ENERGY

To whom it may concern

Date 2017.09.19

Ramboll AG
Hardturmstrasse 132
CH-8005 Zürich
Schweiz

T +41 44 500 35 80
F +41 44 500 35 89

info@ramboll.ch
www.ramboll.com

File; TNGWTE-141-032-Addendum Letter BAT Evaluation Memo 4.docx
Ver. 100

THE NEXT GENERATION NSW
ENERGY FROM WASTE FACILITY, EASTERN CREEK

ADDENDUM TO BAT EVALUATION MEMO 4

Background

The Best Available Techniques (BAT) are defined in the document "Reference Document on the Best Available Techniques for Waste Incineration" dated August 2006 (BREF), which is based on the long term experience of Waste-to-Energy in Europe.
In February 2016 the design of the TNG facility including step 1 and 2 was evaluated in relation to the above BREF requirements and the results were summarized in a Memo (see Memo 4, dated 18th of February 2016).

Ramboll was asked to review this evaluation under the condition, that only stage 1 will be realized.

Review results

Ramboll reviewed the evaluation with main focus on design, emissions and energy. Following the conclusions of this review:

1. Design
   - No changes of the process design parameters (grate, boiler, flue gas treatment, turbine etc).
   - No changes in the handling of the waste, bunker construction and capacity.
   - No changes in the combustion control system.
2. Emissions
   - No changes in the emission levels, specific bottom ash and fly ash quantity and quality.
   - No changes in the amount of chemicals used
3. Energy efficiency
   - No changes in thermal efficiency, specific net power production per tonne of waste

Conclusions

In summary the results of the reviewed evaluation are:

1. Design: all requirements defined by BREF still are fulfilled
2. Emissions: The expected emissions are still within the required operational values given by BREF
3. Energy efficiency: The TNG facility still exceeds the requirements of the BREF

It can therefore be concluded that the TNG facility still exceeds the BREF requirements and therefore is Best Available Techniques.

Yours sincerely

M. Brunner

Martin Brunner
Director

MEMO

Job	**BAT Evaluation**
Client	**DADI TNG NSW**
Memo no.	**4**
Date	**23/02/2016**
To	**To whom it may concern**
From	**Martin Brunner**
Copy to	**Ian Malouf (DADI)**
	Phill Andrew (Savills)
	Rachael Snape (Urbis)
	Geert Stryg (Ramboll)

Ramboll
Hardturmstrasse 132
CH-8005 Zürich

T +41 44 500 35 80
F +41 44 500 35 89
www.ramboll.com/energy

Made by	BIKO
Checked by	MBR
Approved by	GES

Revision 200

1. Methodology to compare the TNG technology with the BAT requirements

Based on the long term experience of Waste-to-Energy in Europe the best available techniques (BAT) have been evaluated, defined and documented in the "Reference Document on the Best Available Techniques for Waste Incineration (August 2006)" (in short BREF).

Following a request by TNG Ramboll has compared the requirements as summarized as 68 basic requirements in Chapter 5.1 and 5.2 of the above document.

2. Results and conclusions

The detailed evaluation of each point is found in the attachment. In summary the results of the evaluation are:

1. Design: all requirements defined by BREF are fulfilled
2. Emissions: The expected emissions are within the required operational values given by BREF
3. Energy efficiency: The TNG facility exceeds the requirements of the BREF

It can therefore be concluded that the TNG facility fulfils the BREF requirements and therefore is BAT.

BAT	TNG	BAT fullfilled?
1. the selection of an installation design that is suited to the characteristics of the waste received, as described in 4.1.1 and 4.2.1 and 4.2.3	The thermal treatment is calculated for a calorific value of 8,5 MJ/kg- 16,5 MJ/kg. The plant is designed for a waste throughput of 25,35 t/h to 46,48 t/h. The waste type is mainly Chute Residual Waste (CRW) from the Genesis Facility, Commercial and Industrial (C&I), Construction and Demolition (C&D) and flock waste. A combination of water cooled grate and air cooled grate was chosen. The air cooled grate is characterized through: - suitable for waste with low to medium heat values - suitable for municipal and other heterogeneous solid wastes - can cope with sewage sludge and/or medical waste mixed with municipal waste - applied at most modern MSW installations The water cooled grate protects the grate against intense heat (LCV: 10 – 20 GJ/t) otherwise it has the same characteristics. The design features of the secondary combustion chamber are a central current flow.	Yes
2. the maintenance of the site in a generally tidy and clean state, as described in 4.1.2	It is integral part of the contract; it is defined as one the operator’s tasks.	Yes
3. to maintain all equipment in good working order, and to carry out maintenance inspections and preventative maintenance in order to achieve this	The Proposed Facility will be operated and maintained by a dedicated Operations and Maintenance team. For planning the major shutdown a short shutdown is carried out approx. 1 year in advance. A normal duration for such a short shutdown is generally a few days. The operator installs a computer-controlled program used to ensure ongoing maintenance of the plant components. The program records conducted maintenance jobs and systematic maintenance can be planned for the individual components. A maintenance plan will be established to determine weekly, monthly, annual or longer interval inspections, tests and maintenance activities which have to be performed.	Yes

BAT	TNG	BAT fullfilled?
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.	A three point checking procedure will be on-site to ensure only permitted waste is unloaded into the waste bunker. Initial inspections of the vehicle loads are undertaken at the weighbridge to check the content of the incoming and its origin. All loads are recorded and monitored by on-site CCTV when entering the tipping hall and while the loads are tipped off. Suspect loads are either rejected from the facility or are analysed in a designated inspection area or on the tipping hall floor prior to being tipped into the waste bunker. If the analysis shows that the load contains unsuitable material the waste is reloaded to the vehicle and rejected. Detectors for radioactive material are not necessary.	Yes
5. the storage of wastes according to a risk assessment of their properties, such that the risk of potentially polluting released 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 4.1.4.1.	The waste bunker is built of concrete and has a resistant surface. Due to the high thermal value of the waste there is no need for controlled and separated drainage.	Yes
6. to use techniques and procedures to restrict and manage waste 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 - in so far as is practicable, control and manage deliveries by communication with waste suppliers, etc.	- The waste bunker has the capacity to store the amount of 5-7 days of waste delivery. - The waste is continuously removed. - It is ensured that no excessive amounts will arrive.	Yes
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	The incineration air supply (primary or secondary) is taken from the waste storage areas. By enclosing the waste storage areas and limiting the size of the entrances to the waste storage areas, a slight under pressure can be ensured on whole waste storage area.	Yes
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	The waste is delivered in defined fractions. Segregation of the storage of wastes is not necessary.	Yes

BAT	TNG	BAT fullfilled?
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.	The waste is not stored in containers.	Not relevant
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. 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.	Fire detection and firefighting systems are installed at the critical areas of the plant (e.g. waste bunker, electrical rooms, feed hopper,...). In case of fire detection the firefighting systems start automatically.	Yes
11. the 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). When considering the degree of use of mixing/pre-treatment it is of particular importance to consider the cross-media effects (e.g. energy consumption, noise, odour or other releases) of the more extensive pre-treatment's (e.g. shredding). Pre-treatment is most likely to be a requirement where the installation has been designed for a narrow specification, homogeneous waste.	The waste bunker has sufficient space and sufficient capacity for the mixing of different waste streams. The waste is mainly delivered as shredded fraction.	Yes
12. the 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.	The recyclable material is removed before the waste is delivered to the waste incineration plant.	Yes
13. the 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	A video system is installed to monitor waste reception, feeding and storage, furnace as well as main out streams and their loading areas.	Yes
14. the minimisation of the uncontrolled ingress of air into the combustion chamber via waste loading or other routes, as described in 4.1.6.4	To minimize the uncontrolled ingress of air into the combustion chamber, the feed hopper always has to be filled to a certain level during operation. The level of the feed hopper is checked by the DCS.	Yes

BAT	TNG	BAT fullfilled?
15. the use of flow modelling which may assist in providing information for new plants or existing plants where concerns exist regarding the combustion or FGT performance (such as described in 4.2.2), and to provide information in order to: a. optimise furnace and boiler geometry so as to improve combustion performance, and b. optimise combustion air injection so as to improve combustion performance, and c. where SNCR or SCR is used, to optimise reagent injection points so as to improve the efficiency of NO_X abatement whilst minimising the generation of nitrous oxide, ammonia and the consumption of reagent (see general sections on SCR and SNCR at 4.4.4.1 and 4.4.4.2).	The incineration and the boiler layout are based on good experiences and are realised on several operating plants. The SNCR (injection of ammonia), the secondary combustion chamber and the FGT design is based on a fluid dynamics flow model.	Yes
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	The waste feeding is continuously. Implementation of a process orientated automatic start up and shut down procedure to minimise the emissions in those operational cases. Mixture of the waste to get a homogeneous fuel and preventative maintenance system avoid unplanned shutdowns.	Yes
17. the identification of a combustion control philosophy, and 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, as described in 4.2.6. Techniques to consider for combustion control may include the use of infrared cameras (see 4.2.7), or others such as ultra-sound measurement or differential temperature control	The following information is part of the combustion control system: - grate temperatures at various positions - caloric value of the waste - thickness of waste layer on the grate (visual control) - furnace and flue gas temperature at various positions - CO-, O_2-, CO_2- and H_2O-measurements at various positions - steam production data (e.g. temperature, pressure) - openings in the combustion wall for visual observation by cameras - length and position of the fire in the furnace - emission data for combustion related substances	Yes

BAT	TNG	BAT fullfilled?
18. 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. Appropriate techniques for securing these objectives are described in: 4.2.8 Optimisation of air supply stoichiometry 4.2.9 Primary air supply optimisation and distribution 4.2.11 Secondary air injection, optimisation and distribution 4.2.19 Optimisation of time, temperature, turbulence of gases in the combustion zone, and oxygen concentrations 4.2.4 Design to increase turbulence in the secondary combustion chamber	For an optimal combustion the thermal processes are monitored and regulated by measurements of the furnance temperature and the content of CO and O2 in the flue gas. For a more detailed description see point 17. by means of combustion control the following elements are controlled: - Primary air quantity and distribution - Oxygen content of flue gas (stoichiometry) - Secondary air quantity and distribution - Injection of recirculating flue gas in order to increase turbulence in the secondary combustion chamber	Yes
19. in general it is BAT to use those operating conditions (i.e. combustion temperatures residence times and turbulence) that are 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. For example, where the use of operational temperatures of below the 1100 °C (as specified for certain hazardous waste in 2000/76/EC) have been demonstrated to provide for a similar or better level of overall environmental performance, the use of such lower temperatures is considered to be BAT.	The temperature / time requirements of the post-combustion chamber are continuously monitored. See point 17.	Yes
20. 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/high moisture wastes are burned) as described in 4.2.10. In general this technique is not applicable to hazardous waste incinerators.	For high energy efficiency and optimal combustion conditions preheating of primary and secondary combustion air is realised by using low pressure steam and saturated steam from the boiler drum.	Yes
21. 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, as described in 4.2.20	Only in the case that the temperature in the secondary combustion chamber drops below a minimum temperature of 850 °C oil or gas fired support burners automatically start operation. Otherwise, the burners remain in a standby position.	Yes

BAT	TNG	BAT fullfilled?
22. 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 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) The conditions under which the various techniques may be applicable are described in 4.2.22 and 4.3.12	To protect the walls of the boiler against corrosion Inconel will be cladded in sections where the flue gas temperature exceeds 850 °C.	Yes
23. 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, as described in 4.2.23	The furnace dimensions are large enough to ensure that for 2 seconds residence time the flue gas has a temperature above 850 °C (for all operational conditions). Experiences of several plants have shown low values for CO and VOC. After the combustion chamber two empty passes are installed to enable a complete burnout. In addition to secondary air a part of the flue gas is recirculated and injected together with the secondary air to achieve a maximum turbulence and burnout as well as stable CO and VOC emissions.	Yes
24. When gasification or pyrolysis is used, in order to avoid the generation of waste, it is BAT to: a. combine the gasification or pyrolysis stage with a subsequent combustion stage with energy recovery and flue-gas treatment that provides for operational emission levels to air within the BAT associated emission ranges specified in this BAT chapter, and/ or b. recover or supply for use of the substances (solid, liquid or gaseous) that are not combusted	No gasification or pyrolysis.	Not relevant

BAT	TNG	BAT fullfilled?
25. 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), as described in 4.2.23 and 4.3.11. The actual temperature above which fouling is significant is waste type and boiler steam parameter dependent. In general for MSW it is usually 600 – 750 ºC, lower for HW and higher for SS. Radiative heat exchangers, such as platten type super heaters, may be used at higher flue-gas temperatures than other designs (see 4.3.14).	At the first position in the horizontal pass a protection evaporator is installed. The calculated gas temperature before the protection evaporator is around 650°C. This evaporator protects the superheater in order to minimize fouling. Further a conservative spacing of the boiler tubes prevents clogging and resulting operational problems.	Yes
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 pretreated municipal wastes (or similar waste) treated in fluidized 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 % iv. for other wastes conversion efficiency should generally be increased in the range 60 to 90 % c. for gasification and pyrolysis processes that are combined with a subsequent combustion stage, the use of a boiler with a thermal conversion efficiency of at least 80 %, or the use of a gas engine or other electrical generation technology	The most important measures to reduce the energy loss are: a) reduce excess air b) recirculate flue gas c) reduce the flue gas temperature at the boiler exit of 145°C d) heat recovery by condensate preheating The thermal conversion of the boiler is 91,9%.	Yes
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 of the incinerated waste may be used.	The average net electrical efficiency is 29,6%. Necessary measures have been foreseen for later export of heat.	Yes

BAT	TNG	BAT fullfilled?
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: a. electricity generation with heat or steam supply for use (i.e. use CHP) b. the supply of heat or steam for use in district heating distribution networks c. the supply of process steam for various, mainly industrial, uses (see examples in 4.3.18) d. the supply of heat or steam for use as the driving force for cooling/air conditioning systems Selection of a location for a new installation is a complex process involving many local factors (e.g. waste transport, availability of energy users, etc) which are addressed by IPPC Directive Article 9(4). The generation of electricity only may provide the most energy efficient option for the recovery of the energy from the waste in specific cases where local factors prevent heat/steam recovery.	See point 27.	Yes
29. 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 4.3.8): 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.	Depending on the flue gas composition and the waste conditions the steam parameters were determined to be 73barA/430°C. This superheated steam parameters ensure high energy efficiency. The net electrical efficiency is 29,6%.	Yes
30. the selection of a turbine suited to: a. the electricity and heat supply regime, as described in 4.3.7 b. high electrical efficiency	A condensing turbine was chosen as there are no possibilities to supply heat to customers.	Yes
31. at new or upgrading installations, where electricity generation is the priority over heat supply, the minimisation of condenser pressure, as described in 4.3.9	The turbine exhaust pressure (100 mbar, 22°C) and the air cooled condenser are designed so that the high ambient temperatures of Sydney can be handled.	Yes

BAT	TNG	BAT fullfilled?
32. the general minimisation of overall installation energy demand, including consideration of the following (see 4.3.6): 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	To minimise the overall energy consumption the following measures were taken: - SNCR instead of SCR to avoid the flue gas reheating for the catalytic reaction - efficient preheating of primary and secondary air - minimal condenser pressure - placing high temperature equipment before (upstream) lower temperature equipment - use of frequency controlled rotating equipment for those equipment parts which operate at variable speeds. - high efficient DCS system to minimise the measure failure SCR is not relevant.	Yes
33. 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 4.3.10	As result of the local conditions and to minimize the water consumption an air cooled condenser has been chosen.	Yes
34. 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 4.3.19	Online cleaning devices for all parts of the boiler are foreseen. Offline cleaning is carried out manually during revisions.	Yes
35. the 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 for releases to air associated with the use of BAT listed in Table 5.2	The emission guarantees are in accordance with the European Industrial Emission Directive. The expected operational emission levels are in line with the values given in Table 5.2.	Yes

BAT	TNG	BAT fullfilled?
36. when selecting the overall FGT system, to 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 c. the additional overall-system compatibility issues that may arise when retrofitting existing installations (see 4.4.1.4)	The following factors have been taken account for the selection of the FGT system: - type of waste, its composition and variation - type of combustion process, and its size - through recirculation of flue gases less flue gas flow and lower flue gas temperature - flue gas composition and fluctuations in the composition - target emission limit values - restrictions on discharge of aqueous effluents - availability of land and space - availability and cost of outlets for residues accumulated/recovered - minimize consumables	Yes
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 [See at the end of this document]	The Flue gas cleaning process is characterised by the following features: - No effluent as necessary for wet FGT - minimized consumables and residues - Dry injection of Calcium Hydroxide (Ca(OH)2) and Powdered Activated Carbon (PAC) - Separate injection of water for conditioning and reactivation of recycled lime particles - Compact design - Low manpower requirement	Yes
38. to prevent the associated increased electrical consumption, to generally (i.e. unless there is a specific local driver) avoid the use of. two bag filters in one FGT line (as described in 4.4.2.2 and 4.4.2.3)	The installation has only one bag filter.	Yes

BAT	TNG	BAT fullfilled?
39. 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, as described in 4.4.3.9 c. the re-circulation of a proportion of the FGT residues collected, as described in 4.4.3.7 The applicability and degree of use of the above techniques that represents BAT will vary according to, in particular: the waste characteristics and consequential flue-gas nature, the final emission level required, and technical experience from their practical use at the installation	a) The quantity of reagents injected is regularly checked by measuring the target final operational emission levels. Depending on the emission level the reagents are injected. b) Measuring devices are installed to check the raw gas c) A part of the residues are recirculated into the semi dry reactor which results in a high efficiency, lower consumption of absorbent, protection of filter bags and a higher operational safety.	Yes
40. the use of primary (combustion related) NO_X reduction measures to reduce NO_X production, together with either SCR (4.4.4.1) or SNCR (4.4.4.2), according to the efficiency of flue-gas reduction required. In general SCR is considered BAT where higher NO_X reduction efficiencies are required (i.e. raw flue-gas NO_X levels are high) and where low final flue-gas emission concentrations of NOX are desired. 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. NOX reduction per unit cost) of NOX abatement (e.g. SNCR) is lower at small MSWIs (i.e. those MSWIs of capacity <6 tonnes of waste/hour).	In the first pass of the boiler ammonia is injected into the flue gas stream. The results are well controlled and low NOx emissions which are below the levels given by the Industrial Emissions Directive. The most important factors for NOx reduction measures are: - O_2 content - flue gas recirculation - optimized secondary air injection Neither retrofitting nor small installation, therefore not relevant.	Yes

BAT	TNG	BAT fullfilled?
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	For the reduction of PCDD/F emissions the following techniques are applied: - optimized secondary air injection - maximal gas burn out - minimization of fly ash deposits in the boiler - continuous boiler cleaning - no dedusting equipment where the gas temperature is above 200°C - SNCR	Yes
42. 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.	No wet scrubbers are used.	Not relevant
43. 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	No re-burn of FGT residues is applied.	Not relevant

BAT	TNG	BAT fullfilled?
44. 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 (as described in 4.4.6.1, 4.4.6.6 and 4.4.6.5), in combination with the following additional measures 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, as described in 4.4.6.2, or c. activated carbon or coke filters, as described in 4.4.6.7	No wet scrubbers are used.	Not relevant
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	For the control of Hg emissions an activated carbon injection into the semi dry reactor is applied. The reagent dose rate is controlled to ensure that the final air emissions are within the BAT ranges given for Hg.	Yes
46. the general optimisation of the re-circulation and re-use of waste water arising on the site within the installation, as described in 4.5.8, 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 4.5.6)	To avoid additional water consumption a complete recirculation of condensate is installed. The boiler drain water is used for the bottom ash quenching.	Yes
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	A separate system is used for the drainage, treatment and discharge of rainwater so that it does not mix with potential or actual contaminated waste water streams.	Yes

BAT	TNG	BAT fullfilled?
48. 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, as described in 4.5.11, and thereby to achieve, at the point of discharge from the effluent treatment plant (ETP), emission levels generally within the BAT associated operational emission level ranges that are identified in Table 5.4 [See at the end of this document] b. the separate treatment of the acid and alkaline waste water streams arising from the scrubber stages, as described in 4.5.13, 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, as de- scribed in 4.5.4 d. the provision of storage/buffering capacity for scrubber effluents, to provide for a more stable waste water treatment process, as described in 4.5.10 e. the use of sulphides (e.g. M-trimercaptotriazine) or other Hg binders to reduce Hg (and other heavy metals) in the final effluent, as described in 4.5.11 f. when SNCR is used with wet scrubbing the ammonia levels in the effluent discharge may be reduced using ammonia stripping, as described in 4.5.12, and the recovered ammonia re-circulated for use as a NOX reduction reagent	No wet flue gas treatment is used.	Not relevant

BAT	TNG	BAT fullfilled?
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 d. the optimisation and control of combustion conditions, including air (oxygen) supply and distribution, as described in BAT 18	The expected value of TOC is < 1%. A combination of different techniques/measures is used to improve the waste burnout: - optimal combustion conditions with a classic combustion control system, - flow optimised secondary combustion chamber, - visual check of the fire on the grate, - optimal design of the boiler geometry, - optimal temperature distribution on the grate, - optimal waste distribution over the grate - adjustment of particular grate speed - ensuring that the plant is operated within its capacity (fire control diagram) - good mixing of the waste before feeding	Yes
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.	There is a separate management of bottom ash from fly ash and FGT residues. The FGT residues will be stored in separate enclosed silos before being transported by sealed tankers to an appropriate offsite treatment facility. This complies with the hazardous waste legislation.	Yes
51. where a pre-dedusting stage (see 4.6.3 and 4.4.2.1) is in use, 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	No pre-dedusting stage is installed.	Not relevant
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	A magnetic separator is placed above a conveyor to remove ferrous metals from bottom ash.	Yes

BAT	TNG	BAT fullfilled?
53. the treatment of bottom ash (either on or off-site), by a suitable combination of: a. dry bottom ash treatment with or without ageing, as described in 4.6.6 and 4.6.7, or b. wet bottom ash treatment, with or without ageing, as described in 4.6.6and 4.6.8, or c. thermal treatment, as described in 4.6.9 (for separate treatment) and 4.6.10 (for in-process thermal treatment) or d. screening and crushing (see 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 bottom ash is treated according to b) before reuse or landfill	Yes
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	The FGT residues will be stored in separate enclosed silos before being transported by sealed tankers to an appropriate offsite treatment facility. This complies with the hazardous waste legislation.	Yes
55. the implementation of noise reduction measures to meet local noise requirements (techniques are described in 4.7 and 3.6)	Noise reduction measures are installed at the turbine-generator, at the fans and at other critical plant sections.	Yes
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) [Number of bullet points omitted]	The plant is operated by qualified personnel and the staff will be sent to relevant qualifying courses. To ensure that employees are aware of the relevant parts of the environmental permit, regular dialogue meetings are held with the employees. The plant is ISO 14001 and OHSA 18001 certified. Additional information can be found in the quality manual where environmental measurements, reports and factors such as environmental requirements, responsibilities and competencies of facilities and technical installations are described. The operator is responsible to install the environmental system.	Yes
57. the storage of all waste, (with the exception of wastes specifically prepared for storage or bulk items with low pollution potential e.g. furniture), on sealed surfaces with controlled drainage inside covered and walled buildings	The waste is stored in the waste bunker. The waste bunker has sealed surfaces.	Yes

BAT	TNG	BAT fullfilled?
58. when waste is stockpiled (typically for later incineration) it should generally be baled (see Section 4.1.4.3) or otherwise prepared for such storage so that it may be stored in such a manner that risks of odour, vermin, litter, fire and leaching are effectively controlled.	The risks of odour, vermin, litter, fire and leaching are effectively controlled because the waste is stockpiled in a closed building. There is no influence to the environment (only the open delivery boxes).	Yes
59. to pre-treat the waste, in order to improve its homogeneity and therefore combustion characteristics and burn-out, by: a. mixing in the bunker (see 4.1.5.1), and b. the use of shredding or crushing for bulky wastes e.g. furniture (see 4.1.5.2) that are to be incinerated, to the extent that is beneficial according to the combustion system used. In general grates and rotary kilns (where used) require lower levels of pre-treatment (e.g. waste mixing with bulky waste crushing) whereas fluidized bed systems require greater waste selection and pre- treatment, usually including full shredding of the MSW.	The pre-treat of waste in order to improve its homogeneity is a) mixing of waste in the bunker b) shredding of waste.	Yes
60. 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 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 average NCV of up to approx 18 MJ/kg. Higher NCV wastes may require water (or other liquid) cooling in order to prevent the need for excessive primary air levels (i.e. levels that result in a greater air supply than the optimum for combustion control) to control grate temperature and length/position of fire on the grate (see section 4.2.14)	For the grate a combination of water cooled blocks and air cooled blocks is used. The calorific value is below 18 GJ/t (usually 10-11 GJ/t).	Yes
61. the location of new installations so that the use of CHP and/or the heat and/or steam utilisation can be maximised, so as to generally exceed an overall total energy export level of 1.9 MWh/tonne of MSW (ref. Table 3.42), based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11)	Currently no heat or steam export is planned (however the plant is designed for heat export in case of future possibilities)	Yes

BAT	TNG	BAT fullfilled?
62. in situations where less than 1.9 MWh/tonne of MSW (based on an average NCV of 2.9 MWh /tonne) can be exported, the greater of: a. the generation of an annual average of 0.4 – 0.65 MWh electricity/tonne of MSW (based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11) processed (ref. Table 3.40), with additional heat/steam supply as far as practicable in the local circum- stances, or b. the generation of at least the same amount of electricity from the waste as the annual average electricity demand of the entire installation, including (where used) on-site waste pre-treatment and on-site residue treatment operations (ref. Table 3.48)	The annual average production is 1,02 MWh electricity/tonne of waste.	Yes
63. to reduce average installation electrical demand (excluding pre-treatment or residue treatment) to be generally below 0.15 MWh/tonne of MSW processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 2.9 MWh/tonne of MSW (ref. Table 2.11)	The electrical demand of the of the plant is 0,123 MWh electricity/tonne of waste.	Yes
64. the storage of wastes: a. in enclosed hoppers or, b. on sealed surfaces with controlled drainage inside covered and walled buildings	The waste is stored in the waste bunker. The waste bunker has sealed surfaces and is inside a closed building.	Yes
65. when waste is stockpiled (typically for later incineration) it should generally be baled (see Section 4.1.4.3) or otherwise prepared for such storage so that it may be stored in such a manner that risks of odour, vermin, litter, fire and leaching are effectively controlled	see point 58.	
66. at new and existing installations, the generation of the greater of: a. an annual average of generally at least 0.6 – 1.0 MWh electricity/tonne of waste (based on an average NCV of 4.2 MWh/tonne), or b. the annual average electricity demand of the entire installation, including (where used) on-site waste pretreatment and on-site residue treatment operations	The annual average production is 1,02 MWh electricity/tonne of waste.	Yes

BAT	TNG	BAT fullfilled?
67. the location of new installations so that: a. as well as the 0.6 – 1.0 MWhe/ tonne of electricity generated, the heat and/or steam can also be utilised for CHP, so that in general an additional thermal export level of 0.5 – 1.25 MWh/tonne of waste (ref. section 3.5.4.3) can be achieved (based on an average NCV of 4.2 MWh/tonne), or b. where electricity is not generated, a thermal export level of 3 MWh/tonne of waste can be achieved (based on an average NCV of 4.2 MWh/tonne)	The annual average production is 1,02 MWh electricity/tonne of waste.	Yes
68. to reduce installation energy demand and to achieve an average installation electrical demand (excluding pretreatment or residue treatment) to generally below 0.2 MWh/tonne of waste processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 4.2 MWh/tonne of waste	The electrical demand of the plant is 0,123 MWh electricity/tonne of waste.	Yes