Title of Document Review of Reference Document on Best Available Techniques for Waste Incineration

BAT reference Number	BAT Statement	Applicability to installation	Proposed/in place
5.1	**Generic BAT for all Waste Incineration** In general BAT for waste incineration is considered to be:		
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	Yes	**BAT In place** Incinerator No.1 IN1951 installation designed to take Salty Waste Incinerator with a capacity to burn up to 7000MT pa Incinerator No.3 IN1931 installation designed to take Non-Salty Waste with a capacity to burn up to 10000MT pa. The design is suitable to Incinerate Liquid Streams Containing < = 0.5 % Inorganic Salts Incinerator No.1 and 3 designed to take vents gases from production processes and connected to bypass scrubber. Note: EWC codes currently permitted for disposal in the incinerators, ie 070503 - Organic halogenated solvents, washing liquids and mother liquors and 070204 - Other organic solvents, washing liquids and mother liquors.
2	the maintenance of the site in a generally tidy and clean state, as described in 4.1.2	Yes	**BAT In place** GSK Cork is accredited to the Environmental Management System ISO14001. All key components of an EMS are in place on site.
3	to maintain all equipment in good working order, and to carry out maintenance inspections and preventative maintenance in order to achieve this	Yes	**BAT In place** A preventive maintenance (PM) system is in place through which routine maintenance checks are carried out and results recorded. An Engineering Operations Maintenance protocol is in place for calibration and preventive maintenance of safety critical instrumentation and equipment.
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,	Yes	**BAT In place** The Manufacturing Batch Record (MBR), Cleaning Batch Record (CBR) and Solvent Batch Record (SBR) indicate where liquid waste is to be

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	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.		routed for each process (i.e. for incineration on or offsite, recovery or WWTP). Operating procedures ensure that: In the process buildings, the waste streams are segregated into the salty or non-salty waste header system, to where it is stored in waste tanks dedicated to either salty or non-salty waste. En route to these waste tanks, both salty & non-salty waste is split automatically into high and low calorific value waste based on density of the waste stream. Salty Waste, i.e. waste containing > 0.5 % inorganic salts must only be sent to Incinerator No.1 Streams containing wastes with extremes of pH, or with high % acids or bases may result in exotherms occurring in the waste vessels. These streams must be neutralised, before sending to the incinerators. Waste steams that are not suitable for on site incineration are sent off site for suitable disposal by a licensed waste contractor. ENVP 063 Bulk Waste Characterisation and Storage Compatibility procedure in place for introduction of new waste streams into the bulk waste storage tanks. Weekly sampling of waste streams in place for composite testing.
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.	Yes	**BAT In place** Materials for use in plant or for disposal are stored in areas protected against leakage run-off. All materials are stored in suitable tanks or containers. Storage of all bulk and drummed materials are in sealed bunded areas which are hydraulically tested every three years. Site storage tanks and pipelines are on planned routine inspection programme (Risk Based Inspection programme) in accordance with IE

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			Licence Requirements
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.	Yes	**BAT In place** GSK operate a Waste Accountability Programme on site that focuses on waste management of incinerator waste streams to ensure incinerator campaigns operate to maximum efficiency. This programme ensures that waste streams are not stored for too long and storage volumes are kept to a minimum.
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	Yes	**BAT In place** Reactors and tankage are vented to the incinerators and all VOC emissions are destroyed at 1150°C. Incinerator bypass system in place with emergency VOC scrubber.
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	Yes	**BAT In place** Segregation of incinerator waste streams is in place to optimise efficiency and ensure safe storage. The site's Safety Report demonstrates that adequate safety and reliability have been incorporated into the design and construction, and operation and maintenance of installations, storage facilities, equipment and infrastructure connected with its operation which are linked to major accident hazards inside the establishment.

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			ENVP 063 Bulk Waste Characterisation and Storage Compatibility procedure in place for introduction of a new waste streams into the bulk waste storage tanks.
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.	Yes	**BAT In place** All waste tanks on site are clearly labeled and identified. Bulk tanks have a standard label in place identifying contents, no. and hazards. Standard waste labels in place for waste drums. Database in place for identification of bulk tanks and drums.
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 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.	Yes	**BAT In place** • GSK Cork is a top tier site under the SEVESO II Directive and as such is subject to the requirements of the COMAH Regulations. • A Site Crisis Management Plan is in place to prepare the site in the event of a major accident. Site crisis management training is conducted twice per annum. • The current Health and Safety risks for the site have been identified within the site's Safety Report. All major accident scenarios have been identified, assessed and agreed with the Health & Safety Authority (HSA). • Chemical Process Hazard Evaluation Reports (identifies gas evolutions, adiabatic temperature rises, optimum operating parameters etc.) have been completed for all processes. • GSK has an Internal & External Emergency Plan in place to prevent accidents and limit their consequences. There is a statutory obligation to test the internal emergency plan every three years in consultation with the HSA. • Mal-operations studies and Process Safety Files have been completed for all processes on site. • The site is inspected annually by HSA under the SEVESO II Directive and annually by Factory Mutual.

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11	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 (4.1.5.1). When considering the degree of use of mixing/pretreatment it is of particular importance to consider the cross-media effects (e.g. energy consumption, noise, odour or other releases) 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.	Yes	**BAT In place** Mixing of waste streams is done on line via the transfer process. Filtration is the only pretreatment of waste streams for incineration. Segregation of incinerator waste streams is in place to optimise efficiency and ensure safe storage. Streams are segregated into salty and non salty waste streams. Both salty & non-salty waste streams are split automatically into high and low calorific value waste based on density of the waste stream.
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.	NA	N/A
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	Yes	**BAT In place** Environmental Control Room in place adjacent to the incinerators with television monitoring screens (Delta V and Provox monitoring systems in place)
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	Yes	**BAT In place** Air and fuel-gases are under automatic flow control depending on the flow rates of the following; fuel-gas and combustion air, flow rates of individual waste streams, combustion air temperature and excess oxygen in the flue-gas.
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	Yes	**BAT In place** Both incinerators are fitted with DeNOx units that use ammonia via catalyst bed to remove NOx.

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	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 NOX 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).		Each Incinerator has a burner system which ensures that the wastes introduced into the combustion chamber are : • Adequately mixed with Combustion Air and that all liquids are properly atomised. • Raised to a temperature of 1100°C to 1200°C • Given the required residence time. • Combusted in a manner which ensures that the flue gases contain at least 3% excess Oxygen.
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	Yes	**BAT In place** Incinerators campaigned to minimise natural gas consumption and maximise steam output from IN1931. Focus on planning waste to plan incinerator campaigning resulting in minimised shutdowns, gas consumption and tanker budgets. Waste volumes are reviewed weekly and on a quarterly basis "Rebaseline" of the Waste Accountability Programme.
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	Yes	**BAT In place** Air and fuel-gases are under automatic flow control depending on the flow rates of the following; fuel-gas and combustion air, flow rates of individual waste streams, combustion air temperature and excess oxygen in the flue-gas.
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	Yes	**BAT In place** Each Incinerator has a burner system which ensures that the wastes introduced into the combustion chamber are : • Adequately mixed with Combustion Air and that all liquids are

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	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: 4.2.8,4.2.9, 4.2.11, 4.2.19 and 4.2.4.		properly atomised. • Raised to a temperature of 1100°C to 1200°C • Given the required residence time. • Combusted in a manner which ensures that the flue gases contain at least 3% excess Oxygen .
19	in general it is BAT to use those operating conditions (i.e. temperatures, residence times and turbulence) as specified in Article 6 of Directive 2000/76. The use of operating conditions in excess of those that are required for efficient destruction of the waste should generally be avoided. The use of other operating conditions may also be BAT – if they provide for a similar or better level of overall environmental performance. 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.	NA	**BAT In Place** Capability of Incinerator No. 3 to operate on Thermal Oxidiser (TO) mode during periods of low production with prior agreement of EPA.
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.	Yes	**BAT In place** Capability in place to preheat the combustion air where there is excess of steam from the waste heat boiler.
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	Yes	**BAT In place** Incinerator 1 and 3 Pilot burners and RF burners that assist in start up and shut downs in addition to running continuously.
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)	Yes	**BAT In place** RF Burner and main chamber

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	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		The hot flue-gas leaves the combustion chamber via a refractory lined duct to the waste heat boiler. The vertical (Incin No. 3) and angled (Incin 1) installed combustion chambers are completely refractory lined and is designed with a special hastelloy protection system to avoid corrosion by acid gases on critical points such as nozzles, supports etc. Incinerator No.3 has a Waste to Energy Boiler Installed which recovers Heat Generated from Incinerating Waste Liquids.
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	Yes	**BAT In place** • Each Incinerator has a burner system which ensures that the wastes introduced into the combustion chamber are : • Adequately mixed with Combustion Air and that all liquids are properly atomised. • The main combustion parameters are 1150°C at 5 % excess oxygen and a 2-second residence time.
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	NA	N/A
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	Yes	**BAT In place** • The hot flue-gas leaves the combustion chamber via a refractory lined duct to the waste heat boiler.

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	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).		• The waste heat boiler is a water tube boiler with a radiation section and a convection section. The radiation section is an enclosure of water cooled tube walls & is designed to solidify most of the salt, which is contained in the flue-gas that had been formed in the gaseous state due to partial pressure at the combustion temperature. The final cooling (typically exits boiler at 350 deg. C) is achieved in the convection section consisting of a tube bundle with inclined and nearly horizontal tubes.

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
		Yes	**BAT in place**
			• Incinerator No.3 (designed to take <= 0.5% inorganic salts) has a Waste to Energy Boiler Installed which recovers Heat Generated from Incinerating Waste Liquids and in so doing, produces 8 tonnes/hr of steam at 8bar- equivalent to ~70 % of the sites steam requirements thus reduces the natural gas usage on existing site boilers.
			• Capability in place to preheat the combustion air where there is excess of steam from the waste heat boiler.
			• Waste streams with >0.5% inorganic salts are sent to incinerator no. 1 (not fitted with waste heat boiler)
			• Burning high CV (mainly solvent) and low CV (mainly water) wastes at the same time reduces the demand for natural gas and significantly reduces running costs.
			• Each Incinerator has a burner system which ensures that the wastes introduced into the combustion chamber are :
			  • Adequately mixed with Combustion Air and that all liquids are properly atomised.
			  • Raised to a temperature of 1100°C to 1200°C
			  • Given the required residence time.

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	generation technology		• Combusted in a manner which ensures that the flue gases contain at least 3% excess Oxygen. • Annual check of boiler to ensure efficiency (tubes cleaned out)
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	N/A	N/A
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) 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.	N/A	N/A
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	N/A	N/A

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	composition.		
30	the selection of a turbine suited to: a. the electricity and heat supply regime, as described in 4.3.7 b. high electrical efficienc	N/A	N/A
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	N/A	N/A
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	Yes	**BAT In place** Flue gas is used in counter current heat exchanger, flue gas entering is used to reheat gas exiting the DeNOx unit. Flue gas scrubber: Inside the first scrubber stage a heat exchanger transfers the residual heat from combustion to the cooling water circuit. For operation with only minor particulate load, the differential pressure across the scrubber may be lowered in order to save energy. Incinerator No.3 has a Waste to Energy Boiler Installed which recovers Heat Generated from Incinerating Waste Liquids and in so doing, produces 8 tonnes/hr of steam. Blending high and low CV wastes: Burning high CV (mainly solvent) and low CV (mainly water) wastes at the same time reduces the demand for natural gas and significantly reduces running costs.

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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	Yes	**BAT In place** Cooling water temperature controller (TIC 19-2857) Cooling water to the steam condenser is only required in case there is a surplus steam production. The water flow is controlled depending on the cooling water return temperature.
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	Yes	**BAT in Place** The heat recovery boiler generates plant steam and cools incinerator exhaust gas before quenching. However, salt in the incinerator feed condenses in the boiler. As salt accumulates on the boiler tubes, the cooling capacity falls and the efficiency decreases. 3 acoustic blowers were installed in the boiler to prevent the ash/salt from settling on the boiler tubes and annual cleaning of the boiler.
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 listed in Table 5.2 for releases to air associated with the use of BAT.	Yes	**BAT in Place** Refer to Schedule B.1 : Emissions to Air within IE License P0004-04 and Condition 4 Interpretation, these limits for Incinerators No. 1 and No.3 generally provide for the operational emission Levels as listed in Table 5.2. (refer to Column B of Schedule B.1) and reflect the requirements of the Incineration of Waste Directive (2000/76/EC) for existing incineration plants.
	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)		
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	Yes	**BAT in Place** All pertinent factors such as energy consumption, type of waste, its composition and variation, type of combustion process, and its size, flue-gas flow and temperature, flue-gas content, size and rate of fluctuations in composition, target emission limit values, restrictions on discharge of aqueous effluents, plume visibility requirements etc.

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	c. the additional overall-system compatibility issues that may arise when retrofitting existing installations (see 4.4.1.4)		were duly considered and implemented at the time of installation of FGT systems in accordance with Incineration of Waste Directive requirements and with the approval of EPA.
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:	Yes	**BAT in Place** Wet FGT (scrubbing with Sodium Hydroxide solutions carried out in the scrubber unit which is an integral part of each Incinerator.).System in place due to capability of achieving required emission levels for HCl, HF, HBr & SO_2.
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)	NA	NA
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.	Yes	**BAT in Place** DeNOx unit monitored by online continuous NOx monitor and ammonia dosing automatically connected to NOx monitor. In line continuous pH analyser connected to caustic dosing in quench tank.
40	the use of primary (combustion related) NOX reduction measures to reduce NOX 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	Yes	**BAT in Place** Incinerator No. 1 and No. 3 have two stage burner system. The first

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	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. 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).		stage, the RF burner, is sub stoiciometric, and the reducing atmosphere in the burner converts the fuel Nitrogen to N2. The Nitrogen is then ducted into the secondary burner and low levels of Nitrogen Oxides result. Incinerators have Selective Catalytic Nitrogen Reduction (SCNR) units which reduces NOx to N_2 in the presence of Ammonia injected into the catalyst.
41	for the reduction of overall PCDD/F emissions to all environmental media, the use of: see a) to d)	Yes	**BAT in Place** Incinerators have Selective Catalytic Nitrogen Reduction (SCNR) units which reduces NOx to N2 in the presence of Ammonia injected into the catalyst. SCR- DeNOx/DeDioxin system with an integrated superheating device for suppression of visible plume is in place. A super-heater burner increases the flue-gas temperature to the final catalyst operating temperature of 330 °C. by the addition of atomized urea solution; the NOx and potential Dioxins are destructed with high efficiency. Dioxin measurements are undertaken twice yearly & to date have always registered considerably less than the IE Licence limits.
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.	NA	Note: Quench W1 tested biannually for Dioxins in accordance with IE License Schedule C.
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	NA	NA
44	for the control of Hg emissions where wet scrubbers are applied as the only or main effective means of total Hg emission control:	NA	NA

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	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		
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	NA	NA
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)	NA	NA
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	Yes	**BAT in Place** Separate drainage system for stormwater in place in accordance with IE licence requirements and action trigger levels agreed with EPA.
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),	Yes	**BAT in Place** Incinerators scrubbers run off is directed following pH adjustment to the quench vessel in the bio plant , from the quench vessel W1 combines with clarifier overflow from main WWTP plant before being

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	emission levels generally within the operational emission level ranges associated with BAT that are identified in Table 5.4 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 described 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		disposed via main outfall SW01. The purpose of the quench and scrubber is to remove HCl and some dust / molten inorganic salts exiting the boiler. HCL is neutralised in the quench scrubber by addition of caustic (controlled by continuous pH monitoring) and the neutralised water is then sent to the bioplant for disposal. (e) and (f) not applicable.
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	NA	NA

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	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 pretreatment 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		
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.	NA	Note: Ash collection from Incinerator No. 3 waste heat boiler is disposed of off site.
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	NA	NA
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	NA	NA

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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.	NA	NA
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	NA	NA
55	the implementation of noise reduction measures to meet local noise requirements (techniques are described in 4.7 and 3.6)	Applicable	**BAT in Place** Acoustic hoods and/or attenuators are fitted to the Incinerator Gas Fans There is a requirement in the IE Licence for annual Noise monitoring at noise sensitive locations off site adjacent to the plant. The noise levels recorded at noise-sensitive locations as reported to the EPA are within the IE limits during both daytime and night-time.

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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)	Applicable	**BAT in Place** In 2011, GSK Cork was accredited to the Environmental Management System ISO14001. Successful surveillance and recertification audits have been completed since this. All key components of an EMS are in place on site, including, System manual, annual objectives and targets relating to key EHS issues, procedures, monitoring performance through daily, weekly and monthly performance management, and auditing of key components. The site is also accredited to IS018000 (Safety Management System) and the ISO50000 (Energy Management System). All three systems are externally certified.
5.2	**5.2 Specific BAT for municipal waste incineration**	NA	
5.3	**Specific BAT for Pretreated or Selected Municipal Waste Incineration**	NA	
5.4	**Specific BAT for Hazardous Waste Incineration** In addition to the generic measures given in Section 5.1, for hazardous waste incineration BAT is in general considered to be:	Applicable	See comments below:
69	in addition to the quality controls outlined in BAT4, at HWI to use specific systems and procedures, using a risk based approach according to the source of the waste, for the labelling, checking, sampling and testing of waste to be stored/treated (see 4.1.3.4). Analytical procedures should be managed by suitable qualified personnel and using appropriate procedures. In general equipment is required to test: □ the calorific value □ the flashpoint □ PCBs □ Halogens (e.g. Cl, Br, F) and sulphur	Applicable	**BAT in Place** **Currently only site generated process waste is sent for incineration under the following control measures:** The MBR,CBR & SBR indicates where liquid waste is to be routed for each process (i.e. for incineration on or offsite, recovery or WWTP). High CV is taken as waste with specific gravity < 0.95,Low CV as waste with CV> 0.95. Flashpoint is taken from relevant SDS PCBs not applicable. Halogens and heavy metals subject to ELVs within IE licence, contracted sampling and monitoring. ENVP 063 Bulk Waste Characterisation and Storage Compatibility

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	□ heavy metals □ waste compatibility and reactivity □ radioactivity (if not already covered by BAT3 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		procedure in place for introduction of new waste streams into the bulk waste storage tanks. Radioactivity not applicable. As part of the IE License Review, it is proposed to accept waste from offsite (GSK sites within Ireland and other pharmaceutical sites within Ireland) to bring in high calorific, solvent by-product or waste for use as a substitute for natural gas usage in Incinerator No. 3A (IN1931). No change is proposed to the EWC codes currently permitted for disposal in the incinerators, ie 07 05 03 - Organic halogenated solvents, washing liquids and mother liquors and 07 02 04 - Other organic solvents, washing liquids and mother liquors. Waste streams brought to site will be subject to ENVP 063 Bulk Waste Characterisation and Storage Compatibility procedure.
70	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 4.1.5.3 and 4.1.5.6. If shredding is carried out then blanketing with an inert atmosphere should be carried out.	Yes	**BAT in Place** ENVP 063 Bulk Waste Characterisation and Storage Compatibility procedure in place for introduction of new waste streams into the bulk waste storage tanks. Segregation is based on salty and non salty waste streams and high CV and low CV streams. Waste not suitable for incineration on site is sent off site for incineration. Mixing prior to incineration is done in line. Burning high CV (mainly solvent) and low CV (mainly water) wastes at the same time reduces the demand for natural gas and significantly reduces running costs.
71	the use of a feed equalisation system for solid hazardous wastes (e.g. as	NA	NA

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	described in 4.1.5.4 or other similar 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.		
72	the direct injection of liquid and gaseous hazardous wastes, where those wastes require specific reduction of exposure, releases or odour risk, as described in 4.1.6.3	NA	Note 4.1.6.3 applies to Rotary Kilns
73	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 4.2.15), 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)	NA	Note 4.2.15 applies to Water Cooling of Rotary Kilns
74	to reduce installation energy demand and in general, and to achieve an average installation electrical demand (excluding pretreatment or residue treatment) of generally below 0.3 – 0.5 MWh/tonne of waste processed (see 3.5.5 and 4.3.6). 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.	Yes	**BAT in Place** Campaigning of Incinerator to run when there is enough waste to minimise gas consumption Incinerator No. 3 runs preferentially and particularly during the winter months for its ability to provide for site steam demand. Excess steam used to pre heat combustion air. Incin No. 1 Average installation electrical demand of 0.29 MWh/MT of total waste processed (2013 data) Incin No. 3 Average installation electrical demand of 0.18 MWh/MT of total waste processed (2013 data)
75	for merchant HWI and other hazardous waste incinerators feeding wastes of highly varying composition and sources, the use of: a. wet FGT, as described in 4.4.3.1, is generally BAT to provide for improved	N/A	Note: Waste not of highly varying composition and sources.

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	control of short-term air emissions (see concluding remarks 7.4.3 ref. other systems and BAT37 regarding FGT system selection) b. specific techniques for the reduction of elemental iodine and bromine emissions, as described in 4.4.7.1, where such substances exist in the waste at appreciable concentrations		