Conclusions on BAT from the Waste Incineration BAT Reference Document

READ ME:

The European IPPC Bureau provides a draft of '*Conclusions on BAT from the Waste Incineration BAT Reference Document'*, Waste incineration plant must follow this BAT when it is finalised.

In this case, you are required to identify the Conclusions on BAT relevant to your installation. Please use the 'Scope' box to describe the relevant activities/processes that come within the scope of this BREF and clearly identify the Conclusions on BAT (sections and subsections) that are 'Not Applicable'.

For each applicable BAT, in the following table, state the status; 'Yes' or 'Will be' as appropriate in the 'State whether it is in place or state schedule for implementation' box. The use of each of these terms is described below.

Information on compliance in the 'Applicability Assessment' box should include, where applicable, the following:

(i) Identification of the relevant process/ activity or individual emission points that the BAT requirement applies to at your installation;

(ii) Where BAT is to use one or a combination of listed techniques, specify the technique(s) implemented/proposed at your installation to achieve the BAT; and

(iii) A comment on how the requirements are being met or will be met, e.g., a description of the technology/operational controls/management proposed to meet the requirements.

Use of terms:

(a) 'Yes' – To be entered where the installation is currently compliant with this BAT requirement.

(b) 'Will be' – To be entered where a further technique is required to be installed to achieve compliance with the BAT requirement. In this case you must also specify the date by which the installation will comply with the BAT Conclusion requirement.

Zoetis assessment of compliance – CID (EU) 2019/2010 of 12 November 2019 establishing best available techniques (BAT) conclusions for waste incineration.

The full and complete text from the BAT reference document for waste incineration (November 2019) is available at the EIPPC Bureau website: http://eippcb.jrc.ec.europa.eu/reference/

SCOPE: Zoetis Belgium SA (Zoetis) has applied for a revision of the existing site IE Licence P0015-05. As part of the evaluation of the application, the Agency has requested an assessment of the on-site Liquid Vapour Incinerator (LVI) against BAT for waste incineration as defined in the Waste Incineration Commission Implementing Decision ((EU) 2019/2010) (WI CID). The LVI was originally installed at the site in 1998 as a high-temperature thermal oxidiser to treat volatile organic compound (VOC) contaminated vent gases arising from on-site production processes. In 2007 permission was granted to use site-generated waste liquid solvent as a substitute fuel (in place of natural gas) to maintain the combustion temperature for the treatment of VOC contaminated vent gases. The IE Licence revision granted in 2007 (P0015-004) and subsequent revisions (P0015-05) contain conditions specifying full compliance of the LVI with the requirement of the Waste Incineration Directive 2000/76/EC and subsequently Chapter IV of the Industrial Emissions Directive 2010/75/EU. The LVI system consists of a main combustion chamber designed to provide a residence time in excess of two seconds at either 850 or 1,100 °C. The operating temperature is dependent on whether chlorinated solvents are introduced to the LVI system. The hot flue gases are cooled in a steam-raising heat recovery boiler before being treated in a two-stage quench/ caustic scrubber followed by reheat and treatment in an SCR system prior to release to atmosphere.

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
1.1 Environmental management systems		
BAT 1. In order to improve the overall environmental performance, BAT is to elaborate and implement an environmental management system (EMS) that incorporates all of the following features:	Applicable Zoetis maintains an Environmental Management System (EMS) in compliance with Condition 2.2 of the site Industrial Emissions Licence (IEL) (P0015-05).	In place

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i. commitment, leadership, and accountability of the management, including senior management, to the implementation of an effective EMS; ii. an analysis that includes the determination of the organisation's context, the identification of the needs and expectations of interested parties, the identification of characteristics of the installation that are associated with possible risks for the environment (or human health) as well as of the applicable legal requirements relating to the environment; iii. development of an environmental policy that includes the continuous improvement of the environmental performance of the installation; iv. establishing objectives and performance indicators in relation to significant environmental aspects, including safeguarding compliance with applicable legal requirements; v. planning, and implementing the necessary procedures and actions (including corrective and preventive actions where needed), to achieve the environmental objectives and avoid environmental risks; vi. determination of structures, roles and responsibilities in relation to environmental aspects and objectives and provision of the financial and human resources needed; vii. ensuring the necessary competence and awareness of staff whose work may affect the environmental performance of the installation (e.g. by providing information and training); viii. internal and external communication; ix. fostering employee involvement in good environmental management practices;	Each year Zoetis produces an Environmental Management Programme (EMP) which sets out the objectives and targets for the forthcoming year. The EMP is reviewed on an annual basis and changes are reported to the Agency through the Annual Environmental Report (AER). As part of the site EMS and quality management system Zoetis maintain operational procedures in compliance with BAT 1 (i) – (xx) requirements. With respect to benchmarking, Zoetis is a member of the Irish Business and Employers Confederation (IBEC) BioPharmaChem Ireland Responsible Care Group. This group annually reports on performance of its members for a range of environmental indicators including energy use. Using these reports, Zoetis can benchmark their environmental performance against similar sites in Ireland.	

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x. establishing and maintaining a management manual and written procedures to control activities with significant environmental impact as well as relevant records; xi. effective operational planning and process control; xii. implementation of appropriate maintenance programmes; xiii. emergency preparedness and response protocols, including the prevention and/or mitigation of the adverse (environmental) impacts of emergency situations; xiv. when (re)designing a (new) installation or a part thereof, consider its environmental impacts throughout its life, which includes construction, maintenance, operation and decommissioning; xv. implementation of a monitoring and measurement programme. If needed, information can be found in the Reference Report on Monitoring of Emissions to Air and Water from IED Installations; xvi. application of sectoral benchmarking on a regular basis; xvii. periodic independent (as far as practicable), internal auditing and periodic, independent external auditing in order to assess the environmental performance and to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; xviii. evaluation of causes for nonconformities, implementation of corrective actions in response to nonconformities, review of the effectiveness of corrective actions, and determination of whether similar nonconformities exist or could potentially occur; xix. periodic review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness;		

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xx. following and taking into account the development of cleaner techniques. Specifically, for incineration plants and, where relevant, bottom ash treatment plants, BAT is also to incorporate the following features in the EMS: xxi. for incineration plants, waste stream management (see BAT 9); xxii. for bottom ash treatment plants, output quality management (see BAT 10); xxiii. residues management plan including measures aiming to: a. minimise the generation of residues; b. optimise the reuse, regeneration, recycling of, and/or energy recovery from the residues; c. ensure the proper disposal of residues; xxiv. for incineration plants, other than normal operating conditions management plan (see BAT 18); xxv. for incineration plants, accident management plan (see Section 2.4); xxvi. for bottom ash treatment plants, diffuse dust emissions management (see BAT 23); xxvii. odour management plan where an odour nuisance at sensitive receptors is expected and/or has been substantiated (see Section 2.4); xxviii. noise management plan (see also BAT 37) where a noise nuisance at sensitive receptors is expected and/or has been substantiated (see Section 2.4)	Specifically, for incineration plants: • xxi – Zoetis meets the requirements of BAT 9 as discussed later in this document; • xxii – not applicable, Zoetis does not generate or treat bottom ash on-site; • xxiii – the only residue from the Zoetis LVI is waste water from the scrubbing system which is monitored and managed in accordance with the site's IEL; • xxiv – see discussion of BAT 18 below; • xxv – Zoetis has a documented Accident Prevention Policy (APP) in place; • xxvi – not applicable, the Zoetis LVI does not generate bottom ash; • xxvii – the Zoetis pharmaceutical manufacturing site manages potentially odorous materials and processes in line with the requirements of the sites IEL. However, the Zoetis LVI has not been identified as a potential source of odour which could have an off-site impact. No off-site odours complaints have	

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	been notified to Zoetis since recommissioning of the site in 2018. • xxviii – the Zoetis pharmaceutical manufacturing site monitors and manages noise in accordance with the specific requirements of the sites current IEL. Monitoring takes place in accordance with Condition 6.15 and meets noise levels specified in Condition 4.7. The Zoetis LVI has not been identified as a source of noise which could have an off-site impact.	
1.2 Monitoring		
BAT 2. BAT is to determine either the gross electrical efficiency, the gross energy efficiency, or the boiler efficiency of the incineration plant as a whole or of all the relevant parts of the incineration plant	Applicable The applicable BAT AEEL for the Zoetis LVI is boiler efficiency as the LVI treats hazardous waste and has a heat recovery boiler. Boiler efficiency defined as: ratio between boiler output (steam) and waste (and auxiliary fuel) inputs expressed as lower heating values. A formal efficiency test has not been completed on the LVI heat recovery boiler and this was not included in previously completed test programmes. Completing an accurate test would be technically difficult. Whereas the thermal inputs to the LVI in terms of support liquid	See BAT 20

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
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<tr><td></td><td>solvent or natural gas fuel can be characterised, the highly variable nature (and hence variable calorific value) of the vent gases arising from site production processes mitigates against accurate determination of the total thermal inputs to the system.

However, the boiler efficiency can be readily estimated from measurement of the drop in flue gas temperature across the heat recovery boiler as discussed for BAT 20 below.</td><td></td></tr>
<tr><td>BAT 3.

BAT is to monitor key process parameters relevant for emissions to air and water

<table>
<tr><th>Stream/Location</th><th>Parameter (s)</th><th>Monitoring</th></tr>
<tr><td>Flue-gas from the incineration of waste</td><td>Flow, oxygen content, temperature, pressure, vapour content</td><td rowspan="4">Continuous measurement</td></tr>
<tr><td>Combustion chamber</td><td>Temperature</td></tr>
<tr><td>Waste water from wet FGC</td><td>Flow, pH, temperature</td></tr>
<tr><td>Waste water from bottom ash treatment plants</td><td>Flow, pH, conductivity</td></tr>
</table>
</td><td>Applicable

The monitoring of key process parameters is included in the sites current IEL P0015-05 Schedule C: Control & Monitoring.

Zoetis currently monitors all parameters required in BAT 3.

The site does not generate or treat bottom ash on site and consequently no monitoring is required.</td><td>In place</td></tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr>
<td>BAT 4.

BAT is to monitor channelled emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

<table>
<tr><th>Substance/ Parameter</th><th>Process</th><th>Standard(s) (1)</th><th>Minimum monitoring frequency(2)</th><th>Monitoring associated with</th></tr>
<tr><td>NO_X</td><td>Incineration of waste</td><td>Generic EN standards</td><td>Continuous</td><td>BAT 29</td></tr>
<tr><td>NH_3</td><td>Incineration of waste when SNCR and/or SCR is used</td><td>Generic EN standards</td><td>Continuous</td><td>BAT 29</td></tr>
<tr><td>N_2O</td><td>Incineration of waste in fluidised bed furnace
Incineration of waste when SNCR is operated with urea</td><td>EN 21258 (3)</td><td>Once every year</td><td>BAT 29</td></tr>
<tr><td>CO</td><td>Incineration of waste</td><td>Generic EN standards</td><td>Continuous</td><td>BAT 29</td></tr>
<tr><td>SO_2</td><td>Incineration of waste</td><td>Generic EN standards</td><td>Continuous</td><td>BAT 27</td></tr>
</table>
</td>
<td>Applicable

The current site IEL requires:

• the continuous monitoring of NOx (as NO_2), CO, SO_2, HCl, TVOC and dust;

• quarterly monitoring of HF (Note HF is currently monitored continuously);

• biannual monitoring of metals including Cd, Tl, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, NI, and V.

• biannual measurement of PCDD/F

The monitoring requirement conforms to the requirements of the Waste Incineration Directive (and Chapter IV of the Industrial Emissions Directive (IED, 2010/75/EU) and all measured parameters are monitored according to EN standards. Zoetis is currently upgrading the LVI CEMs system to replace and existing unit. Once installed the new system will be subject to QAL 2 calibration and testing as required by IS EN 14181.

Consequently, the Zoetis LVI complies with the requirement of BAT 4 with the following exceptions:</td>
<td>In place subject to exceptions.</td>
</tr>
</table>

Conclusions on BAT					Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
HCl	Incineration of waste	Generic EN standards	Continuous	BAT 27	1. NH_3 (ammonia) monitoring is not required in the sites current IEL or in Chapter IV or Annex VI of the IED. Aqueous ammonia solution is injected into the reheated flue gas prior to the SCR system. The amount of solution injected is controlled by a feedback loop which measures the outlet NOx and the injection rate is automatically adjusted to maintain an output set point. If NOx levels are below the set point no ammonia is injected. The SCR system was installed to facilitate the high temperature oxidation of nitrogen containing VOCs (whether in vapour or liquid form) while still maintain low NOx emissions. Current site operations do not use solvents with a high nitrogen content and the ammonia injection system operates infrequently. The feedback loop ensures that ammonia injection is tailored to the instantaneous NOx level and the final flue gas contains minimal (if any) NH_3 slip. If continuous NH3 monitoring is required under the new licence, Zoetis will examine the feasibility of upgrading the new CEMs to accommodate this requirement N_2O monitoring is not required in the sites current IEL. The Zoetis LVI is not a fluidised bed system, nor does it use SNCR with	
HF	Incineration of waste	Generic EN standards	Continuous[4]	BAT 27		
Dust	Bottom ash treatment	EN 13284-1	Once every year	BAT 26		
	Incineration of waste	Generic EN standards and EN 13284-2	Continuous	BAT 25		
Metals and metalloids except mercury (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, TI, V)	Incineration of waste	EN 14385	Once every six months	BAT 25		
Hg	Incineration of waste	Generic EN standards and EN 14884	Continuous [5])	BAT 31		
TVOC	Incineration of waste	Generic EN standards	Continuous	BAT 30		
PBDD/F	Incineration of waste[6]	No EN standard available	Once every 6 months	BAT 30		
PCDD/F	Incineration of waste	EN 1948-1, EN 1948-2, EN 1948-3	Once every 6 months for short-term sampling	BAT 30		

Conclusions on BAT					Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
		No EN standard available for long-term sampling, EN 1948-2, EN 1948-3	Once every month for long-term sampling (7)	BAT 30	UREA. Consequently, monitoring of N_2O is not required. 2. Bottom ash is neither generated nor treated on site, hence annual testing for dust related to bottom ash treatment is not applicable. 3. Hg (mercury) is not monitored continuously. The Zoetis LVI incinerates liquid solvent waste generated on site. The site does not use Hg in any process operations and hence there is no source of potential Hg contamination on site. The waste is tested regularly and is well characterised with respect to metals and periodic monitoring of Hg emissions in both final flue gas and in FGC effluent since 2007 has indicated either 'not detected' (N.D.) or very low levels of Hg. Consequently, and in accordance with footnote (5) to BAT 4, biannual testing for Hg should remain as the monitoring strategy. 4. PBDD/F is not monitored under the terms of the current IEL. Furthermore, brominated fire retardants are not incinerated on site and bromine is not injected into the incineration system. Consequently, and in accordance with footnote (6) to BAT 4, no monitoring is required. 5. No long-term sampling for PCDD/PCDF is currently carried out nor is it required under the	
Dioxin-like PCBs	Incineration of waste	EN 1948-1, EN 1948-2, EN 1948-4	Once every 6 months for short-term sampling(8)	BAT 30		
		No EN standard available for long-term sampling, EN 1948-2, EN 1948-4	Once every month for long-term sampling (7)(8)	BAT 30		
Benzo[a]pyrene	Incineration of waste	No EN standard available	Once every year	BAT 30		

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
(1) Generic EN standards for continuous measurements are EN 15267-1, EN 15267-2, EN 15267-3, and EN 14181. EN standards for periodic measurements are given in the table or in the footnotes. (2) For periodic monitoring, the monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement. (3) If continuous monitoring of N_2O is applied, the generic EN standards for continuous measurements apply. (4) The continuous measurement of HF may be replaced by periodic measurements with a minimum frequency of once every six months if the HCl emission levels are proven to be sufficiently stable. No EN standard is available for the periodic measurement of HF. (5) For plants incinerating wastes with a proven low and stable mercury content (e.g. mono-streams of waste of a controlled composition), the continuous monitoring of emissions may be replaced by long-term sampling (no EN standard is available for long-term sampling of Hg [to check before publication if an EN standard has become available]) or periodic measurements with a minimum frequency of once every six months. In the latter case the relevant standard is EN 13211. (6) The monitoring only applies to the incineration of waste containing brominated flame retardants or to plants using BAT 31 d with continuous injection of bromine. (7) The monitoring does not apply if the emission levels are proven to be sufficiently stable. (8) The monitoring does not apply where the emissions of dioxin-like PCBs are proven to be less than 0.01 ng WHO-TEQ/Nm^3.	current IEL. However, the site has monitored PCDD/F every six months (when in operation) since 2007 and the data indicates low and stable levels significantly below the current licence ELV of 0.1 ng/Nm^3 TEQ. Consequently, and in accordance with footnote (7) to BAT 4, monitoring every six-months is sufficient for compliance with BAT. 6. Dioxin-like PCBs are not monitored under the terms of the current IEL. Furthermore, Zoetis has not identified any possible source of PCB contamination of the waste streams generated and incinerated on site. Consequently, and in accordance with footnote (8) to BAT 4, no monitoring is required. 7. Benzo(a)pyrene is not monitored under the terms of the current IEL. Furthermore, Zoetis has not identified any possible source of benzo(a)pyrene contamination of the waste streams generated and incinerated on site. Consequently, no monitoring is required.	

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
BAT 5. BAT is to appropriately monitor channelled emissions to air from the incineration plant during other than normal operating conditions (OTNOC). *(The monitoring can be carried out by direct emission measurements (e.g. for the pollutants that are monitored continuously) or by monitoring of surrogate parameters if this proves to be of equivalent or better scientific quality than direct emission measurements. Emissions during start-up and shutdown while no waste is being incinerated, including emissions of PCDD/F, are estimated based on measurement campaigns, e.g. every three years, carried out during planned start-up/shutdown operations.)*	Partially applicable The Zoetis LVI has the facility to switch to natural gas as a support fuel or to shut down completely in the event of OTNOC. Conditions 3.15.5 and 3.16.1 of the IE Licence requires the cessation of waste feed or complete shut-down of the LVI in the event of OTNOC. Zoetis has alternative monitoring arrangements in place in the event that the CEMs system is offline. The alternative monitoring arrangement is in accordance with the alternative monitoring guidance note issued by the Agency in January 2019 and was agreed with the Agency in correspondence dated November 2019.	In place
BAT 6. BAT is to monitor emissions to water from FGC and/or bottom ash treatment with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Applicable The site IE licence currently requires the following monitoring of emission from the FGC system prior to discharge to the sites wate water treatment plant: • continuous monitoring of flow, temperature and pH; • daily measurement of TSS • monthly assessment of Hg, Cd, Tl, As, Pb, Cr, Cu, Ni and Zn • biannual measurement of PCDD/F	Generally, in place. TOC, Mo and Sb to be added to the analytical suite for the monthly FGC waste water sample.

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
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<tr><td>
<table>
<tr><th>Substance/ Parameter</th><th>Process</th><th>Standard(s)</th><th>Minimum monitoring frequency</th><th>Monitoring associated with</th></tr>
<tr><td rowspan="2">Total organic carbon (TOC)</td><td>FGC</td><td rowspan="2">EN 1484</td><td>Once every month</td><td rowspan="15">BAT 34</td></tr>
<tr><td>Bottom ash treatment</td><td>Once every month(1)</td></tr>
<tr><td rowspan="2">Total suspended solids (TSS)</td><td>FGC</td><td>EN 872</td><td>Once every day(2)</td></tr>
<tr><td>Bottom ash treatment</td><td>Once every month(1)</td></tr>
<tr><td>As</td><td>FGC</td><td rowspan="6">Various EN standards available (e.g. EN ISO 11885, EN ISO 15586 or EN ISO 17294-2)</td><td rowspan="6">Once every month</td></tr>
<tr><td>Cd</td><td>FGC</td></tr>
<tr><td>Cr</td><td>FGC</td></tr>
<tr><td>Cu</td><td>FGC</td></tr>
<tr><td>Mo</td><td>FGC</td></tr>
<tr><td>Ni</td><td>FGC</td></tr>
<tr><td rowspan="2">Pb</td><td>FGC</td><td rowspan="2">Once every month</td></tr>
<tr><td>Bottom ash treatment</td><td>Once every month(1)</td></tr>
<tr><td>Sb</td><td>FGC</td><td></td></tr>
<tr><td>Tl</td><td>FGC</td><td></td></tr>
</table>
</td><td>All monitoring is complete according to the relevant EN standard.

Consequently, current site monitoring complies with BAT 6 with the following exceptions:

• Total Organic Carbon (TOC) is not currently measured in the waste water from the FGC system. However, this can be added to the analytical suite for the monthly sample.
• metals Mo and Sb are currently not assessed but can be added to the analytical suite for the monthly sample.
• Monitoring of PCDD/F is biannual rather than monthly. However, PCDD/F levels in the FGC system waste water has been monitored since 2007 and the results indicate very low and stable levels. Consequently, in accordance with footnote (1) to the BAT 6 table, biannual monitoring is sufficient for BAT compliance.
• No bottom ash treatment is undertaken at the facility.</td><td></td></tr>
</table>

Conclusions on BAT					Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
Zn	FGC		Once every month	BAT 34		
Hg	FGC	Various EN standards available (e.g. EN ISO 12846 or EN ISO 17852)				
NH_4-N	Bottom ash treatment	Various EN standards available (e.g. EN ISO 11732, EN ISO 14911)				
Chloride (Cl^-)	Bottom ash treatment	Various EN standards available (e.g. EN ISO 10304- -1, EN ISO 15682)	Once every month (1)			
Sulfate (SO_4^{2-})	Bottom ash treatment	EN ISO 10304-1				
PCDD/F	FGC	No EN standard available	Once every month(1)			
	Bottom ash treatment		Once every 6 months	BAT 34		
(1) The monitoring frequency may be at least once every six months if the emissions are proven to be sufficiently stable. (2) The daily 24-hour flow-proportional composite sampling measurements may be substituted by daily spot sample measurements.						

<table>
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<tr><td>BAT 7.

BAT is to monitor the content of unburnt substances in slags and bottom ashes at the incineration plant with at least the frequency given below and in accordance with EN standards.
<table>
<tr><th>Parameter</th><th>Standard(s)</th><th>Minimum monitoring frequency</th><th>Monitoring associated with</th></tr>
<tr><td>Loss on ignition(1)</td><td>EN 14899, and either EN 15169 or EN 15935</td><td rowspan="2">Once every three months</td><td rowspan="2">BAT 14</td></tr>
<tr><td>Total organic carbon(1)(2)</td><td>EN 14899, and either EN 13137 or EN 15936</td></tr>
</table>
(1) Either the loss on ignition or the total organic carbon is monitored.
(2) Elemental carbon (e.g. determined according to DIN 19539) may be subtracted from the measurement result.</td><td>Not applicable

The Zoetis LVI burns liquid waste only and does not produce slags or bottom ash.</td><td>Not applicable</td></tr>
<tr><td>BAT 8.

For the incineration of hazardous waste containing POPs, BAT is to determine the POP content in the output streams (e.g. slags and bottom ashes, flue-gas, waste water) after the commissioning of the incineration plant and after each change that may significantly affect the POP content in the output streams.</td><td>Not applicable

The Zoetis waste streams incinerated in the LVI do not contain persistent organic pollutants (POPs).</td><td>Not applicable</td></tr>
</table>

<table>
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<tr><td>1.3 General environmental and combustion performance</td><td></td><td></td></tr>
<tr><td>BAT 9.

In order to improve the overall environmental performance of the incineration plant, as part of the waste stream management plan (see BAT 1), BAT is to use all of the techniques (a) to (d) given below, and, where relevant, also techniques (e) and (f).

<table><tr><th></th><th>Technique</th><th>Description</th></tr><tr><td>a)</td><td>Determination of the types of waste that can be incinerated</td><td>Based on the characteristics of the incineration plant, identification of the types of waste which can be incinerated in terms of, for example, the physical state the chemical characteristics, the hazardous properties, and the acceptable ranges of calorific value, humidity, ash content and size.</td></tr><tr><td>b)</td><td>Set-up and implementation of waste characterisation and pre-acceptance procedures</td><td>These procedures aim to ensure the technical (and legal) suitability of waste treatment operations for a particular waste prior to the arrival of the waste at the plant. They include procedures to collect information about the waste input and may include waste sampling and characterisation to achieve sufficient knowledge of the waste composition. Waste pre-acceptance procedures are risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).</td></tr></table></td><td>Applicable

Techniques (a) to (d) are applicable.

The sites IEL defines the waste that can be incinerated in the on-site LVI, i.e.:

• limited to waste generated on-site;
• EWC 070504 “other organic solvents, washing liquids and mother liquors” with a calorific value between 10,000 and 50,000 kJ/kg.

Each batch of waste sent from production to the LVI plant is subject to analysis in accordance with Annex C4 of the IEL.

All waste streams are analysed by a cross functional team and segregated based on composition. Solvent which is determined to be fit for burning is sent to two dedicated tanks. Once these tanks are full, a sample is sent for analysis. If the analysis shows that the solvent meets the criteria for burning it is sent to the LVI tank. Once the LVI tank is full a sample is taken for analysis and</td><td>In place</td></tr>
</table>

Conclusions on BAT		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
c) Set-up and implementation of waste acceptance procedures	Acceptance procedures aim to confirm the characteristics of the waste, as identified at the pre-acceptance stage. These procedures define the elements to be verified upon the delivery of the waste at the plant as well as the waste acceptance and rejection criteria. They may include waste sampling, inspection and analysis. Waste acceptance procedures are risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s). The elements to be monitored for each type of waste are detailed in BAT 11	if the contents again meet the criteria for burning then it will be sent forward into the LVI	
d) Set-up and implementation a waste tracking system and inventory	A waste tracking system and inventory aims to track the location and quantity of waste in the plant. It holds all the information generated during waste pre-acceptance procedures (e.g. date of arrival at the plant and unique reference number of the waste, information on the previous waste holder(s), pre-acceptance and acceptance analysis results, nature and quantity of waste held on site including all identified hazards), acceptance, storage, treatment and/or transfer off site. The waste tracking system is risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s). The waste tracking system includes clear labelling of wastes that are stored in places other than the waste bunker or sludge storage tank (e.g. in containers, drums, bales or other forms of packaging) such that they can be identified at all times.		
e) Waste segregation	Wastes are kept separated depending on their properties in order to enable easier and environmentally safer storage and		

Conclusions on BAT		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	incineration. Waste segregation relies on the physical separation of different wastes and on procedures that identify when and where wastes are stored.		
f) Verification of waste compatibility prior to mixing or blending of waste	Compatibility is ensured by a set of verification measures and tests in order to detect any unwanted and/or potentially dangerous chemical reactions between wastes (e.g. polymerisation, gas evolution, exothermal reaction, decomposition) upon mixing or blending. The compatibility tests are risk-based considering, for example, the hazardous properties of the waste, the risks posed by the waste in terms of process safety, occupational safety and environmental impact, as well as the information provided by the previous waste holder(s).		
BAT 10. BAT is to set up and implement an output quality management system (see BAT 1) in order to improve the overall environmental performance of the bottom ash treatment plant. Description An output quality management system is set up and implemented so as to ensure that the output of the bottom ash treatment is in line with expectations, using existing EN standards where available. This management system also allows the performance of the bottom ash treatment to be monitored and optimised.		Not Applicable Bottom ash is neither generated nor treated at the Zoetis LVI.	Not Applicable

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>BAT 11
In order to improve the overall environmental performance of the incineration plant, BAT is to monitor the waste deliveries as part of the waste acceptance procedures (see BAT 9 c) including, depending on the risk posed by the coming waste, the elements given below.

<table>
<tr><th>Waste type</th><th>Monitoring</th></tr>
<tr><td>Municipal solid waste and other non-hazardous waste</td><td>• Radioactivity detection
• Weighing of the waste deliveries
• Visual inspection
• Periodic sampling of individual deliveries and analysis of key properties/substances (e.g. calorific value, content of halogens and metals/metalloids). For municipal solid waste, this involves separate unloading</td></tr>
<tr><td>Sewage sludge</td><td>• Weighing of the waste deliveries (or measuring the flow if the sewage sludge is delivered via pipeline)
• Visual inspection, as far as technically possible
• Periodic sampling and analysis of key properties/substances (e.g. calorific value, content of water, ash and mercury)</td></tr>
<tr><td>Hazardous waste</td><td>• Radioactivity detection
• Weighing of the waste deliveries
• Visual inspection, as far as technically possible
• Control and comparison of individual waste deliveries with the declaration of the waste producer
• Sampling of the content of:
– all bulk tankers and trailers</td></tr>
</table>
</td><td>Not Applicable

The only waste incinerated in the Zoetis LVI is site generated waste solvents which are well characterised.</td><td>Not Applicable</td></tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>
<table>
<tr><td></td><td>– packed waste (e.g. in drums, intermediate bulk containers (IBCs) or smaller packaging)
• and analysis of:
– combustion parameters (including calorific value and flashpoint)
– waste compatibility, to detect possible hazardous reactions upon blending or mixing wastes, prior to storage (BAT 9 f)
– key substances including POPs, halogens and sulphur, metals/metalloids</td></tr>
<tr><td>Clinical waste</td><td>• Radioactivity detection
• Weighing of the waste deliveries
• Visual inspection of the packaging integrity</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>BAT 12.

In order to reduce the environmental risks associated with the reception, handling and storage of waste, BAT is to use both of the techniques given below:

<table>
<tr><th>Technique</th><th>Description</th></tr>
<tr><td>Impermeable surfaces with an adequate drainage infrastructure</td><td>Depending on the risks posed by the waste in terms of soil or water contamination, the surface of the waste reception, handling and storage areas is made impermeable to the liquids concerned and fitted with an adequate drainage infrastructure (see BAT 32). The integrity of this surface is periodically verified, as far as technically possible.</td></tr>
<tr><td>Adequate waste storage capacity</td><td>Measures are taken to avoid accumulation of waste, such as:</td></tr>
</table>
</td><td>Applicable

All waste is stored in tanks with adequate capacity. All tanks are bunded and integrity tested. The bunds are sized for the tanks. The tanks are nitrogen blanketed. The tanks are on the SCADA and, once full, the inlet valve is interlocked to prevent overfilling</td><td>In place</td></tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>

- the maximum waste storage capacity is clearly established and not exceeded, taking into account the characteristics of the wastes (e.g. regarding the risk of fire) and the treatment capacity;
- the quantity of waste stored is regularly monitored against the maximum allowed storage capacity;
- for wastes that are not mixed during storage (e.g. clinical waste, packed waste), the maximum residence time is clearly established.

</td><td></td><td></td></tr>
<tr><td>

BAT 13.

In order to reduce the environmental risk associated with the storage and handling of clinical waste, BAT is to use a combination of the techniques given below.

<table>
<tr><th>Technique</th><th>Description</th></tr>
<tr><td>Automated or semi-automated waste handling</td><td>Clinical wastes are unloaded from the truck to the storage area using an automated or manual system depending on the risk posed by this operation. From the storage area the clinical wastes are fed into the furnace by an automated feeding system.</td></tr>
<tr><td>Incineration of non-reusable sealed containers, if used</td><td>Clinical waste is delivered in sealed and robust combustible containers that are never opened throughout storage and handling operations. If needles and sharps are disposed of in them, the containers are puncture-proof as well.</td></tr>
<tr><td>Cleaning and disinfection of reusable containers, if used</td><td>Reusable waste containers are cleaned in a designated cleaning area and disinfected in a Facility specifically designed for</td></tr>
</table>

</td><td>Not Applicable

The Zoetis LVI does not incinerate clinical waste</td><td>Not Applicable</td></tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>
<table>
<tr><td></td><td></td><td>disinfection. Any leftovers from the cleaning operations are incinerated</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>BAT 14.

In order to improve the overall environmental performance of the incineration of waste, to reduce the content of unburnt substances in slags and bottom ashes, and to reduce emissions to air from the incineration of waste, BAT is to use an appropriate combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a)</td><td>Waste blending and mixing</td><td>Waste blending and mixing prior to incineration includes for example the following operations:
• bunker crane mixing;
• using a feed equalisation system;
blending of compatible liquid and pasty wastes. In some cases, solid wastes are shredded prior to mixing.</td><td>Not applicable where direct furnace feeding is required due to safety considerations or waste characteristics (e.g. infectious clinical waste, odorous wastes, or wastes that are prone to releasing volatile substances).
Not applicable where undesired reactions may occur between different types of waste (see BAT 9 f)</td></tr>
<tr><td>b)</td><td>Advanced control system</td><td>See Section 2.1</td><td>Generally applicable</td></tr>
<tr><td>c)</td><td>Optimisation of the incineration process</td><td>See Section 2.1</td><td>Optimisation of the design is not applicable to existing furnaces</td></tr>
</table>
</td><td>Partially Applicable

The Zoetis LVI is equipped with an advanced combustion control system which optimises the incineration process ensuring a high and steady incineration temperature and adequate excess air to ensure complete combustion.

Compatible liquid wastes are mixed in dedicated LVI storage tanks. A jet mixer in the LVI solvent tank optimises complete mixing so that there is no settling of solvents.

The Zoetis LVI does not produce slags or bottom ash</td><td>In place</td></tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>Table 1: BAT-associated environmental performance levels for unburnt substances in slags and bottom ashes from the incineration of waste
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT-AEPL</th></tr>
<tr><td>TOC content in slags and bottom ashes (1)</td><td>Dry wt-%</td><td>1–3 (2)</td></tr>
<tr><td>Loss on ignition of slags and bottom ashes (1)</td><td>Dry wt-%</td><td>1–5 (2)</td></tr>
</table>
(1) Either the BAT-AEPL for TOC content or the BAT-AEPL for the loss on ignition applies.
(2) The lower end of the BAT-AEPL range can be achieved when using fluidised bed furnaces or rotary kilns operated in slagging mode.</td><td></td><td></td></tr>
<tr><td>BAT 15.

In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement procedures for the adjustment of the plant’s settings, e.g. through the advanced control system (see description in Section 2.1), as and when needed and practicable, based on the characterisation and control of the waste (see BAT 11).</td><td>Applicable

The Zoetis LVI is equipped with an advanced combustion control system which optimised the incineration process ensuring a high and steady incineration temperature and adequate excess air to ensure complete combustion.

The flue gas cleaning system is also subject to automatic control to optimise the removal of potential pollutants before release to atmosphere.</td><td>In place</td></tr>
</table>

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
BAT 16. In order to improve the overall environmental performance of the incineration plant and to reduce emissions to air, BAT is to set up and implement operational procedures (e.g. organisation of the supply chain, continuous rather than batch operation) to limit as far as practicable shutdown and start-up operations.	Applicable The Zoetis LVI does not accept waste from off-site. The amount of waste to be incinerated is dictated by production activity at the Zoetis pharmaceutical production facility as well as the production of waste gases for high temperature treatment. However, the waste is stored and, if necessary, blended to ensure a consistent waste quality and LVI operation is optimised to minimise start-ups and shut-downs. Furthermore, the LVI deals with liquid waste only as a substitute for natural gas as a support fuel for the high temperate oxidation of waste gases from the production facility. Consequently, the start-up and shut-down of liquid waste incineration operations is completed with no increase in environmental impact.	In place
BAT 17. In order to reduce emissions to air and, where relevant, to water from the incineration plant, BAT is to ensure that the FGC system and the waste water treatment plant are appropriately designed (e.g. considering the maximum flow rate and pollutant concentrations), operated within their design range, and maintained so as to ensure optimal availability.	Applicable The Zoetis LVI was specifically designed to treat waste gas from the on-site production facility. The support fuel for waste gas treatment is either natural gas or site generated liquid solvent wastes. The LVI is operated at all times well within its design range and is operated and maintained to ensure optimal availability.	In Place

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
BAT 18. In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions to air and, where relevant, to water from the incineration plant during OTNOC, BAT is to set up and implement a risk-based OTNOC management plan as part of the environmental management system (see BAT 1) that includes all of the following elements: a. identification of potential OTNOC (e.g. failure of equipment critical to the protection of the environment ('critical equipment')), of their root causes and of their potential consequences, and regular review and update of the list of identified OTNOC following the periodic assessment below; b. appropriate design of critical equipment (e.g. compartmentalisation of the bag filter, techniques to heat up the flue-gas and obviate the need to bypass the bag filter during start-up and shutdown, etc.); c. set-up and implementation of a preventive maintenance plan for critical equipment (see BAT 1 xii); d. monitoring and recording of emissions during OTNOC and associated circumstances (see BAT 5); e. periodic assessment of the emissions occurring during OTNOC (e.g. frequency of events, duration, amount of pollutants emitted) and implementation of corrective actions if necessary	Partially applicable The LVI was designed to provide a high level of availability and low levels of unforeseen outage. This combined with a preventative maintenance programme and the inherent simplicity of a liquid waste incinerator has ensured very high levels of availability. As stated previously, operating of the LVI with liquid waste fuel does not take place in the event of any failure of the incineration or FGC system, with the LVI switching back to natural gas as a support fuel or a full shut-down of the LVI. Zoetis has alternative monitoring arrangements in place in the event that the CEMs system is offline. The alternative monitoring arrangement is in accordance with the alternative monitoring guidance note issued by the Agency in January 2019 and was agreed with the Agency in correspondence dated November 2019	In place where applicable

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>1.4 Energy efficiency</td><td></td><td></td></tr>
<tr><td>BAT 19.

In order to increase the resource efficiency of the incineration plant, BAT is to use a heat recovery boiler.

“The energy contained in the flue-gas is recovered in a heat recovery boiler producing hot water and/or steam, which may be exported, used internally, and/or used to produce electricity.”</td><td>Applicable

The Zoetis LVI is equipped with a heat recovery boiler which produces steam that is fed into the sites steam distribution system.</td><td>In place</td></tr>
<tr><td>BAT 20.

In order to increase the energy efficiency of the incineration plant, BAT is to use an appropriate combination of the techniques given below.
<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a)</td><td>Drying of sewage sludge</td><td>After mechanical dewatering, sewage sludge is further dried, using for example low-grade heat, before it is fed to the furnace.
The extent to which sludge can be dried depends on the furnace feeding system</td><td>Applicable within the constraints associated with the availability of low-grade heat</td></tr>
<tr><td>b)</td><td>Reduction of the flue-gas flow</td><td>The flue-gas flow is reduced through, e.g.:
• improving the primary and secondary combustion air distribution;
• flue-gas recirculation (see Section 2.2)</td><td>For existing plants, the applicability of flue-gas recirculation may be limited due to technical constraints (e.g. pollutant load in the</td></tr>
</table></td><td>Partially applicable

Techniques a, b, e, f, g, h and i are not applicable to the Zoetis LVI

With respect to Techniques c and d, the Zoetis LVI system was originally designed with a heat recovery boiler and heat recovery as a design objective.

The boiler is fully insulated to minimise heat loss and the boiler design was chosen for heat recovery efficiency bearing in mind the requirement for very high availability.</td><td>In place, where appropriate</td></tr>
</table>

Conclusions on BAT				Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
		A smaller flue-gas flow reduces the energy demand of the plant (e.g. for induced draft fans).	flue-gas, incineration conditions)	As described under BAT 2 above, direct measurement of the boiler efficiency has not been completed and accurate measurement is problematic as a result of the highly variable nature of thermal inputs. However, boiler efficiency can be estimated from flue gas temperature measurements on the basis of temperature drop across the boiler (assuming minimal radiation losses through the boiler surfaces). The normal combustion chamber temperature is either 900 or 1,150 °C (depending on whether halogenated solvents are being incinerated). The back-end temperature of the boiler before the quench scrubbing system is consistently below 250 °C. The boiler efficiency is therefore estimated to be in the range 70 – 75%. This range is well within the BAT 20 range for boiler efficiency of 60 – 80%.	
c)	Minimisation of heat losses	Heat losses are minimised through, e.g.: • use of integral furnace-boilers, allowing for heat to also be recovered from the furnace sides; • thermal insulation of furnaces and boilers; • flue-gas recirculation (see Section 2.2); • recovery of heat from the cooling of slags and bottom ashes (see BAT 20 i).	Integral furnace-boilers are not applicable to rotary kilns or to other furnaces dedicated to the high-temperature incineration of hazardous waste		
d)	Optimisation of the boiler design	The heat transfer in the boiler is improved by optimising, for example, the: • flue-gas velocity and distribution; • water/steam circulation; • convection bundles; • on-line and off-line boiler cleaning systems in order to minimise the fouling of the convection bundles.	Applicable to new plants and to major retrofits of existing plants		
e)	Low-temperature flue-gas heat exchangers	Special corrosion-resistant heat exchangers are used to recover additional energy from the flue-gas at the boiler exit, after an ESP, or after a dry sorbent injection system	Applicable within the constraints of the operating temperature profile of the FGC system. In the case of existing plants, the applicability may be limited by a lack of space.		

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
f)	High steam conditions	The higher the steam conditions (temperature and pressure), the higher the electricity conversion efficiency allowed by the steam cycle. Working at high steam conditions (e.g. above 45 bar, 400 °C) requires the use of special steel alloys or refractory cladding to protect the boiler sections that are exposed to the highest temperatures.	Applicable to new plants and to major retrofits of existing plants, where the plant is mainly oriented towards the generation of electricity. The applicability may be limited by: • the stickiness of the fly ashes; • the corrosiveness of the flue-gas.		
g)	Cogeneration	Cogeneration of heat and electricity where the heat (mainly from the steam that leaves the turbine) is used for producing hot water/steam to be used in industrial processes/activities or in a district heating/cooling network	Applicable within the constraints associated with the local heat and power demand and/or availability of networks.		
h)	Flue-gas condenser	A heat exchanger where the water vapour contained in the flue-gas condenses, transferring the latent heat to water at a sufficiently low temperature (e.g. return flow of a district heating network). The flue-gas condenser also provides co-benefits by reducing emissions to air (e.g. of dust and acid gases).	Applicable within the constraints associated with the demand for low-temperature heat, e.g. by the availability of a district heating network with a sufficiently low return temperature.		

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation

	The use of heat pumps can increase the amount of energy recovered from flue-gas condensation	
i) Dry bottom ash handling	Dry, hot bottom ash falls from the grate onto a transport system and is cooled down by ambient air. Useful energy is recovered by using the cooling air for combustion	Only applicable to grate furnaces. There may be technical restrictions that prevent retrofitting to existing furnaces.

BAT-associated energy efficiency levels (BAT-AEELs) for incineration

Plant	BAT-AEEL (%)			
	Municipal solid waste, other non-hazardous waste and hazardous wood waste		Hazardous waste other than hazardous wood waste (1)	Sewage sludge
	Gross electrical efficiency (%)(2) (3)	Gross energy efficiency (%) (4)	Boiler efficiency	
New plant	25–35	72–91(5)	60-80	60-70(6)
Existing plant	20 - 35			

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
((1) The BAT-AEEL only applies where a heat recovery boiler is applicable. (2) The BAT-AEELs for gross electrical efficiency only apply to plants or parts of plants producing electricity using a condensing turbine. (3) The higher end of the BAT-AEEL range can be achieved when using BAT 20 f. (4) The BAT-AEELs for gross energy efficiency only apply to plants or parts of plants producing only heat or producing electricity using a back-pressure turbine and heat with the steam leaving the turbine. (5) A gross energy efficiency exceeding the higher end of the BAT-AEEL range (even above 100 %) can be achieved where a flue-gas condenser is used. (6) For the incineration of sewage sludge, the boiler efficiency is highly dependent on the water content of the sewage sludge as fed into the furnace.		
1.5 Emission to air 1.5.1 Diffuse emissions		
BAT 21. In order to prevent or reduce diffuse emissions from the incineration plant, including odour emissions, BAT is to: a. store solid and bulk pasty wastes that are odorous and/or prone to releasing volatile substances in enclosed buildings under controlled sub atmospheric pressure and use the extracted air as combustion air for incineration or send it to another suitable abatement system in the case of a risk of explosion;	Partially applicable The only Technique applicable to the Zoetis LVI is (b). The storage tanks used for the storage of LVI liquid wastes are under appropriate pressure and fitted with conservation vents to minimise releases of diffuse emissions.	In place

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
b. store liquid wastes in tanks under appropriate controlled pressure and duct the tank vents to the combustion air feed or to another suitable abatement system; c. control the risk of odour during complete shutdown periods when no incineration capacity is available, e.g. by: ▪ sending the vented or extracted air to an alternative abatement system, e.g. a wet scrubber, a fixed adsorption bed; ▪ minimising the amount of waste in storage, e.g. by interrupting, reducing or transferring waste deliveries, as a part of waste stream management (see BAT 9); ▪ storing waste in properly sealed bales.		
BAT 22. In order to prevent diffuse emissions of volatile compounds from the handling of gaseous and liquid wastes that are odorous and/or prone to releasing volatile substances at incineration plants, BAT is to feed them to the furnace by direct feeding. Description For gaseous and liquid wastes delivered in bulk waste containers (e.g. tankers), direct feeding is carried out by connecting the waste container to the furnace feeding line. The container is then emptied by pressurising it with nitrogen or, if the viscosity is low enough, by pumping the liquid.	Applicable All liquid waste is fed directly to the LVI via a dedicated burner lance.	In place

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>For gaseous and liquid wastes delivered in waste containers suitable for incineration (e.g. drums), direct feeding is carried out by introducing the containers directly in the furnace</td><td></td><td></td></tr>
<tr><td>BAT 23.

In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to include in the environmental management system (see BAT 1) the following diffuse dust emissions management features:
a. identification of the most relevant diffuse dust emission sources (e.g. using EN 15445);
b. definition and implementation of appropriate actions and techniques to prevent or reduce diffuse emissions over a given time frame.</td><td>Not applicable

The Zoetis LVI does not produce or treat slags or bottom ash.</td><td>Not applicable</td></tr>
<tr><td>BAT 24.

In order to prevent or reduce diffuse dust emissions to air from the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below.

<table><tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>a)</td><td>Enclose and cover equipment</td><td>Enclose/encapsulate potentially dusty operations (such as grinding, screening) and/or cover conveyors and elevators.
Enclosure can also be accomplished by installing all of the equipment in a closed building.</td><td>Installing the equipment in a closed building may not be applicable to mobile treatment devices</td></tr></table></td><td>Not Applicable

The Zoetis LVI does not produce or treat slags or bottom ash.</td><td>Not Applicable</td></tr>
</table>

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
b) Limit height of discharge	Match the discharge height to the varying height of the heap, automatically if possible (e.g. conveyor belts with adjustable heights)	Generally applicable		
c) Protect stockpiles against prevailing winds	Protect bulk storage areas or stockpiles with covers or wind barriers such as screening, walling or vertical greenery, as well as correctly orienting the stockpiles in relation to the prevailing wind	Generally applicable		
d) Use water sprays	Install water spray systems at the main sources of diffuse dust emissions. The humidification of dust particles aids dust agglomeration and settling. Diffuse dust emissions at stockpiles are reduced by ensuring appropriate humidification of the charging and discharging points, or of the stockpiles themselves.	Generally applicable		
e) Optimise moisture content	Optimise the moisture content of the slags/bottom ashes to the level required for efficient recovery of metals and mineral materials while minimising the dust release.	Generally aplicable		

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>
<table>
<tr><td>f) Operate under subatmospheric pressure</td><td>The treatment of slags and bottom ashes is carried out in enclosed equipment or buildings (see technique a) under subatmospheric pressure to enable treatment of the extracted air with an abatement technique (see BAT 26) as channelled emissions.</td><td>Only applicable to dry-discharged and other low-moisture bottom ashes</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>1.5.2 Channelled emissions

Emissions of dust, metals and metalloids</td><td></td><td></td></tr>
<tr><td>BAT 25.

In order to reduce channelled emissions to air of dust, metals and metalloids from the incineration of waste, BAT is to use one or a combination of the techniques given below.

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a) Bag filter</td><td>See Section 2.2</td><td>Generally applicable to new plants.
Applicable to existing plants within the constraints associated with the</td></tr>
</table>
</td><td>Partially applicable

The Zoetis LVI treats waste gases and site generated liquid waste with very low ash/solids/metals content.

The FGC system comprises a water quench, a pH-controlled scrubber followed by reheat and then an SCR DENOX system.

Emission data since 2007 indicates that emissions of dust, metals and metalloids are very low and well below the emission limit values specified in the sites current IE Licence.

Consequently, the only Technique of relevance under BAT 25 is (d). The liquid wastes incinerated in the LVI</td><td>In place where appropriate</td></tr>
</table>

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
		operating temperature profile of the FGC system.	have very low solid content and consequently produce little or no ash/particulate in the resulting flue gas. A wet scrubbing system, whereas not primarily designed to capture particulate, is more than sufficient to deal with any dust/metal or metalloid loading that occurs. The LVI system was designed in 1998 and 2007 to comply with the dust and metal emission limit values specified in the Waste Incineration Directive and Chapter IV of IED The daily ELVs in the current IE licence are: Dust : 10 mg/Nm^3 Cd & Tl : 0.05 mg/Nm^3 Other metals : 0.5 mg/Nm^3 The higher end of the BAT AELs indicated in Table 3 of BAT 25 range from 30% to 60% lower than the current ELVs. However, actual performance of the LVI with regard to these parameters has been excellent. Consequently, Zoetis is confident that the LVI can meet the upper end of the BAT 25 ELVs as daily averages or average over the sampling period, i.e.: Dust :7 mg/Nm^3 (see footnote 1 to Table 3) Cd+Tl :0.02 mg/Nm^3 (average over sampling period)	
b) Electrostatic precipitator	See Section 2.2	Generally applicable		
c) Dry sorbent injection	See Section 2.2. Not relevant for the reduction of dust emissions. Adsorption of metals by injection of activated carbon or other reagents in combination with a dry sorbent injection system or a semi-wet absorber that is used to reduce acid gas emissions.	Generally applicable		
d) Wet scrubber	See Section 2.2. Wet scrubbing systems are not used to remove the main dust load but, installed after other abatement techniques, to further reduce the concentrations of dust, metals and metalloids in the flue-gas	There may be applicability restrictions due to low water availability, e.g. in arid areas		
e) Fixed- or moving-bed adsorption	See Section 2.2. The system is used mainly to adsorb mercury and other metals and metalloids as well as organic compounds including PCDD/F, but	The applicability may be limited by the overall pressure drop associated with the FGC system configuration. In the case of existing plants, the applicability may be limited by a lack of space.		

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>also acts as an effective polishing filter for dust.

Table 3: BAT-associated emission levels (BAT-AELs) for channelled emissions to air of dust, metals and metalloids from the incineration of waste.

<table>
<tr><th>Parameter</th><th>BAT-AEL (mg/Nm³)</th><th>Averaging period</th></tr>
<tr><td>Dust</td><td><2–5 (1)</td><td>Daily average</td></tr>
<tr><td>Cd + Tl</td><td>0.005–0.02</td><td>Average over the sampling period</td></tr>
<tr><td>Sb + As + Pb + Cr + Co + Cu+ Mn + Ni + V</td><td>0.01–0.3</td><td>Average over the sampling period</td></tr>
</table>
(1) For existing plants dedicated to the incineration of hazardous waste and for which a bag filter is not applicable, the higher end of the BAT-AEL range is 7 mg/Nm³.</td><td>Other metals :0.3 mg/Nm³ (average over the sampling period.</td><td></td></tr>
<tr><td>BAT 26.

In order to reduce channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air (see BAT 24 f), BAT is to treat the extracted air with a bag filter (see Section 2.2).

Table 4: BAT-associated emission levels (BAT-AELs) for channelled dust emissions to air from the enclosed treatment of slags and bottom ashes with extraction of air.</td><td>Not Applicable

The Zoetis LVI does not produce or treat slags or bottom ash.</td><td>Not Applicable</td></tr>
</table>

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
Parameter BAT-AEL (mg/Nm^3) Averaging period Dust 2–5 Average over the sampling period		
Emissions of HCl, HF and SO_2		
BAT 27. In order to reduce channelled emissions of HCl, HF and SO_2 to air from the incineration of waste, BAT is to use one or a combination of the techniques given below. a) Wet scrubber — There may be applicability restrictions due to low water availability, e.g. in arid areas b) Semi-wet absorber — Generally applicable c) Dry sorbent injection — Generally applicable d) Direct desulphurisation — Only applicable to fluidised bed furnaces e) Boiler sorbent injection — Generally applicable	Applicable The LVI is equipped with a quench/scrubber to reduce/eliminate emission of HCl, HF and SO_2.	In place

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>BAT 28.

In order to reduce channelled peak emissions of HCl, HF and SO_2 to air from the incineration of waste while limiting the consumption of reagents and the amount of residues generated from dry sorbent injection and semi-wet absorbers, BAT is to use technique (a) or both of the techniques given below.

<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a)</td><td>Optimised and automated reagent dosage</td><td>The use of continuous HCl and/or SO_2 measurements (and/or of other parameters that may prove useful for this purpose) upstream and/or downstream of the FGC system for the optimisation of the automated reagent dosage</td><td>Generally applicable</td></tr>
<tr><td>b)</td><td>Recirculation of reagents</td><td>The recirculation of a proportion of the collected FGC solids to reduce the amount of unreacted reagent(s) in the residues.
The technique is particularly relevant in the case of FGC techniques operating with a high stoichiometric excess.</td><td>Generally applicable to new plants.
Applicable to existing plants within the constraints of the size of the bag filter.</td></tr>
</table>
</td><td>Not Applicable Re BAT.. see comment on BAT AELs

The Zoetis LVI does not employ dry sorbent injection or semi-wet adsorbers.</td><td>Not Applicable</td></tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr>
<td>Table 5 : BAT-associated emission levels (BAT-AELs) for channelled emissions to air of HCl, HF and SO_2 from the incineration of waste.

<table>
<tr><th rowspan="2">Parameter</th><th colspan="2">BAT-AEL (mg/Nm^3)</th><th rowspan="2">Averaging period</th></tr>
<tr><th>New plants</th><th>Existing plants</th></tr>
<tr><td>HCl</td><td><2 – 6 (1)</td><td><2 – 8 (1)</td><td>Daily average</td></tr>
<tr><td>HF</td><td><1</td><td><1</td><td>Daily average or average over the sampling period</td></tr>
<tr><td>SO_2</td><td>5 – 30</td><td>5 – 40</td><td>Daily average</td></tr>
<tr><td colspan="4">(1) The lower end of the BAT-AEL range can be achieved when using a wet scrubber; the higher end of the range may be associated with the use of dry sorbent injection.</td></tr>
</table>
</td>
<td>The LVI system was designed in 1998 and 2007 to comply with the HCl, HF and SO_2 emission limit values specified in the Waste Incineration Directive and Chapter IV of IED

The daily ELVs in the current IE licence are:

HCl : 10 mg/Nm^3
HF : 1 mg/Nm^3
SO2 : 50 mg/Nm^3

The higher end of the BAT AELs are 20% lower than the current ELVs for HCl and SO_2 However,actual performance of the LVI with regard to these parameters has been good, i.e. low level of emissions below the current ELV.

Consequently, Zoetis is confident that the LVI can meet the upper end of the BAT 28 ELVs as daily averages, i.e:

HCl : 8 mg/Nm^3
HF : 1 mg/Nm^3
SO_2 : 40 mg/Nm^3</td>
<td></td>
</tr>
</table>

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr>
<td>Emissions of NO_X, N_2O, CO and NH_3
BAT 29.

In order to reduce channelled NO_X emissions to air while limiting the emissions of CO and N_2O from the incineration of waste and the emissions of NH_3 from the use of SNCR and/or SCR, BAT is to use an appropriate combination of the techniques given below.

<table>
<tr><th></th><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a)</td><td>Optimisation of the incineration process</td><td>See Section 2.1</td><td>Generally applicable</td></tr>
<tr><td>b)</td><td>Flue-gas recirculation</td><td>See Section 2.2</td><td>For existing plants, the applicability may be limited due to technical constraints (e.g. pollutant load in the flue-gas, incineration conditions)</td></tr>
<tr><td>c)</td><td>Selective non-catalytic reduction (SNCR)</td><td>See Section 2.2</td><td>Generally applicable</td></tr>
<tr><td>d)</td><td>Selective catalytic reduction (SCR)</td><td>See Section 2.2</td><td>In the case of existing plants, the applicability may be limited by a lack of space</td></tr>
<tr><td>e)</td><td>Catalytic filter bags</td><td>See Section 2.2</td><td>Only applicable to plants fitted with a bag filter</td></tr>
</table>
</td>
<td>Applicable

The Zoetis LVI employs a quench/scrubber followed by reheat and SCR to control emissions.

The applicable techniques are therefore (a), (d) and (f).

The Zoetis LVI has an optimised combustion control system designed to maximise destruction efficiency while at the same time minimising the production of secondary pollutants. To manage NOx emissions, the LVI is also equipped with an SCR system which determines the NH_3 dosing rate on the basis of a NOx feedback loop. This system maximises NOx reduction while at the same time ensuring that only sufficient NH_3 is injected to ensure that the exit NOx levels does not exceed the set point.</td>
<td>In place</td>
</tr>
</table>

Conclusions on BAT				Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
f)	Optimisation of the SNCR/SCR design and operation	Optimisation of the reagent to NO_X ratio over the cross-section of the furnace or duct, of the size of the reagent drops and of the temperature window in which the reagent is injected	Only applicable where SNCR and/or SCR is used for the reduction of NO_X emissions		
g)	Wet scrubber	See Section 2.2. Where a wet scrubber is used for acid gas abatement, and in particular with SNCR, unreacted ammonia is absorbed by the scrubbing liquor and, once stripped, can be recycled as SNCR or SCR reagent.	There may be applicability restrictions due to low water availability, e.g. in arid areas		

Table 6: BAT-associated emission levels (BAT-AELs) for channelled NO_X and CO emissions to air from the incineration of waste and for channelled NH_3 emissions to air from the use of SNCR and/or SCR.

Parameter	BAT-AEL (mg/Nm³)		Averaging period
	New plants	Existing plants	
NO_X	50–120 (1)	50–150 (1)(2)	Daily average

The LVI system was designed in 1998 and 2007 to comply with the NOx and CO emission limit values specified in the Waste Incineration Directive and Chapter IV of IED

The daily ELVs in the current IE licence are:

NOx : 400 mg/Nm^3

CO : 50 mg/Nm^3

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
CO 10–50 10–50 NH_3 2–10 (1) 2–10 (1)(3) (1) The lower end of the BAT-AEL range can be achieved when using SCR. The lower end of the BAT-AEL range may not be achievable when incinerating waste with a high nitrogen content (e.g. residues from the production of organic nitrogen compounds). (2) The higher end of the BAT-AEL range is 180 mg/Nm3 where SCR is not applicable. (3) For existing plants fitted with SNCR without wet abatement techniques, the higher end of the BATAEL range is 15 mg/Nm^3	There is no ELV for NH_3 The higher end of the BAT AELs for NOx is over 60% lower than the current ELV. However, actual performance of the LVI with regard to these parameters has been good, i.e. low level of emissions below the current ELV. Consequently, Zoetis is confident that the LVI can meet the upper end of the BAT 29 ELVs as daily averages, i.e: NO_x : 150 mg/Nm^3 CO : 50 mg/Nm^3 NH_3 : 10 mg/Nm^3	
Emissions of organic compounds		
BAT 30. In order to reduce channelled emissions to air of organic compounds including PCDD/F and PCBs from the incineration of waste, BAT is to use techniques (a), (b), (c), (d), and one or a combination of techniques (e) to (i) given below.	Applicable The Zoetis LVI employs a number techniques to ensure minimal TVOC and PCDD/F emissions, i.e. The incineration process is optimised to ensure complete combustion either at 850°C or 1,100°C	In place

Conclusions on BAT				Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	Technique	Description	Applicability	depending on the percentage of halogenated solvent in the waste feed. The waste feed is well characterised with each batch sent for incineration tested for main solvent content as well as halogenated solvents. The ash/solids content of the waste feed is very low resulting in low levels of dust generation and deposition on boiler surfaces and the boiler is cleaned annually. TVOC is continuously monitored and the results indicate low levels well below the ELV are consistently achieved. The flue gas is rapidly quenched to below 250^{o}C in a quench/scrubber. The LVI is equipped with an SCR system. Whereas the SCR system is primarily design for NO_x control the system may also have an impact to further reduce the already vey low PCDD/F content of the flue gas The site has PCDD/F emission data since 2007 and in all cases, emissions are low and well below the licence limit of 0.1 ng/Nm^3 TEQ.	
a)	Optimisation of the incineration process	See Section 2.1. Optimisation of incineration parameters to promote the oxidation of organic compounds including PCDD/F and PCBs present in the waste, and to prevent their and their precursors' (re)formation	Generally applicable		
b)	Control of waste feed	Knowledge and control of the combustion characteristics of the waste being fed into the furnace, to ensure optimal and, as far as possible, homogeneous and stable incineration conditions	Not applicable to clinical waste or to municipal solid waste		
c)	On-line and off-line boiler cleaning	Efficient cleaning of the boiler bundles to reduce the dust residence time and accumulation in the boiler, thus reducing PCDD/F formation in the boiler. A combination of on-line and off-line boiler cleaning techniques is used.	Generally applicable		
d)	Rapid flue-gas cooling	Rapid cooling of the flue-gas from temperatures above 400 °C to below 250 °C before dust abatement to prevent the de novo synthesis of PCDD/F. This is achieved by appropriate design of the boiler and/or with the use of a quench	Generally applicable		

Conclusions on BAT				Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
		system. The latter option limits the amount of energy that can be recovered from the flue-gas and is used in particular in the case of incinerating hazardous wastes with a high halogen content.		There are no sources of possible PCB contamination of the waste stream at the Zoetis site,	
e)	Dry sorbent injection	See Section 2.2. Adsorption by injection of activated carbon or other reagents, generally combined with a bag filter where a reaction layer is created in the filter cake and the solids generated are removed.	Generally applicable		
f)	Fixed- or moving-bed adsorption	See Section 2.2.	The applicability may be limited by the overall pressure drop associated with the FGC system. In the case of existing plants, the applicability may be limited by a lack of space.		
g)	SCR	See Section 2.2. Where SCR is used for NO_X abatement, the adequate catalyst surface of the SCR system also provides for the partial reduction of the emissions of PCDD/F and PCBs. The technique is generally used in combination with technique (e), (f) or (i).	In the case of existing plants, the applicability may be limited by a lack of space		
h)	Catalytic filter bags	See Section 2.2	Only applicable to plants fitted with a bag filter		

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
i) Carbon sorbent in a wet scrubber — PCDD/F and PCBs are adsorbed by carbon sorbent added to the wet scrubber, either in the scrubbing liquor or in the form of impregnated packing elements. The technique is used for the removal of PCDD/F in general, and also to prevent and/or reduce the re-emission of PCDD/F accumulated in the scrubber (the so-called memory effect) occurring especially during shutdown and start-up periods — Only applicable to plants fitted with a wet scrubber		

Table 7: BAT-associated emission levels (BAT-AELs) for channelled emissions to air of TVOC, PCDD/F and dioxin-like PCBs from the incineration of waste

Parameter	Unit	BAT-AEL		Averaging period
		New plant	Existing plant	
TVOC	mg/Nm^3	<3 – 10	<3 – 10	Daily average
PCDD/F (1)	ng I-TEQ/Nm^3	< 0.01–0.04	< 0.01–0.06	Average over the sampling period
		< 0.01–0.06	< 0.01–0.08	Long-term sampling period (2)
PCDD/F + dioxin-like PCBs (1)	ng WHO-TEQ/Nm^3	< 0.01–0.06	< 0.01–0.08	Average over the sampling period
		< 0.01–0.08	< 0.01–0.1	Long-term sampling period (2)

(1) Either the BAT-AEL for PCDD/F or the BAT-AEL for PCDD/F + dioxin-like PCBs applies.

(2) The BAT-AEL does not apply if the emission levels are proven to be sufficiently stable.

The LVI system was designed in 1999 and 2007 to comply with the TVOC and PCDD/F emission limit values specified in the Waste Incineration Directive and Chapter IV of IED

The daily ELV in the current IE licence is:

TVOC : 10 mg/Nm^3

For PCDD/F the current ELV is:

PCDD/F : 0.1 ng/Nm^3 TEQ

However, actual performance of the LVI with regard to these parameters has been good, i.e. low level of emissions below the current ELV.

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td></td><td>Consequently, Zoetis is confident that the LVI can meet the upper end of the BAT 30 ELVs as daily averages or average over the sampling period, i.e:

TVOC : 10 mg/Nm^3
PCDD/F : 0.08 ng/Nm^3 TEQ</td><td></td></tr>
<tr><td>Emissions of mercury</td><td></td><td></td></tr>
<tr><td>BAT 31.

In order to reduce channelled mercury emissions to air (including mercury emission peaks) from the incineration of waste, BAT is to use one or a combination of the techniques given below.

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a) Wet scrubber (low pH)</td><td>See Section 2.2.
A wet scrubber operated at a pH value around 1.
The mercury removal rate of the technique can be enhanced by adding reagents and/or adsorbents to the scrubbing liquor, e.g.:</td><td>There may be applicability restrictions due to low water availability, e.g. in arid areas</td></tr>
</table>
</td><td>Not applicable

Mercury is not used on the Zoetis site and there is no source of possible mercury contamination of the waste stream.

Mercury in emission to air has been monitored since 2007 and the results indicate either N.D. or very low levels of emissions.</td><td>Not applicable</td></tr>
</table>

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	• oxidants such as hydrogen peroxide to transform elemental mercury to a water-soluble oxidised form; • sulphur compounds to form stable complexes or salts with mercury; • carbon sorbent to adsorb mercury, including elemental mercury. When designed for a sufficiently high buffer capacity for mercury capture, the technique effectively prevents the occurrence of mercury emission peaks.			
b) Dry sorbent injection	See Section 2.2. Adsorption by injection of activated carbon or other reagents, generally combined with a bag filter where a reaction layer is created in the filter cake and the solids generated are removed.	Generally applicable		
c) Injection of special, highly reactive activated carbon	Injection of highly reactive activated carbon doped with sulphur or other reagents to enhance the reactivity with mercury. Usually, the injection of this special activated carbon is not continuous but only takes place when a mercury peak is detected. For this purpose, the technique can be used in combination with the continuous monitoring of mercury in the raw flue-gas.	May not be applicable to plants dedicated to the incineration of sewage sludge		
d) Boiler bromine addition	Bromide added to the waste or injected into the furnace is converted at high temperatures to elemental bromine, which oxidises elemental	Generally applicable		

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
		mercury to the water-soluble and highly adsorbable HgBr2. The technique is used in combination with a downstream abatement technique such as a wet scrubber or an activated carbon injection system. Usually, the injection of bromide is not continuous but only takes place when a mercury peak is detected. For this purpose, the technique can be used in combination with the continuous monitoring of mercury in the raw flue-gas		
e)	Fixed- or moving-bed adsorption	See Section 2.2. When designed for a sufficiently high adsorption capacity, the technique effectively prevents the occurrence of mercury emission peaks.	The applicability may be limited by the overall pressure drop associated with the FGC system. In the case of existing plants, the applicability may be limited by a lack of space.	

Table 8: BAT-associated emission levels (BAT-AELs) for channelled mercury emissions to air from the incineration of waste:

Parameter	BAT-AEL (µg/Nm³) (1)		Averaging period
	New plant	Existing plant	
Hg	< 5–20(2)	< 5–20(2)	Daily average over the sampling period
	1-10	1-10	Long-term sampling period

The LVI system was designed in 1999 and 2007 to comply with the Hg emission limit values specified in the Waste Incineration Directive and Chapter IV of IED

The ELV in the current IE licence is:

Hg : 50 µg/Nm³

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
(1) Either the BAT-AEL for daily average or average over the sampling period, or the BAT-AEL for long-term sampling period, applies. The BAT-AEL for long-term sampling may apply in the case of plants incinerating waste with a proven low and stable mercury content (e.g. mono-streams of waste of a controlled composition). (2) The lower end of the BAT-AEL ranges may be achieved when: • incinerating wastes with a proven low and stable mercury content (e.g. mono-streams of waste of a controlled composition), or • using specific techniques to prevent or reduce the occurrence of mercury peak emissions while incinerating non-hazardous waste. The higher end of the BAT-AEL ranges may be associated with the use of dry sorbent injection. As an indication, the half-hourly average mercury emission levels will generally be: • < 15–40 µg/Nm³ for existing plants; • < 15–35 µg/Nm³ for new plants	However,actual performance of the LVI with regard to this parameter has been good, i.e. low level of emissions below the current ELV. Consequently, Zoetis is confident that the LVI can meet the upper end of the BAT 31 ELVs as an average over the sampling period, i.e: Hg : 20 µg/Nm³	
1.6 Emissions to water		
BAT 32. In order to prevent the contamination of uncontaminated water, to reduce emissions to water, and to increase resource efficiency, BAT is to segregate waste water streams and to treat them separately, depending on their characteristics.	Not Applicable The only waste water generated from the LVI is waste water from the quench/scrubber system which is sent for treatment in the sites waste water treatment facility.	Not applicable

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
Description Waste water streams (e.g. surface run-off water, cooling water, waste water from flue-gas treatment and from bottom ash treatment, drainage water collected from the waste reception, handling and storage areas (see BAT 12 (a)) are segregated to be treated separately based on their characteristics and on the combination of treatment techniques required. Uncontaminated water streams are segregated from waste water streams that require treatment. When recovering hydrochloric acid and/or gypsum from the scrubber's effluent, the waste waters arising from the different stages (acidic and alkaline) of the wet scrubbing system are treated separately. Applicability Generally applicable to new plants. Applicable to existing plants within the constraints associated with the configuration of the water collection system.	Management of water and waste water streams is completed on a facility wide basis whereby the LVI facility is one part of the wider pharmaceutical production facility. BAT 32 is specific to waste incineration facilities.	
BAT 33. In order to reduce water usage and to prevent or reduce the generation of waste water from the incineration plant, BAT is to use one or a combination of the techniques given below. Technique Description Applicability	Not applicable The Zoetis LVI is a minor user of water.	Not applicable

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
a) Waste-water-free FGC techniques	Use of FGC techniques that do not generate waste water (e.g. dry sorbent injection or semi-wet absorber, see Section 2.2)	May not be applicable to the incineration of hazardous waste with a high halogen content		
b) Injection of waste water from FGC	Waste water from FGC is injected into the hotter parts of the FGC system)	Only applicable to the incineration of municipal solid waste		
c) Water reuse/recycling	Residual aqueous streams are reused or recycled. The degree of reuse/recycling is limited by the quality requirements of the process to which the water is directed.	Generally applicable		
d) Dry bottom ash handling	Dry, hot bottom ash falls from the grate onto a transport system and is cooled down by ambient air. No water is used in the process.	Only applicable to grate furnaces. There may be technical restrictions that prevent retrofitting to existing incineration plants.		
BAT 34. In order to reduce emissions to water from FGC and/or from the storage and treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below, and to use secondary techniques as close as possible to the source in order to avoid dilution. Technique / Typical pollutants targeted Primary techniques			Partially applicable The only waste water generated at the LVI is waste water from the quench/scrubber system and the amount is relatively small at approximately 200 l per hour. The LVI does not generate or treat bottom ash.	In place

Conclusions on BAT		Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
a) Optimisation of the incineration process (see BAT 14) and/or of the FGC system (e.g. SNCR/SCR, see BAT 29 (f))	Organic compounds including PCDD/F, ammonia/ammonium	The scrubber blowdown is separately collected and analysed for metals and metalloids and PCDD/F in accordance with the sites current IEL before mixing with the sites waste water in the on-site waste water treatment plant. The scrubber waste water is subject to specific limit values and analysis before release to the site waste water treatment plant as described in Schedules B and C in the current IEL. The current limit values and analysis complies with the requirements of Chapter IV of IED and represents BAT for the specific circumstances of the Zoetis LVI. The site does not produce nor treat slag or bottom ash on site and hence no waste water is produced from these processes. The volume of waste water from the LVI is small compared to the overall volume of waste water generated and treated on site and comprises waste water from the scrubber system only. This scrubber waste water is not released directly to surface water but is treated in the sites waste water treatment plant. Consequently, the BAT AELs described in Table 9 <u>for direct emission</u> to a receiving water body are not applicable. The appropriate BAT AELs for the LVI	
Secondary techniques (1)			
Preliminary and primary treatment			
b) Equalisation	All pollutants		
c) Neutralisation	Acids, alkalis		
d) Physical separation, e.g. screens, sieves, grit separators, primary settlement tanks	Gross solids, suspended solids		
Physico-chemical treatment			
e) Adsorption on activated carbon	Organic compounds including PCDD/F, mercury		
f) Precipitation	Dissolved metals/metalloids, sulphate		
g) Oxidation	Sulphide, sulphite, organic compounds		
h) Ion exchange	Dissolved metals/metalloids		
i) Stripping	Purgeable pollutants (e.g. ammonia/ammonium)		
j) Reverse osmosis	Ammonia/ammonium, metals/metalloids, sulphate, chloride, organic compounds		
Final solids removal			
k) Coagulation and flocculation			

Conclusions on BAT	Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
l) Sedimentation m) Filtration n) Flotation — Suspended solids, particulate-bound metals/metalloids (1) The descriptions of the techniques are given in Section 2.3.	plant are described in the Table 10, i.e. <u>for indirect emissions</u> to a receiving water body. See separate memo on ELVs appropriate to the scrubber waste water (AECOM document reference *60653933_ACM_MO_EN_002_2_BAT-AELs for emissionpoint W1-2*) Treated water from the sites waste water treatment plant is released to the River Avoca and is subject to emission limit values and monitoring appropriate to emissions from an operating pharmaceutical manufacturing site.	

Table 9: BAT-AELs for direct emissions to a receiving water body

Parameter		Process	Unit	BAT-AEL(1)
Total suspended solids (TSS)		FGC Bottom ash treatment	mg/l	10 – 30
Total organic carbon (TOC)		FGC Bottom ash treatment		15 – 40
Metals and metalloids	As	FGC		0.01 – 0.05
	Cd	FGC		0.005 – 0.03
	Cr	FGC		0.01 – 0.1
	Cu	FGC		0.03 – 0.15
	Hg	FGC		0.001 – 0.01

Conclusions on BAT					Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	Ni	FGC		0.03 – 0.15		
	Pb	FGC Bottom ash treatment		0.02 – 0.06		
	Sb	FGC		0.02–0.9		
	Tl	FGC		0.005 – 0.03		
	Zn	FGC		0.01 – 0.5		
Ammonium-nitrogen (NH_4-N)		Bottom ash treatment		10 – 30		
Sulphate (SO_4^{2-})		Bottom ash treatment		400 – 10000		
PCDD/F		FGC	ng I-TEQ/I	0.01 – 0.05		

1) The averaging periods are defined in the General considerations

The associated monitoring is in BAT 6.

Table 10: BAT-AELs for indirect emissions to a receiving water body

Parameter	Process	Unit	BAT-AEL(1) (daily average)
As	FGC		0.01 – 0.05
Cd	FGC		0.005 – 0.03

Conclusions on BAT					Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
Metals and metalloids	Cr	FGC	mg/l	0.01 – 0.1		
	Cu	FGC		0.03 – 0.15		
	Hg	FGC		0.001 – 0.01		
	Ni	FGC		0.03 – 0.15		
	Pb	FGC Bottom ash treatment		0.02 – 0.06		
	Sb	FGC		0.02–0.9		
	Tl	FGC		0.005 – 0.03		
	Zn	FGC		0.01 – 0.5		
PCDD/F		FGC	ng I-TEQ/l	0.01 – 0.05		
(1) The BAT-AELs may not apply if the downstream waste water treatment plant is designed and equipped appropriately to abate the pollutants concerned, provided this does not lead to a higher level of pollution in the environment.						
The associated monitoring is in BAT 6.						
1.7 Material efficiency						
BAT 35.					Not applicable	Not applicable

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.</td><td>The Zoetis LVI does not generate bottom ash</td><td></td></tr>
<tr><td>BAT 36.

In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes.

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a) Screening and sieving</td><td>Oscillating screens, vibrating screens and rotary screens are used for an initial classification of the bottom ashes by size before further treatment</td><td>Generally applicable</td></tr>
<tr><td>b) Crushing</td><td>Mechanical treatment operations intended to prepare materials for the recovery of metals or for the subsequent use of those materials, e.g. in road and earthworks construction.</td><td>Generally applicable</td></tr>
<tr><td>c) Aeraulic separation</td><td>Aeraulic separation is used to sort the light, unburnt fractions commingled in the bottom ashes by blowing off light fragments.
A vibrating table is used to transport the bottom ashes to a chute, where the material falls through an air stream that</td><td>Generally applicable</td></tr>
</table>
</td><td>Not applicable

The Zoetis LVI does not generate bottom ash or slags</td><td>Not applicable</td></tr>
</table>

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	blows uncombusted light materials, such as wood, paper or plastic, onto a removal belt or into a container, so that they can be returned to incineration.			
d) Recovery of ferrous and non-ferrous metals	Different techniques are used, including: • magnetic separation for ferrous metals • eddy current separation for non-ferrous metals • induction all-metal separation	Generally applicable		
e) Ageing	The ageing process stabilises the mineral fraction of the bottom ashes by uptake of atmospheric CO2 (carbonation), draining of excess water and oxidation. Bottom ashes, after the recovery of metals, are stored in the open air or in covered buildings for several weeks, generally on an impermeable floor allowing for drainage and run-off water to be collected for treatment. The stockpiles may be wetted to optimise the moisture content to favour the leaching of salts and the carbonation process. The wetting of bottom ashes also helps prevent dust emissions.	Generally applicable		
f) Washing	The washing of bottom ashes enables the production of a material for recycling	Generally applicable		

<table>
<tr><th>Conclusions on BAT</th><th>Applicability Assessment
(describe how the technique applies or not to your installation)</th><th>State whether it is in place or state schedule for implementation</th></tr>
<tr><td>with minimal leachability of soluble substances (e.g. salts)</td><td></td><td></td></tr>
<tr><td>1.8 Noise</td><td></td><td></td></tr>
<tr><td>BAT 37.

In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below.

<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>a) Appropriate location of equipment and buildings</td><td>Noise levels can be reduced by increasing the distance between the emitter and the receiver and by using buildings as noise screens</td><td>In the case of existing plants, the relocation of equipment may be restricted by a lack of space or by excessive costs</td></tr>
<tr><td>b) Operational measures</td><td>These include:
• improved inspection and maintenance of equipment
• closing of doors and windows of enclosed areas, if possible
• operation of equipment by experienced staff
• avoidance of noisy activities at night, if possible</td><td>Generally applicable</td></tr>
</table>
</td><td>Applicable

Noise emissions from the site are limited in the sites IE licence.

Noise monitoring data for licence compliance purposes indicates low off-site noise levels well within the limit values. The LVI has not bene identified as a source of off-site noise</td><td>In place</td></tr>
</table>

Conclusions on BAT			Applicability Assessment (describe how the technique applies or not to your installation)	State whether it is in place or state schedule for implementation
	• provisions for noise control during maintenance activities			
c) Low-noise equipment	This includes low-noise compressors, pumps and fans	Generally applicable when existing equipment is replaced or new equipment is installed		
d) Noise attenuation	Noise propagation can be reduced by inserting obstacles between the emitter and the receiver. Appropriate obstacles include protection walls, embankments and buildings.	In the case of existing plants, the insertion of obstacles may be restricted by a lack of space		
e) Noise-control equipment/ infrastructure	This includes: • noise-reducers • equipment insulation • enclosure of noisy equipment • soundproofing of buildings	In the case of existing plants, the applicability may be limited by a lack of space		