ANNEX 19

Annex I: Comparison of the processes at the Marsa Thermal Treatment Facility with the BREF for Waste Incineration (published August 2006).

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
Installation design	Selection of an installation design suited to the characteristics of the waste received at the installation in terms of both its physical and chemical characteristics. This BAT is fundamental to ensuring the installation may treat the waste received with a minimum of process disturbances – which themselves may give rise to additional environmental impacts. In operation, it is considered BAT to use various techniques (e.g. control of air supply and distribution) to control combustion.	The Thermal Treatment Facility is designed to co-incinerate slaughtering waste together with other hazardous waste including clinical waste, pharmaceutical waste and other hazardous solid waste and sludges. Air inside the PCC is manually controlled via inverters while air in the SCC is automatically controlled via an oxygen probe. The quantity of air is controlled manually by the Plant Operator according to the instantaneous emissions released through the stack.
	Specific BAT for hazardous waste incineration and for clinical waste incineration: The use of a combustion chamber design that provides for containment, agitation and transport of the waste, for example: rotary kilns - either with or without water cooling. Water cooling for rotary kilns (see section 4.2.15 of BREF), may be favourable in situations where: a. the LHV of the fed waste is higher (e.g. >15-17 GJ/tonne), or b. higher temperatures e.g. >1100 °C are used (e.g. for ash slagging or destruction of specific wastes).	The rotary kiln at the Thermal Treatment Facility is not equipped with a water cooling system since the highest percentage of the waste incinerated is slaughtering waste with a calorific value less than 5MJ/kg. According to section 4.2.1 the Rotary Kiln technology for our type of waste is according to the BAT.
Environmental management system (EMS)	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 of BREF)	The Thermal Treatment Facility has been awarded ISO 14000 and ISO9001 by MCCAA. An EMS is fully implemented.

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	• 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 - safeguarding compliance with environmental legislation. • checking performance and taking corrective action, paying particular attention to - monitoring and measurement - corrective and preventive action - maintenance of records - 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	

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	stepwise, are considered as supporting measures: • 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 • implementation and adherence to an internationally accepted voluntary system such as EMAS and EN ISO 14001:1996. The following potential features of the EMS also need to be considered: • giving consideration to the environmental impact from the eventual decommissioning of the unit at the stage of designing a new plant • 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	

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility

	works describing the commissioning programme
	• 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
	  • power interruption
	• where the plant commissioning and tuning period may give rise to emissions outside the normal regulatory controls.
	
	In 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 on:
	- explosion and fire prevention
	- fire extinguishing	

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	- knowledge of chemical risks (labelling, carcinogenic substances, toxicity, corrosion, fire) and transportation	
Site management	The maintenance of the site in a generally tidy and clean state (see Section 4.1.2 of BREF).	Due to the type of waste delivered at the Thermal Treatment Facility and the way waste is delivered, cleaning is carried out continuously throughout the day. Cleaning tasks are usually categorised into two, the cleaning of the waste marshalling area where the waste is received, stored and/or shredded prior to incineration and cleaning of the mechanical part of the Plant which falls under the maintenance section. Cleaning of the waste marshalling area from spillages of blood or tissue waste is done to maintain the site clean and reduce nuisance odours. Cleaning of the mechanical part of the Plant is done as preventive maintenance to avoid equipment break downs, such as cleaning of air compressors from dust, cleaning dust from chains prior to lubrication, etc. Periodical cleaning jobs done as part of preventive maintenance are recorded on job sheets.
	The provision of operators with a means to visually monitor, directly or using television screens or similar, waste storage and loading areas.	The site is equipped with various CCTV cameras. Cameras are monitored by the Security personnel and a back up of the recordings are kept in case some evidence is needed.
Waste input	Establishing and maintaining quality controls over the waste input, according to the types of waste that may be received at the installation, by: • Establishing installation input limitations and identifying key risks; • Communicating with waste suppliers to improve	The most significant waste fraction delivered to the Thermal Treatment Facility is slaughtering waste from the private slaughter houses, from the Civil Abattoir and from the food processors. Apart from slaughtering waste the facility also receives fallen animals from farms. These waste fractions

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	incoming waste quality control; • Controlling waste feed quality on the incinerator site (see Section 4.1.3.3 of BREF); • Checking, sampling and testing incoming wastes, and • Installation of detectors for radioactive materials, for example at the entrance of the plant, in particular for wastes at risk of containing higher radioactivity levels, e.g. hospital wastes.	cannot be tested analytically. Each consignment is visually checked to ensure that the waste does not have items which can damage the plant such as steel objects. Fallen animals which are delivered to the site and which have been dead more than 24 hours are reported to the Chief Veterinary within the Veterinary Department and fined €100. Clinical waste from hospitals cannot be tested and analysed due to the potential risks associated with such wastes. Pharmaceutical waste is accepted after that the list of all the pharmaceutical items is submitted. Once each item is confirmed by the Scientist that it is safe to be incinerated a confirmation acceptance is sent to the supplier. The supplier needs also to submit a declaration by a pharmacist that the consignment does not include cytotoxic material. Waste is accepted by appointment only. Once on site, the weighbridge officer confirms that the waste is accompanied by all documents such as MEPA consignment note, declaration from Pharmacist, WasteServ transfer note and waste list. The Scientist confirms that the waste delivered is what has been declared and also that the packaging used is according to the material delivered. Other waste streams accepted such as paper and shredded wood are not considered as hazardous.
	Specific BAT for hazardous waste incinerators: In addition to the above quality controls, 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.	First and foremost, the full waste analysis is requested to the waste producer before any waste acceptance takes place. In case that a waste stream is found to be acceptable from the analysis provided or from the MSDS sheet, a sample is taken and analysed at the TTF laboratory for ignition

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	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 • radioactivity (if not already covered 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.	temperature, calorific value, moisture contents and pH. If some parameter is needed which cannot be analysed at the TTF laboratory, it is sub-contracted to an independent laboratory. The site is equipped with a bomb calorimeter to measure the calorific value as well as a photometer, colorimeter, pH and conductivity meter, KF titrant, BOD analyser, oven and furnace, different types of balances, moisture analyser, laboratory fridge, safety cabinets and all necessary laboratory accessories..
Waste storage	The storage of wastes according to a risk assessment of their properties, such that the risk of potentially polluting releases and odours is minimised.	Waste is stored, as far as technically feasible, in enclosed areas. Hazardous filter cake from the flue gas scrubber is stored in a water proof dry container. Paints from Civic Amenity Sites are also stored in a dry container to ensure that spillages are contained. Pharmaceutical waste is stored in a masonry shed. Two fire vaults are installed within the facility for the storage of waste streams with high flash points. Slaughtering waste that will not be incinerated within the same day is stored in freezers (cold room) to stop biological degradation.
	To store waste in areas that have sealed and resistant surfaces, with controlled and separated drainage.	The site drainage is connected to a waste water sump from where it is pumped to a blood coagulator for sterilisation due to blood content from animal waste prior to being

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
		deviated to the public sewers. Waste water is being analysed on a daily basis. A waste Water treatment Plant will be installed to treat all the waste water generated at the TTF site in compliance to the limits stipulated in L.N. 139 of 2002. The treatment plant will be installed in line with the Master Plan submitted for the plant.
	To use techniques and procedures to restrict and manage waste storage times, 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 • in so far as is practicable, control and manage deliveries by communication with waste suppliers, etc.	Hazardous waste is only accepted if it can be treated within 48 hours. Waste is accepted by appointment. In case that the Plant is down for maintenance, waste appointments are cancelled and postponed.
	The segregation of the storage of wastes according to a risk assessment of their chemical and physical characteristics to allow safe storage and processing (see Section 4.1.4.5 of BREF).	Different types of waste streams are stored in different locations depending on their properties. Temperature controlled fire vaults are used for waste streams which are flammable and with low flash point, dry containers are used for storage of filter cake from the TTF and for storage of paints, and a lockable store is used for the storage of pharmaceutical waste.
	The clear labelling of wastes stored in containers such that they may continually be identified.	Hazardous waste is labelled as part of the waste acceptance procedure. On each label waste producers are asked to specify the Name of company which owned the waste, the Consignment Document number, date of delivery to the TTF.
	Specific BAT for clinical waste incineration: The receipt and storage of clinical wastes in closed	Clinical waste is delivered in ADR approved clinical waste bins.

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	containers that are suitably resistant to leaks and punctures.	
	Specific BAT for clinical waste incineration: 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.	All bins are washed using hot water and disinfectant before being sent back to clients.
Waste pretreatment	The mixing (e.g. using bunker crane mixing) or further pretreatment (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, taking into consideration cross-media effects (e.g. energy consumption, noise) of the more extensive pretreatments (e.g. shredding). Pretreatment is most likely to be a requirement where the installation has been designed for a narrow specification, homogeneous waste.	The only pre-treatment of waste is the shredding of slaughtering waste and fallen animals prior to incineration. Mixing of waste takes place in the loading hopper where waste is inserted from different loading areas, i.e. the Archimedean screw transferring meat from the shredder and the elevator and bin tipper transferring solid waste from bins. Once the waste is emptied in the loading hopper, this is closed and all the waste is pushed into the Primary Combustion Chamber.
	Specific BAT for hazardous waste incineration: The mixing, blending and pretreating of the waste in order to improve its homogeneity, combustion characteristics and burn-out to a suitable degree with due regard to safety considerations. Examples are the shredding of drummed and packaged hazardous wastes, described in sections 4.1.5.3 and 4.1.5.6 of the BREF. If shredding is carried out then blanketing with an inert atmosphere should be carried out.	Hazardous waste is not shredded. It is incinerated directly in the Primary Combustion Chamber (PCC). Quantities of hazardous waste accepted are very low. Waste in metal containers is not accepted.
Waste loading into incinerator	*Specific BAT for hazardous waste incineration:* The use of a feed equalisation system for solid hazardous wastes (e.g. section 4.1.5.4 of BREF or other similar	The Plant has an automatic control on the waste feeding mechanism. Waste is only loaded when the temperature is above the 850°C and stops when the

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	feeding technology) in order to improve the combustion characteristics of the fed waste and to improve the stability of flue-gas composition including the improved control of short-term CO peak emissions.	temperature reaches 1100°C. Furthermore, the time between each batch loading is equal to ensure that continuous equal loads are loaded. However, the operator still needs to monitor the plant operational parameters in respect to emissions generated and temperatures. The burners of the Plant are modulating type to ensure that when temperature is high enough due to combustion of waste, the burners switch to minimum power on the pilot flame. The intervention of the operator may still be required to reduce emissions and to stop rapidly increasing temperatures in order to avoid emergency situations whereby the Emergency Stack may open. The operators needs to control the quantity of waste loaded into each bin. Emission values are also dependent on the Plant Operator who regulates the feeding rate of Sodium Bicarbonate, oxygen and temperature depending on the instantaneous emissions released in order to maintain these below the established thresholds.
	Specific BAT for hazardous waste incineration: The direct injection of liquid and gaseous hazardous wastes, where those wastes require specific reduction of exposure, releases or odour risk.	Liquid waste such as solvents can be mixed with diesel and injected into the burner. Other liquids are pumped directly into a liquid lance into the PCC. Hence odours are minimised. Gaseous waste cannot be incinerated.
	Specific BAT for clinical waste incineration: The use of non-manual waste handling and loading systems.	Clinical waste is loaded through a semi-manual operation. The bin is attached to the elevator manually. The operator presses the button to start the elevator. The bin is raised up to the unloading hopper. As the bin tilts, the contents are emptied automatically. The empty bin comes down again. The operator removes the empty bin manually from the

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
		elevator and moves it to the bin washing area.
Conditions of combustion	The minimisation of the uncontrolled ingress of air into the combustion chamber via waste loading or other routes (see section 4.1.6.4 of BREF).	Waste loading is controlled via a two shutter system. When the loading hopper lid is open to load the waste the fire door is closed. Only when the hopper lid is closed that the fire door could be opened and waste loaded into the Plant. Secondary air required for combustion is done through blowers which are controlled manually via inverters depending on the oxygen level in the Secondary Combustion Chamber (SCC).
	Use of the combustion operating conditions (i.e. temperatures, residence times and turbulence) specified in Article 6 of Directive 2000/76/EC (WID). In order to limit potential cross-media impacts, combustion conditions should generally not be significantly in excess of those conditions.	Loading of waste is done continuously and regularly to maintain uniform parameters. The bottom ash is continuously monitored and sampled to ensure that it conforms to the parameters stipulated in the landfill waste acceptance procedure. Temperature in the SCC is maintained above 850°C to ensure low CO levels. Waste with chlorine content higher than 1% is not accepted. The PCC is equipped with a modulating burner that fluctuates depending on the energy released from the waste.
	The provision of auxiliary burner(s) for achieving and maintaining operational conditions is considered to be BAT when waste is being burned.	A secondary burner is installed in the SCC in line with the Incineration Directive to ensure a temperature above 850°C and a residence time of 2 seconds. This burner ensures that organic particles and CO are fully combusted.
	The use of flow modelling which may assist in providing information for new plants or existing plants where concerns exist regarding the combustion or flue-gas treatment (FGT) performance.	There are no concerns on the flue gas treatment performance of the Marsa Plant.
	The use of key combustion criteria and a combustion control system to monitor and maintain these criteria within appropriate boundary conditions, in order to maintain effective combustion performance (see section 4.2.6 of	Combustion inside the PCC is controlled manually by the Plant Operator. First and foremost the waste loaded (type and quantity) are monitored. Temperature in the PCC and SCC are monitored together with the rotation velocity of the

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	BREF). Techniques to consider for combustion control may include the use of infrared cameras, or others such as ultra-sound measurement or differential temperature control.	PCC, ID Fan velocity and emissions released in the stack. The Plant Operator may take different actions to control the Plant stable and emissions within limits.
	The optimisation and control of combustion conditions by a combination of: a. the control of air (oxygen) supply, distribution and temperature, including gas and oxidant mixing b. the control of combustion temperature level and distribution, and c. the control of raw gas residence time. (See sections 4.2.8, 4.2.9, 4.2.11, 4.2.19 and 4.2.4 of BREF).	The Plant is capable of operating automatically under the continuous supervision by a Plant Operator. The Plant Operator has the faculty to modify manually the PCC rotation velocity in order to control the PCC temperature by modifying the frequency of the inverter. The Plant operator can also control the waste feeding rate by modifying the frequency of the inverters of the feeding conveyors as well as deciding not to load any waste. The Plant operator can control the secondary air required for combustion inside the PCC by increasing the speed of the PCC secondary air Blowers via an inverter and regulated the dosing rate of Sodium Bicarbonate in the flue gas stream. The Plant is highly dependent on the Plant Operator's decisions and needs to be monitored continuously (24 hours).
	The preheating of primary combustion air for low calorific value wastes, by using heat recovered within the installation, in conditions where this may lead to improved combustion performance (e.g. where low LCV (Lower Calorific Value)/high moisture wastes are burned). In general this technique is not applicable to hazardous waste incinerators.	Primary combustion air is not preheated. This is another contributing fact to the high diesel combustion required for the Incineration of slaughtering waste since this waste is wet and with low calorific value. Hence, diesel is required to heat the secondary air and to dry the material from all the water prior to burning. Secondary air for combustion is extracted from the Shredder Room to reduce odours during shredding and also from the bottom ash container to reduce dust generation from this area.
	The use of auxiliary burner(s) for start-up and shut-down and for maintaining the required operational combustion temperatures (according to the waste concerned) at all times when unburned waste is in the combustion chamber.	The incineration of waste inside the PCC is done by using a burner. The burning process is not self sufficient. The waste is very wet and has very low calorific value and will not self ignite. The burners are modulating burners to ensure that the

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
		combustion temperature is always maintained. When the waste can keep the combustion temperature, the burner switch to pilot flame. When the waste is too wet and cannot sustain the combustion temperature, the burner flame increases to keep a constant combustion temperature which is pre-set in the Operating program of the Plant.
	The use of a combination of heat removal close to the furnace (e.g. the use of water walls in grate furnaces and/or secondary combustion chambers) and furnace insulation (e.g. refractory areas or other lined furnace walls) that, according to the net calorific value (NCV) and corrosiveness of the waste incinerated, provides for: a. adequate heat retention in the furnace (low NCV wastes require higher retention of heat in the furnace); b. additional heat to be transferred for energy recovery (higher NCV wastes may allow/require heat removal from earlier furnace stages); (See sections 4.2.22 and 4.3.12 of the BREF).	The PCC and SCC are lined with a 30cm thickness refractory and insulation material that can withstand the combustion temperature inside the furnace as well as limit the heat transfer from the PCC and SCC to the outer shell of the Plant. In fact the combustion temperature inside the PCC and SCC is always above 850°C while the temperature on the outer shell of the rum is in the range if 150°C - 180°C. As regards to section 4.3.12 of the BREF, this is not applicable to the TTF since the boiler is installed directly after the SCC and there are no tubes on the refractory of the SCC to cool down the gases before entering into the boiler.
	The 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.	The Plant has been designed and sized in a way to guarantee a residence time of 2 seconds in the SCC and to ensure that CO and TOC are within the IPPC limits. The SCC also has a burner to ensure the temperature in the SCC exceeds the 850°C.
	Specific BAT for clinical waste incineration: Where grates are used, the use of a grate design that incorporates sufficient cooling of the grate such that it permits the variation of the primary air supply for the main	The Thermal Treatment Facility at Marsa is a Rotary Kiln.

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	purpose of combustion control, rather than for the cooling of the grate itself. Air-cooled grates with well distributed air cooling flow are generally suitable for wastes of NCV of up to approx. 18 MJ/kg. Higher NCV wastes (e.g. above approx. 18 MJ/kg) may require water (or other liquid) cooling in order to prevent the need for excessive primary air levels to control grate temperature, i.e. levels that result in a greater air supply than the optimum for combustion control (see section 4.2.14 of BREF).	
Maintenance	To maintain all equipment in good working order, and to carry out maintenance inspections and preventative maintenance in order to achieve this.	All equipment needs to be kept in good working order to ensure that the Plant provides the service expected. Preventive maintenance is done on a daily basis such a lubrication of chains, cleaning of certain equipment, etc. However, the majority of the maintenance needs the Plant to be switched off due to safety reasons. The maintenance program is included in the EMS and records of maintenance work carried out are maintained.
Shutdowns	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.	Plant shut downs for maintenance cannot be reduced due to the design. The fact that the SCC is in a horizontal position and the boiler does not have a radiation heat boiler before, dust accumulates along the SCC and blocks the entrance to the boiler. Hence switching off is done every 4 weeks, whereby the Plant is cooled down and cleaned. However, additional soot blowers will be installed at the entrance of the boiler to extend the operational periods of the Plant.
Emissions to air	The use of an overall flue-gas treatment (FGT) system that generally provides for the operational emission levels listed in Table 5.2 of the BREF for releases to air associated with the use of BAT (see pp. 25-26 of this document). (Concentrations are standardised at 11 % Oxygen, dry gas,	*(Please provide a document showing whether compliance with the upper associated emission levels indicated in Table 5.2 is being achieved. Please also compare this data to the emission limit values indicated in Annex VI the Industrial Emissions Directive, 2010/75/EU).*

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
	273K and 101.3kPa).	Compliance table for 2012 in respect of upper 24 hour threshold:

Total Data tally NH3	**4756**								
Total Data tally	**10498**	**MEAN ANNUAL COMPLIANCE**							
Number of Months Filed		**12**		**Number of months remaining**			**0**		
		HCl	**CO**	**SO2**	**TOC**	**NOx**	**Dust**	**HF**	**NH3**
% Compliance with 100% limit		**99.3**		**99.8**	**99.4**	**99.6**	**99.8**	**98.6**	**87.5**
% Compliance with 97% limit		**97.0**		**97.4**	**96.9**	**86.2**	**99.2**	**98.5**	**87.5**
% Compliance with 95% limit			**96.7**						
% Daily compliance (CO)			**83.9**						

Aspect of BAT	BAT	Status at Marsa Thermal Treatment Facility
Flue gas treatment	When selecting the overall FGT system, to take into account: a. the general factors described in section 4.4.1.1 and 4.4.1.3 of the BREF; b. the potential impacts on energy consumption of the	The FGT system has been designed to treat the emissions expected to be generated from the incineration of abattoir waste. It was designed to use lime. However, when the Facility was upgraded to co-incinerate small fractions of hazardous wastes, the FGT was upgraded to use Sodium

	installation (section 4.4.1.2 of BREF); c. the additional overall-system compatibility issues that may arise when retrofitting existing installations (see section 4.4.1.4 of BREF)	Bicarbonate and Activated Carbon. It was designed to achieve the emission limits stipulated in the Incineration Directive 2000/76 EC. WasteServ has upgrading further the FGT system with the introduction of UREA injection in the SCC to improve the NOX emission levels. With the introduction of the Autoclave Plant, the FGT will be further upgraded to cater for waste streams that may produce higher emissions of SO2, HCl and HF.
	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 (p. 27 of this document).	Considering the quantities and type of waste incinerated, a dry scrubber was sufficiently efficient to achieve the emission thresholds.
	To prevent the associated increased electrical consumption, to generally avoid the use of two bag filters in one FGT line.	The FGT has only one bag house filter since there is only one incineration line.
	The reduction of FGT reagent consumption and of FGT residue production in dry, semi-wet, and intermediate FGT systems by a suitable combination of: a. adjustment and control of the quantity of reagent(s) injected in order to meet the requirements for the treatment of the flue-gas such that the target final operational emission levels are met; b. the use of the signal generated from fast response upstream and/or downstream monitors of raw HCl and/or SO2 levels (or other parameters that may prove useful for this purpose) for the optimisation of FGT reagent dosing rates; c. the re-circulation of a proportion of the FGT	The injection of reagent is manually controlled whereby the Plant operator monitoring the emission values increase and decrease manually the feeding rate. This is done by varying the frequency on the motor that rotates the feeding screw. In case that the feeding rate cannot be increased further and the HCl and SO_2 levels are high, waste loading is stopped. The filter cake collected from the Bag House filter is not re-circulated. It is collected and exported for final disposal.

	residues collected (which usually contain a significant proportion of unreacted flue-gas treatment reagents). The applicability and degree of use of the above techniques that represents BAT will vary according to the waste characteristics and consequential flue-gas nature, the final emission level required, and technical experience from their practical use at the installation.	
	The use of primary (combustion-related) NOX reduction measures to reduce NOX production, together with either SCR or SNCR, according to the efficiency of flue-gas reduction required. In general SCR is considered BAT where higher NOX reduction efficiencies are required (i.e. raw flue-gas NOX levels are high) and where low final flue-gas emission concentrations of NOX are desired.	An automatic UREA injection system to lower further the NOX emission values has been installed.
	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 section 4.1 of the BREF; b. primary (combustion related) techniques (summarised in section 4.4.5.1 of BREF) to destroy PCDD/F in the waste and possible PCDD/F precursors; 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	Incineration of waste takes place at temperatures above 850°C and the temperature is manually maintained at a constant temperature In order to reduce the formation of PCDD/F the Plant is equipped with an economiser following the Waste Heat Recovery Boiler to ensure that the temperature coming out of the Economiser is not above the 180°C. Only after that the temperature is low enough that flue gas cleaning commences. The flue gas cleaning starts by the injection of Sodium Bicarbonate and Activated Carbon. The mixture of flue gas and reagent passes through a cyclone where the gas is mixed thoroughly with the reagent and then passes through the Bag House Filter.

	temperature range of 250–400°C (even 200-400 °C); 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, or ii. adsorption using fixed beds with a suitable adsorbent replenishment rate, or iii. multi layer SCR, adequately sized to provide for PCDD/F control, or iv. the use of catalytic bag filters (but only where other provision is made for effective metallic and elemental Hg control).	
	Where wet scrubbers are used, to carry out an assessment of PCDD/F build up (memory effects) in the scrubber and adopt suitable measures to deal with this build up and prevent scrubber breakthrough releases. Particular consideration should be given to the possibility of memory effects during shut-down and start-up periods.	The FGT at the Thermal Treatment Facility is a Dry System.
	If re-burn of FGT residues is applied, then suitable measures should be taken to avoid the re-circulation and accumulation of Hg in the installation.	Not applicable
	For the control of Hg emissions where wet scrubbers are applied as the only or main effective means of total Hg emission control: a. the use of a low pH first stage with the addition of specific reagents for ionic Hg removal, in combination with the following additional measures	Not applicable

	for the abatement of metallic (elemental) Hg, as required in order to reduce final air emissions to within the BAT emission ranges given for total Hg, b. activated carbon injection, or c. activated carbon or coke filters.	
	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 (section 4.4.6.2 of BREF), with the reagent dose rate controlled so that final air emissions are within the BAT emission ranges given for Hg.	Hg is controlled by the injection of Activated Carbon at an hourly rate of 4kg.
	Specific BAT for hazardous waste incineration: For merchant hazardous waste incinerators (commercial plants normally accepting a wide range of hazardous wastes) and other hazardous waste incinerators feeding wastes of highly varying composition and sources, the use of: a. wet FGT is generally BAT to provide for improved control of short-term air emissions (although dry FGT is also applied at some hazardous waste incinerators treating such wastes; such systems may have specific local advantages where there are particular restrictions e.g. on the use or discharge of water); b. specific techniques for the reduction of elemental iodine and bromine emissions (section 4.4.7.1 of BREF), where such substances exist in the waste at appreciable concentrations.	Not applicable
Odour	To minimise the release of odour (and other potential	Secondary combustion air used for the Incineration of waste

	fugitive releases) from bulk waste storage areas (including tanks and bunkers, but excluding small volume wastes stored in containers) and waste pretreatment areas by passing the extracted atmosphere to the incinerator for combustion.	is extracted from the shredder room to reduce odours and also from the bottom ash container to maintain the room at a negative pressure to avoid dust release into the atmosphere.
	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.	When the Plant is down for maintenance, hazardous waste acceptance is stopped but waste acceptance of slaughtering waste and fallen animals cannot be stopped due to the fact that there is no alternative disposal plant and storage of this particular place at the place of origin is not possible due to lack of facilities. Through the implementation of the Master Plan it is foreseen that all Plant enclosures will be equipped with an air recirculating systems. The air will be recirculated through active carbon filters to neutralise the odours. A water misting system will be installed at different points of the plant to suppress odour generation and also dust generation.
Discharges of waste water	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.	Roof rain water is currently collected in a dedicated water reservoir and used at the Plant. surface run-off is considered as contaminated water and is discharged in the sewers.
	Where wet flue-gas treatment is used: a. the use of on-site physico/chemical treatment of the scrubber effluents prior to their discharge from the site (section 4.5.11 of the BREF), and thereby to achieve, at the point of discharge from the effluent treatment plant (ETP), emission levels generally within the operational emission level ranges	*(Amongst others, for point (a) please compare the monitoring and emission levels at the MTTF to the ones in Table 5.4).* The facility is equipped with a dry flue-gas treatment.

	associated with BAT that are identified in Table 5.4 (p. 28 of this document); b. the separate treatment of the acid and alkaline waste water streams arising from the scrubber stages, when there are particular drivers for the additional reduction of releases to water that result, and/or where HCl and/or gypsum recovery is to be carried out; c. the re-circulation of wet scrubber effluent within the scrubber system, and the use of the electrical conductivity (mS/cm) of the re-circulated water as a control measure, so as to reduce scrubber water consumption by replacing scrubber feed-water; d. the provision of storage/buffering capacity for scrubber effluents, to provide for a more stable waste water treatment process; e. the use of sulphides (e.g. M-trimercaptotriazine) or other Hg binders to reduce Hg (and other heavy metals) in the final effluent; f. when SNCR is used with wet scrubbing the ammonia levels in the effluent discharge may be reduced using ammonia stripping, and the recovered ammonia re-circulated for use as a NOX reduction reagent.	
Residue (waste) production	In order to avoid operational problems that may be caused by higher temperature sticky fly ashes, to use a boiler design that allows gas temperatures to reduce sufficiently before the convective heat exchange bundles (e.g. the provision of sufficient empty passes within the furnace/boiler and/or water walls or other techniques that aid cooling). The actual temperature above which fouling is significant is waste type	The facility is not equipped with a Radiation Heat Boiler. Immediately after the Secondary Combustion Chamber is found the convective heat exchange bundles. This is the reason why the Plant needs to be switched off after 4 weeks of operations. The sticky fly ash blocks the entrance to the boiler.

	and boiler steam parameter dependent. In general for MSW it is usually 600 – 750 ºC, lower for hazardous waste and higher for sewage sludges. Radiative heat exchangers, such as platten type super heaters, may be used at higher flue-gas temperatures than other designs.	Modifying the Plant to introduce a radiation heat boiler would entail a long shutdown which cannot be afforded.
	The use of a suitable combination of the techniques and principles described in section 4.6.1 of the BREF 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, furnace operation and waste throughput rate 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; c. the use of techniques for mixing and pretreatment of the waste, according to the type(s) of waste received at the installation; d. the optimisation and control of combustion conditions, including air (oxygen) supply and distribution.	All slaughtering waste is shredded to a particle size of 50mm to facilitate its incineration. The rotation of the PCC is maintained at a low rotational velocity not higher than 15 Hz so that while mixing takes place, the waste will have ample time to dry and incinerate properly. On the waste entrance side, the main Primary Chamber burner is installed and secondary air needed for combustion is introduced. At the opposite end another secondary air blower is installed to assist the incineration of waste that is not fully combusted in case not sufficient oxygen is available in the PCC. Furthermore, clinical and hazardous waste with higher calorific value is introduced in the PCC in small quantities to assist combustion of abattoir waste which has a low calorific value. With the introduction of the Autoclave Plant, waste will be pre-treated prior to incineration in order to reduce the water content and hence reduce the fossil fuel consumption currently used to treat this waste stream, reduce the damages caused by the waste onto the refractory due to thermal shocks, reduce the volumes of waste treated and have a backup facility for when the TTF is switched off for maintenance. This Autoclave Plant will further decrease the

		dependency on freezing waste during maintenance shutdowns.
Management of residues (wastes) from incineration	The use of the techniques described in sections 4.1.5.5 or 4.6.4 of the BREF 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.	Due to the fact that the waste incinerated consists mainly of slaughtering waste and fallen animals, ferrous and non-ferrous recyclable metals are not found in the waste stream. There was no scope in installing such a recovery system.
	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. 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.	Bottom ash is collected separately from Boiler ash and filter ash. Bottom ash is considered (through ash analysis) as non-hazardous and can be landfilled. Filter cake and boiler dust are considered to be hazardous and needs to be exported to authorised facilities for final disposal.
	Where a pre-dedusting stage is in use (see sections 4.6.3 and 4.4.2.1 of the BREF), an assessment of the composition of the fly ash so collected should be carried out to assess whether it may be recovered, either directly or after treatment, rather than disposed of.	Not applicable
	The treatment of bottom ash (either on or off-site), by a suitable combination of: a. dry bottom ash treatment with or without ageing	Dry bottom ash is collected and kept in a container for a week (to cool down) and then taken to the landfill for disposal. No further treatment is carried out.

	(sections 4.6.6 and 4.6.7 of the BREF), or b. wet bottom ash treatment, with or without ageing (sections 4.6.6 and 4.6.8 of the BREF), or c. thermal treatment (section 4.6.9 of the BREF for separate treatment, and section 4.6.10 for in-process thermal treatment) or d. screening and crushing (section 4.6.5) to the extent that is required to meet the specifications set for its use or at the receiving treatment or disposal site e.g. to achieve a leaching level for metals and salts that is in compliance with the local environmental conditions at the place of use.	The reutilisation/treatment of bottom ash is currently being investigated.
	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 section 4.6.11 of the BREF.	Filter cake from the FGT is exported to an authorised facility for final disposal.
Noise and vibration	The implementation of noise reduction measures to meet local noise requirements (techniques are described in sections 4.7 and 3.6 of the BREF); for IPPC sites in Malta, noise limits are normally set at less than 5 dB above background.	The main equipment which generates noise is all enclosed in sound proof chambers to limit noise emissions. Noise monitoring was carried out to ensure that the Plant is compliant with the noise limits stipulated for a safe work environment.
Raw material consumption	The general optimisation of the re-circulation and re-use of waste water arising on the site within the installation, as described in section 4.5.8 of the BREF, including for example, if of sufficient quality, the use of boiler drain water as a water supply for the wet scrubber in order to reduce scrubber water consumption by replacing scrubber feed-water (see section 4.5.6 of the BREF).	Waste water from the boiler together with reject water from the RO are mixed with clean rain water and used for the washing of the Facility. Waste water contaminated with blood is treated in the Blood coagulator where it is sterilised prior to being disposed in the sewer system since it cannot be recycled.

Accident prevention and control	The development of a plan for the prevention, detection and control (described in section 4.1.4.7 of the BREF) of fire hazards at the installation, in particular for: • waste storage and pretreatment areas • furnace loading areas • electrical control systems • bag house filters and static bed filters. It is generally BAT for the plan implemented to include the use of: a. automatic fire detection and warning systems, and b. the use of either a manual or automatic fire intervention and control system as required according to the risk assessment carried out.	The Plant is equipped with a number of fire extinguishers depending on the fire class that is possible in that particular area where the extinguisher is installed. Around the Plant perimeter there is a fire extinguishing ring installation. The Plant has a dedicated fire fighting water reservoir. The Solvents Platform has an automatic fire sensing installation. In case of fire, foam is used to extinguish the fire. A tender for the automatic fire detection system has been published and is currently under evaluation.
Energy efficiency and energy recovery	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 section 4.3.1 of the BREF, and in general: a. to reduce energy losses with flue-gases, using a combination of the techniques described in sections 4.3.2 and 4.3.5 of the BREF; 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 %; ii. for pretreated municipal wastes (or similar waste) treated in fluidised bed furnaces, 80 to	The Thermal Treatment Facility is not equipped with a steam turbine to transfer the heat energy into electrical energy. However, it is foreseen in the Development Brief to utilise the steam for the Autoclave Plant in order to dry and sterilise the material (pre-treat) the waste prior to incineration.

	90 %; iii. for hazardous wastes giving rise to increased boiler corrosion risks (typically from chlorine/sulphur content), above 60 to 70 %; iv. for other wastes, conversion efficiency should generally be increased in the range 60 to 90 %.	
	To secure where practicable, long-term base-load heat/steam supply contracts to large heat/steam users, so that a more regular demand for the recovered energy exists and therefore a larger proportion of the energy value of the incinerated waste may be used.	The plant only produces maximum of 3500kg/hr of steam at a pressure of 8.5bar. There are no industrial applications in the vicinity of the TTF interested in using the steam being generated by the TTF. furthermore, the infrastructural costs in having to build steam distribution lines will not justify the project considering the small quantity of steam produced.
	In cases where electricity is generated, the optimisation of steam parameters (subject to user requirements for any heat and steam produced), including consideration of (see section 4.3.8 of the BREF): a. the use of higher steam parameters to increase electrical generation, and b. the protection of boiler materials using suitably resistant materials (e.g. claddings or special boiler tube materials). The optimal parameters for an individual installation are highly dependent upon the corrosivity of the flue-gases and hence upon the waste composition.	Not applicable
	The selection of a turbine suited to: a. the electricity and heat supply regime, as described in section 4.3.7 of the BREF; b. high electrical efficiency.	Not applicable

	At new or upgrading installations, where electricity generation is the priority over heat supply, the minimisation of condenser pressure, as described in section 4.3.9 of the BREF.	Not applicable
	The general minimisation of overall installation energy demand, including consideration of the following (see section 4.3.6 of the BREF): a. for the performance level required, the selection of techniques with lower overall energy demand in preference to those with higher energy demand; b. wherever possible, ordering flue-gas treatment systems in such a way that flue-gas reheating is avoided (i.e. those with the highest operational temperature before those with lower operational temperatures); c. where SCR is used: i. to use heat exchangers to heat the SCR inlet flue-gas with the flue-gas energy at the SCR outlet; ii. to generally select the SCR system that, for the performance level required (including availability/fouling and reduction efficiency), has the lower operating temperature; d. where flue-gas reheating is necessary, the use of heat exchange systems to minimise flue-gas reheating energy demand; e. avoiding the use of primary fuels by using self produced energy in preference to imported sources.	The Incineration process is kept to the minimum requirements to maintain electricity consumption at a minimum level. There is no flue gas reheating and no SCR.
	Specific BAT for hazardous waste incineration: To reduce installation energy demand in general, and to achieve an average installation electrical demand (excluding	Electricity demand can only be improved by the installation of a new Power Factor for all the Plant. This needs an upgrade of the Plant Switch Room. In terms of equipment,

	pretreatment or residue treatment) of generally below 0.3-0.5 MWh/tonne of waste processed (see sections 3.5.5 and 4.3.6 of BREF). Smaller installations generally result in consumption levels at the upper end of this range. Weather conditions may have a significant impact on consumption owing to heating requirements, etc.	no further reduction is possible.
Selection of cooling system	Where cooling systems are required, the selection of the steam condenser cooling system technical option that is best suited to the local environmental conditions, taking particular account of potential cross-media impacts, as described in section 4.3.10 of the BREF.	Not applicable
Boiler cleaning	The use of a combination of on-line and off-line boiler cleaning techniques to reduce dust residence and accumulation in the boiler, as described in section 4.3.19 of the BREF (this results in better heat exchange and may also reduce the risk of dioxin formation in the boiler).	The boiler is equipped with soot blowers which operate every 18 hours to clean dust which accumulates around the boiler water tubes.

Table 5.2: Operational emission level ranges associated with the use of BAT (see notes below) for releases to air (in mg/Nm³ or as stated)

Substance(s)	Non-continuous samples	½ hour average	24 hour average	Comments
Total dust		1 – 20 (see split view 2)	1 – 5	In general the use of fabric filters give the lower levels within these emission ranges. Effective maintenance of dust control systems is very important. Energy use can increase as lower emission averages are sought. Controlling dust levels generally reduces metal emissions too.
Hydrogen chloride (HCl)		1 – 50	1 – 8	Waste control, blending and mixing can reduce fluctuations in raw gas concentrations that can lead to elevated short-term emissions. Wet FGT systems generally have the highest absorption capacity and deliver the lowest emission levels for these substances, but are generally more expensive. See Table 5.3 for consideration of criteria for selection between the main FGT systems, including cross-media impacts.
Hydrogen fluoride (HF)		<2 (see split view 2)	<1	
Sulphur dioxide (SO_2)		1 – 150 (see split view 2)	1 – 40 (see split view 2)	
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2), expressed as nitrogen dioxide for installations using SCR		40 – 300 (see split view 2)	40 – 100 (see split view 2)	Waste and combustion control techniques coupled with SCR generally result in operation within these emission ranges. The use of SCR imposes an additional energy demand and costs. In general at larger installations the use of SCR results in less significant additional cost per tonne of waste treated. High N waste may result in increased raw gas NO_X concentrations.
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2) expressed as nitrogen dioxide for installations not using SCR		30 – 350	120 – 180	Waste and combustion control techniques with SNCR generally result in operation within these emission ranges. 24 hour averages below this range generally require SCR although levels below 70mg/Nm³ have been achieved using SNCR e.g. where raw NO_X is low and/or at high reagent dose rates) Where high SNCR reagent dosing rates are used, the resulting NH_3 slip can be controlled using wet FGT with appropriate measures to deal with the resultant ammoniacal waste water. High N waste may result in increased raw gas NO_X concentrations. (See also note 8 below in respect of small installations).
Gaseous and vaporous organic substances, expressed as TOC		1 – 20	1 – 10	Techniques that improve combustion conditions reduce emissions of these substances. Emission concentrations are generally not influenced greatly by FGT. CO levels may be higher during start-up and shut down, and with new boilers that have not yet established their normal operational fouling level
Carbon monoxide (CO)		5 – 100	5 – 30	
Mercury and its compounds (as Hg)	<0.05 (see split view 2)	0.001 – 0.03	0.001 – 0.02	Adsorption using carbon based reagents is generally required to achieve these emission levels with many wastes - as metallic Hg is more difficult to control than ionic Hg. The precise abatement performance and technique required will depend on the levels and distribution of Hg in the waste. Some waste streams have very highly variable Hg concentrations – waste pretreatment may be required in such cases to prevent peak overloading of FGC system capacity. Continuous monitoring of Hg is <u>not</u> required by Directive 2000/76/EC but has been carried out in some MSs
Total cadmium and thallium (and their compounds expressed as the metals)	0.005 - 0.05 (see split view 2)			See comments for Hg. The lower volatility of these metals than Hg means that dust and other metal control methods are more effective at controlling these substances than Hg.
Σ other metals	0.005 - 0.5			Techniques that control dust levels generally also control these metals
Dioxins and furans (ng TEQ/Nm³)	0.01 – 0.1 (see split view 2)			Combustion techniques destroy PCDD/F in the waste. Specific design and temperature controls reduce *de-novo* synthesis. In addition to such measures, abatement techniques using carbon based absorbents reduce final emissions to within this emission range. Increased dosing rates for carbon absorbent may give emissions to air as low as 0.001 but result in increased consumption and residues.

Substances not included in Directive 2000/76/EC on waste incineration:				
Ammonia (NH_3)	<10	1 – 10	<10 (see split view 1)	Effective control of NO_X abatement systems, including reagent dosing contributes to reducing NH_3 emissions. Wet scrubbers absorb NH_3 and transfer it to the waste water stream.
Benz(a)pyrene	For these substances there was insufficient data to draw a firm BAT conclusion on emission levels. However, the data provided in Chapter 3 indicates that their emission levels are generally low. PCBs, PAHs and benz(a)pyrene can be controlled using the techniques applied for PCDD/F. N_2O levels are determined by combustion technique and optimisation, and SNCR optimisation where urea is used.			Techniques that control PCDD/F also control Benz(a)pyrene, PCBs and PAHs
PCBs				
PAHs				
Nitrous oxide (N_2O)				Effective oxidative combustion and control of NO_X abatement systems contribute to reducing N_2O emissions. The higher levels may be seen with fluidised beds operated at lower temperatures e.g. below ~900 °C

NOTES:

1. The ranges given in this table are the levels of operational performance that may generally be expected as a result of the application of BAT – they are not legally binding emission limit values (ELVs)
2. Σ other metals = sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V and their compounds expressed as the metals
3. Non-continuous measurements are averaged over a sampling period of between 30 minutes and 8 hours. Sampling periods are generally in the order of 4 – 8 hours for such measurements.
4. Data is standardised at 11 % Oxygen, dry gas, 273K and 101.3kP
5. Dioxin and furans are calculated using the equivalence factors as in EC/2000/76
6. When comparing performance against these ranges, in all cases the following should be taken into account: the confidence value associated with determinations carried out; that the relative error of such determinations increases as measured concentrations decrease towards lower detection levels
7. The operational data supporting the above-mentioned BAT ranges were obtained according to the currently accepted codes of good monitoring practice requiring measurement equipment with instrumental scales of 0 – 3 times the WID ELV. For parameters with an emission profile of a very low baseline combined with short period peak emissions, specific attention has to be paid to the instrumental scale. For example changing the instrumental scale for the measurement of CO from 3-times the WID ELV to a 10-times higher value, has been reported in some cases, to increase the reported values of the measurement by a factor of 2 – 3. This should be taken into account when interpreting this table.
8. One MS reported that technical difficulties have been experienced in some cases when retrofitting SNCR abatement systems to existing small MSW incineration installations, and that the cost effectiveness (i.e. NO_X reduction per unit cost) of NO_X abatement (e.g. SNCR) is lower at small MSWIs (i.e. those MSWIs of capacity <6 tonnes of waste/hour).

SPLIT VIEWS:

1 BAT 35 : Based upon their knowledge of the performance of existing installations a few Member States and the Environmental NGO expressed the split view that the 24 hour NH_3 emission range associated with the use of BAT should be <5 mg/Nm^3 (in the place of <10 mg/ Nm^3)

2 BAT 35 : One Member State and the Environmental NGO expressed split views regarding the BAT ranges in table 5.2 (air). These split views were based upon their knowledge of the performance of a number of existing installations, and their interpretation of data provided by the TWG and also of that included in this BREF document (e.g. in Chapter 3). The final outcome of the TWG meeting was the ranges shown in Table 5.2, but with the following split views recorded: total dust 1/2hr average 1 - 10 mg/Nm^3; NO_X (as NO_2) using SCR 1/2hr average 30 - 200 and 24hr average 30 - 100 mg/Nm^3; Hg and its compounds (as Hg) non-continuous 0.001 - 0.03 mg/Nm^3; Total Cd + Tl non-continuous 0.005 - 0.03mg/Nm^3; Dioxins and furans non-continuous 0.01 - 0.05 ng TEQ/Nm^3. Based on the same rationale, the Environmental NGO also registered the following split views: HF 1/2hr average <1 mg/Nm^3; SO_2 1/2hr average 1 – 50 mg/Nm^3 and 24hr average 1 – 25 mg/Nm^3.

Table 5.2 Operational emission level ranges associated with the use of BAT for releases to air from waste incinerators

Criteria	Wet FGT (W)	Semi-wet FGT (SW)	Dry lime FGT (DL)	Dry sodium bicarbonate FGT (DS)	Comments
Air emissions performance	+	0	-	0	• in respect of HCl, HF, NH_3 & SO_2 wet systems generally give the lowest emission levels to air • each of the systems are usually combined with additional dust and PCDD/F control equipment • DL systems may reach similar emission levels as DS & SW but only with increased reagent dosing rates and associated increased residue production.
Residue production	+	0	-	0	• residue production per tonne waste is generally higher with DL systems and lower with W systems with greater concentration of pollutants in residues from W systems • material recovery from residues is possible with W systems following treatment of scrubber effluent, and with DS systems
Water consumption	-	0	+	+	• water consumption is generally higher with W systems • Dry systems use little or no water
Effluent production	-	+	+	+	• the effluents produced (if not evaporated) by W systems require treatment and usually discharge – where a suitable receptor for the salty treated effluent can be found (e.g. marine environments) the discharge itself may not be a significant disadvantage • ammonia removal from effluent may be complex
Energy consumption	-	0	0	0	• energy consumption higher with W systems due to pump demand – and is further increased where (as is common) combined with other FGT components e.g. for dust removal
Reagent consumption	+	0	-	0	• generally lowest reagent consumption with W systems • generally highest reagent consumption with DL – but may be reduced with reagent re-circulation • SW, and DL & DS systems can benefit from use of raw gas acid monitoring (see 4.4.3.9)
Ability to cope with inlet variations of pollutant	+	0	-	0	• W systems are most capable of dealing with wide ranging and fast changing inlet concentrations of HCl, HF and SO_2 • DL systems generally offer less flexibility – although this may be improved with the use of raw gas acid monitoring (see 4.4.3.9)
Plume visibility	-	0	+	+	• plume visibility is generally higher with wet systems (unless special measures used) • dry systems generally have the lowest plume visibility
Process complexity	- (highest)	0 (medium)	+ (lowest)	+ (lowest)	• W systems themselves are quite simple but other process components are required to provide an all round FGT system, including a waste water treatment plant etc.
Costs - capital	Generally higher	medium	Generally lower	Generally lower	• additional cost for wet system arises from the additional costs for complementary FGT and auxiliary components – most significant at smaller plants
Costs – operational	medium	Generally lower	medium	Generally lower	• there is an additional operational cost of ETP for W systems – most significant at smaller plants • higher residue disposal costs where more residues are produced, and more reagent consumed. W systems generally produce lowest amounts of reagents and therefore may have lower reagent disposal costs. • op. costs include consumables, disposal and maintenance costs. Op. costs depend very much on local prices for consumables and residue disposal.

Note: + means that the use of the technique generally offers an advantage in respect of the assessment criteria considered
0 means that the use of the technique generally offers no significant advantage or disadvantage in respect of the assessment criteria considered
- means that the use of the technique generally offers a disadvantage in respect of the assessment criteria considered

Table 5.3: An example assessment of some IPPC relevant criteria that may be taken into account when selecting between wet/semi-wet/dry FGT options

Parameter	BAT range in mg/l (unless stated)	Sampling and data information
Total suspended solids as defined by Directive 91/271/EEC	10 – 30 (95 %) 10 – 45 (100 %)	• based on spot daily or 24 hour flow proportional sample
Chemical oxygen demand	50 – 250	• based on spot daily, or 24 hour flow proportional sample
pH	pH 6.5 – pH 11	• continuous measurement
Hg and its compounds, expressed as Hg	0.001 – 0.03 (see split view 1)	• based on monthly measurements of a flow proportional representative sample of the discharge over a period of 24 hours with one measurement per year exceeding the values given, or no more than 5 % where more than 20 samples are assessed per year • There have been some positive experiences with continuous monitoring of Hg • Total Cr levels below 0.2 mg/l provide for control of Chromium VI • Sb, Mn, V and Sn are not included in Directive 2000/76
Cd and its compounds, expressed as Cd	0.01 – 0.05 (see split view 1&2)	
Tl and its compounds, expressed as Tl	0.01 – 0.05 (see split view 2)	
As and its compounds, expressed as As	0.01 – 0.15 (see split view 1)	
Pb and its compounds, expressed as Pb	0.01 – 0.1	
Cr and its compounds, expressed as Cr	0.01 – 0.5 (see split view 2)	
Cu and its compounds, expressed as Cu	0.01 – 0.5 (see split view 2)	
Ni and its compounds, expressed as Ni	0.01 – 0.5 (see split view 2)	
Zn and its compounds, expressed as Zn	0.01 – 1.0 (see split view 2)	
Sb and its compounds, expressed as Sb	0.005 – 0.85 (see split view 1)	
Co and its compounds, expressed as Co	0.005 – 0.05	
Mn and its compounds, expressed as Mn	0.02 – 0.2	
V and its compounds, expressed as V	0.03 – 0.5 (see split view 1)	
Sn and its compounds, expressed as Sn	0.02 – 0.5	
PCDD/F (TEQ)	0.01 – 0.1 ng TEQ/l (see split view 1&2)	• average of 6 monthly measurements of a flow proportional representative sample of the discharge over a period of 24 hours

NOTE:

1. Values are expressed in mass concentrations for unfiltered samples
2. Values relate to the discharge of treated scrubber effluents without dilution
3. BAT ranges are not the same as ELVs – see comments in introduction to Chapter 5
4. pH is one important parameter for waste water treatment process control
5. Confidence levels decrease as measured concentrations decrease towards lower detection levels

SPLIT VIEWS:

1 BAT 48: One Member State and the Environmental NGO expressed split views regarding the BAT ranges in table 5.4 (water). These split views were based upon their knowledge of the performance of a number of existing installations, and their interpretation of data provided by the TWG and also of that included in this BREF document (e.g. in Chapter 3). The final outcome of the TWG meeting was the ranges shown in Table 5.4, but with the following split views recorded: Hg 0.001 - 0.01 mg/l; Cd 0.001 - 0.05 mg/l; As 0.003 - 0.05 mg/l; Sb 0.005 - 0.1 mg/l; V 0.01 - 0.1 mg/l; PCDD/F <0.01 - 0.1 ng TEQ/l.

2 BAT 48: Based on the same rationale, the Environmental NGO also registered the following split views: Cd 0.001 - 0.02 mg/l; Tl 0.001 – 0.03 mg/l; Cr 0.003 – 0.02 mg/l; Cu 0.003 – 0.3 mg/l; Ni 0.003 – 0.2 mg/l.; Zn 0.01 – 0.05 mg/l; PCDD/F <0.01 ng TEQ/l.

Table 5.4: BAT associated operational emission levels for discharges of waste water from effluent treatment plant receiving FGT scrubber effluent