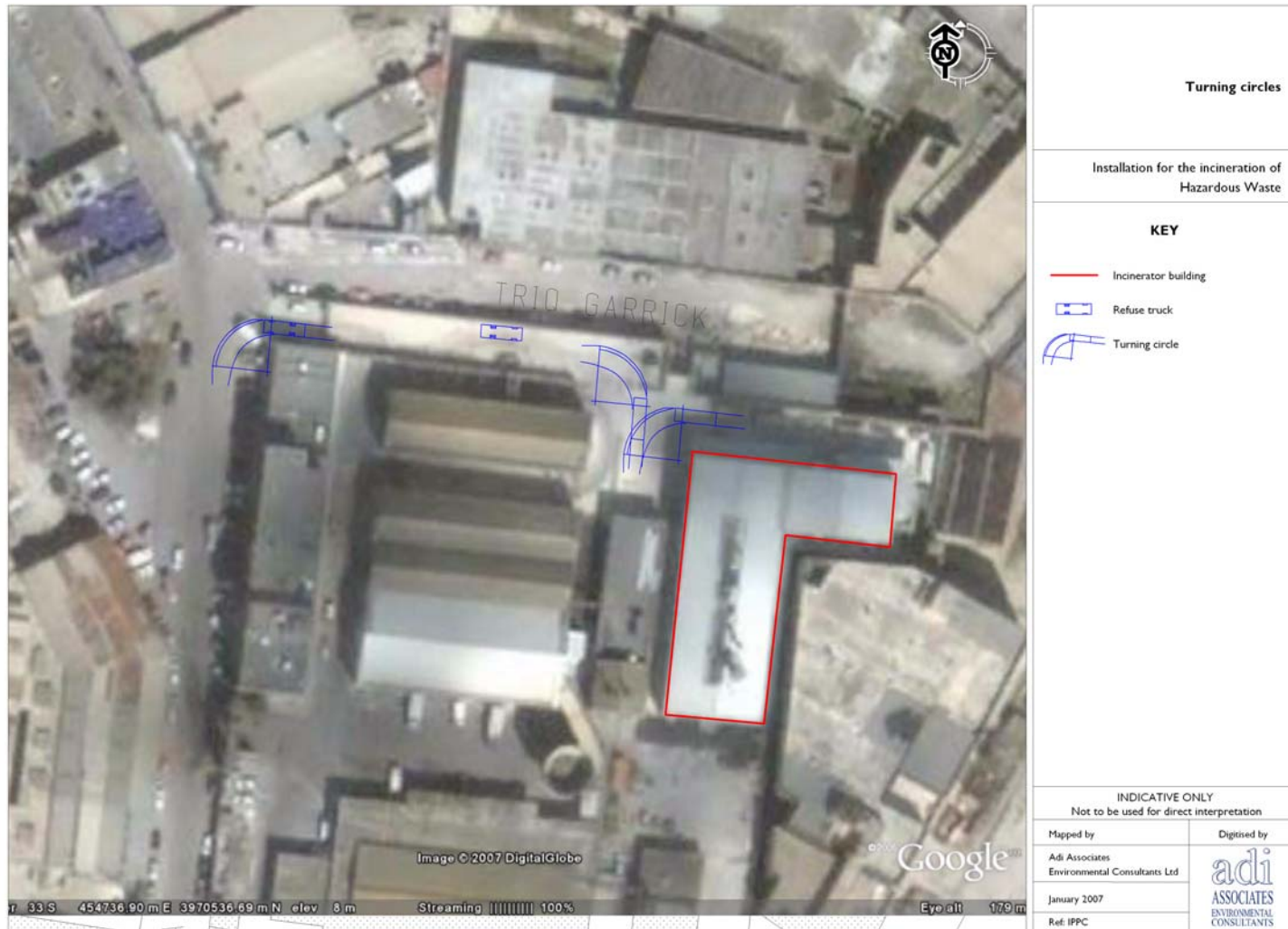
<sup>37</sup> This includes other waste streams such as solvents, sludges and clinical waste.

<sup>38</sup> This involves use of software to model the track that the wheels of vehicles (in this case refuse trucks) take when turning a corner, making an allowance for the over hang of the vehicle.

**Figure 5.1: Routes to and from the installation**



**Figure 5.2: Internal circulation for refuse trucks at the installation**



## 6. EMISSIONS

6.1. This Section addresses section **B3.1** of the IPPC Application.

### EMISSIONS TO AIR

6.2. Releases to the environment that can be expected to arise from the incineration of hazardous wastes, clinical waste, and animal carcasses are summarised below.

Releases →	Particulate matter	Hydrogen chloride	Oxides of sulphur	Oxides of nitrogen	Oxides of carbon	Dioxins	Organic compounds / odour	Mercury & cadmium	Other heavy metals	Alkali metals & oxides and alkali earth metals & oxides	Acids/alkalis/salts	Hydrogen fluoride
Source ↓												
Unloading and storage	AL						AWL	WL	WL	WL		
Loading and charging / macerating and crushing	AWL						AWL					
Boiler water treatment and blowdown											W	
Bottom ash and fly ash	AL					AL	AL	AL	AL	AL	AL	
Stack emissions	A	A	A	A	A	A	A	A	A	A		A
<b>KEY</b>	<b>A-Release to Air, W-Release to Water, L-Release to Land</b>											

Source: Adapted from *Scottish Environment Protection Agency, Environment and Heritage Service, Environment Agency (2004); Guidance for the Incineration of Waste and Fuel Manufactured from or Including Waste*

6.3. The control of these emissions will be achieved mainly through good management practices and the FGT system. The former will be used to control odour emissions from unloading and storage and the latter will be used to control stack emissions. Bottom ash and fly ash will be managed as described in the section on Waste Management above.

6.4. During start up the incinerator will be switched on until the temperature reaches 850°C, using just diesel (i.e. no waste will be added). Reagents will be added to the flue gas so that a filter cake will build up on the sleeves of the bag house filter. This ensures that when the waste is inserted, there is the reagent deposited in the bag house for the neutralisation process. During shut down, waste will be allowed to burn completely. This may mean that diesel will be burned until all the solid waste in the PCC is incinerated.

- 6.5. As described in preceding sections, the operation will be a continuous one; the plant will operate 24 hours a day and will burn waste continuously and not in batches. The spectrum of waste that can be burnt by the installation is such that there will always be material to burn. In the eventuality that supply of waste is low, the operator will burn RDF to ensure that the incinerator does not shut down unless absolutely necessary. Shut down will only be for planned maintenance or emergencies, as described above. This is in line with the requirements of BAT 16.

### **Control of Emissions through the FGT System**

- 6.6. Legal Notice 336 of 2001 and the Waste Incineration Directive lay down the Emission Limit Values (ELVs) for the fumes to be released from the stack. The installation will conform to these values.
- 6.7. The FGT system, described above, is responsible for neutralising the fumes to acceptable levels.
- 6.8. The FGT system makes use of fabric filters, also called bag filters. The BAT BREF states that they are very widely used in waste incineration plants. Filtration efficiencies are very high across a wide range of particle sizes. At particle sizes below 0.1 microns, efficiencies are reduced, but the fraction of these that exist in the flue-gas flow from waste incineration plants is relatively low. Low dust emissions are achieved with this technology.
- 6.9. In continuous operation, there is gradual loss of pressure across the filtering media due to the deposit of particles. The FGT system at the installation is a dry system; this allows the formation of a cake on the media to provide the acid removal.
- 6.10. Sulphur dioxide and gaseous halogens are cleaned from the flue-gases by the injection of chemical or physical sorption agents, which are brought into contact with the flue-gas. The installation uses the dry sorption process whereby sodium bicarbonate is fed into the reactor as a dry powder. This ensures emission limits are complied with over a range of inlet concentrations. The reaction products generated are solid and are deposited from the flue-gas in the bag filter. The cake of reagent that forms on fabric filters gives effective contact between flue-gas and absorbent.
- 6.11. Directive 2000/76/EC requires a daily average  $\text{NO}_x$  (as  $\text{NO}_2$ ) clean gas value of 200  $\text{mg}/\text{Nm}^3$ . In order to achieve compliance at this level, urea will be used as a reduction agent. This ensures that nitrogen oxides in the flue-gas ( $\text{NO}$  and  $\text{NO}_2$ ) are reduced to nitrogen ( $\text{N}_2$ ) and water vapour. This Selective Non-Catalytic Reduction process for the abatement of nitrogen oxides is considered BAT for the installation because lower  $\text{NO}_x$  reduction efficiencies are required (i.e. raw flue-gas  $\text{NO}_x$  levels are low). This is congruent with BAT 41.
- 6.12. PCDD / F emissions are controlled in the installation in a number of ways:
- Waste containing chlorides greater than 1% will not be accepted (see Section 3 on Waste Acceptance Criteria above);

- The dust filtration system uses bag house technology; temperature of the flue-gas is 180°C – well below the 200 °C required by the BREF so that PCDD / F do not form; and
  - An additional measure for PCDD / F abatement comprises the injection of activated carbon. This system is the BAT for removal of dioxins and furans. This has been described above.
- 6.13. Activated carbon is also used for the adsorption of mercury. This is congruent with BAT 45.

## **AIR DISPERSION MODELLING RESULTS**

### **Methodology**

- 6.14. Temple Group Limited (UK) prepared an air quality impact assessment in support of the IPPC application for the hazardous and non-hazardous materials incinerator at Marsa.
- 6.15. An air quality model is a simplified representation of the atmospheric/pollution system, and is often used to predict changes in air quality and also to understand the behaviour of different components of the system. Models vary in their complexity with modified Gaussian plume models, such as AERMOD (American Meteorological Society and Environmental Protection Agency Regulatory Model) and ADMS (Atmospheric Dispersion Modelling System), being widely and effectively used to model air quality. Gaussian models describe the transport and mixing of pollutants within a system, by assuming that dispersion in the horizontal and vertical direction will take the form of a normal Gaussian curve with the maximum pollutant concentration at the centre of the plume.
- 6.16. In order to assess the air quality conditions around the proposed incinerator, the BREEZE AERMOD dispersion model has been chosen, due to its effectiveness as a dispersion model to predict ground level concentrations arising from emissions to atmosphere from elevated point sources.
- 6.17. BREEZE AERMOD is a new generation air quality modelling system used to support both regulatory and non-regulatory modelling requirements worldwide. It is intended to be the 'new generation model' for US regulatory purposes. This application is used to assess the impact of air emissions from a variety of industrial sources and predicts pollutant concentrations from point, line, area, volume, and flare sources with variable emissions in all terrain regimes. AERMOD is a state of the practice modified Gaussian plume dispersion model whose formulation is based on planetary boundary layer principles (US Environment Protection Agency (EPA), 2000<sup>39</sup>) and incorporates the latest understanding of the atmospheric boundary layer. As stated by the EPA, AERMOD has been adequately tested and represents, through

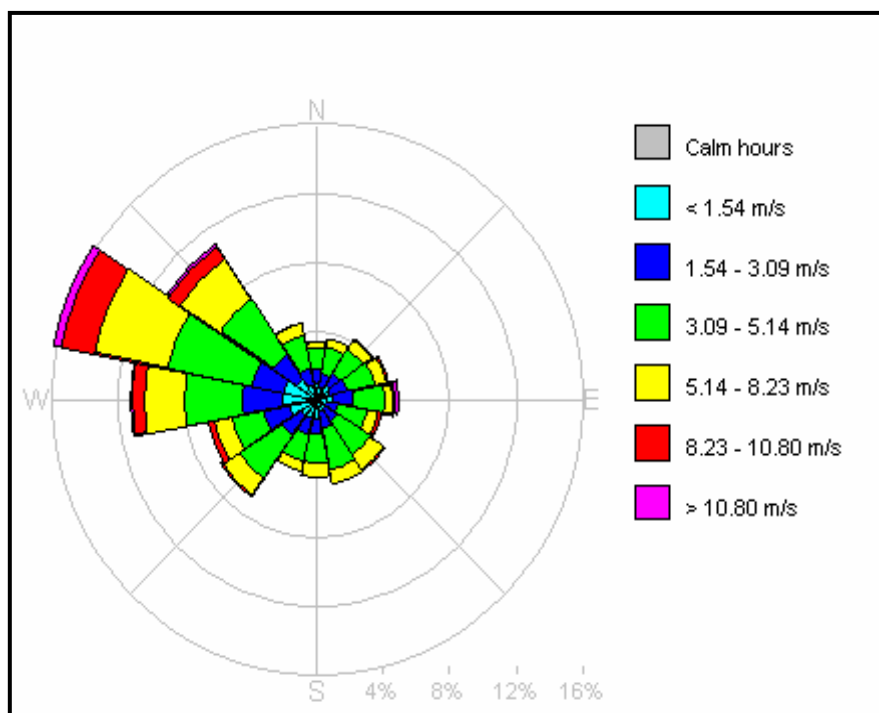
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<sup>39</sup> Environmental Protection Agency (2000) Requirements for Preparation, Adoption and Submittal of State Implementation Plans (Guideline on Air Quality Models)

its formulations, a technical advancement over its predecessors. AERMOD simulates essential atmospheric physical processes and provides refined concentration estimates over a wide range of meteorological conditions and modelling scenarios.

- 6.18. AERMOD operates by using algorithms of convective and stable boundary layers, for computing vertical profiles of wind, turbulence, and temperature, and for the treatment of all types of terrain.
- 6.19. **Tables 6.1 to 6.3** detail the values that were modelled. Screening runs of the dispersion model were undertaken to determine the worst case meteorological data set. As the values produced from meteorological data for 2003, 2004, and 2005 were very similar, it was decided that modelling would be carried out using the 2005 meteorological data; therefore the most recent year of data was used for the modelling exercise.
- 6.20. Meteorological data was obtained from meteorological observations at Luqa Airport Malta for the period 2003-2005, in order for detailed air quality modelling to be carried out. From these data, a series of wind roses have been produced for the three year period. These plots clearly show that the dominant wind direction affecting the island of Malta is from a North Westerly direction (**Figure 6.1**). It is also apparent that the strongest winds also blow from this direction, reaching maximum speeds of 10.80 m/s. Such dominant winds will greatly affect dispersal of emissions from the incinerator stack, with highest pollutant concentrations predicted to occur downwind of the stack. As a result, it is predicted that receptors in a South Easterly direction will be most affected by stack emissions.
- 6.21. Pollutant emission concentrations were based on the air emission limit values provided within Annex V of the Waste Incineration Directive. As exact pollutant emission concentrations were not available, it was decided that modelling would be based on a 'worst case' assumption. Therefore the limit values (both half-hourly and daily) provided within the Directive would be used as worst case emission concentrations from the proposed incinerator. Pollutant emission rates were then calculated based upon the pollutant concentrations and the normalised flow rate.

**Figure 6.1: Luqa Wind Rose (2005)**



**Table 6.1: Stack Dimensions and Flow Characteristics**

Emissions Data	Daily	Half-Hourly	Range		
				to	
Stack Height (m)	18	18	-		-
Diameter (m)	0.63	0.63	-		-
Velocity	18.6	18.6	16.9	to	20.3
Temp (deg C)	155	155	150	to	160
Actual Flow (Am <sup>3</sup> /s)	5.8	5.8	5.3	to	6.3
Oxygen (% v/v dry)	9.5	9.5	8	to	11
Water (%)	14	14	10	to	18
Normalised Flow (Nm <sup>3</sup> /s)	3.7	3.7	-		-

**Table 6.2: Pollutant Emission Concentrations (mg/Nm<sup>3</sup>)**

<b>Pollutant Emission Concentration (mg/Nm<sup>3</sup>)</b>	<b>Daily</b>	<b>Half-Hourly</b>
NO <sub>x</sub>	200	400
SO <sub>2</sub>	50	200
PM <sub>10</sub>	10	30
CO	50	100
HCl	10	60
HF	1	4
Mercury	-	0.05
Total Metals	-	0.5
Dioxins and furans (ng/m <sup>3</sup> )	-	0.1
Cd and Tl	-	0.05
TOC	10	20

**Table 6.3: Pollutant Emission Rates (g/s)**

<b>Pollutant Emission Rate (g/s)</b>	<b>Daily</b>	<b>Half-Hourly</b>
NO <sub>x</sub>	0.74	1.48
SO <sub>2</sub>	0.185	0.74
PM <sub>10</sub>	0.037	0.111
CO	0.185	0.37
HCl	0.037	0.222
HF	0.0037	0.0148
Mercury	0	0.000185
Total Metals	0	0.00185
Dioxins and furans (ng/m <sup>3</sup> )	0	3.70-10
Cd and Tl	0	0.000185
TOC	0.037	0.074

6.22. The following are the modelling assumptions:

- Pollutant discharge rates were based on data supplied by B&T;
- No terrain effects have been included within the modelling as effects will be negligible;
- Downwash effects of the main building have been included as effects will be significant;
- Local topography was incorporated into the model;
- Hourly averaged meteorological data for 2005 was used; and
- Modelling scenarios were developed to estimate the potential impact on air quality of pollutant emissions in compliance with WID requirements.

## Air Quality Standards

### *Waste Incineration Directive*

- 6.23. Waste incineration of both dangerous and harmless wastes may cause emissions of substances that pollute air, water, and soil and have harmful effects on human health. The Waste Incineration Directive (WID) entered into force on 28 December 2000, and aims to prevent or reduce, as far as possible, air, water, and soil pollution caused by the incineration or co-incineration of waste, as well as the resulting risk to human health. This is to be achieved through the application of operational conditions, technical requirements, and emission limit values for waste incineration and co-incineration plants within the community.
- 6.24. Reductions for air emissions will be achieved for nitrogen oxides (NO<sub>x</sub>), sulphur dioxide (SO<sub>2</sub>), hydrogen chloride (HCl), heavy metals, particles, dioxins, and furans as stated within the WID.
- 6.25. All incineration or co-incineration plants must be authorised and permits will be issued by the competent authority listing the categories and quantities of hazardous and non-hazardous waste that may be treated, the plant's capacity, sampling, and measurement procedures that are to be used.
- 6.26. The Directive requires all plants to keep incineration gases at a temperature of at least 850°C for at least two seconds, in order to guarantee complete waste combustion. If hazardous wastes with a content of more than 1% halogenated organic substances are incinerated, then the temperature has to be raised to 1,100°C for at least two seconds. The quantity and harm potential of incineration residues must be reduced to a minimum and residues must, as far as possible, be recycled.
- 6.27. Most of the plants that are covered by the WID are also covered by the Integrated Pollution Prevention and Control (IPPC) Directive. The WID only sets minimum obligations which are not necessarily sufficient to comply with the IPPC Directive. Such compliance may involve more stringent emission limit values, emission limit values for other substances and other media, and other appropriate conditions.
- 6.28. As stated within the WID, incineration plants should be designed, equipped, built, and operated in such a way that the Emission Limit Values set out in **Table 6.4** are not exceeded within the exhaust gas. Measurement equipment should therefore be installed and techniques used in order to monitor the parameters, conditions, and mass concentrations relevant to the incineration process.

**Table 6.4: WID Stack Emission Limit Values**

Pollutant (mg/Nm <sup>3</sup> )	Daily Average Value	Half-Hourly Average Value
NO <sub>x</sub>	200	400
SO <sub>2</sub>	50	200
PM <sub>10</sub>	10	30
CO	50	100
HCl	10	60
HF	1	4
Hg	-	0.05
Total Metals	-	0.5
Dioxins and Furans (ng/m <sup>3</sup> )	-	0.1
Cd and Tl	-	0.05
TOC	10	20

6.29. It is appropriate to model using the daily averages from the WID for the longer term limits (for example, annual and daily) and the half-hourly averages from the WID for the shorter term limits (for example, hourly and 15 minute). Therefore modelling has been carried out accordingly.

#### ***EC Environmental Quality Standards***

6.30. The current air quality objectives (AQOs), as found within the EU air quality daughter directives, will be used to compare against the modelling results. **Table 6.5** details the current AQOs. From this, a conclusion can be made on the impact of the proposed incinerator upon human health.

**Table 6.5: EC Environmental Quality Standards**

Pollutant	Objective	Measured As	Date to have be achieved by
Benzene (C <sub>6</sub> H <sub>6</sub> )	5 µg/m <sup>3</sup>	Annual mean	01/01/2010
Carbon Monoxide (CO)	10 mg/m <sup>3</sup> (10 000 µg/m <sup>3</sup> )	8-hour mean	01/01/2005
Lead (Pb)	0.5 µg/m <sup>3</sup>	Annual Mean	01/01/2005
Nitrogen Dioxide (NO <sub>2</sub> )	200 µg/m <sup>3</sup> (not to be exceeded more than 18 times a year) 40 µg/m <sup>3</sup>	1-hour mean (Short Term)	01/01/2010
		Annual mean (Long Term)	01/01/2010
Particles (PM <sub>10</sub> )	50 µg/m <sup>3</sup> (not to be exceeded more than 35 times) 50 µg/m <sup>3</sup> (not to be exceeded more than 7 times) 40 µg/m <sup>3</sup> 20 µg/m <sup>3</sup>	24-hour mean	01/01/2005
		24-hour mean	01/01/2010
		Annual mean	01/01/2005
		Annual mean	01/01/2010
Sulphur Dioxide (SO <sub>2</sub> )	350 µg/m <sup>3</sup> (not to be exceeded more than 24 times) 125 µg/m <sup>3</sup> (not to be exceeded more than 3 times)	1-hour mean	01/01/2005
		24-hour mean	01/01/2005

- 6.31. At present there are no air quality objectives for mercury, total metals, hydrogen chloride, hydrogen fluoride, dioxins, cadmium, and thallium. However, modelling concentrations have been compared to the UK Environmental Benchmarks, which have been listed within the Horizontal Guidance IPPC HI on Integrated Pollution Prevention and Control (IPPC) and Environmental Assessment and Appraisal of BAT, in order to determine the potential impacts of hydrogen chloride and fluoride, dioxins and cadmium and thallium on human health.
- 6.32. Where air quality standards have not been defined Regulators have adopted interim values known as Environmental Assessment Levels (EALs). The EAL is the concentration of a substance which in a particular environmental medium the Regulators regard as a comparator value to enable a comparison to be made between the environmental effects of different substances in that medium and between environmental effects in different media and to enable the summation of those effects (Environment Agency, 2002).
- 6.33. **Table 6.6** details these Environmental Benchmarks.

**Table 6.6: Environmental Benchmarks**

Pollutant	Objective ( $\mu\text{g}/\text{m}^3$ )	Measured As
Mercury (Hg)	0.25	Long Term EAL
	7.5	Short Term EAL
Hydrogen Chloride (HCl)	20	Long Term EAL
	800	Short Term EAL
Hydrogen Fluoride (HF)	-	Long Term EAL
	250	Short Term EAL
Cadmium and Thallium (Cd + Tl)	0.005	Long Term EAL
	1.5	Short Term EAL

Source: Environment Agency (2002) – HI Guidance (Environmental Assessment and Appraisal of BAT)

- 6.34. At present there are no air quality standards or environmental benchmarks with regard to dioxins and other Persistent Organic Pollutants (POP's). Persistent Organic Pollutants (POPs) are chemical substances that persist in the environment, bio-accumulate through the food chain, and pose a risk of causing adverse effects to human health and the environment. Pollutants within this category include dioxins and furans. The terms 'dioxins' and 'furans' are frequently used to describe families of compounds which are, more correctly, known as polychlorinated dibenzo-*para*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs).
- 6.35. In the absence of short term EAL standards for dioxins, the following methodology was used to derive such standards. A Tolerable Daily Intake (TDI) is considered to be a conservative estimate of the amount of a substance that may be taken in daily. In 1998, the World Health Organisation reviewed its TDI for dioxins in light of new epidemiological data. The TDI was reduced from 10 picogrammes/kilogram body weight to a range of 1 to 4pg/kg body weight. The current levels of exposure in industrialized countries are in the range of 1 to 3 picogrammes / kilogram body weight. The TDI recommended by the WHO consultation is internationally recognized as a reference value for ensuring that safe levels of exposure are not exceeded. A value of 2pg/kg body weight was used in this assessment.
- 6.36. An air quality standard value for dioxins was derived using the methodology used by Millennium Science and Engineering Limited (MSE) in 2005<sup>40</sup> based upon the method described in "Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes", published by Her Majesty's Inspectorate of Pollution (HMIP) (1996). To determine the maximum average dioxin concentration assessment level an assumption was made of the acceptable level of dioxin exposure from the Site. This was assumed to be 2% of the TDI, as it is UK practice to accept 2% of the TDI as an EAL. Taking account of these assumptions the dioxin assessment level was determined to be  $1.206 \times 10^{-7} \mu\text{g}/\text{m}^3$  (see **Appendix 17** for methodology).

<sup>40</sup> Millennium Science and Engineering Limited, 2005, Proposed Energy Recovery Facility, Lancing, West Sussex, Air Dispersion Modelling Report

## Modelling Assessment

- 6.37. Maximum ground level concentrations for the key pollutants (NO<sub>x</sub>, SO<sub>2</sub>, PM<sub>10</sub>, CO, HCl, HF, Hg, Total Metals, Dioxins and Furans, Cd and TI, TOC) were predicted using 2005 meteorological data, a stack height of 18 to 26 metres and emission concentrations based upon the limit values set within the WID. The results are provided in **Tables 6.7** to **6.15** with a comparison against the air quality standards, objectives and exposure limit values provided in **Tables 6.5** and **6.6**. Ground level concentrations refer to the concentration of pollutants at the site of the incinerator itself and not at the sensitive receptors. The impact on sensitive receptors is discussed in **Section 7**.
- 6.38. The ambient concentrations for certain pollutants have been included where data is available in order for a comparison to be made with the predicted concentrations. Ambient concentrations for the pollutants NO<sub>2</sub> and SO<sub>2</sub> have been obtained from MEPA's air quality monitoring station for the Marsa area (Triq Aldo Moro, Triq Azzopardi, Triq is-Salib tal-Marsa, and Spencer Hill), and have then been averaged for the 2005 period (see **Section 7** of this Report for baseline data).

**Table 6.7: Maximum Predicted Ground Level Concentrations for Nitrogen Dioxide**

Nitrogen Dioxide	Concentration (µg/m <sup>3</sup> )			
	Annual Mean (µg/m <sup>3</sup> )		99.8th Percentile of 1-hr means (µg/m <sup>3</sup> )	
Air Quality Data	18m	26m	18m	26m
Standard/Limit Value	40	40	200	200
Ambient Concentration (2005)	26.2	26.2	-	-
Modelling Results	31.3	6	204	55
Total (modelled + ambient)	57.5	32.2	204	55

- 6.39. From **Table 6.7** it is apparent that ground level concentrations of NO<sub>2</sub> with a stack height of 18 metres exceed the air quality standards when added to the ambient concentrations. It is therefore concluded that with at stack height of 18 metres, the incinerator would have a significant impact on the existing air quality of Marsa, when compared to existing ambient concentrations. If the stack height is increased to 26 metres, the incinerator will create a negligible impact on ambient pollutant concentrations for NO<sub>2</sub>.

**Table 6.8: Maximum Predicted Ground Level Concentrations for Sulphur Dioxide**

Sulphur Dioxide	Concentration ( $\mu\text{g}/\text{m}^3$ )			
	99.7th percentile 1-hr means ( $\mu\text{g}/\text{m}^3$ )		99.2th Percentile of 24-hr means ( $\mu\text{g}/\text{m}^3$ )	
Air Quality Data	18m	26m	18m	26m
Standard/Limit Value	350	350	125	200
Ambient Concentration (2005)	15.87	15.87	-	-
Modelling Results	196	53.9	32.0	8.4

- 6.40. The predicted ground level concentrations of  $\text{SO}_2$  are clearly well within the air quality standards and the results indicate that the proposed incinerator would have negligible impact on the existing air quality of Marsa and so does not pose any threats to environmental or human health.

**Table 6.9: Maximum Predicted Ground Level Concentrations for  $\text{PM}_{10}$** 

Particulate Matter	Concentration ( $\mu\text{g}/\text{m}^3$ )			
	90.4th percentile 24-hr means ( $\mu\text{g}/\text{m}^3$ )		Annual Mean ( $\mu\text{g}/\text{m}^3$ )	
Air Quality Data	18m	26m	18m	26m
Standard/Limit Value	50	50	40	40
Ambient Concentration (2005)	-	-	-	-
Modelling Results	3.4	0.7	1.6	0.3

- 6.41. Ground level concentrations of  $\text{PM}_{10}$  are also well within air quality standards. As a result, the emissions from the proposed incinerator are likely to have negligible impact on existing air quality in terms of both environmental and human health.

**Table 6.10: Maximum Predicted Ground Level Concentrations for Carbon Monoxide**

Carbon Monoxide	Concentration ( $\mu\text{g}/\text{m}^3$ )			
	8-hour Mean		8-hour Mean	
Air Quality Data	18m (Daily WID)	26m (Daily WID)	18m (1/2 hr WID)	26m (1/2 hr WID)
Standard/Limit Value ( $\mu\text{g}/\text{m}^3$ )	10 000	10 000	10 000	10 000
Ambient Concentration (2005)	-	-	-	-
Modelling Results	46.4	11.4	92.9	22.8

- 6.42. From **Table 6.10** it is apparent that ground level concentrations of CO are well within air quality standards. It can be concluded that the incinerator would have negligible impact on the existing air quality of Marsa with regards to CO.

**Table 6.11: Maximum Predicted Ground Level Concentrations for Hydrogen Chloride**

Hydrogen Chloride	Concentration ( $\mu\text{g}/\text{m}^3$ )			
	Long Term EAL		Short Term EAL	
Air Quality Data	18m	26m	18m	26m
Standard/Limit Value	20	20	800	800
Ambient Concentration (2005)	-	-	-	-
Modelling Results	1.6	0.3	84.3	17.6

- 6.43. The predicted ground level concentrations of HCl are clearly well within the environmental benchmarks and the results indicate that the proposed incinerator would have negligible impact on the existing air quality of Marsa and so does not pose any threats to environmental or human health.

**Table 6.12: Maximum Predicted Ground Level Concentrations for Hydrogen Fluoride**

Hydrogen Fluoride	Concentration ( $\mu\text{g}/\text{m}^3$ )	
	Short Term EAL	
Air Quality Data	18m	26m
Standard/Limit Value	250	250
Ambient Concentration (2005)	-	-
Modelling Results	5.6	1.2

- 6.44. The predicted ground level concentrations of HF are clearly well within the environmental benchmarks and the results indicate that the proposed incinerator would have negligible impact on the existing air quality of Marsa and so does not pose any threats to environmental or human health.

**Table 6.13: Predicted Ground Level Concentrations for Mercury**

Mercury	Concentration ( $\mu\text{g}/\text{m}^3$ )	
	Short Term EAL	
Air Quality Data	18m	26m
Standard/Limit Value	7.5	7.5
Ambient Concentration (2005)	-	-
Modelling Results	0.1	0.01

- 6.45. From **Table 6.13** it is apparent that ground level concentrations of Hg are well within the environmental benchmarks. Therefore it can be concluded that the incinerator would have negligible impact on the existing air quality of Marsa.

**Table 6.14: Predicted Ground Level Concentrations for Dioxins and Furans**

Dioxins and Furans	Concentration ( $\mu\text{g}/\text{m}^3$ )	
	Short Term EAL	
Air Quality Data	18m	26m
Standard/Limit Value (Source: MSE Report (2005) <sup>41</sup> )	$1.206 \times 10^{-7}$	$1.206 \times 10^{-7}$
Ambient Concentration (2005)	-	-
Modelling Results	$1.41 \times 10^{-7}$	$2.9 \times 10^{-8}$

- 6.46. The dioxin assessment level has been expressed as 2.0% of the Tolerable Daily Intake (TDI). This method is standard UK practice by the UK EA for review against EALs or EQSs. It is apparent that both the predicted level and the assessment level are only marginally different. As the predicted level is a maximum value rather than an average and it compares well to the UK standard of 2% of the TDI, it can be concluded that the proposed incinerator will have minimal impact on existing air quality in terms of both environmental and human health with a stack height of 18 metres. The risk becomes negligible with a stack height of 26 metres.

**Table 6.15: Maximum Predicted Ground Level Concentrations for Cadmium and Thallium**

Cadmium and Thallium	Concentration ( $\mu\text{g}/\text{m}^3$ )	
	Short Term EAL	
Air Quality Data	18m	26m
Standard/Limit Value	1.5	1.5
Ambient Concentration (2005)	-	-
Modelling Results	0.1	0.01

- 6.47. It is clear that ground level concentrations of cadmium and thallium are well within the environmental benchmarks. As a result, the proposed incinerator is likely to have negligible impact on existing air quality in terms of both environmental and human health.

### Stack Height Calculations

- 6.48. Although modelling results demonstrated that a stack height of 18 metres would be sufficient (for all pollutants except for nitrogen dioxide) to ensure that the proposed incinerator is likely to have minimal impact on existing air quality in terms of both environmental and human health, further modelling calculations were carried out at a variety of stack heights – 18m, 20m, 22m, 24m, and 26m (**Table 6.16**).

<sup>41</sup> MSE (2005). Sussex Waste Recycling Ltd. Proposed Energy Recovery Facility, Lancing, West Sussex. Air Dispersion Modelling Report

**Table 6.16: Changes in Maximum Pollutant Concentration with Stack Height**

Average Pollutant Concentrations ( $\mu\text{g}/\text{m}^3$ )	Height (metres)				
	18	20	22	24	26
NO <sub>2</sub> (Annual)	31.3	25.7	19.1	11.7	6.0
SO <sub>2</sub> (Annual)	7.8	6.4	4.8	2.9	1.5
PM <sub>10</sub> (Annual)	1.6	1.3	1.0	0.6	0.3
CO (8-Hourly)	92.9	76.3	56.8	36.9	22.8
HCl (Annual)	1.6	1.3	1.0	0.6	0.3
HF (Hourly)	5.6	3.8	2.9	2.0	1.2
Hg (Hourly)	0.10	0.05	0.04	0.02	0.01
Dioxins and Furans (Hourly)	$1.41 \times 10^{-7}$	$9.6 \times 10^{-8}$	$7.3 \times 10^{-8}$	$4.9 \times 10^{-8}$	$2.9 \times 10^{-8}$
Cd and Tl (Hourly)	0.1	0.05	0.04	0.02	0.01

- 6.49. **Table 6.16** highlights that a stack height of 26 metres would be adequate to ensure minimal impact on existing air quality around the proposed incinerator. It is clear that there would be significant benefits by increasing the stack height to 26 metres, with noticeable reductions in the impact of the proposed incinerator on ambient air quality. In particular the maximum ground level concentrations would be much reduced, thus significantly reducing the ambient concentration of NO<sub>2</sub>.
- 6.50. The assessment determined that a stack height of 26m would be required for this installation, noting that for only NO<sub>2</sub>, of the pollutants modelled, was a height of greater than 18m required. The increased stack height would also have benefits for other pollutants. The principal reason is that the existing background levels are already relatively high and the additional NO<sub>2</sub> from a shorter stack leads to an exceedance of the Air Quality Standard at those locations where the maximum pollutant concentration occurs.
- 6.51. The impact on sensitive receptors is discussed in **Section 7**.

## ODOUR EMISSIONS

- 6.52. A baseline survey was not carried out because no data exists locally. The EPS for the Incinerator of the Abattoir stated that no measurements of ambient odour concentration are available in Malta. This position was accepted by MEPA.
- 6.53. It has been reported in the local media that there are “strong smells coming from the abattoir and from its incinerator<sup>42</sup>.” This refers to odour from the operation of the abattoir and the burning of waste in a mobile incinerator. It is also reported that in 2002 teachers and students from F.X. Attard School and Fra Diegu Bonanno Girls Secondary School in Marsa were evacuated because of the sulphur odours from the Marsa Power Station<sup>43</sup>.
- 6.54. The sources of odour from the installation are mainly from the transfer of abattoir / slaughterhouse waste from the trucks to the refrigerated unit. Once this waste reaches the enclosed refrigerated area it will not release odours to the outside. The other area in the installation that could potentially generate odours is the shredding room.
- 6.55. Other sources of odour include storage of spent solvents and sludges. Since the waste streams will be stored on site for no longer than 48 hours, they are unlikely to generate continuous odours. They will be stored in a refrigerated container and pumped into the incinerator through a closed system. This ensures that the pungent smells associated with sludges and solvents are not released into the environment.
- 6.56. The odour sensitive receptors are those residences and the school identified above as noise sensitive receptors; the nearest sensitive receptor is about 170 metres away (the school).
- 6.57. The design and operation of the plant is such that the generation of odours is minimal. Abattoir waste arrives on site in closed 1,100 litre wheeled bins. The bins are removed from the vehicles and immediately transferred to the weighbridge. It is noted that the bins will come from the abattoir itself. It is anticipated that the production of waste is gradual and the bins will be transported to the incinerator once they are full. This means that the bins will not be held in the reception yard for long; they will be loaded onto the weighbridge and taken into the refrigerated area. This process will minimise the generation of odours.
- 6.58. Once inside the storage room the bins are either stored or sent to the shredder. Storage in the refrigerated room is for a maximum of 3 days.
- 6.59. The shredding of abattoir waste could also generate odours. The plant has a number of features to mitigate this impact:
- The shredder is located inside a closed building;

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<sup>42</sup> <http://www.mut.org.mt/pressrel/Press%20Conference.htm> accessed on 24<sup>th</sup> October 2006

<sup>43</sup> <http://www.maltapolitics.com/ledukazzjoni.htm> accessed on 24<sup>th</sup> October 2006

- The shredder has a lid so that when waste is tipped into it, it is closed before shredding starts;
  - The air in the shredder room is pumped out into the incinerator; the room is always under negative pressure; and
  - No personnel are allowed into the room when the shredder is operational.
- 6.60. Whole carcasses that need to be incinerated are not held in the storage area. When a carcass needs to be incinerated it is immediately brought into the shredder room and loaded onto a lift that transports it directly to the shredder. This means that carcasses are not kept on site; they are incinerated immediately. This helps to reduce odours.
- 6.61. Clinical waste will be stored in the refrigerated area. The Just In Time system that will be adopted (see earlier) ensures that clinical waste is transferred straight into the Primary Combustion Chamber. In addition, clinical waste bags will not be opened on site as they will not be inspected. Risks of odour from clinical waste containers are minimal.
- 6.62. When the installation is not in operation, during maintenance, waste will not be accepted at the facility and will therefore be stored at the producer's end. It is anticipated that the refrigerated bin storage area will not be maintained as regularly as the main installation meaning that it will not be disconnected as often. In the unlikely event that some waste must be stored on site during shut down of the main plant, it will be refrigerated and will therefore not generate odours. In the case of a power failure, sub-contractors that provide 24 hour generator services will be contracted by WasteServ to provide a back-up service to the refrigerated areas.
- 6.63. The installation equipment and operation are in line with the requirements of BAT 7.
- 6.64. It is anticipated that under normal operation of the plant, odour will not be a nuisance to the sensitive receptors. This was also confirmed in the EPS for the Incinerator at the Public Abattoir.
- 6.65. The following are references taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration that are relevant to odour emissions. As explained above, the installation is congruent with these requirements.

**BAT BOX**

**Reference 7:**

**To minimise the release of odour (and other potential fugitive releases) from bulk waste storage areas (including tanks and bunkers, but excluding small volume wastes stored in containers), and waste pre-treatment areas by passing the extracted atmosphere to the incinerator for combustion (see 4.1.4.4). In addition it is also considered to be BAT to make provision for the control of odour (and other potential fugitive releases) when the incinerator is not available (e.g. during maintenance) by:**

- (a) Avoiding waste storage overload; and/or**
- (b) Extracting the relevant atmosphere via an alternative odour control system.**

## NOISE AND VIBRATION EMISSIONS

- 6.66. This Section addresses section **B2.9** of the IPPC Application.
- 6.67. This Section considers the noise and vibration impacts arising from the **operation** of the installation. Construction impacts are not relevant since these are dealt with in the EIA process.
- 6.68. The existing noise climate was established through the baseline noise survey that was carried out by AIS Environmental Ltd for the EPS of the Incinerator at the Public Abattoir. The locations of sensitive receptors that may be potentially affected by changes to the noise environment were identified in the EPS. These locations were agreed with MEPA (see Section 2.7.1 of the EPS).
- 6.69. The operation of the Scheme is likely to give rise to noise possibly from traffic generated by the Scheme and the operation of the plant itself. Vibrations are unlikely to arise<sup>44</sup>.
- 6.70. The potential key noise-related issue associated with the Scheme is outlined below:

### Key Issues

- **Effects of noise on sensitive uses**

- 6.71. The EPS provided the following measurements:
- $L_{Aeq}$  - the 'A' weighted average or residual noise;
  - $L_{max}$  and  $L_{A10}$  - usually used to assess traffic noise; and
  - $L_{A90}$  - to indicate the background noise condition.
- 6.72. Measurements and procedures were undertaken in accordance with BS 4142:1997.

## BASELINE CONDITIONS

- 6.73. The four locations at which measurements were taken are shown on **Figure 6.2**. They were chosen as they represent the closest sensitive noise receptors. The EPS reported the full results of the survey; these are summarised in **Table 6.17** below. Noise measurements were carried out in 15-minute periods over total measurement periods of 1 to 2 hours at each location. The results in **Table 6.17** present the average over day time and night time periods.

<sup>44</sup> AIS Environmental and SLR Consulting, 2005, Environmental Planning Statement for an Incinerator at the Public Abattoir, Marsa. Final Draft pp 82 (accepted by MEPA).

6.74. The survey showed that the background noise level measured at the two noise monitoring points is 45 - 59 dB(A) ( $L_{A90}$ ) during day light hours, and 32 - 40dB(A) ( $L_{A90}$ ) at night time.

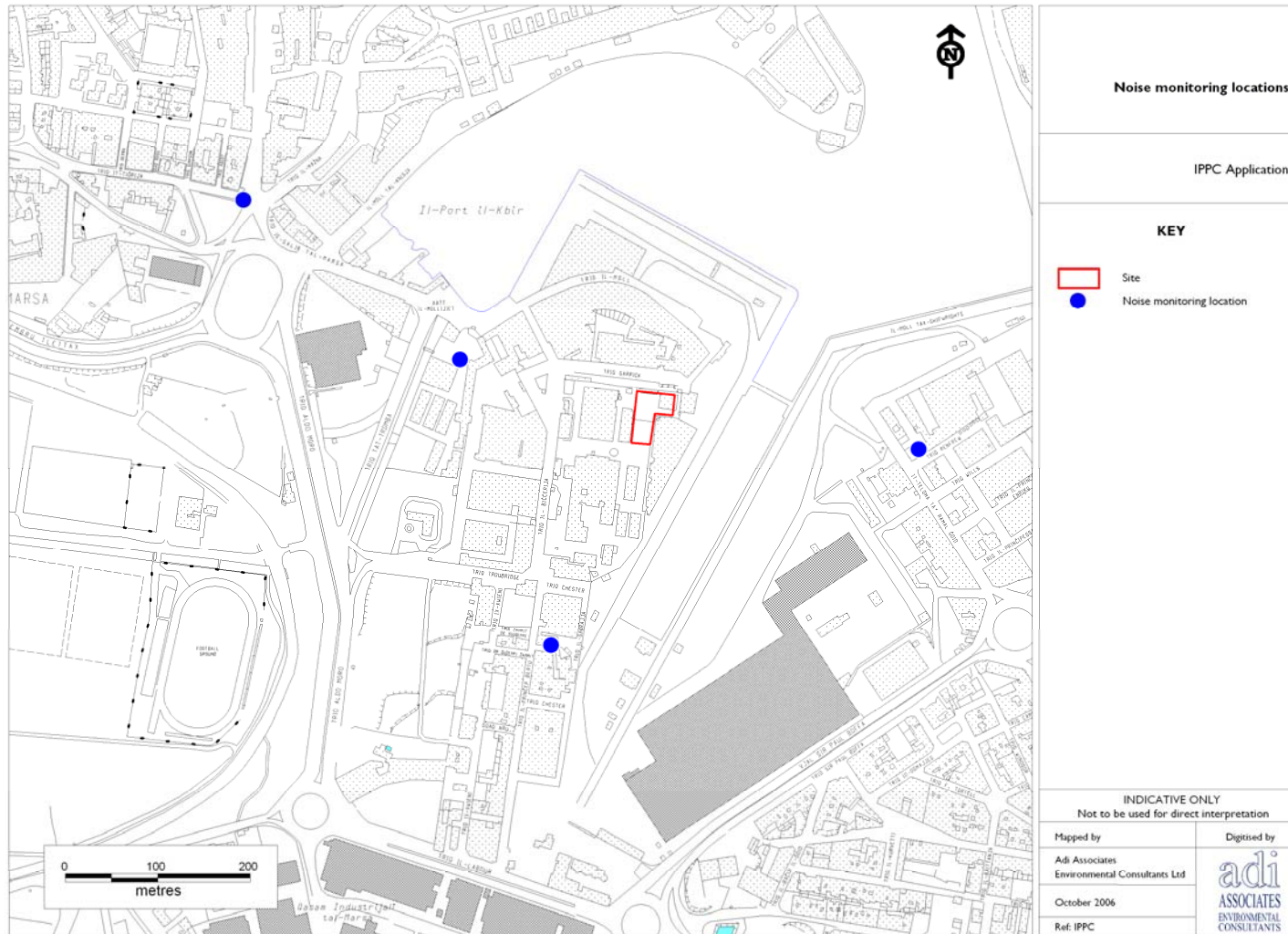
**Table 6.17: Summary of survey results from EPS of the Incinerator at the Public Abattoir**

Location	Distance from Scheme	Period	$L_{Aeq60}$	$L_{Amax}$	$L_{A10}$	$L_{A90}$	Predominant noise source
Property on the corner of Triq Renfrew to the east of the Scheme	275 metres	26/02/2002 14:03 to 15:33	69.7	93.4	70.4	53.8	Traffic
		26/02/2002 23:42 to 23:57	51.7	63.2	52.7	50.5	Equipment from nearby winery and cold storage
Property off Triq il-Princep Bertu to the south of the Scheme	245 metres	26/02/2002 12:02 to 13:32	55.5	76.3	58.1	49.8	Traffic and fan from cold storage
		26/02/2002 23:16 to 23:31	54.4	75.9	50.8	45.7	Fan from cold storage
School on Xatt il-Mallijiet to the west of the Scheme*	170 metres	27/02/2002 08:58 to 10:28	63.0**	112.4	67.1	56.6	Traffic and school activities
Property on Triq it-Tigrija to the north west of the Scheme	470 metres	27/02/2002 10:38 to 12:38	64.9	90.7	66.6	58.9	Traffic
		27/02/2002 22:55 to 23.20	62.2	84.4	62.2	55.7	Traffic

\* NOTE: No night time measurements were taken as the school does not operate at night

\*\* NOTE: This represents the noise level without noise generated from students during break time

**Figure 6.2: Location of noise monitoring points**



## POTENTIAL NOISE IMPACTS

6.75. The potential impacts associated with the Scheme include:

- Noise disturbance to the residents in the properties near the development during installation of the modifications to the existing plant;
- Noise disturbance to residents of the Scheme and nearby properties during operation; and
- Noise disturbance during operation to users of the facilities in the area.

## DETERMINING IMPACT SIGNIFICANCE

6.76. The following criteria have been used to assess the significance of impacts of the Scheme on the noise climate of the Area of Influence:

- **Not significant** (e.g. no material change in noise climate - a change of less than 3dB to the background noise levels);
- **Minor significance** (e.g. a change between 3 and 10dB to the background noise levels - such a change would be noticeable but would not usually give rise to widespread complaints); and
- **Major significance** (e.g. a change of 10dB or higher to the background noise levels as predicted at the noise sensitive receptor - such a change is likely to adversely affect the sensitive noise receptors in the vicinity of the site, and give rise to widespread complaints).

6.77. **Table 6.18** provides an indication of the loudness of sound pressure levels measured in dB(A), in order to give an idea of typical noise levels.

**Table 6.18: Equivalent dB(A) levels**

Noise environment	Typical dB(A)
Library	30 to 35dB(A)
Living room	40 to 45dB(A)
Office	60 to 65dB(A)
Heavy road traffic	75 to 80dB(A)
Pneumatic drill	100dB(A)

Source: Bruel & Kjaer chart

## Prediction and Significance of Impacts

6.78. The noise sources during the construction of the Scheme are not likely to be significant because the incinerator has already been dry commissioned and the modifications (described above) that need to be made are minor. Furthermore most of the modifications will be made inside an enclosed building. The only external modifications include the installation of a container for spent solvents and bunding of

the reception yard. The waste water reservoirs will only necessitate minor construction work that is short term.

- 6.79. During operation of the incinerator there are a number of activities and equipment that generate noise. These include:
- Trucks that deliver waste (mainly hazardous waste, as abattoir waste is already being delivered to the site);
  - The shredder;
  - The rotary kiln;
  - The Secondary Combustion Chamber;
  - The boiler;
  - Air pollution control equipment;
  - The stack fan and motor;
  - The switch room;
  - The diesel generator;
  - Cold store exhaust vents; and
  - Cars.
- 6.80. Since the plant will be operating 24 hours a day, the assessment of night time noise impacts is relevant.
- 6.81. The sound power levels generated by the plant are given in **Table 6.19**. The data were obtained from the certified EPS for the Incinerator at the Public Abattoir prepared by AIS Environmental Ltd and SLR Consulting Ltd.

**Table 6.19: Sound power levels of the incinerator components**

Plant Item	Sound Power Level dB(A)
Shredder	91
Rotary kiln	91
Waste heat recovery boiler	91
Secondary Combustion Chamber	91
Air Pollution Control Equipment	91
Stack fan and motor	91
Switch room	91
Diesel generator	91
Cold store exhaust vents	91
Trucks	108
Cars	90

6.82. The EPS states that in predicting the noise levels at the sensitive receptors the following assumptions were made:

- The worst case scenario was used and it was assumed that at a distance of 1 metre from the plant the noise level will be of 83dB  $L_{Aeq, 1h}$ ; and
- Vehicle movements were assumed to be two vehicles an hour.

6.83. The predicted noise levels at the noise monitoring points are set out in **Table 6.20**. In determining the noise level at the sensitive receptor it should be noted that distance from the noise source and buildings in between the receptor and the site contribute to attenuation of noise generated by the plant.

**Table 6.20: Predicted noise levels at sensitive receptors**

Location	Distance from Scheme	Period	$L_{Aeq60}$	$L_{A90}$	Predicted noise level at sensitive receptor
Property on the corner of Triq Renfrew to the east of the Scheme	275 metres	Day	69.7	53.8	39.0
		Night	51.7	50.5	38.0
Property off Triq il-Princep Bertu to the south of the Scheme	245 metres	Day	55.5	49.8	37.5
		Night	54.4	45.7	37.5
School on Xatt il-Mallijiet to the west of the Scheme*	170 metres	Day	63.0**	56.6	49.0
Property on Triq it-Tigrija to the north west of the Scheme	470 metres	Day	64.9	58.9	39.0
		Night	62.2	55.7	39.0

6.84. The noise at residences in Triq Renfrew was estimated to be 39 dB (A); this includes noise from vehicle movements. An additional 5 dB(A) were added to account for the continuous noise generated by the incinerator. In accordance with BS 4142:1997 this level of 44 dB(A) is not considered significant because it is below the background noise level for both day and night time measurements. The noise environment in the weekend would be similar to the night time noise scenario. No complaints from neighbours are likely at any time of the day.

6.85. The same assessment was carried out for the remaining noise sensitive receptors. The table shows that the operation of the plant results in noise levels at the sensitive receptors that are lower than the background during both the day and the night. On this basis the EPS concludes that there will be no complaints from the noise sensitive receptors.

6.86. The same conclusions are reached for the upgraded installation because there will be no increase in vehicles as a result of the upgrade of the installation. WasteServ estimates that the upgraded installation will generate about 15 vehicle trips a day (10 vehicles for abattoir waste and 5 vehicles for hazardous waste). This compares with the two vehicles per hour used for the noise assessment in the EPS.

- 6.87. The EPS states that there will be no perceptible vibration from the operation of the incinerator at all four sensitive receptors.
- 6.88. The following reference is taken from the European Commission's IPPC Reference Document on the Best Available Techniques for Waste Incineration; it is relevant to noise emissions. As explained above, the installation is congruent with this requirement.

**BAT BOX**

**Reference 55:**

**The implementation of noise reduction measures to meet local noise requirements (techniques are described in 4.7 and 3.6).**

## DISCHARGES TO GROUNDWATER

- 6.89. This Section addresses section **B2.4.1** of the IPPC Application.
- 6.90. All IPPC permits are subject to compliance with components of the Groundwater Regulations, 2002 (Legal Notice 203 of 2002). The Regulations relate to direct or indirect discharges of List I and List II substances.
- 6.91. There will be no direct or planned indirect discharge of List I or II substances during operation of the incinerator.
- 6.92. In order to minimise the risk of a release of a potentially contaminating substance the on-site control strategy consists of:
- Appropriate use and storage of substances;
  - Bunding of areas where potential leaks could occur such as in the waste reception yard, and the spent solvents storage area;
  - Managed drainage system which can be isolated in the event of accidental release;
  - Spill kits located in close proximity to the storage of hazardous materials;
  - Periodic inspection and maintenance of on-site systems; and
  - Training and safety awareness of handling materials on-site.
- 6.93. These systems ensure that no waste water seeps into the ground; this implies that there are no groundwater contamination issues at the site. The provisions of Legal Notice 203 of 2002 are safeguarded.
- 6.94. There will be no release of any substances directly into territorial waters or coastal waters.
- 6.95. A detailed drainage plan is found in **Appendix 12** and wastewater management has been described in Section 5.

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## 7. IMPACTS

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### INTRODUCTION

- 7.1. This Section addresses section **B4** of the IPPC Application.
- 7.2. The purpose of this Section is to assess the impacts of the Scheme on people.
- 7.3. Although noise and odour impacts have been described in the previous Section, they will be discussed briefly in this Section.
- 7.4. The impact of air quality is assessed in this Section of the IPPC Application. Baseline air quality data acquired from MEPA is used to assess the impact on air quality as a result of the installation.
- 7.5. The potential key issues associated with the Scheme are outlined below:

#### Key Issues

- **Effects of emissions from the operation of the installation on sensitive receptors**
- **Effects of odours from the operation of the installation on sensitive receptors**
- **Effects of noise from the operation of the installation on sensitive receptors**

### AIR QUALITY

- 7.6. Although Legal Notice 336 of 2001 lays down the limit values for emissions from incinerators, other sources of guidance are the following national legislation concerning atmospheric pollution:
  - **Legal Notice 216 of 2001:** *Ambient Air Quality Assessment and Management Regulations, 2001*;
  - **Legal Notice 224 of 2001 (as amended by L.N. 231/2004):** *Limit values for Sulphur Dioxide, Nitrogen Dioxide and Oxides of Nitrogen, Particulate Matter and Lead in Ambient Air Regulations, 2001*;
  - **Legal Notice 163 of 2002:** *Limit Values for Benzene and Carbon Monoxide in Ambient Air Regulations, 2002.*; and
  - **Legal Notice 291 of 2002:** *National Emission Ceilings for Certain Atmospheric Pollutants Regulations, 2002.*

- 7.7. Dispersion and concentration of emissions from traffic will be guided by the air quality section of the UK's Design Manual for Roads and Bridges<sup>45</sup>.
- 7.8. Emission limit values for sulphur dioxide, nitrogen dioxide, and particulate matter are set out in Legal Notice 224 of 2001 and are summarised in **Table 7.1**. The limit value for carbon monoxide is set in Annex II of Legal Notice 163 of 2002 at 10 mg/m<sup>3</sup> as the maximum daily 8-hour mean.

**Table 7.1: Acceptable Mean Pollutant Levels**

Pollutant	Objective	Measures As	Date to be achieved by
Nitrogen Dioxide (NO <sub>2</sub> )	200 µg/m <sup>3</sup> (not to be exceeded more than 24 times a year) 40 µg/m <sup>3</sup>	1-hour mean (Short Term)	01/01/2010
		Annual mean (Long Term)	01/01/2010
Particles (PM <sub>10</sub> )	50 µg/m <sup>3</sup> (not to be exceeded more than 35 times) 40 µg/m <sup>3</sup>	24-hour mean	01/01/2005
		Annual mean	01/01/2005
Sulphur Dioxide (SO <sub>2</sub> )	350 µg/m <sup>3</sup> (not to be exceeded more than 24 times) 125 µg/m <sup>3</sup> (not to be exceeded more than 3 times)	1-hour mean	01/01/2005
		24-hour mean	01/01/2005

Source: LN 224 of 2001

### Baseline Data

- 7.9. Principal emissions arising from the operation of the incinerator are dust, gaseous and vaporous organic substances (expressed as total organic carbon), hydrogen fluoride, hydrogen chloride, sulphur dioxide, nitrogen oxide, nitrogen dioxide, carbon monoxide, heavy metals, dioxins, and furans.
- 7.10. Principal emissions arising from traffic are carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), Volatile Organic Compounds (VOCs), particulates, 1,3-butadiene, and lead (Pb)<sup>46</sup>. Increased use of unleaded petrol has meant a decline in lead pollution from petrol in recent years<sup>47</sup>.
- 7.11. The State of the Environment Report (SoER) for Malta, 2005 provides data for localities for the following parameters – sulphur dioxide (SO<sub>2</sub>), NO<sub>2</sub>, benzene and ozone. Ozone in Malta occurs mainly from transboundary sources. Therefore, the study of ozone has no direct relevance to the Scheme and will not be considered further.

<sup>45</sup> Highways Agency(UK) Design Manual for Roads and Bridges.

<sup>46</sup> Harrop, 2002, *Air Quality Assessment and Management – A Practical Guide*; Spon Press.

<sup>47</sup> The International Bank for Reconstruction and Development / The World Bank, 2000, *Beyond Economic Growth, Meeting the Challenges of Global Development*, accessed from <http://www.worldbank.org/depweb/beyond/global/chapter10.html> on 7th January 2007

- 7.12. Although the SoER (2005) also provides data for particulate matter concentrations from two fixed monitoring stations in Floriana and Kordin, such data are not considered relevant to this Study as the Application Site is located in a street that is relatively free of traffic.
- 7.13. Data for the areas around the Scheme was purchased from MEPA<sup>48</sup> as the SoER data did not contain the areas required. Data for sulphur dioxide, nitrogen dioxide, ozone, benzene, ethylbenzene, toluene, mp-xylene, and o-xylene were obtained from the following streets: Triq Aldo Moro<sup>49</sup>, Triq Azzopardi, Spencer Hill, and Triq Is-Salib tal-Marsa (see **Figure 7.1**). Only sulphur dioxide and nitrogen dioxide readings are relevant to this study.

### **Sampling Methodology**

- 7.14. MEPA set up a diffusion tube network in 124 locations located in 31 towns and villages across Malta and Gozo to monitor emissions of SO<sub>2</sub>, NO<sub>2</sub>, and ozone. The majority of the sampling locations were set up in the Northern and Southern Harbour districts.
- 7.15. Sampling results are presented for the period between January 2003 and August 2006.

### **Results**

- 7.16. The data presented by MEPA gives monthly (three to four weeks) concentrations for each of the pollutants. However, for the purposes of this report only annual average concentrations are given. These were derived from the monthly data taking the average for the yearly period. In some cases data for a particular month were absent. The average of the remaining months was used to obtain the annual data<sup>50</sup>.
- 7.17. The data for the 4 sites in Marsa for sulphur dioxide and nitrogen dioxide are given in **Tables 7.2** and **7.3**. It is noted that none of the readings exceed the limit values set out in Annexes I and II of Legal Notice 224 of 2001. The readings for Triq Aldo Moro are higher than for the other monitoring points; this could be due to the heavy traffic that passes through Triq Aldo Moro everyday. These readings are used to determine the impact on sensitive receptors in the area.

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<sup>48</sup> E-mail from MEPA (Dr Michael Nolle) to WasteServ (Ms Henriette Putzulu Caruana) dated 18<sup>th</sup> December 2006.

<sup>49</sup> Although the MEPA data states that data was collected from this street, the diffusion tube was placed in Triq it-Tromba just behind Triq Aldo Moro.

<sup>50</sup> As agreed with MEPA (Dr Michael Nolle) on 10<sup>th</sup> January 2007.

**Table 7.2 Annual average concentrations of sulphur dioxide for Marsa**

Street	2003* ( $\mu\text{g}/\text{m}^3$ )	2004 ( $\mu\text{g}/\text{m}^3$ )	2005 ( $\mu\text{g}/\text{m}^3$ )	2006 (until August 2006) ( $\mu\text{g}/\text{m}^3$ )	Daily limit value as per LN 224/01 ( $\mu\text{g}/\text{m}^3$ )
Triq Aldo Moro	43.45	23.23	17.47	13.39	125
Triq Azzopardi	30.44	16.26	12.12	12.00	125
Spencer Hill	35.77	35.52	21.24	16.01	125
Triq Is-Salib tal-Marsa	27.01	21.38	12.65	15.65	125

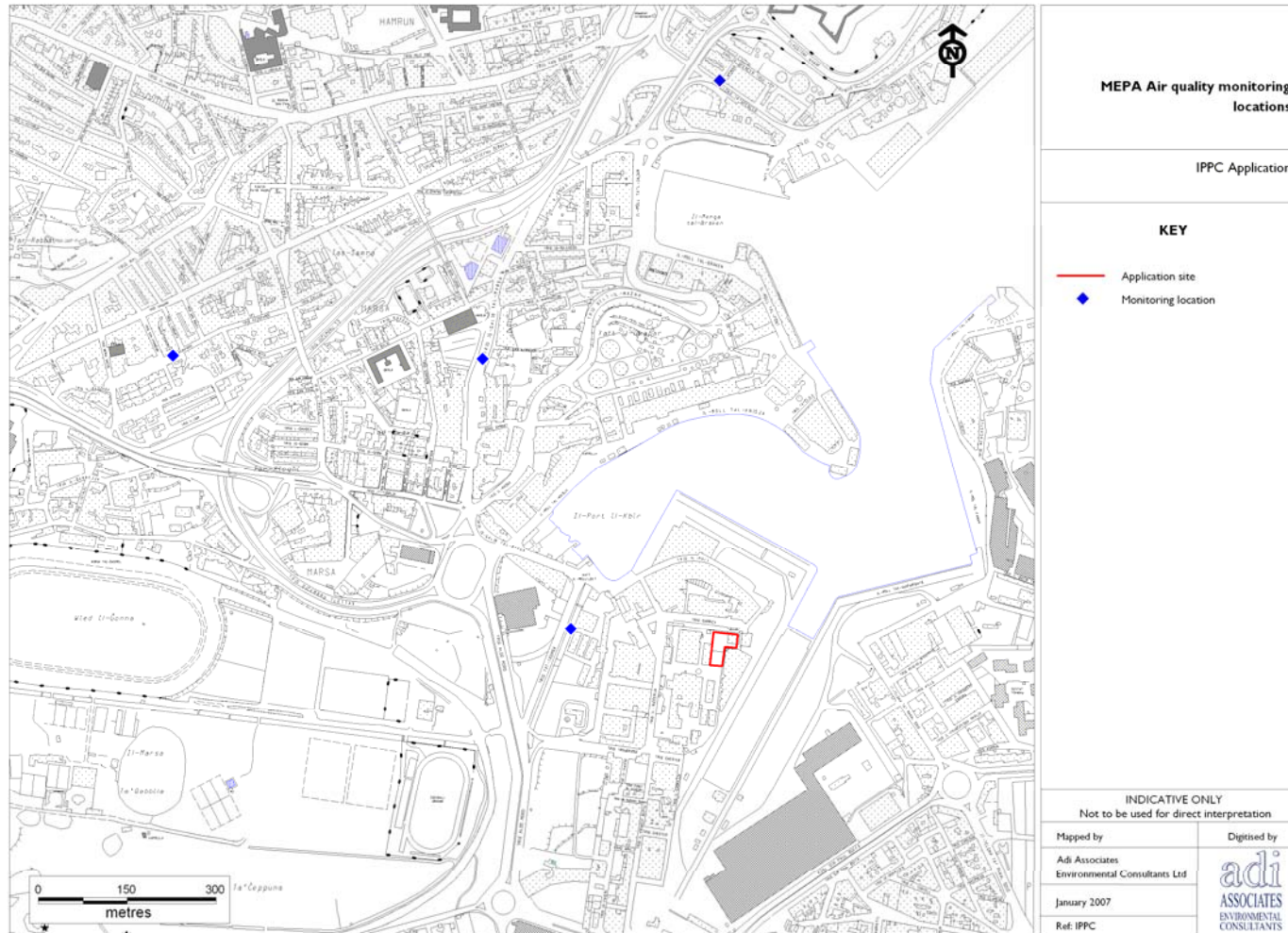
\* Note: Reading for 2003 available only until November

**Table 7.3 Annual average concentrations of nitrogen dioxide for Marsa**

Street	2003* ( $\mu\text{g}/\text{m}^3$ )	2004 ( $\mu\text{g}/\text{m}^3$ )	2005 ( $\mu\text{g}/\text{m}^3$ )	2006 (until August 2006) ( $\mu\text{g}/\text{m}^3$ )	Annual limit as per LN 224/01 ( $\mu\text{g}/\text{m}^3$ )
Triq Aldo Moro	28.26	27.44	33.29	37.33	40
Triq Azzopardi	21.34	22.27	23.84	26.25	40
Spencer Hill	23.15	27.53	22.13	25.45	40
Triq Is-Salib tal-Marsa	26.52	25.51	25.55	27.70	40

\* Note: Reading for 2003 available only until November

**Figure 7.1: MEPA's air monitoring locations in Marsa**



Source: MEPA, Pollution Prevention Control Unit, Fax dated 9<sup>th</sup> January 2007

## Heavy Metals

- 7.18. MEPA conducted a study to determine heavy metal concentrations in particulate matter<sup>51</sup>. Sampling was carried out between January 2003 and December 2004. Concentrations of particulate matter were sampled from the two fixed monitoring stations in Floriana and Kordin. These samples were then analysed for cadmium (Cd), nickel (Ni), mercury (Hg), arsenic (As), lead (Pb), vanadium (V), chromium (Cr), manganese (Mn), and sodium (Na).
- 7.19. The results indicated that nickel was the only heavy metal that repeatedly exceeded limit values (results for filters 4, 5, and 7, i.e. more than 20 µg/m<sup>3</sup>). The results are presented in **Table 7.4**. It is noted that the monitoring stations are located in areas that are exposed to high levels of traffic.
- 7.20. The results are not relevant to the study as they do not provide baseline conditions for mercury, cadmium, and thallium.

**Table 7.4: Heavy metal concentrations in particulate matter**

Filter No	Cd	Ni	Hg	As	Pb	V	Cr	Mn	Na
	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>
1	*	0.0077	*	0.0026	0.0877	0.0026	*	0.0103	2.3202
2	*	0.0145	*	*	0.1341	*	*	0.0145	2.5376
3	*	0.0051	*	*	0.0945	0.0026	*	0.0077	1.4551
4	*	0.1820	*	*	0.1794	*	*	0.0494	3.4848
5	0.0013	0.2356	*	*	0.0947	0.0042	*	0.0652	2.3348
6	*	0.0187	*	*	0.1962	*	*	0.0117	1.7983
7	*	0.0338	*	*	0.1383	0.0184	*	0.0092	3.5961

Note: The \* denotes that values were below the detection limits of the instrument

Source: MEPA 2005. *Report for the Analysis of Heavy Metals by Dust Speciation*.

## Air Quality Impact Assessment

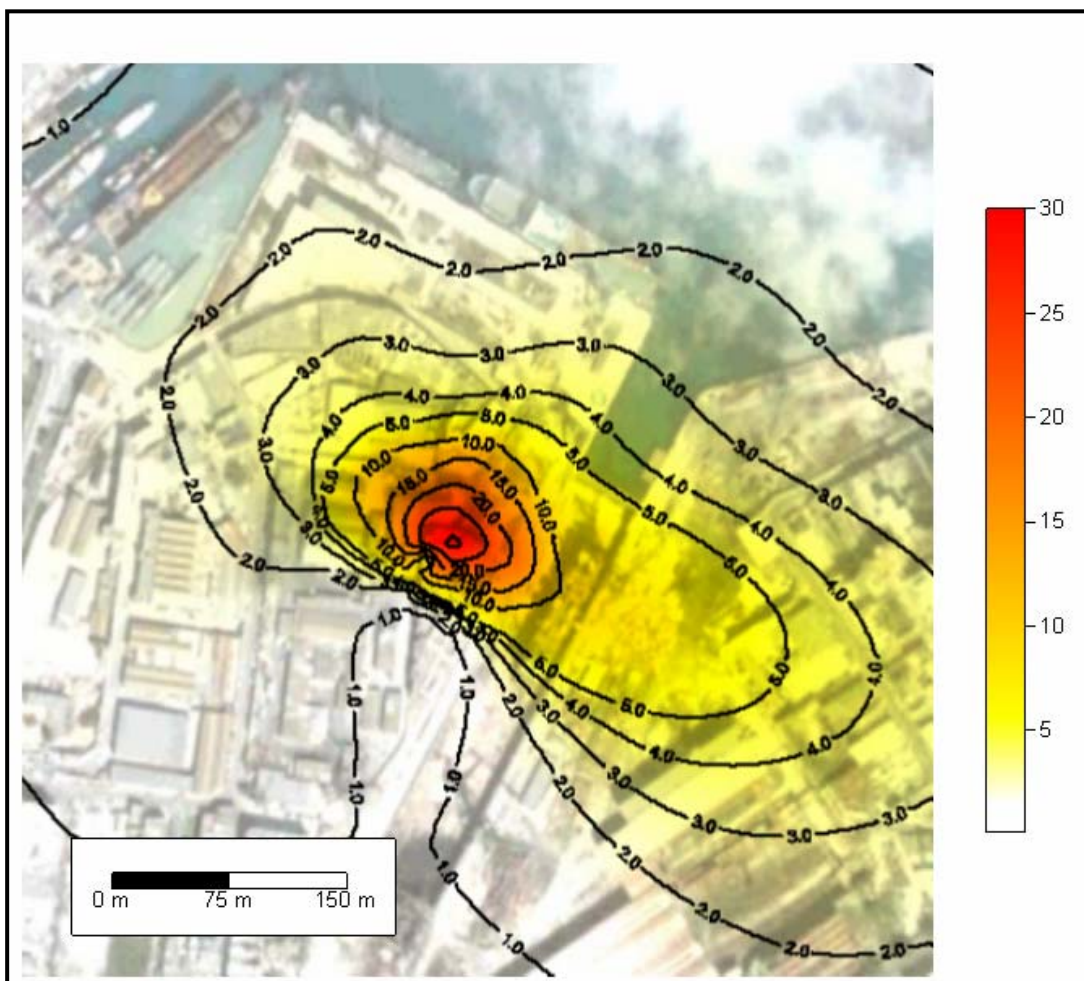
### Emissions from the incinerator

- 7.21. **Section 6** of the Report discussed the results of the air modelling dispersion study. In summary, the air quality assessment was carried out to assess the impact of emissions from the incineration process on air quality for a variety of stack heights ranging from 18 to 26 metres. The assessment indicated that the proposed stack height of 18m would be sufficient to provide adequate dispersion for all the flue gases except for NO<sub>x</sub> emissions. The predicted ground level concentrations of NO<sub>x</sub> at the site of the incinerator are below the relevant air quality standard. The results showed that if the stack height is increased by 8 metres (from 18 to 26 metres), the effect of the stack emissions is significantly reduced, and none of the standards would be exceeded.

<sup>51</sup> MEPA 2005. *Report for the Analysis of Heavy Metals by Dust Speciation*.

- 7.22. Considering that the only pollutant that exceeded the AQS in the model was  $\text{NO}_x$ , contour maps were drawn up to assess the impact of the emissions on key sensitive receptors.
- 7.23. The air dispersion model produced contour maps showing pollution concentration for  $\text{NO}_x$  around the site (see **Figure 7.2**). Pollution from  $\text{NO}_x$  is greatest at the site of the incinerator and disperses rapidly as the distance from the incinerator increases. Dispersal is in a South Easterly direction across Marsa; this is explained by the dominance of North Westerly winds on the island. The contour map only shows that concentration of emissions from the stack; it does not include ambient concentrations which have been estimated at  $26.2 \mu\text{g}/\text{m}^3$ .

**Figure 7.2: Annual Average  $\text{NO}_x$  ( $\mu\text{g}/\text{m}^3$ ) from an 18m Stack**



- 7.24. In order to determine the effect of the proposed incinerator on the ambient air quality at the key sensitive receptors, a comparison was made between the contour plots (**Figure 7.2**) and the location map highlighting the key sensitive receptors (**Figure 7.3**). The assessment shows that the receptor at Triq Garrick (less than 50 metres North of the site) is likely to be most affected by pollutant emissions from the incinerator, with the highest pollutant concentrations being recorded here ( $34.2 \mu\text{g}/\text{m}^3$  for  $\text{NO}_2$ , including the background concentrations of  $26.2 \mu\text{g}/\text{m}^3$ , at a stack height of 18m). The concentration is below the AQS of  $40 \mu\text{g}/\text{m}^3$ .
- 7.25. Triq Renfrew to the East (approximately 300 metres from the site) and the receptor South of Xatt il Mollijiet (approximately 200 metres West of the site) may be affected by plume dispersal, however concentrations will be much reduced at these receptor locations (reaching less than  $30.2 \mu\text{g}/\text{m}^3$  for  $\text{NO}_x$  at these two sites).
- 7.26. These results show that, although ground concentration at the site of the incinerator exceeds the AQS, at the sensitive receptors the AQS are not exceeded. The high ambient concentration of  $\text{NO}_x$  explains the exceedance at the site of the incinerator.
- 7.27. The AQS at both Marsa and Paola will not be exceeded as a result of the operation of the incinerator.
- 7.28. **Figure 7.4** shows the contour map for  $\text{NO}_x$  emissions from a 26 metre stack. Again ambient  $\text{NO}_x$  emissions are not shown. It is clear that with an increase in stack height, pollutant concentrations away from the site are considerably reduced (particularly in a Westerly direction). The reason for this is that a higher stack height enables a greater dispersal of pollutants when these are emitted from the stack, and reduces the effects of buildings and other topographical features.
- 7.29. The increase stack height guarantees that even with a very high ambient concentration of  $\text{NO}_x$  of  $26.2 \mu\text{g}/\text{m}^3$ , the emissions released from the incinerator will not increase the AQS at the site of the incinerator and its surroundings.
- 7.30. A stack height of 26 metres also ensures that all the other pollutants are diluted and dispersed. The modelling clearly indicated that atmospheric emissions from the proposed incinerator will comply with the environmental standards against which it has been assessed for stack heights of 26 metres and greater.

### ***Emissions from traffic***

- 7.31. The amount of traffic generated by the installation is expected to be about 15 to 24 (maximum) vehicle trips a day. This minimal amount of traffic generation will not adversely affect the local air quality.

**Figure 7.3: Sensitive receptors around the site**

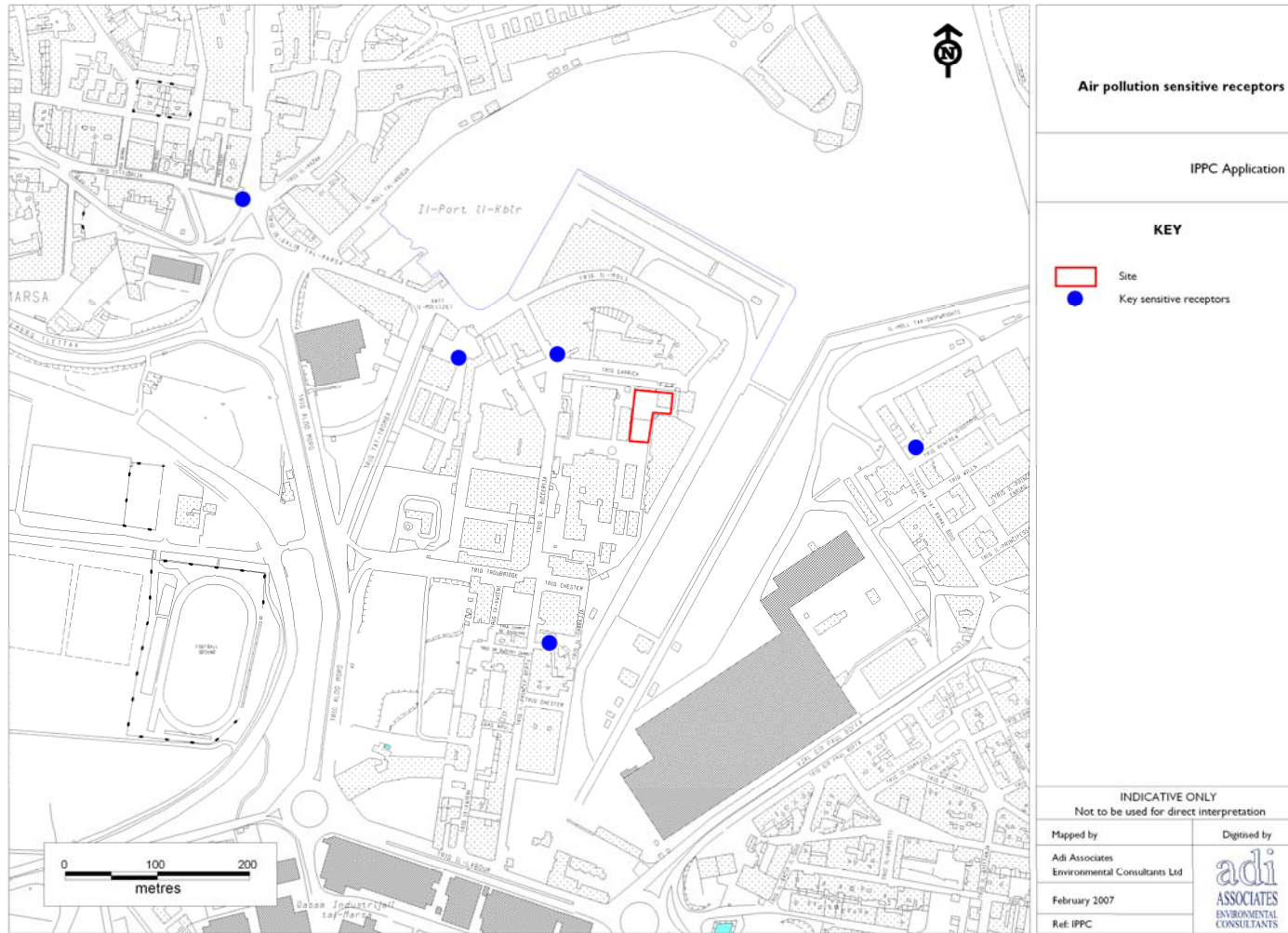
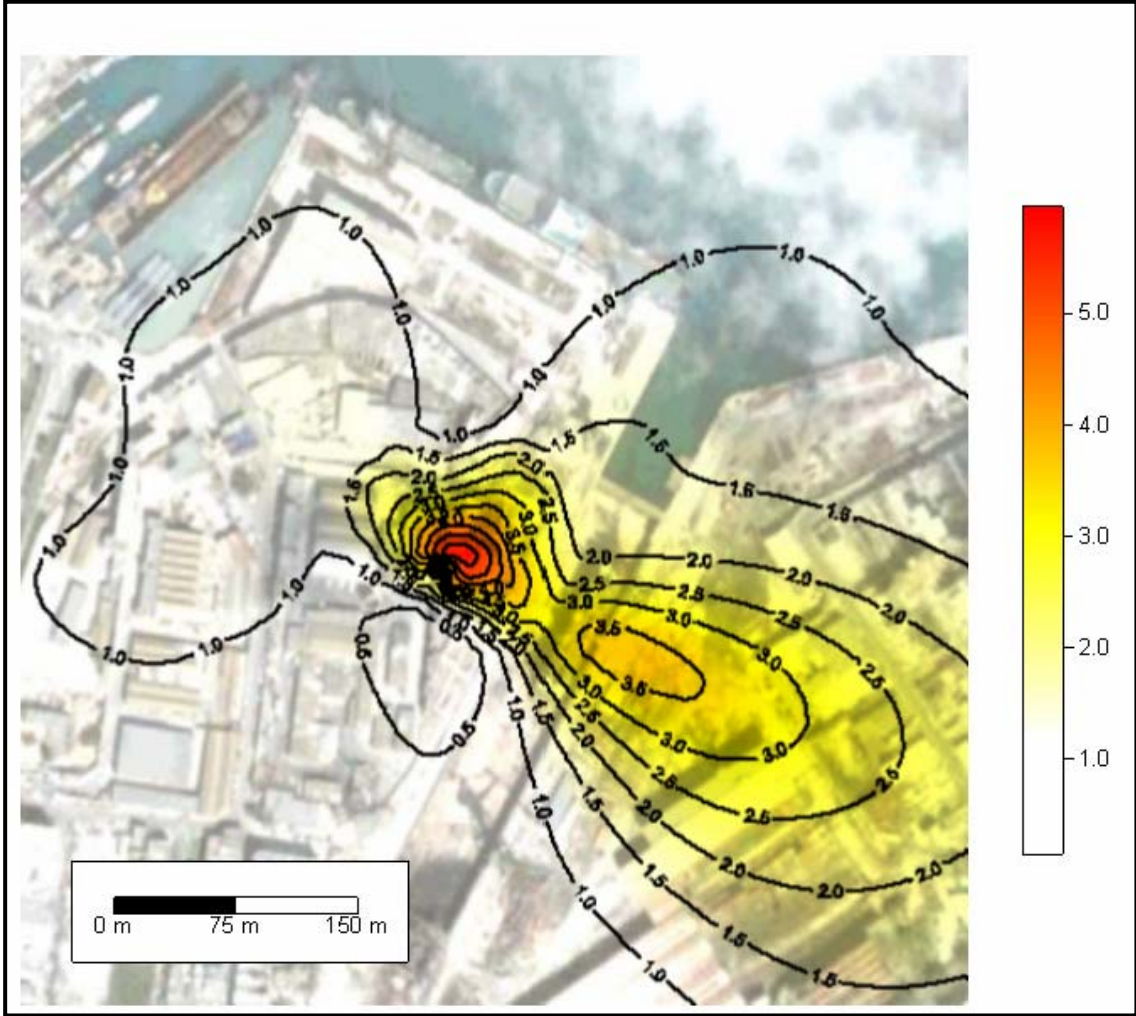


Figure 7.4: Annual Average NO<sub>x</sub> (µg/m<sup>3</sup>) from a 26m stack



## ODOUR IMPACTS

- 7.32. Wind movement in the atmosphere carries away odorous gases emitted from a source. Odour annoyance occurs when a person exposed to the odour perceives it as unwanted. Significant odour annoyance may trigger a complaint to a regulatory authority. The major factors relevant to perceived odour annoyances are:
- Offensiveness (a mixture of odour concentration, odour intensity, odour character and hedonic tone);
  - Duration of exposure to the odour;
  - Frequency of the odour occurrence; and
  - Tolerance and expectation of the receptor<sup>52</sup>.
- 7.33. There is general agreement that frequency, intensity, duration, offensiveness, and location (FIDOL) are factors that ought to be considered when attempting to judge the likelihood of odour nuisance. These so called FIDOL factors are not easy to quantify individually, and even less so when they interact<sup>53</sup>. This renders any quantitative assessment of whether there is “pollution” in the form of offence to the sense of smell very difficult<sup>54</sup>.
- 7.34. The UK Technical Guidance Note on Odour notes that the point at which “pollution” in the form of offence to the sense of smell is occurring is taken to be the point at which there is “reasonable cause for annoyance”. Consequently the aim of BAT should be to ensure that there is “no reasonable cause for annoyance”.
- 7.35. It is noted that the scientific basis underpinning regulation of odour is still a developing field. The response to exposure to an odour is primarily subjective – how strong is it, what does it smell like and how often/when does it occur and in what context? Each individual will make their own subjective assessment, which will either lead to a feeling of annoyance, or it will be considered to be acceptable. This subjectivity is apparent in Malta where no guidance, legislation, or regulatory body exists to quantify and control odour.
- 7.36. In the absence of a national baseline or an odour panel to establish baseline odour, the assessment of odours from the installation is based on the risk of generation of odours from the installation, as discussed above.
- 7.37. It is recognised that sensitive receptors in the vicinity of the site currently do experience odour problems from: (i) activities at the slaughterhouse; and (ii)

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<sup>52</sup> University of New South Wales, Australia, Centre for Water and Waste Technology website: <http://www.odour.unsw.edu.au/odour-impact-assessment.html> accessed on 7th January 2007

<sup>53</sup> Queensland Government, 2004 Guideline, Odour Impact Assessment from Developments accessed from [www.epa.qld.gov.au](http://www.epa.qld.gov.au) on 7th January 2007

<sup>54</sup> Environment Agency, 2003, Technical Guidance Note on Integrated Pollution Prevention and Control Draft Horizontal Guidance for Odour, Part I – Regulation and Permitting accessed from <http://www.environment-agency.gov.uk/yourenv/consultations/367609/> on 7<sup>th</sup> January 2007.

incomplete combustion of waste from the mobile incinerator. It is, however, also noted that in their submission to MEPA on PA 02201/01 (the construction of the incinerator at the public abattoir) the Marsa Local Council did not include odour as an issue<sup>55</sup>.

- 7.38. While the odours generated from the abattoir are beyond the scope of this assessment, it is likely that those generated from the mobile incinerator will cease once the installation is operational.
- 7.39. As discussed above, the generation of odours will result from delivery and storage of waste, and incomplete combustion of waste. Odours can be reduced through the application of BAT.
- 7.40. The UK's Technical Guidance Note on Integrated Pollution Prevention and Control Draft Horizontal Guidance for Odour, Part I – Regulation and Permitting states that where there is potential for pollution in the form of offence to the sense of smell (i.e. where there is potential for reasonable cause for annoyance), the aim of BAT should be to achieve the following:
- To keep the exposure to odour at sensitive receptors below the level at which it would give reasonable cause for annoyance;
  - To prevent the generation of odour where possible;
  - To contain the odour and use effective treatment techniques, or other means of minimising emissions, where prevention is not possible; and
  - To promote the use of good practices for the control of odour, including adequate maintenance and cleaning, storage, containment, etc.
- 7.41. The requirements for odour control for incinerators are contained in BAT 7 in the waste incineration BREF, referred to above. The plant is congruent with the BAT requirements and therefore it is unlikely that the installation will cause annoyance to sensitive receptors in the vicinity of the plant.
- 7.42. Notwithstanding, it is still recommended that the EMS contains a procedure wherein any odour complaints are logged, action is taken to identify the source of odour, and measures taken to reduce the odour.
- 7.43. The procedure to be adopted for each complaint should be based on the following steps:
- Officer responsible for receiving odour complaints logs the complaint and verifies whether the odour was generated from the installation or whether other sources could be responsible;
  - Once it is verified that the odour was generated from the installation, the source and cause of the odour must be identified;

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<sup>55</sup> Development Planning Application Report for PA2201/01 accessed from MEPA website: [www.mepa.org.mt](http://www.mepa.org.mt)

- The work / technical adjustments that need to be made to the plant or the operation must be identified and an action plan for the work to be carried out prepared;
  - Appropriate action is taken;
  - Incorporate procedures for on-going maintenance and performance assessment; and
  - Inform the complainant that the problem has been fixed.
- 7.44. If complaints persist the Competent Authority may consider setting up an odour panel that would objectively monitor odours.

## **NOISE IMPACTS**

- 7.45. As discussed above, the installation has planning permission (PA 02201/01). An Environmental Planning Statement (EPS) supporting this application was prepared in accordance with the requirements of the EIA Regulations, 2001. The EPS was certified by MEPA. The EPS contained a noise impact assessment that has been reproduced above.
- 7.46. The noise impact assessment described above shows that there will be no noise impact from the operation of the Scheme.

## **IMPACTS ON GROUNDWATER**

- 7.47. The operation of the installation foresees that there will be no discharges to groundwater. The site will be adequately bunded and reservoirs constructed to contain spillages (see **Appendix I2**) and firewater in the case of accident. The mitigation measures have been described above.

## 8. MONITORING

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### INTRODUCTION

8.1. This Section addresses section **B2.10** of the IPPC Application.

#### **Air Emission Monitoring**

8.2. Articles 10 and 11 of the Waste Incineration Directive stipulate the type and frequency of monitoring that must be carried out for a waste incinerator. The installation will carry out monitoring as required by the Directive.

8.3. When the temperature in the SCC has reached the assigned set point at which to start air modulation (set point value lower than that to enable PCC loading) the emissions monitoring is enabled.

8.4. The incinerator is fitted with a System for Continuous Emission Monitoring and Management aimed at emission control and comprises the following devices:

- Thermocouples for measuring the temperature in the combustion and post-combustion chambers (for operation and for safety) at the boiler outlet and in the filter's intake section;
- A system for the measurement of free oxygen in wet fumes in the last quarter of the post-combustion chamber that includes a solid state probe for detecting the oxygen content with a zirconium oxide cell, a diaphragm pump for supplying sample air, and a flow metre for measuring the flow rate of the sample air;
- An instrument for the measurement of dust; the system utilises an Opacity meter model LAND 4500nMKII;
- An instrument for the measurement of the concentration of pollutants in the flue including hydrochloric acid (HCl), carbon monoxide (CO), sulphur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>) and total organic carbon (TOC). The system is of the infrared multi-parameter type with a long optical path and includes sample collection and a preliminary treatment system, connecting tubes, a final sample treatment system and calibration unit and a multi-parameter analyser with infra-red beams for the measurement of the various parameters;
- Fume pressure and water vapour are also measured by transducers, sensitive to each of the two parameters. Both instruments provide a current signal that is sent to a central processing unit and used to record the data monitored;
- Computerised system for acquisition, supervision, and recording of the plant's process parameters. The SCADA system is a comprehensive computerised system that regulates the functioning of the entire installation and allows the

operator to view the operation inside the incinerator at different stages (see **Figure 8.1** and **Appendix I I**: SCADA system).

- 8.5. MIR 9000 will be used to monitor emissions continuously. The sampling point is connected to the main chimney (on the inside of the building to protect the sensors from atmospheric elements) in accordance to the standard UNI 10169/2001. The Standard requires that this section is connected in a rectilinear way having total length at least equivalent to 7 times the internal diameter of the chimney. The sampling point should be distant from curves or cross sectional changes mounted (upstream) not less than 5 times the internal diameter (distance from the lowest point upwards) and not less than twice the internal diameter on the downstream (from the upper point downstream).

Internal cross sectional diameter of chimney:  $D = 838 \text{ mm}$

Linear vertical distance upwards upstream (the vertical straight height of the chimney from the bottom part upwards) = 4547mm

Upstream distance/internal diameter =  $4547/838 = 5.42 > 5$  verified

Linear vertical distance downstream = 3300 mm

Downstream / internal diameter =  $3300/838 = 3.94 > 2$  verified

Total linear distance = Upstream + Downstream = 7847 mm

$7847 / 838 = 9.36 > 7$  verified

- 8.6. According to the results obtained from SCADA system on the flue gas emissions (see **Figure 8.2** and **Appendix I I**), the operator will regulate the quantity of sodium bicarbonate, activated carbon and Urea added to the flue gas. The operator can also control what type of waste should be burnt.
- 8.7. Frequency of monitoring will be in accordance with Legal Notice 336 of 2001. Continuous monitoring will be carried out for all the parameters listed above. Continuous measurement of hydrogen chloride, hydrogen fluoride, and sulphur dioxide may be replaced by periodic measurements if MEPA is satisfied that under no circumstances the emissions of these pollutants will be higher than the limit values.
- 8.8. Flue gas will be tested every three months for hydrogen fluoride, heavy metals, dioxins, and furans during the first year of operation. Monitoring of these parameters will be carried out bi-annually after the first year of operation provided that the data recorded during the first year is in accordance with emission limit values. The frequency of monitoring for these parameters may be further reduced if monitoring results are consistently below 50% of the emission limit values and if agreed to by the competent authority, as specified in Legal Notice 336 of 2001. An independent company will be appointed to take samples of flue gas that will then be sent to an authorised accredited laboratory to test for emission values.

- 8.9. Monitoring of air emissions will be integrated into the EMS to be set up to facilitate operation of the facility. Therefore, as part of the EMS, all measurement results will be recorded, processed, and presented as required by the Standard Operating Procedure for Air Emissions Monitoring. The monitoring results will then be fed back into the EMS. Where necessary, the Environmental Management Programme will be adjusted as required depending on the results obtained. Data exchange with MEPA will need to be agreed.
- 8.10. In addition to internal measurements performed by the operator, measurements by accredited, external, and independent laboratories should be done and reported.
- 8.11. It should be noted that calibration of continuous emission monitoring systems should be done by accredited and independent laboratories.

### **Monitoring of Effluent**

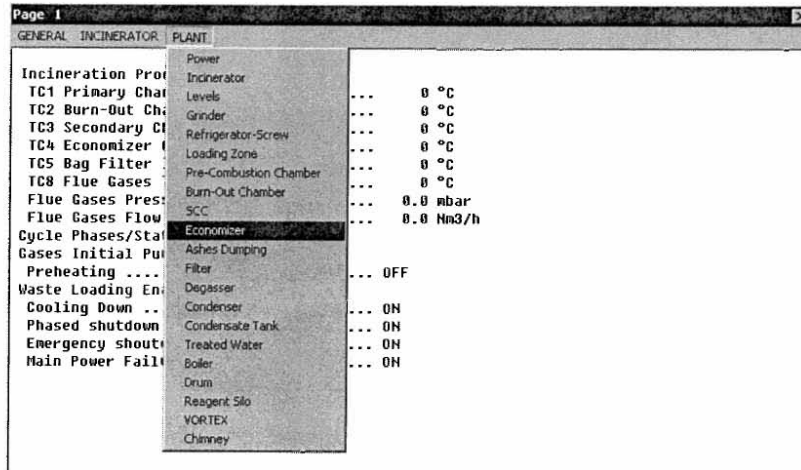
- 8.12. In accordance with Regulation 11 (7) of Legal Notice 336 of 2001, any contaminated water collected in the reservoirs arising from spillages or fire-fighting operations will be tested prior to discharge. The appropriate method of discharge will be discussed with the Competent Authority.
- 8.13. Wasteserv Malta Ltd, the operator of the plant, is in discussions with the Competent Authority, Water Services Corporation – Drainage Department, to agree on discharge parameters.

### **Reporting**

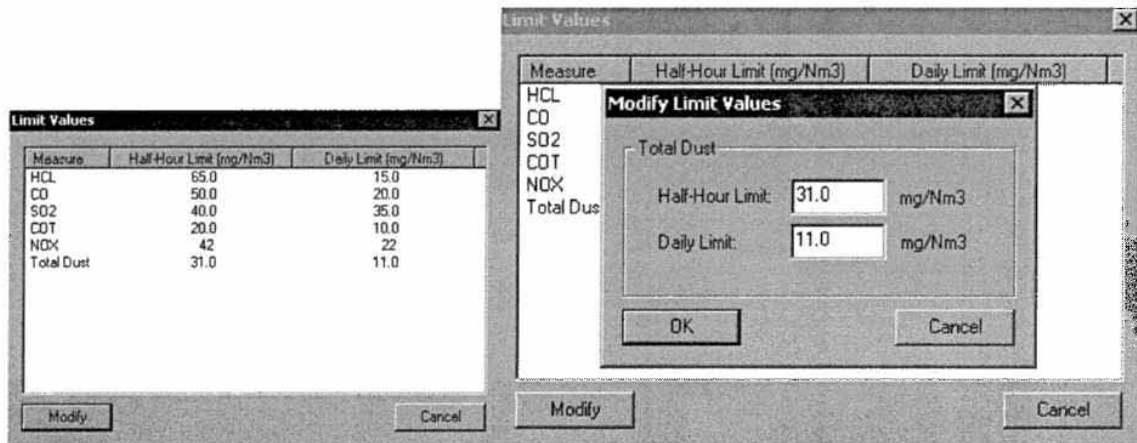
- 8.14. Legal Notice 152 of 2007, European Pollutant Release and Transfer register Reporting Obligations, 2007 was published in June 2007. The Installation will be required to comply with the reporting requirements set out in the Legal Notice.

**Figure 8.1: Extract from the SCADA operating manual showing how the system controls the entire plant**

These submenus show the status of the plant in details. Each of them reports the state of the parameters which it refers to. (For example the menu POWER reports all the inputs referring the supply power to the boards, their manual/automatic state, etc...):



**Figure 8.2: The SCADA system showing the operator how to set emission limit values**



## 9. HAZOP

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- 9.1. This Section addresses section **B2.8** of the IPPC Application.
- 9.2. A hazard and operability (HAZOP) study has been undertaken for the installation. The study excludes the components related to hazardous and clinical waste incineration including the injection lances, new burners, and the equipment to transfer clinical and hazardous waste into the Primary Combustion Chamber. Once plans are prepared for the installation, the rest of the HAZOP will be submitted.
- 9.3. The full HAZOP Study is found in **Appendix I8**.
- 9.4. The Study considers the safety procedures for manual intervention and not other procedures for operating the plant; the latter are evaluated by the manufacturer and are described in the user handbooks.
- 9.5. The following main areas are considered in the HAZOP Study:
- Storage area;
  - Shredder; and
  - Firing area.
- 9.6. The persons considered in the assessment are:
- Strangers: people not informed about the hazards and the way to avoid them, e.g. truck drivers;
  - Operatives: people assigned to the normal operation of the plant; they are informed about the residual risks and the way to avoid them;
  - Mechanics: people assigned to the mechanical maintenance of the plant; they are informed about the residual risks and the way to avoid them; they are able to recognize hazardous situations; and
  - Electricians: people assigned to the electric maintenance of the plant; they are informed about the residual risks and the way to avoid them; they are able to recognize hazardous situations.
- 9.7. Emergency shutdown and emergency stop are also considered in detail.

## 10. DECOMMISSIONING

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- 10.1. This Section addresses section **B2.11** of the IPPC Application.
- 10.2. The Site History Report shows that over the years the uses on the site were such that ground contamination was unlikely. Once operations on site cease, the site must be returned to its original, uncontaminated state.
- 10.3. At the end of the plant life, a detailed plant decommissioning plan will be implemented to ensure that the site is returned to a satisfactory state for on-going use.
- 10.4. An inventory of assets to be decommissioned will be produced followed by consideration of the need for risk assessments, site supervision/management, and consultation of Regulations. Disconnection of site services, whether partial or complete will be considered before dismantling work commences on-site.
- 10.5. Equipment, where possible, will be decontaminated on-site, followed by inspection and if necessary further decontamination, once the equipment has been removed from position and before it has been removed from site.
- 10.6. Despatch of equipment from site whether as a saleable asset or as scrap, will be accompanied by a Certificate of Decontamination. All equipment containing chemicals will be drained and the chemical stored in appropriate containers and removed off-site to reduce the potential for spillage.
- 10.7. Dismantling of equipment shall be subject to the same conditions and control of works as required by relevant Health and Safety legislation.
- 10.8. The site will be left in a safe manner and adequate regular site inspections will be carried out until such time as responsibility for the site has been transferred to the new owners.
- 10.9. A fully detailed site closure plan will be developed and submitted to MEPA within two years following the issue of the IPPC permit. The plan will document the residual materials with the potential to cause contamination and the steps that will be undertaken to eliminate pollution risk and return the site to the baseline condition established as part of the Site Report.

## II. EXPENDITURE PLAN

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- II.1. Section **B7.8** of the IPPC Application requires an Expenditure Plan. This has been submitted to MEPA but the Applicant requested that the information is not made available to the public as it is commercially sensitive.