

BAT Conclusion Review

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BAT Conclusion Review

**SmartPly Europe Ltd,
Belview Port,
Slieverue,
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1.0 Introduction

SmartPly Europe Ltd. (SmartPly), are currently in the process of consulting with the Environmental Protection Agency (EPA) regarding a review of their Industrial Emissions Directive (IED) licence, formally an Integrated Pollution Prevention and Control (IPPC) licence, P0001-04¹, to accommodate new air emission points and other IED related requirements associated with the plant upgrade to their facility located at Slieverue, Co. Kilkenny.

The proposed expansion works initially received planning permission in 2009 with additional permission received in 2011 (File Ref No. 09/635 & 11/443). Planning permission was also received in 2013 for the alteration to the entrance to the plant (File Ref No. 12/346). Following receipt of this planning permission in 2013 Smartply applied to the EPA for a review of their IED licence.

1.1 Background and purpose of this report

An assessment of the proposed plant upgrades in relation to Best Available Technologies (BAT) was completed in October 2014 and submitted as part of the licence review application.

In a letter from the EPA dated 03rd March 2015 a request was made to *“Tabulate all of the relevant conclusions on BAT from the following BREF documents:”*

- *“Reference Document on Best Available Techniques for Large Combustion Plants, July 2006;*
- *Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003;*
- *Reference Document on Best Available Techniques for Energy Efficiency, February 2009; and,*
- *Reference Document on Best Available Techniques on Emissions from Storage, July 2006.”*

The EPA also requested that *“for all applicable conclusions on BAT, state if it is already in place at your installation or if it is proposed to be put in place and the timeline for implementation. Details of any proposals must be provided.”*

The EPA also requested that *“any other relevant BAT should also be tabulated”*, in compliance with this request the relevant conclusions on BAT from the following BREF documents have also been assessed:

- JRC Reference Report on Monitoring of emissions from IED-installations, Final Draft, 2013; and,
- BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008.

Malone O’ Regan (MOR) has been commissioned to prepare this assessment of BAT conclusions to satisfy the EPA’s requirements. This report aims to assess the applicability of each BAT conclusion and to what extent it is in place on site or is proposed to be put in place in future in accordance with Regulation 9(2)(h) of S.I.137 of 2013 which states the following:

¹ P0001-03 is currently being reviewed in accordance with the Industrial Emissions Directive requirements 2013 of the European Union (Industrial Emissions) Regulations 2013. However it is still the active license for the facility until P0001-04 is approved by the EPA.

“indicate how the requirements of section 83(5)(a)(i) to (v) and (vii) to (xa) of the Act of 1992 shall be met, having regard, where appropriate, to any relevant specification issued by the Agency under section 5(3)(b) of that Act or any applicable best available techniques (BAT) conclusions adopted in accordance with Article 13(5) of the Industrial Emissions Directive and the reasons for the selection of the arrangements proposed”

1.2 Methodology

A review of relevant BAT Reference Documents (BREFs) was carried out in compliance with the following guidance and legislation:

- European Union (Industrial Emissions) Regulations 2013 S.I. 138 of 2013;
- New Environmental Protection Agency (Industrial Emissions) (Licensing) Regulations 2013 S.I. 137 of 2013;
- EPA, March 2014, Industrial Emissions Directive (1) Newly Licensable Activities and (2) BAT, Webinar; and,
- Section 1.8 of the Industrial Emissions Activities Licence Application Form, Version 3.0, EPA, January 2015.

2.0 BAT Conclusion Review

2.1 BAT for Large Combustion Plants

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
3.15 Environmental Management Tools			
3.15.1 BAT for Environmental Management	<p>BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the following features: (see section above)</p> <ul style="list-style-type: none"> • definition of an environmental policy for the installation by top management (commitment of the top management is regarded as a precondition for a successful application of other features of the EMS) • planning and establishing the necessary procedures • implementation of the procedures, paying particular attention to <ul style="list-style-type: none"> ○ structure and responsibility ○ training, awareness and competence ○ communication ○ employee involvement ○ documentation ○ efficient process control ○ maintenance programme ○ emergency preparedness and response ○ safeguarding compliance with environmental legislation. • checking performance and taking corrective action, paying particular attention to <ul style="list-style-type: none"> ○ monitoring and measurement (see also the Reference document on Monitoring of Emissions) ○ corrective and preventive action ○ maintenance of records ○ independent (where practicable) internal auditing in order to determine whether or not the environmental management system conforms to planned arrangements and has been properly implemented and maintained. • review by top management. 	Applicable	In place
4.5 Best available techniques (BAT) for the combustion of coal and lignite			

Title of Document BAT for Large Combustion Plants, July 2006					
BAT ref Number	BAT Statement		Applicability	Proposed/ in place	
4.5.2 BAT for Unloading, storage and handling of fuel and additives.	Table 4.65: BAT for the unloading, storage, and handling of coal, lignite and additives		Not Applicable	SmartPly do not handle coal, lignite or related additives	
	Material	Pollutant			BAT
	Coal and lignite	Dust			<ul style="list-style-type: none"> the use of loading and unloading equipment that minimises the height of fuel drop to the stockpile, to reduce the generation of fugitive dust in countries where freezing does not occur, using water spray systems to reduce the formation of fugitive dust from coal stockpiles according to the generation of fugitive emissions, covering stockpiles of petroleum coke grassing over long-term storage areas of coal to prevent fugitive emission of dust and fuel loss caused by oxidation in contact with the oxygen of air applying the direct transfer of lignite via belt conveyors or trains from the mine to the on-site lignite storage area placing transfer conveyors in safe, open areas aboveground so that damage from vehicles and other equipment can be prevented. using cleaning devices for conveyor belts to minimise the generation of fugitive dust using enclosed conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points to prevent the emission of dust rationalising transport systems to minimise the generation and transport of dust within the site the use of good design and construction practices and adequate maintenance.
	Water contamination	<ul style="list-style-type: none"> having storage on sealed surfaces with drainage, drain collection and water treatment for settling out collecting surface run-off (rainwater) from coal and lignite storage areas that washes fuel particles away and treating this collected stream (settling out) before discharge. 			
	Fire prevention	<ul style="list-style-type: none"> surveying storage areas for coal and lignite with automatic systems, to detect fires, caused by self-ignition and to identify risk points. 			

Title of Document BAT for Large Combustion Plants, July 2006										
BAT ref Number	BAT Statement		Applicability	Proposed/ in place						
4.5.2 BAT for Unloading, storage and handling of fuel and additives. (Continued)	Table 4.65: BAT for the unloading, storage, and handling of coal, lignite and additives (Continued). <table border="1"> <tr> <td>Lime and limestone</td> <td>Dust</td> <td> <ul style="list-style-type: none"> having enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. </td> </tr> <tr> <td>Pure liquified ammonia</td> <td>Health and safety risk according to ammonia</td> <td> <ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing processes from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquefied ammonia. </td> </tr> </table>		Lime and limestone	Dust	<ul style="list-style-type: none"> having enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. 	Pure liquified ammonia	Health and safety risk according to ammonia	<ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing processes from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquefied ammonia. 	Not Applicable	SmartPly do not handle coal, lignite or related additives
Lime and limestone	Dust	<ul style="list-style-type: none"> having enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. 								
Pure liquified ammonia	Health and safety risk according to ammonia	<ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing processes from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquefied ammonia. 								
4.5.3 BAT for Fuel pre-treatment	For the fuel pretreatment of coal and lignite, blending and mixing of fuel are considered to be part of BAT, in order to ensure stable combustion conditions and to thus reduce peak emissions. Switching fuel, for example from one coal to another coal with a better environmental profile, can also be regarded as BAT.		Not Applicable	SmartPly do not handle coal, lignite or related additives						
4.5.4 BAT for Combustion	For the combustion of coal and lignite, pulverised combustion (PC), fluidised bed combustion (CFBC and BFBC) as well as pressurised fluidised bed combustion (PFBC) and grate firing are all considered to be BAT for new and existing plants. Grate firing should preferably only be applied to new plants with a rated thermal input below 100 MW. For the design of new boilers or retrofit projects for existing plants, those firing systems are BAT which assure a high boiler efficiency and which include primary measures to reduce the generation of NOX emissions, such as air and fuel staging, advanced low-NOX burners and/or reburning, etc. The use of advanced computerised control system in order to achieve a high boiler performance with increased combustion conditions that support the reduction of emissions are also considered as BAT.		Not Applicable	SmartPly do not handle coal, lignite or related additives						
4.5.5 BAT for Thermal efficiency	the heat rate and the efficiency level associated with the use of BAT for new coal- or lignite-fired condensing power plants (pulverised coal or lignite combustion in DBB or WBB boilers) with direct water cooling (with a capacity of over 300 MWth) is considered to be 2.3 – 2.2 (43 – 47 %), using supercritical steam parameters. Increasing steam parameters (supercritical steam) is another means to increase efficiency when CHP is not possible.		Not Applicable	SmartPly do not handle coal, lignite or related additives						
4.5.5 BAT for Thermal efficiency	Co-generation is therefore considered as the most important BAT option in order to reduce the amount of CO2 released to the air per unit of energy generated. CHP should be a task for any new build power plant whenever economically feasible.		Not Applicable	SmartPly do not handle coal, lignite or related additives						

Title of Document BAT for Large Combustion Plants, July 2006							
BAT ref Number	BAT Statement					Applicability	Proposed/ in place
4.5.6 BAT for Dust	For dedusting off-gases from coal- and lignite-fired new and existing combustion plants, BAT is considered to be the use of an electrostatic precipitator (ESP) or a fabric filter, where fabric filter archives normally emission levels well below 5 mg/Nm ³ . Furthermore, the best levels of Hg control are generally achieved by emission control systems (e.g. FGD + particulate control device) that use fabric filters.					Not Applicable	SmartPly do not handle coal, lignite or related additives
4.5.6 BAT for Dust	Table 4.67: BAT for dedusting off-gases from coal- and lignite-fired combustion plants					Not Applicable	SmartPly do not handle coal, lignite or related additives
	Capacity (MW _{th})	Dust-emission level (mg/Nm ³)		BAT to reach these levels	Monitoring	Applicability	Comments
		New plants	Existing plants				
	50 – 100	5 – 20 ⁽¹⁾	5 – 30 ⁽²⁾	ESP or FF	Continuous	New and existing plants	<ul style="list-style-type: none"> the reduction rate associated with the use of an ESP is considered to be 99.5 % or higher
	100 – 300	5 – 20 ⁽³⁾	5 – 25 ⁽⁴⁾	ESP or FF in combination FGD (wet, sd or dsi) for PC ESP or FF for CFBC	Continuous	New and existing plants	<ul style="list-style-type: none"> the reduction rate associated with the use of a fabric filter is considered to be 99.95 % or higher.
	>300	5 – 10 ⁽⁵⁾	5 – 20 ⁽⁶⁾	ESP or FF in combination with FGD (wet) for PC	Continuous	New and existing plants	<ul style="list-style-type: none"> the reduction rate associated with the use of an ESP is considered to be 99.5 % or higher
		5 – 20 ⁽⁵⁾	5 – 20 ⁽⁶⁾	ESP or FF for CFBC			<ul style="list-style-type: none"> the reduction rate associated with the use of a fabric filter is considered to be 99.95 % or higher a wet scrubber used for desulphurisation also reduces dust.

Title of Document BAT for Large Combustion Plants, July 2006															
BAT ref Number	BAT Statement	Applicability	Proposed/ in place												
4.5.6 BAT for Dust (Continued)	<p>Table 4.67: BAT for dedusting off-gases from coal- and lignite-fired combustion plants (Continued).</p> <p>Notes: ESP (Electrostatic precipitator) FF (Fabric filter) FGD(wet) (Wet flue-gas desulphurisation) FGD(sds) (Flue-gas desulphurisation by using a spray dryer) FGD(dsi) (Flue-gas desulphurisation by dry sorbent injection) For very high dust concentrations in the raw gas, which might be the case when low calorific lignite is used as a fuel, the reduction rate of 99.95 % for the ESP or 99.99 % for fabric filters is considered to be the BAT associated level, rather than the dust concentration levels mentioned in this table.</p> <table border="1"> <tr> <td>1</td> <td>Industry and one MS proposed 10 – 50 mg/Nm³</td> </tr> <tr> <td>2</td> <td>Industry and one MS proposed 20 – 100 mg/Nm³</td> </tr> <tr> <td>3</td> <td>Industry and one MS proposed 10 – 30 mg/Nm³</td> </tr> <tr> <td>4</td> <td>Industry and one MS proposed 10 – 100 mg/Nm³ for ESP or FF, and 10 – 50 mg/Nm³ in the case of combination with wet FGD</td> </tr> <tr> <td>5</td> <td>Industry and one MS proposed for 10 – 30 mg/Nm³</td> </tr> <tr> <td>6</td> <td>Industry and one MS proposed for 10 – 100 mg/Nm³ for ESP or FF, and 10 – 50 mg/Nm³ in the case of combination with wet FGD</td> </tr> </table> <p>The rationale given by Industry proposing for the values given above, is that issues such as fuel characteristics, ash resistivity, the flue-gas inlet SO₂ concentration which determines the necessity for an FGD, economics, as well as high net unit efficiency requirements have not been fully taken into account. One Member State supported the Industry view and maintained that even with high efficiency ESPs, the dust emission levels achieved, when using low quality lignite with high ash resistivity and high ash content, will never reach values lower than the proposed levels for existing plants that do not need wet FGD, due to natural desulphurisation.</p> <p>1, 2 One Industry representative mentioned that for coal fired plants between 50 and 100 MW, dust emissions of less than 30 mg/Nm³ are too optimistic and gives no margin for plant deterioration in service (especially FF) or collection variability (especially ESPs). A still very stringent, but more practically attainable dust emission limit is 50 mg/Nm³.</p> <p>5,6 One Member State proposed that the BAT level should be 10 – 50 mg/Nm³, because these levels comply with the Member States emission limits. Their abatement systems have been installed to comply with these limits. As far as new power plants are concerned, the Member State in question has a programme on coal firing plants, where a dust emission level of 20 mg/Nm³ is foreseen.</p>	1	Industry and one MS proposed 10 – 50 mg/Nm ³	2	Industry and one MS proposed 20 – 100 mg/Nm ³	3	Industry and one MS proposed 10 – 30 mg/Nm ³	4	Industry and one MS proposed 10 – 100 mg/Nm ³ for ESP or FF, and 10 – 50 mg/Nm ³ in the case of combination with wet FGD	5	Industry and one MS proposed for 10 – 30 mg/Nm ³	6	Industry and one MS proposed for 10 – 100 mg/Nm ³ for ESP or FF, and 10 – 50 mg/Nm ³ in the case of combination with wet FGD	Not Applicable	SmartPly do not handle coal, lignite or related additives
1	Industry and one MS proposed 10 – 50 mg/Nm ³														
2	Industry and one MS proposed 20 – 100 mg/Nm ³														
3	Industry and one MS proposed 10 – 30 mg/Nm ³														
4	Industry and one MS proposed 10 – 100 mg/Nm ³ for ESP or FF, and 10 – 50 mg/Nm ³ in the case of combination with wet FGD														
5	Industry and one MS proposed for 10 – 30 mg/Nm ³														
6	Industry and one MS proposed for 10 – 100 mg/Nm ³ for ESP or FF, and 10 – 50 mg/Nm ³ in the case of combination with wet FGD														
4.5.7 BAT for Heavy Metals	<p>Taking into account that spray dryer FGD scrubbers and wet lime/limestone scrubbers are regarded as BAT for the reduction of SO₂ for larger combustion plants, low Hg emission levels are achieved.</p> <p>Periodic monitoring of Hg is BAT. A frequency of every year up to every third year, depending on the coal used, is recommended. Total Hg emissions need to be monitored and not only Hg present as part of the particle matter.</p>	Not Applicable	SmartPly do not handle coal, lignite or related additives												

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
4.5.8 BAT for SO ₂ emissions.	In general, for coal- and lignite-fired combustion plants desulphurisation (FGD) and the use of low sulphur fuel are considered to be BAT. However, the use of low sulphur fuel can be a supplementary technique (particularly for plants over 100 MWth), but generally is not itself sufficient to reduce SO ₂ emissions. A distinction of BAT has been made according to the boiler technology: large pulverised coal and lignite-fired plants are considered separately from fluidised bed boilers, because of the different technical options for desulphurisation. Besides the use of low sulphur coal, the techniques that are considered to be BAT for pulverised coal- and lignite-fired combustion plants are: wet scrubbers, spray dry scrubbers, and for smaller applications below approximately 250 MWth also dry sorbent injection (i.e. dry FGD with an adjacent fabric filter).	Not Applicable	SmartPly do not handle coal, lignite or related additives
4.5.9 BAT for NO _x emissions	In general, for coal- and lignite-fired combustion plants, the reduction of nitrogen oxides (NO _x) by using a combination of primary and/or secondary measures is considered to be BAT. A distinction of BAT has been made according to the boiler technology, i.e. pulverised or fluidised bed combustion, and whether coal or lignite is used as a fuel.	Not Applicable	SmartPly do not handle coal, lignite or related additives

Title of Document BAT for Large Combustion Plants, July 2006										
BAT ref Number	BAT Statement						Applicability	Proposed/ in place		
4.5.9 BAT for NO _x emissions	Table 4.69: BAT for nitrogen oxide prevention and control in coal- and lignite- fired combustion plants.						Not Applicable	SmartPly do not handle coal, lignite or related additives		
	Capacity (MW _a)	Combustion technique	NO _x emission level associated with BAT (mg/Nm ³)		Fuel	BAT options to reach these levels			Applicability	Monitoring
			New plants	Existing plants						
	50 – 100	Grate firing	200 – 300	200 – 300 ⁽¹⁾	Coal and lignite	Pm and or SNCR			New and existing plants	Continuous
		PC	90 – 300 ⁽²⁾	90 – 300 ⁽³⁾	Coal	Combination of Pm (such as air and fuel staging, low NO _x burner, etc.), SNCR or SCR as an additional measure			New and existing plants	Continuous
		BFBC, CFBC and PFBC	200 – 300	200 – 300	Coal and lignite	Combination of Pm (such as air and fuel-staging)			New and existing plants	Continuous
		PC	200 – 450	200 – 450 ⁽³⁾	Lignite	Combination of Pm (such as air and fuel-staging)			New and existing plants	Continuous
	100 – 300	PC	90 ⁽⁴⁾ – 200	90 – 200 ⁽⁵⁾	Coal	Combination of Pm (such as air and fuel-staging, low NO _x burner, reburning, etc), in combination with SCR or combined techniques			New and existing plants	Continuous
		PC	100 – 200	100 – 200 ⁽⁶⁾	Lignite	Combination of Pm (such as air and fuel-staging, low NO _x burner, reburning, etc.)			New and existing plants	Continuous
		BFBC, CFBC and PFBC	100 – 200	100 – 200 ⁽⁷⁾	Coal and lignite	Combination of Pm (such as air and fuel-staging), if necessary, together with SNCR			New and existing plants	Continuous
	>300	PC	90 – 150	90 – 200 ⁽⁸⁾	Coal	Combination of Pm (such as air and fuel-staging, low NO _x burner, reburning, etc.), in combination with SCR or combined techniques			New and existing plants	Continuous
		PC	50 – 200 ⁽⁹⁾	50 – 200 ⁽¹⁰⁾	Lignite	Combination of Pm (such as air and fuel-staging, low NO _x burner, reburning, etc)			New and existing plants	Continuous
		BFBC, CFBC and PFBC	50 – 150	50 – 200 ⁽¹¹⁾	Coal and lignite	Combination of Pm (such as air and fuel-staging)			New and existing plants	Continuous
Notes: PC (Pulverised combustion) BFBC (Bubbling fluidised bed combustion) CFBC (Circulating fluidised bed combustion) PFBC (Pressurised fluidised bed combustion) Pm (Primary measures to reduce NO _x) SCR (Selective catalytic reduction of NO _x) SNCR (Selective non catalytic reduction of NO _x) The use of anthracite hard coal may lead to higher emission levels of NO _x because of the high combustion temperatures.										
Industry and one Member State proposed that the levels should be as follows: 2, 6 upper level 450 mg/Nm ³ 3 upper level 500 mg/Nm ³ 4 lower level 100 mg/Nm ³ 5, 7 upper level 300 mg/Nm ³ 9 range 100 – 200 mg/Nm ³ 10 range 100 – 450 mg/Nm ³ Industry claimed that their proposed figures better consider the issue that the application of primary measures are restricted by boiler geometry and configuration (height restrictions may not allow retrofitting of air and fuel staging). One Member State added that for existing plants burning low quality lignite, the produced NO _x emission levels are quite low, due to the combustion technique inherent primary measures for NO _x reductions (flue-gas recirculation, fuel and air staging, etc.). Further modifications for improvement of already installed primary measures are restricted by boiler geometry and configuration and are not cost effective.										
Another Member State proposed that the BAT range for existing plants should be as follows: 5-7 range to be 100 – 300 mg/Nm ³ 8,10,11 lower end of the range to be 100 mg/Nm ³ The rationale is that these levels comply with the Member State's emission limits. As far as new power plants are concerned, the Member State in question has a programme on coal firing plants, where an emission level of 150 mg/Nm ³ is foreseen.										
8,10,11 Another Member State claimed that they had explored the different instruments to meet a strict target of 150 mg/Nm ³ . This is possible in a cost effective way by a system of NO _x emission trading. To have maximum flexibility in the system of NO _x emission trading, the Member State explained that for the oldest combustion plants, the highest level in the range (associated with the use of BAT) should be as practicable possible, and proposed a range of 100 – 650 mg/Nm ³ for existing plants over 300 MW.										
1,3 Another Industry representative proposed that an upper emission level of 400mg/Nm ³ for plants in the 50 – 100 MW range.										

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
4.5.10 BAT for Carbon monoxide (CO)	BAT for the minimisation of CO emission is complete combustion, which goes along with good furnace design, the use of high performance monitoring and process control techniques, and maintenance of the combustion system. Because of the negative effects of NO _x reduction on CO, a well-optimised system to reduce emissions of NO _x will also keep the CO levels down.	Not Applicable	SmartPly do not handle coal, lignite or related additives
4.5.11 BAT for Hydrogen fluoride (HF) and hydrogen chloride (HCl)	For combustion plants, the wet scrubber process and the spray dryer have been considered as BAT for the reduction of SO ₂ . These techniques also give a high reduction rate for HF and HCl. In measuring elevated levels of HF or HCl in the stack, the problem might be related to an internal flue-gas leakage in the rotating gas-gas heat-exchanger. Therefore, a modern type of gas-gas heat-exchanger has been considered as part of the BAT conclusion. However, because of operational and economic reasons, replacement only needs to be considered when the heat exchanger needs to be changed or replaced.	Not Applicable	SmartPly do not handle coal, lignite or related additives
4.5.12 BAT for Ammonia (NH ₃)	The ammonium concentration associated with the use of BAT is considered to be below 5 mg/Nm ³ to avoid problems in the utilisation of fly ash and possibly the smell of the flue-gas in surrounding areas. The ammonium slip is often the limiting factor in the utilisation of the SNCR technique.	Not Applicable	SmartPly do not handle coal, lignite or related additives
4.5.13 BAT for Water pollution	To reduce emissions to water and to avoid water contamination all measures that have been presented in Section 3.10 are considered to be BAT and are summarised in Table 4.70. The storage of coal and lignite on sealed surfaces with drainage and drain collection has been considered as BAT. The associated BAT emission level in the discharged water is considered to be less than 30mg/l,	Not Applicable	SmartPly do not handle coal, lignite or related additives

Title of Document BAT for Large Combustion Plants, July 2006																																																																					
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4.5.13 BAT for Water pollution	<p>Table 4.70: BAT for waste water treatment.</p> <table border="1"> <thead> <tr> <th rowspan="2">Technique</th> <th rowspan="2">Main environmental benefit</th> <th colspan="2">Applicability</th> </tr> <tr> <th>New plants</th> <th>Existing plants</th> </tr> </thead> <tbody> <tr> <td colspan="4" style="text-align: center;">Wet FGD</td> </tr> <tr> <td>Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation</td> <td>Removal of fluoride, heavy metals, COD and particulates</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td>Ammonia reduction by air stripping, precipitation or biodegradation</td> <td>Reduced ammonia content</td> <td colspan="2">BAT only if the ammonia content in waste water is high because of a SCR/SNCR used upstream of a FGD</td> </tr> <tr> <td>Closed loop operation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td>Mixing of waste water with coal ash</td> <td>An avoided waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Slag flushing and transport</td> </tr> <tr> <td>Closed water circuit by filtration or sedimentation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Regeneration of demineralisers and condensate polishers</td> </tr> <tr> <td>Neutralisation and sedimentation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Elutriation</td> </tr> <tr> <td>Neutralisation</td> <td></td> <td colspan="2">BAT only with alkaline operation</td> </tr> <tr> <td colspan="4" style="text-align: center;">Washing of boilers, air preheaters and precipitators</td> </tr> <tr> <td>Neutralisation and closed loop operation, or replacement by dry cleaning methods</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Surface run-off</td> </tr> <tr> <td>Sedimentations or chemical treatment and internal re-use</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> </tbody> </table>	Technique	Main environmental benefit	Applicability		New plants	Existing plants	Wet FGD				Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation	Removal of fluoride, heavy metals, COD and particulates	BAT	BAT	Ammonia reduction by air stripping, precipitation or biodegradation	Reduced ammonia content	BAT only if the ammonia content in waste water is high because of a SCR/SNCR used upstream of a FGD		Closed loop operation	Reduced waste water discharge	BAT	BAT	Mixing of waste water with coal ash	An avoided waste water discharge	BAT	BAT	Slag flushing and transport				Closed water circuit by filtration or sedimentation	Reduced waste water discharge	BAT	BAT	Regeneration of demineralisers and condensate polishers				Neutralisation and sedimentation	Reduced waste water discharge	BAT	BAT	Elutriation				Neutralisation		BAT only with alkaline operation		Washing of boilers, air preheaters and precipitators				Neutralisation and closed loop operation, or replacement by dry cleaning methods	Reduced waste water discharge	BAT	BAT	Surface run-off				Sedimentations or chemical treatment and internal re-use	Reduced waste water discharge	BAT	BAT	Not Applicable	SmartPly do not handle coal, lignite or related additives
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BAT ref Number	BAT Statement		Applicability	Proposed/ in place	
5.5.1 BAT for The Unloading, storage and handling of biomass, peat and additives	Table 5.30 BAT for the unloading, storage and handling of coal, lignite and additives.			Applicable for flake and fines only	In place where applicable
	Material	Pollutants or other effects	BAT		
	Biomass and peat	Dust	<ul style="list-style-type: none"> the use of loading and unloading equipment that minimises the height of the fuel drop to the stockpile, to reduce the generation of fugitive dust, especially when storing fine wood material and dry peat water spray systems to reduce the formation of fugitive dust from storage areas the moisture content of peat must be at least 40 % during transport to the plant. This eliminates fugitive dust arising from the fuel and reduces the speeding of fire, in the event of self-ignition placing transfer conveyors in safe, open areas above ground so that damage from vehicles and other equipment can be prevented using cleaning devices for conveyor belts to minimise the generation of fugitive dust for dry peat and dusty biomass, enclosing conveyors with well designed, robust extraction and filtration equipment on conveyor transfer points, to prevent dust emissions rationalising transport systems to minimise the generation and transport of dust within the site using good design and construction practices and adequate maintenance. 		
		Water contamination	<ul style="list-style-type: none"> having storage on sealed surfaces with drainage and drain collection, and water treatment by settling-out collecting the surface run-off (rainwater) from biomass and peat storage areas that washes fuel particles away, and treating this collected stream (i.e. the settling-out portion) before discharge. 		
Stable combustion		<ul style="list-style-type: none"> carrying out quality checks of the delivered straw and subsequently storing the data on a central logistics computer ensuring that, in the co-firing of several types of biomass, there are two or more storage systems so that the mixture of fed fuel can be controlled according to the quality of the fuels. 			

Title of Document BAT for Large Combustion Plants, July 2006													
BAT ref Number	BAT Statement		Applicability	Proposed/ in place									
5.5.1 BAT for The Unloading, storage and handling of biomass, peat and additives (Continued)	<p>Table 5.30 BAT for the unloading, storage and handling of coal, lignite and additives. (Continued).</p> <table border="1"> <tr> <td></td> <td>Fire prevention</td> <td> <ul style="list-style-type: none"> surveying the biomass and peat storage areas, to detect fires, caused by self-ignition, and to identify risk points. </td> </tr> <tr> <td>Lime and limestone</td> <td>Dust</td> <td> <ul style="list-style-type: none"> having enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. </td> </tr> <tr> <td>Pure liquified ammonia</td> <td>Health and safety risk according to ammonia</td> <td> <ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing process from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquefied ammonia. </td> </tr> </table>			Fire prevention	<ul style="list-style-type: none"> surveying the biomass and peat storage areas, to detect fires, caused by self-ignition, and to identify risk points. 	Lime and limestone	Dust	<ul style="list-style-type: none"> having enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. 	Pure liquified ammonia	Health and safety risk according to ammonia	<ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing process from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquefied ammonia. 	Applicable	In place where applicable No lime and limestone or pure liquefied ammonia is used on site.
	Fire prevention	<ul style="list-style-type: none"> surveying the biomass and peat storage areas, to detect fires, caused by self-ignition, and to identify risk points. 											
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5.5.2 BAT for Fuel pretreatment	<p>For the pretreatment of biomass, in particular for wood, classification based on the size and the contamination of the wood are considered to be BAT, in order to ensure stable combustion conditions, to reduce the amount of unburned fuel in the ash, and to thus reduce peak emissions.</p> <p>In case the wood used is contaminated, it is BAT to know the type of contamination of the wood and an analytical knowledge of the contaminants for each load that arrives to the power plant.</p> <p>To increase the thermal efficiency of peat-fired power plants, the drying system is considered to be BAT. To reduce the amount of water and to thus increase thermal efficiency of peat-fired boiler, the drying of peat by an intermediate storage on the harvesting peat field is also considered to be part of BAT.</p>		Applicable.	Fuel is homogenised if required. Contaminated wood not used. Peat is not used.									

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BAT ref Number	BAT Statement	Applicability	Proposed/ in place																			
5.5.3 BAT for Combustion	<p>With regard to grate-fired systems for biomass, spreader-stoker travelling grates are part of the BAT conclusion.</p> <p>The use of advanced computerised control systems in order to achieve a high boiler performance with increased combustion conditions that support the reduction of emissions are also considered as BAT.</p> <p>Pulverised peat combustion plants have not been considered as BAT for new plants, because of their low thermal efficiency.</p>	Applicable	<p>Grate-fired system in place utilising spreader-stoker travelling reciprocating grates.</p> <p>Advanced computerised control is in place.</p>																			
5.5.4 BAT for Thermal efficiency.	<p>The exergetic efficiency associated with the operation of the plant under BAT conditions is considered to be 40-42%. The fuel efficiency of a BAT co-generation plant is considered to be between 75 and 90% which corresponds to a heat rate in the range of 1.3-1.1. It should be borne in mind that these BAT levels are not reached under all operating conditions.</p>	Applicable	Geka Biomass Burning Furnace was assessed to be 65% and the dryers to be 68%																			
5.5.4 BAT for Thermal efficiency	<p>Table 5.31 Thermal efficiency levels associated with the application of the BAT measures.</p> <table border="1" style="margin-left: 40px;"> <thead> <tr> <th rowspan="2">Fuel</th> <th rowspan="2">Comb. Tech.</th> <th colspan="2">Unit thermal efficiency (net) (%)</th> </tr> <tr> <th>Electric efficiency</th> <th>Fuel efficiency (co-generation, CHP)</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Biomass</td> <td>Grate-firing</td> <td>Around 20</td> <td>75 – 90</td> </tr> <tr> <td>Spreader-stoker</td> <td>>23</td> <td rowspan="2">Depending on the specific plant application and the heat and electricity demand.</td> </tr> <tr> <td>FBC (CFBC)</td> <td>>28 – 30</td> </tr> <tr> <td>Peat</td> <td>FBC (BFBC and CFBC)</td> <td>>28 – 30</td> <td>Co-generation (CHP) is the most important BAT measure to achieve a high fuel efficiency and should be considered whenever the heat demand is high enough.</td> </tr> </tbody> </table>	Fuel	Comb. Tech.	Unit thermal efficiency (net) (%)		Electric efficiency	Fuel efficiency (co-generation, CHP)	Biomass	Grate-firing	Around 20	75 – 90	Spreader-stoker	>23	Depending on the specific plant application and the heat and electricity demand.	FBC (CFBC)	>28 – 30	Peat	FBC (BFBC and CFBC)	>28 – 30	Co-generation (CHP) is the most important BAT measure to achieve a high fuel efficiency and should be considered whenever the heat demand is high enough.	Applicable	Geka Biomass Burning Furnace was assessed to be 65% and the dryers to be 68%
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5.5.5 BAT for Dust	<p>For dedusting off-gases from biomass- and peat-fired new and existing combustion plants, BAT is considered to be the use of bag-houses with fabric filters or an electrostatic precipitator (ESP). In this sense, it needs to be noted that when using low sulphur fuels such as biomass, the potential for reduction performance of ESPs is reduced with low flue-gas sulphur dioxide concentrations. In this context, the FF, which leads to dust emission around 5mg/Nm³, is the preferred technical option to reduce dust emissions.</p>	Applicable	WESPs are in use to reduce dust emissions from combustion processes on-site.																			

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5.5.5 BAT for Dust	<p>The BAT associated emission levels are based on a daily average, standard conditions and an O₂ level of 6%, and represents a typical load situation. For peak load, start up and shut down periods as well as for operational problems of the flue-gas cleaning systems, short-term peak values, which could be higher, have to be regarded.</p> <p>Table 5.32: BAT for dedusting off-gases from biomass and peat fired combustion plants</p> <table border="1"> <thead> <tr> <th rowspan="2">Capacity (MW_{th})</th> <th colspan="2">Dust-emission level (mg/Nm³)</th> <th rowspan="2">BAT to reach these levels</th> <th rowspan="2">Monitoring</th> <th rowspan="2">Applicability</th> <th rowspan="2">Comments</th> </tr> <tr> <th>New plants</th> <th>Existing plants</th> </tr> </thead> <tbody> <tr> <td>50 – 100</td> <td>5 – 20</td> <td>5 – 30</td> <td>FF/ESP</td> <td>Continuous</td> <td>New and existing plants</td> <td>The reduction rate associated with the use of a fabric filter is considered to be 99.95 % or higher and is, therefore, considered as the first BAT choice for dedusting biomass- and peat-fired plants.</td> </tr> <tr> <td>100 – 300</td> <td>5 – 20</td> <td>5 – 20</td> <td>FF/ESP</td> <td>Continuous</td> <td>New and existing plants</td> <td></td> </tr> <tr> <td>>300</td> <td>5 – 20</td> <td>5 – 20</td> <td>FF/ESP</td> <td>Continuous</td> <td>New and existing plants</td> <td>The reduction rate associated with the use of an ESP is considered to be 99.5 % or higher.</td> </tr> </tbody> </table> <p>Notes: ESP (Electrostatic precipitator) FF (Fabric filter))</p>					Capacity (MW _{th})	Dust-emission level (mg/Nm ³)		BAT to reach these levels	Monitoring	Applicability	Comments	New plants	Existing plants	50 – 100	5 – 20	5 – 30	FF/ESP	Continuous	New and existing plants	The reduction rate associated with the use of a fabric filter is considered to be 99.95 % or higher and is, therefore, considered as the first BAT choice for dedusting biomass- and peat-fired plants.	100 – 300	5 – 20	5 – 20	FF/ESP	Continuous	New and existing plants		>300	5 – 20	5 – 20	FF/ESP	Continuous	New and existing plants	The reduction rate associated with the use of an ESP is considered to be 99.5 % or higher.	Applicable	SmartPly have a total capacity of between 100-300MW. A particulates limit of 9.4kg/hr (approx. 15mg/m ³) is in place at the emission point from the WESPs.
Capacity (MW _{th})	Dust-emission level (mg/Nm ³)		BAT to reach these levels	Monitoring	Applicability		Comments																														
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5.5.6 BAT for Heavy metals	<p>BAT to reduce the emissions of heavy metals from flue-gases of biomass and peat-fired combustion plants is the use of a fabric filter or a high performance ESP where the fabric filter should be seen as the first choice in the hierarchy of BAT for dedusting.</p>					Applicable	WESPs are in use to reduce emissions from combustion processes on-site.																														

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BAT ref Number	BAT Statement	Applicability	Proposed/ in place
5.5.7 BAT for SO ₂ emissions	In the new smaller LCP boilers (i.e. <100 MWth), fluidised bed combustion is usually applied. In these boilers, wet desulphurisation techniques are too expensive to be considered as BAT and the dry injection processes (in situ desulphurisation by adding limestone or dolomite to the bed) can be effective enough to reach the same emission levels. Calcium hydroxide injection in the dry form before the fabric filter or ESP can also achieve a high reduction rate. In the furnace, limestone injection together with a calcium oxide activation scrubber, is also quite effective in some cases. These measures also remove other harmful emissions, such as HCl. The HC level associated with the use of BAT is considered to be less than 25mg/Nm ³ .	Not Applicable	SmartPly do not plan to commission a new boiler in the near future.
5.5.7 BAT for SO ₂ emissions	In CFBC with high desulphurisation (e.g. >80 %), BAT is a combination of sorbent injection into the furnace including the use of a secondary measure.	Not Applicable	

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BAT ref Number	BAT Statement						Applicability	Proposed/ in place	
5.5.7 BAT for SO ₂ emissions	Table 5.33: BAT for the prevention and control of sulphur dioxides from peat-fired combustion plants.						Not Applicable	SmartPly do not use peat as a fuel on-site.	
	Capacity (MW _{th})	Combustion technique	SO ₂ emission level associated with BAT (mg/Nm ³)		BAT options to reach these levels (non- exhaustive list)	Applicability			Monitoring
			New plants	Existing plants					
	50 – 100	PC	200 – 300	200 – 300	Limestone injection Calcium hydroxide injection in dry form before the baghouse or ESP FGD(sds)	New and existing plants			Continuous
		FBC (BFBC and CFBC)	200 – 300	200 – 300	Co-combustion of biomass and peat, Limestone injection, Calcium hydroxide injection in dry form before the baghouse or ESP, FGD(sds)	New and existing plants			Continuous
	100 – 300	PC	200 – 300	200 – 300	Limestone injection Calcium hydroxide injection in dry form before the baghouse or ESP FGD(sds)	New and existing plants			Continuous
FBC (BFBC and CFBC)		150 – 250	150 – 300	Co-combustion of biomass and peat, Limestone injection, Calcium hydroxide injection in dry form before the baghouse or ESP, FGD(sds)	New and existing plants	Continuous			

Title of Document BAT for Large Combustion Plants, July 2006																																																
BAT ref Number	BAT Statement					Applicability	Proposed/ in place																																									
5.5.8 BAT for NO _x emissions	<p>The BAT conclusion for the prevention and control of NO_x emissions and the associated emission levels are summarised in Table 5.34. The BAT associated emission levels are based on daily average, standard conditions and an O₂ level of 6% and represents a typical load situation.</p> <p>Table 5.34: BAT for nitrogen oxide prevention and control in biomass- and peat-fired combustion plants</p> <table border="1"> <thead> <tr> <th rowspan="2">Capacity (MW_{th})</th> <th rowspan="2">Combustion technique</th> <th colspan="2">NO_x emission level associated with BAT (mg/Nm³)</th> <th rowspan="2">BAT options to reach these levels (not exhaustive list)</th> <th rowspan="2">Applicability</th> <th rowspan="2">Monitoring</th> </tr> <tr> <th>New plants</th> <th>Existing plants</th> </tr> </thead> <tbody> <tr> <td rowspan="3">50 – 100</td> <td>Grate-firing</td> <td>170 – 250</td> <td>200 – 300</td> <td>Spreader-stoker</td> <td></td> <td>Continuous</td> </tr> <tr> <td>PC</td> <td>150 – 250</td> <td>150 – 300</td> <td>Combination of Pm (such as air and fuel staging, low NO_x burner, etc.) SCR</td> <td>New and existing plants</td> <td>Continuous</td> </tr> <tr> <td>FBC(BFBC and CFBC)</td> <td>150 – 250</td> <td>150 – 300</td> <td>Combination of Pm (such as air distribution or by flue-gas recirculation)</td> <td>New and existing plants</td> <td>Continuous</td> </tr> <tr> <td rowspan="2">100 – 300</td> <td>PC</td> <td>150 – 200</td> <td>150 – 250</td> <td>Combination of Pm (such as air and fuel staging, low NO_x burner) if necessary SNCR and/or SCR</td> <td>New and existing plants</td> <td>Continuous</td> </tr> <tr> <td>FBC (BFBC, and CFBC)</td> <td>150 – 200</td> <td>150 – 250</td> <td>Combination of Pm (such as air distribution or by flue-gas recirculation)</td> <td>New and existing plants</td> <td>Continuous</td> </tr> </tbody> </table>					Capacity (MW _{th})	Combustion technique	NO _x emission level associated with BAT (mg/Nm ³)		BAT options to reach these levels (not exhaustive list)	Applicability	Monitoring	New plants	Existing plants	50 – 100	Grate-firing	170 – 250	200 – 300	Spreader-stoker		Continuous	PC	150 – 250	150 – 300	Combination of Pm (such as air and fuel staging, low NO _x burner, etc.) SCR	New and existing plants	Continuous	FBC(BFBC and CFBC)	150 – 250	150 – 300	Combination of Pm (such as air distribution or by flue-gas recirculation)	New and existing plants	Continuous	100 – 300	PC	150 – 200	150 – 250	Combination of Pm (such as air and fuel staging, low NO _x burner) if necessary SNCR and/or SCR	New and existing plants	Continuous	FBC (BFBC, and CFBC)	150 – 200	150 – 250	Combination of Pm (such as air distribution or by flue-gas recirculation)	New and existing plants	Continuous	Applicable	SmartPly have a total capacity of between 100-300MW. A limit of 141kg/hr of NO _x at a rate of 620,000m ³ /hr at A2-1 is in place. This is equivalent to approximately 227mg/m ³ .
Capacity (MW _{th})	Combustion technique	NO _x emission level associated with BAT (mg/Nm ³)		BAT options to reach these levels (not exhaustive list)	Applicability			Monitoring																																								
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	PC	150 – 250	150 – 300	Combination of Pm (such as air and fuel staging, low NO _x burner, etc.) SCR	New and existing plants	Continuous																																										
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100 – 300	PC	150 – 200	150 – 250	Combination of Pm (such as air and fuel staging, low NO _x burner) if necessary SNCR and/or SCR	New and existing plants	Continuous																																										
	FBC (BFBC, and CFBC)	150 – 200	150 – 250	Combination of Pm (such as air distribution or by flue-gas recirculation)	New and existing plants	Continuous																																										

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
5.5.10 BAT for Hydrogen fluoride (HF) and hydrogen chloride (HCl)	In combustion plants using straw as a fuel, the variation in the HCl emissions is from 50 to 300 mg/Nm ³ (daily mean value) with a typical yearly mean value of 100 mg/Nm ³ . For larger straw-fired plants, the application of a wet scrubber or a spray dry scrubber system is considered as part of BAT if higher amounts of HCl have been measured. Both wet scrubber or spray dry scrubber systems reduce HCl (with a reduction rate of about 98 %). SO ₂ emissions, which can be up to 300 mg/Nm ³ in the raw gas of a straw fired plant, can also be reduced (with a reduction rate 80 – 95 %). In this case, the associated HCl emission level is between 5 and 25 mg/Nm ³ .	Not applicable	SmartPly do not use straw as a fuel.
5.5.11 BAT for Ammonia (NH ₃)	One disadvantage of SNCR and SCR systems is the emission of unreacted ammonia into the air (ammonia slip). The ammonia emission concentration associated with the use of BAT is considered to be below 5mg/Nm ³ .	Not Applicable	
5.5.12 BAT for Dioxins and furans	In some biomass fired plants, especially wood-fired combustion plants, the emissions of dioxins and furans have been measured and an emission level of below 0.1ng/Nm ³ is generally regarded as achievable.	Applicable	Concentrations of dioxins and furans emitted from SmartPly are likely insignificant. No contaminated wood is used.
5.5.13 BAT for Noise	Special care has to be taken when cutting straw needed for co-firing with coal in pulverised fuel boilers. BAT for cutting straw is to use hammer-mills (which have a high noise level). Special attention has also to be paid to subsequent pneumatic transport to the burner.	Not Applicable	SmartPly do not use straw as a fuel.

Title of Document BAT for Large Combustion Plants, July 2006																																																									
BAT ref Number	BAT Statement	Applicability	Proposed/ in place																																																						
5.5.14 BAT for Water pollution.	<p>To reduce emissions to water and to avoid water contamination, all measures that have been presented in Section 5.4.8 are considered to be BAT and summarised in the Table 5.35.</p> <p>Table 5.35 BAT for the reduction of waste water contamination</p> <table border="1"> <thead> <tr> <th rowspan="2">Technique</th> <th rowspan="2">Main environmental benefit</th> <th colspan="2">Applicability</th> </tr> <tr> <th>New plants</th> <th>Retrofitted plants</th> </tr> </thead> <tbody> <tr> <td colspan="4">Wet FGD (only applied if necessary under the conditions of Section 5.4.8)</td> </tr> <tr> <td>Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation</td> <td>Removal of fluoride, heavy metal, COD and particulates</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td>Closed loop operation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td>Mixing of waste water with ash</td> <td>Avoided waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4">Slag flushing and transport</td> </tr> <tr> <td>Closed water circuit by filtration or sedimentation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4">Regeneration of demineralisers and condensate polishers</td> </tr> <tr> <td>Neutralisation and sedimentation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4">Washing of boilers, air preheaters and precipitators</td> </tr> <tr> <td>Neutralisation and closed loop operation, or replacement by dry cleaning methods</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4">Surface run-off</td> </tr> <tr> <td>Sedimentations or chemical treatment and internal re-use</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> </tbody> </table>	Technique	Main environmental benefit	Applicability		New plants	Retrofitted plants	Wet FGD (only applied if necessary under the conditions of Section 5.4.8)				Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation	Removal of fluoride, heavy metal, COD and particulates	BAT	BAT	Closed loop operation	Reduced waste water discharge	BAT	BAT	Mixing of waste water with ash	Avoided waste water discharge	BAT	BAT	Slag flushing and transport				Closed water circuit by filtration or sedimentation	Reduced waste water discharge	BAT	BAT	Regeneration of demineralisers and condensate polishers				Neutralisation and sedimentation	Reduced waste water discharge	BAT	BAT	Washing of boilers, air preheaters and precipitators				Neutralisation and closed loop operation, or replacement by dry cleaning methods	Reduced waste water discharge	BAT	BAT	Surface run-off				Sedimentations or chemical treatment and internal re-use	Reduced waste water discharge	BAT	BAT	Not Applicable	SmartPly do not produce process wastewater.
Technique	Main environmental benefit			Applicability																																																					
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5.5.14 BAT for Water pollution.	The surface run-off (rainwater) of the storage areas that washes fuel particles away should be collected and treated (settling-out) before discharge. The associated BAT emission level in the discharged water is considered to be less than 30 mg/l. Small amounts of oil contaminated (washing) water cannot be prevented	Applicable	A limit of 30mg/L suspended solids in STP effluent is in place at the site.																																																						
5.5.15 BAT for Combustion residues	Attention has been paid by industry to the utilisation of combustion residues and by-products, instead of depositing them in landfills. Utilisation and re-use is, therefore, the best available option.	Applicable	Residues are used in landfill cover and cement manufacturing.																																																						
6.5 Best available techniques (BAT) for the combustion of liquid fuels																																																									

Title of Document BAT for Large Combustion Plants, July 2006									
BAT ref Number	BAT Statement		Applicability	Proposed/ in place					
6.5.1 BAT for Unloading, storage and handling of liquid fuel and additives	Table 6.41: BAT for the unloading, storage and handling of liquid fuel and additives.		Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.					
	<table border="1"> <thead> <tr> <th>Material</th> <th>Pollutant</th> <th>BAT (not exhaustive list)</th> </tr> </thead> <tbody> <tr> <td>Liquid fuel</td> <td>Water contamination</td> <td> <ul style="list-style-type: none"> the use of liquid fuel storage systems that are contained in impervious bunds that have a capacity capable of containing 50 - 75 % of the maximum capacity of all tanks or at least the maximum volume of the biggest tank. Storage areas should be designed so that leaks from the upper portions of tanks and from delivery systems are intercepted and contained in the bund. Tank contents should be displayed and associated alarms used. The use of planned deliveries and automatic control systems can be applied to prevent the overfilling of storage tanks pipelines placed in safe, open areas aboveground so that leaks can be detected quickly and damage from vehicles and other equipment can be prevented. If buried pipelines are used their course can be documented and marked and safe excavation systems adopted. For underground pipes, double walled type pipes with automatic control of the spacing and special construction of piping (steel pipes, welded connections and no valves in underground section etc.) are BAT surface run-off (rainwater) that might be contaminated by any spillage of fuel from the storage and handling should be collected and treated before discharge. </td> </tr> <tr> <td>Lime and Limestone</td> <td></td> <td> <ul style="list-style-type: none"> enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. </td> </tr> </tbody> </table>	Material			Pollutant	BAT (not exhaustive list)	Liquid fuel	Water contamination	<ul style="list-style-type: none"> the use of liquid fuel storage systems that are contained in impervious bunds that have a capacity capable of containing 50 - 75 % of the maximum capacity of all tanks or at least the maximum volume of the biggest tank. Storage areas should be designed so that leaks from the upper portions of tanks and from delivery systems are intercepted and contained in the bund. Tank contents should be displayed and associated alarms used. The use of planned deliveries and automatic control systems can be applied to prevent the overfilling of storage tanks pipelines placed in safe, open areas aboveground so that leaks can be detected quickly and damage from vehicles and other equipment can be prevented. If buried pipelines are used their course can be documented and marked and safe excavation systems adopted. For underground pipes, double walled type pipes with automatic control of the spacing and special construction of piping (steel pipes, welded connections and no valves in underground section etc.) are BAT surface run-off (rainwater) that might be contaminated by any spillage of fuel from the storage and handling should be collected and treated before discharge.
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Lime and Limestone		<ul style="list-style-type: none"> enclosed conveyors, pneumatic transfer systems and silos with well designed, robust extraction and filtration equipment on delivery and conveyor transfer points to prevent the emission of dust. 							
6.5.1 BAT for Unloading, storage and handling of liquid fuel and additives (Continued)	Table 6.41: BAT for the unloading, storage and handling of liquid fuel and additives. (Continueud)		Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.					
	<table border="1"> <thead> <tr> <th>Material</th> <th>Pollutant</th> <th>BAT (not exhaustive list)</th> </tr> </thead> <tbody> <tr> <td>Pure liquified ammonia</td> <td>Health and safety risk according to ammonia</td> <td> <ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealling process from a safety point of view, the use of an ammonia water solution is less risky than the storage and handling of pure liquefied ammonia. </td> </tr> </tbody> </table>	Material			Pollutant	BAT (not exhaustive list)	Pure liquified ammonia	Health and safety risk according to ammonia	<ul style="list-style-type: none"> for handling and storage of pure liquified ammonia: pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealling process from a safety point of view, the use of an ammonia water solution is less risky than the storage and handling of pure liquefied ammonia.
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Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
6.5.2 BAT for Pretreatment of liquid fuels used in engines and gas turbines	For diesel oil used as a fuel in gas turbines and engines, fuel pretreatment plants, which comprise diesel oil cleaning units of the centrifuge self-cleaning type or of the electrostatic type, are considered as BAT.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.3.1 BAT for Liquid fuel-fired boilers (Thermal Efficiency)	The co-generation of heat and power (CHP) is one of the technically and economically most efficient means of increasing the energy efficiency of an energy supply system. Co-generation is, therefore, considered as the most important BAT option in order to reduce the amount of O ₂ released to the atmosphere per unit of energy generated. CHP should be an aim for any new build power plant whenever economically feasible For existing liquid fuel-fired plants, a number of retrofit and repowering techniques can be applied to improve the thermal efficiency. The technical measures described in Section 2.7.9 should be taken into account as part of the BAT options to improve the efficiency of existing plants. The use of advanced computerised control systems in order to achieve a high boiler performance with increased combustion conditions that support the reduction of emissions are also considered as BAT.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.3.2 BAT for Liquid fuel-fired boilers (Dust and heavy metal emissions)	For dedusting off-gases from new and existing liquid fuel-fired combustion plants, BAT is considered to be the use of an electrostatic precipitator (ESP) or a fabric filter. Cyclones and mechanical collectors alone are not BAT, but they can be used as a pre-cleaning stage in the flue-gas path.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.3.2 BAT for Liquid fuel-fired boilers (Dust and heavy metal emissions)	Periodic monitoring for heavy metals is BAT. A frequency of every year up to every third year, depending on the kind of liquid fuel used is recommended. Total-Hg especially needs to be monitored and not only the part bound to particles.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.

Title of Document BAT for Large Combustion Plants, July 2006								
BAT ref Number	BAT Statement					Applicability	Proposed/ in place	
6.5.3.2 BAT for Liquid fuel-fired boilers (Dust and heavy metal emissions)	Table 6.42 BAT for dedusting off-gases from liquid fuel fired combustion plants					Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.	
	Capacity (MW_{th})	Dust emission level (mg/Nm³)		BAT to reach these levels	Monitoring			Applicability
		New plants	Existing plants					
	50 – 100	5 – 20 ⁽¹⁾	5 – 30 ⁽²⁾	ESP/FF	Continuous ^(1,2)			New and existing plants
	100 – 300	5 – 20 ⁽³⁾	5 – 25 ⁽⁴⁾	ESP/FF/in combination FGD (wet) (depending on the specific plant size)	Continuous			New and existing plants
>300	5 – 10 ⁽⁵⁾	5 – 20 ⁽⁶⁾	ESP/FF/in combination with FGD (wet)	Continuous	New and existing plants			
Notes:								
ESP (Electrostatic precipitator) FF (Fabric filter) FGD(wet) (Wet flue-gas desulphurisation)								
Industry and one Member State declared that emission levels have to be presented for cases where dust emissions are controlled by ESPs only without the application of a wet FGD. The following levels were proposed:								
1, 2 10 – 50 mg/Nm ³ for ESP, monitoring periodically								
3, 5 upper level 30 mg/Nm ³ for ESP								
4, 6 upper level 50 mg/Nm ³ for ESP								
1 – 6 50 – 100 mg/Nm ³ for burners with steam atomisation or use of additives regardless of the existing power plant's capacity.								
3 – 6 Industry claimed an upper level of 15 mg/Nm ³ for ESP or FF in combination with a wet FGD								
4, 6 One Member State proposed that the BAT range for existing plants with a capacity over 100 MW _{th} should be 10 – 50 mg/Nm ³ , because these levels comply with the Member States emission limits.								
2 One Industry representative mentioned that dust emissions of around 50 mg/Nm ³ are achieved. To reduce this to 30 mg/Nm ³ by fitting fabric filters or ESPs to achieve a corresponding reduction of around 20 tonnes of dust per year cannot represent BAT.								

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
6.5.3.3 BAT for SO ₂ emissions	<p>In general, for liquid fuel-fired combustion plants, the use of low sulphur fuel oil and/or desulphurisation are considered to be BAT. However, the use of low sulphur fuel oil for plants over 100 MWth can, in most cases, only be seen as a supplementary but generally not in itself sufficient way to reduce SO₂. In sites where natural gas is available, co-combustion of gas and oil is also part of BAT.</p> <p>Besides the use of low sulphur fuel oil, the techniques that are considered to be BAT are mainly the wet scrubber (reduction rate 92 - 98 %), and the spray dry scrubber desulphurisation (reduction rate 85 – 92 %), which already has a market share of more than 90 % of flue-gas desulphurisation techniques.</p> <p>The wet scrubbing process is an expensive option for smaller plants and has, therefore, not been considered as BAT for plants with a capacity of less than 100 MWth.</p> <p>The seawater scrubber has been considered to be part of the BAT conclusion because of its high reliability, and because it is a simple process which does not require slurry handling and does not generate by-products.</p>	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.

Title of Document BAT for Large Combustion Plants, July 2006								
BAT ref Number	BAT Statement					Applicability	Proposed/ in place	
6.5.3.3 BAT for SO ₂ emissions	Table 6.43 BAT for the prevention and control of sulphur dioxide from liquid fuel-fired combustion plants					Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.	
	Capacity (MW _{th})	SO ₂ emission level associated with BAT (mg/Nm ³)		BAT options to reach these levels	Applicability			Monitoring
		New plants	Existing plants					
	50 – 100	100 – 350 ⁽¹⁾	100 – 350 ⁽²⁾	Low sulphur fuel oil co-combustion of gas and oil FGD (dsi) or FGD (sds)	New and existing plants			Continuous
	100 – 300	100 – 200 ⁽³⁾	100 – 250 ⁽⁴⁾	Low sulphur fuel oil co-combustion of gas and oil and FGD (dsi) or FGD (sds) or FGD (wet) (depending on the plant size) Seawater scrubbing Combined techniques for the reduction of NO _x and SO ₂	New and existing plants			Continuous
>300	50 – 150 ⁽⁵⁾	50 – 200 ⁽⁶⁾	Low sulphur fuel oil co-combustion of gas and oil and FGD (wet) FGD (sds) Seawater scrubbing Combined techniques for the reduction of NO _x and SO ₂	New and existing plants	Continuous			
Notes: FGD(w et) (Wet flue-gas desulphurisation) FGD(sds) (Flue-gas desulphurisation by using a spray drier) FGD(dsi) (Flue-gas desulphurisation by dry sorbent injection)								

Title of Document BAT for Large Combustion Plants, July 2006													
BAT ref Number	BAT Statement	Applicability	Proposed/ in place										
6.5.3.3 BAT for SO ₂ emissions (Continued)	<p>Table 6.43 BAT for the prevention and control of sulphur dioxide from liquid fuel-fired combustion plants (Continued)</p> <table border="1"> <tr> <td>1,2</td> <td>The following levels were proposed by Industry and the one Member State: range to be 200 – 850 mg/Nm³</td> </tr> <tr> <td>3, 4, 6</td> <td>upper level 400 mg/Nm³</td> </tr> <tr> <td>5</td> <td>upper level 200 mg/Nm³</td> </tr> <tr> <td>2, 4, 6</td> <td>Industry declared no BAT level should be given if low sulphur fuel is used. Their rationale is that for oil-fired LCPs, the SO₂ emission levels by using low sulphur fuel in combination with FGD are designed to optimise environmental benefit with the high cost of fuel and the FGD. The high net unit efficiency requirement has to be optimised among the cost of the fuel, the emission control technique performance (low emission levels) and the related energy consumption (energy penalty). The Member State argued that heavy fuel oil burners operate with a very high cost fuel. The SO₂ reduction techniques and the associated emission levels have to be reasonable, in order to ensure the economic viability of the plants, with very careful assessment of the environmental benefit against all the costs and the cross-media effects involved. It is very important for existing plants to allow the use of low sulphur fuel only in order to avoid any drop in net unit efficiency.</td> </tr> <tr> <td>6</td> <td>One Member State proposed that the BAT range for existing plants over 300 MW should be 200 – 400 mg/Nm³, because these levels comply with the Member States emission limits.</td> </tr> </table>	1,2	The following levels were proposed by Industry and the one Member State: range to be 200 – 850 mg/Nm ³	3, 4, 6	upper level 400 mg/Nm ³	5	upper level 200 mg/Nm ³	2, 4, 6	Industry declared no BAT level should be given if low sulphur fuel is used. Their rationale is that for oil-fired LCPs, the SO ₂ emission levels by using low sulphur fuel in combination with FGD are designed to optimise environmental benefit with the high cost of fuel and the FGD. The high net unit efficiency requirement has to be optimised among the cost of the fuel, the emission control technique performance (low emission levels) and the related energy consumption (energy penalty). The Member State argued that heavy fuel oil burners operate with a very high cost fuel. The SO ₂ reduction techniques and the associated emission levels have to be reasonable, in order to ensure the economic viability of the plants, with very careful assessment of the environmental benefit against all the costs and the cross-media effects involved. It is very important for existing plants to allow the use of low sulphur fuel only in order to avoid any drop in net unit efficiency.	6	One Member State proposed that the BAT range for existing plants over 300 MW should be 200 – 400 mg/Nm ³ , because these levels comply with the Member States emission limits.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
1,2	The following levels were proposed by Industry and the one Member State: range to be 200 – 850 mg/Nm ³												
3, 4, 6	upper level 400 mg/Nm ³												
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2, 4, 6	Industry declared no BAT level should be given if low sulphur fuel is used. Their rationale is that for oil-fired LCPs, the SO ₂ emission levels by using low sulphur fuel in combination with FGD are designed to optimise environmental benefit with the high cost of fuel and the FGD. The high net unit efficiency requirement has to be optimised among the cost of the fuel, the emission control technique performance (low emission levels) and the related energy consumption (energy penalty). The Member State argued that heavy fuel oil burners operate with a very high cost fuel. The SO ₂ reduction techniques and the associated emission levels have to be reasonable, in order to ensure the economic viability of the plants, with very careful assessment of the environmental benefit against all the costs and the cross-media effects involved. It is very important for existing plants to allow the use of low sulphur fuel only in order to avoid any drop in net unit efficiency.												
6	One Member State proposed that the BAT range for existing plants over 300 MW should be 200 – 400 mg/Nm ³ , because these levels comply with the Member States emission limits.												
6.5.3.4 BAT for NO _x emissions	<p>In general, for liquid fuel-fired combustion plants, the reduction of nitrogen oxides (NO_x) by using a combination of primary and/or secondary measures such as SCR is considered to be BAT. The nitrogen compounds of interest are nitric oxide (NO), nitrogen dioxide (NO₂), collectively referred to as NO_x and nitrous oxide (N₂O). For combustion plants over 50 MWth and in particular for large plants over 100 MWth for the reduction of NO_x emissions, BAT is considered to be the use of primary measures in combination with SCR or other end-of-pipe techniques.</p>	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.										

Title of Document BAT for Large Combustion Plants, July 2006								
BAT ref Number	BAT Statement					Applicability	Proposed/ in place	
6.5.3.4 BAT for NO _x emissions	Table 6.44: BAT for nitrogen oxide prevention and control in liquid fuel-fired combustion plants.					Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.	
		NO _x emission level associated with BAT (mg/Nm ³)		BAT options to achieve these levels	Applicability			Monitoring
		new plants	Existing plants					
	50 - 100	150 – 300 ⁽¹⁾	150 – 450	Combination of Pm (such as air and fuel staging, low-NO _x burner, etc. For LFO firing NO _x <300 mg/Nm ³ For HFO firing with max 0,2 % N in fuel oil NO _x <360 mg/Nm ³ For HFO firing with max 0,3 % N in fuel oil NO _x <450 mg/Nm ³ SCR SNCR in case of HFO firing	New and existing plants			Continuous ⁽⁶⁾
100 - 300	50 – 150 ⁽²⁾	50 – 200 ⁽³⁾	Combination of Pm (such as air and fuel staging, low-NO _x burner, reburning, etc) in combination with SNCR, SCR or combined techniques	New and existing plants	Continuous			
>300	50 – 100 ⁽⁴⁾	50 – 150 ⁽⁵⁾	Combination of Pm (such as air and fuel staging, low-NO _x burner, reburning, etc) in combination with SCR or Combined techniques	New and existing plants	Continuous			

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
6.5.3.4 BAT for NO _x emissions (Continued)	<p>Table 6.44: BAT for nitrogen oxide prevention and control in liquid fuel-fired combustion plants. (Continued).</p> <p>Industry and one Member State proposed the following levels</p> <p>1, 5 upper level 400 mg/Nm³ 2, 4 upper level 200 mg/Nm³ 3 upper level 450 mg/Nm³ 6 Industry claimed that they wanted to change 'continuous' by 'periodical' monitoring The rationale given for existing plants is that the new values proposed allow power plants to use heavy fuel oil with high N content with NO_x abatement primary measures only</p> <p>5 One Member State proposed that the BAT range for existing plants over 300 MW should be 100 – 400 mg/Nm³, because these levels comply with the Member States emission limits</p> <p>1 A TWG member proposed to reduce the lower end of the range to 100 mg/Nm³, because this reflected the performance of SCRs</p>	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.3.5 BAT for Carbon monoxide (CO)	BAT for the minimisation of CO emissions is complete combustion, which goes together with good furnace design, the use of high performance monitoring and process control techniques and maintenance of the combustion system. Besides the combustion conditions, a well optimised system to reduce emissions of NO _x will also keep the CO levels between 30 and 50 mg/Nm ³ .	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.3.6 BAT for Ammonia (NH ₃)	The ammonium concentration in the emission associated with the use of BAT is considered to be below 5 mg/Nm ³ . The ammonium slip is often the limiting factor in the utilisation of an SNCR technique. To avoid the ammonia slip with the SNCR technique. A layer of SCR catalyst may be installed in the economiser area of the boiler, if the flue-gas temperature level is adequate to. As this catalyst reduces ammonia slip, it also reduces the corresponding amount of NO _x .	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.3.7 BAT for Water pollution	The BAT conclusion for wet scrubbing desulphurisation is related to the application of a waste water treatment plant. The waste water treatment plant consists of different chemical treatments to remove heavy metals and to decrease the amount of solid matter from the water.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.

Title of Document BAT for Large Combustion Plants, July 2006																																	
BAT ref Number	BAT Statement	Applicability	Proposed/ in place																														
6.5.3.7 BAT for Water pollution	<p>Table 6.4.5 Emissions levels associated with the use of a BAT – FGD waste water treatment plant given as a representative 24 hour composite sample</p> <table border="1"> <thead> <tr> <th colspan="2">Emission to water from Wet FGD waste water treatment plant (mg/l)</th> </tr> </thead> <tbody> <tr> <td>COD</td> <td><150</td> </tr> <tr> <td>F</td> <td>1 – 30</td> </tr> <tr> <td>Nitrogen compounds</td> <td><50</td> </tr> <tr> <td>Solids</td> <td>5 – 30</td> </tr> <tr> <td>Sulphate</td> <td>1000 – 2000</td> </tr> <tr> <td>Sulphide</td> <td><0.2</td> </tr> <tr> <td>Sulphite</td> <td>0.5 – 20</td> </tr> <tr> <td>Cd</td> <td><0.05</td> </tr> <tr> <td>Cr</td> <td><0.5</td> </tr> <tr> <td>Cu</td> <td><0.5</td> </tr> <tr> <td>Hg</td> <td>0.01 – 0.02</td> </tr> <tr> <td>Ni</td> <td><0.5</td> </tr> <tr> <td>Pb</td> <td><0.1</td> </tr> <tr> <td>Zn</td> <td><1</td> </tr> </tbody> </table>	Emission to water from Wet FGD waste water treatment plant (mg/l)		COD	<150	F	1 – 30	Nitrogen compounds	<50	Solids	5 – 30	Sulphate	1000 – 2000	Sulphide	<0.2	Sulphite	0.5 – 20	Cd	<0.05	Cr	<0.5	Cu	<0.5	Hg	0.01 – 0.02	Ni	<0.5	Pb	<0.1	Zn	<1	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
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6.5.3.7 BAT for Water pollution	<p>Table 6.46: BAT for waste water treatment</p> <table border="1"> <thead> <tr> <th rowspan="2">Technique</th> <th rowspan="2">Main environmental benefit</th> <th colspan="2">Applicability</th> </tr> <tr> <th>New plants</th> <th>Retrofitted plants</th> </tr> </thead> <tbody> <tr> <td colspan="4" style="text-align: center;">For plants with wet FGD</td> </tr> <tr> <td>Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation</td> <td>Removal of fluoride, heavy metals, COD and particulates</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td>Ammonia reduction by air stripping, precipitation or biodegradation</td> <td>Reduced ammonia content</td> <td colspan="2">BAT only if ammonia content in waste water is high because of SCR/SNCR used upstream FGD</td> </tr> <tr> <td>Closed loop operation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Regeneration of demineralisers and condensate polishers</td> </tr> <tr> <td>Neutralisation and sedimentation</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Elutriation</td> </tr> <tr> <td>Neutralisation</td> <td></td> <td colspan="2">BAT only in the case of alkaline operation</td> </tr> <tr> <td colspan="4" style="text-align: center;">Washing of boilers, air preheaters and precipitators</td> </tr> <tr> <td>Neutralisation and closed loop operation, or replacement by dry cleaning methods</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> <tr> <td colspan="4" style="text-align: center;">Surface run-off</td> </tr> <tr> <td>Sedimentations or chemical treatment and internal re-use</td> <td>Reduced waste water discharge</td> <td>BAT</td> <td>BAT</td> </tr> </tbody> </table>	Technique	Main environmental benefit	Applicability		New plants	Retrofitted plants	For plants with wet FGD				Water treatment by flocculation, sedimentation, filtration, ion-exchange and neutralisation	Removal of fluoride, heavy metals, COD and particulates	BAT	BAT	Ammonia reduction by air stripping, precipitation or biodegradation	Reduced ammonia content	BAT only if ammonia content in waste water is high because of SCR/SNCR used upstream FGD		Closed loop operation	Reduced waste water discharge	BAT	BAT	Regeneration of demineralisers and condensate polishers				Neutralisation and sedimentation	Reduced waste water discharge	BAT	BAT	Elutriation				Neutralisation		BAT only in the case of alkaline operation		Washing of boilers, air preheaters and precipitators				Neutralisation and closed loop operation, or replacement by dry cleaning methods	Reduced waste water discharge	BAT	BAT	Surface run-off				Sedimentations or chemical treatment and internal re-use	Reduced waste water discharge	BAT	BAT	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
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6.5.3.8 BAT for Combustion residues	A lot of attention has already been paid by industry to the utilisation of combustion residues and by-products instead of depositing them in landfills. Utilisation and re-use is, therefore, the best available option.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.																																																						
6.5.4 BAT for liquid fuel-fired gas turbines.	For gas turbines firing liquid fuel such as LFO or diesel, the injection of water or steam is considered as BAT for the reduction of NO _x emissions. Nowadays, dry low NO _x premix burners (DLN) are also available for liquid fuel-fired gas turbines. These DLN burners can even be used if liquid fuel and natural gas is fired in the same turbine. DLN burners are only BAT for new turbines were the technique is available on the market for the use in gas turbines burning liquid fuels	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.																																																						

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
6.5.5 BAT for liquid fuel-fired (diesel) engines	A diesel flue-gas typically contains about 13 to 15 vol-% O ₂ and, therefore, the emission levels associated with the use of BAT are based on an O ₂ level of 15 vol-%, as the reference point.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
6.5.5.1 BAT for liquid fuel-fired (diesel) engines – Thermal efficiency	Engine driven power plants are fuel flexible and suitable both for decentralised heat and power production (CHP) as well as for larger base load applications. The BAT associated total efficiencies are up to 60 to 70 % in low pressure steam generation. With supplementary firing (with the oxygen content of the engine flue-gas being used as the main 'combustion air' in the burner) a large amount of low pressure or high pressure steam can be generated in an efficient way. In hot water production (outlet temperature typically in range of 80 to 120 °C), a total efficiency of about 85 % in liquid fuel mode and up to 90 % in gas fuel mode, highly depends on the portion of the engine cooling water energy recovered in the application, can be seen as the BAT associated level. Hot water up to 200 °C can, of course, be produced by utilising the energy in the flue-gas and a part of the engine cooling energy. Another advantage is the high thermal efficiency (low fuel consumption, and as a consequence low specific CO ₂ emission) of the engines. The BAT electrical efficiency (at the alternator terminals) ranges from about 40 to 45 % (depending on engine size) calculated based on the lower heating value of the fuel.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.

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6.5.5.2 BAT for liquid fuel-fired (diesel) engines – Dust and heavy metal emissions	<p>The BAT conclusion for the prevention and control of particulate emissions from four stroke engines and the associated emission levels are summarised in Table 6.47. The emission levels of dust from two stroke engines can be higher.</p> <p>Table 6.47: BAT for dedusting off-gases from four stroke engine plants by primary engine measures.</p> <table border="1"> <thead> <tr> <th>Engine type</th> <th>Dust-emission level (mg/Nm³)</th> <th>Monitoring</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>Diesel engine</td> <td><30 LFO/diesel <50⁽¹⁾ HFO</td> <td>Discontinuous once every 6 month</td> <td>Steady state 85 to 100 % load of the engine. O₂-reference point at 15 vol-%, Nm³ at 273 K and 101.3 kPa.</td> </tr> <tr> <td>A dual fuel engine in back-up fuel mode (diesel oil max. 0.02 wt-% ash)</td> <td><30 LFO/diesel <50⁽¹⁾ HFO</td> <td>Discontinuous once every 6 month</td> <td>Particle filter systems are under development for engines over 5 MWth</td> </tr> <tr> <td>1</td> <td colspan="3">One Member State claimed that dust emission levels from diesel engines burning heavy fuel oil should be increased to 100 mg/Nm³ at 15 % O₂, because for diesel engines (4-stroke or 2-stroke) this higher value better reflects the dust emissions for HFO and consider the influence of other fuel parameters better apart from the ash content, such as sulphur and asphaltene content.</td> </tr> </tbody> </table>			Engine type	Dust-emission level (mg/Nm ³)	Monitoring	Comments	Diesel engine	<30 LFO/diesel <50 ⁽¹⁾ HFO	Discontinuous once every 6 month	Steady state 85 to 100 % load of the engine. O ₂ -reference point at 15 vol-%, Nm ³ at 273 K and 101.3 kPa.	A dual fuel engine in back-up fuel mode (diesel oil max. 0.02 wt-% ash)	<30 LFO/diesel <50 ⁽¹⁾ HFO	Discontinuous once every 6 month	Particle filter systems are under development for engines over 5 MWth	1	One Member State claimed that dust emission levels from diesel engines burning heavy fuel oil should be increased to 100 mg/Nm ³ at 15 % O ₂ , because for diesel engines (4-stroke or 2-stroke) this higher value better reflects the dust emissions for HFO and consider the influence of other fuel parameters better apart from the ash content, such as sulphur and asphaltene content.			Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
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6.5.5.3 BAT for liquid fuel-fired (diesel) engines – SO ₂ emissions	<p>The use of low sulphur fuel oil or natural gas, whenever commercially available, is regarded as the first choice of BAT. Secondly, if low sulphur fuel oil or natural gas are not available, the use of a secondary FGD system is considered as BAT for reducing emissions of SO₂.</p>			Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.																
6.5.5.4 BAT for liquid fuel-fired (diesel) engines – NO _x emissions	<p>The application of primary methods and secondary measures, in particular the application of an SCR system is regarded as BAT to reduce NO_x emissions from liquid-fuel-fired engine plants.</p> <p>SCR is an applied technique for diesel engines, but cannot be seen as BAT for engines with frequent load variation, including frequent start up and shut down periods due to technical constraints. A SCR unit would not function effectively when the operating conditions and the consequent catalyst temperature are fluctuating frequently outside the necessary effective temperature window. As a result, SCR is part of BAT, but no specific emission levels are associated with BAT in a general sense.</p>			Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.																

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6.5.5.4 BAT for liquid fuel-fired (diesel) engines – NO _x emissions	<p>Table 6.48: BAT associated NO_x levels for liquid fuel-fired engine plants with SCR as BAT.</p> <table border="1"> <thead> <tr> <th>Engine type</th> <th>BAT</th> <th>Applicability</th> <th>Monitoring</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>Diesel oil-fired engine plant</td> <td>Miller-type engine, injection retard, water injection SCR</td> <td>SCR can be applied to new and existing plants</td> <td>Continuous</td> <td>O₂ reference point at 15 vol-%, Nm³ at 273 K and 101.3 kPa</td> </tr> <tr> <td>A dual fuel engine in back-up mode</td> <td>Miller-type engine, injection retard, water injection SCR</td> <td>SCR can be applied also to dual fuel engines for the gas fuel mode and the back-up mode</td> <td>-</td> <td>O₂ reference point at 15 vol-%, Nm³ at 273 K and 101.3 kPa</td> </tr> <tr> <td>Light fuel-fired engine plant</td> <td>Miller-type engine, injection retard, water injection SCR</td> <td>SCR can be applied to new and existing plants</td> <td>Continuous</td> <td>O₂ reference point at 15 vol-%, Nm³ at 273 K and 101.3 kPa</td> </tr> <tr> <td>Heavy fuel oil-fired engine plant</td> <td>Miller-type engine, injection retard, water injection SCR</td> <td>SCR can be applied to new and existing plants</td> <td>Continuous</td> <td>O₂ reference point at 15 vol-%, Nm³ at 273 K and 101.3 kPa</td> </tr> </tbody> </table>					Engine type	BAT	Applicability	Monitoring	Comments	Diesel oil-fired engine plant	Miller-type engine, injection retard, water injection SCR	SCR can be applied to new and existing plants	Continuous	O ₂ reference point at 15 vol-%, Nm ³ at 273 K and 101.3 kPa	A dual fuel engine in back-up mode	Miller-type engine, injection retard, water injection SCR	SCR can be applied also to dual fuel engines for the gas fuel mode and the back-up mode	-	O ₂ reference point at 15 vol-%, Nm ³ at 273 K and 101.3 kPa	Light fuel-fired engine plant	Miller-type engine, injection retard, water injection SCR	SCR can be applied to new and existing plants	Continuous	O ₂ reference point at 15 vol-%, Nm ³ at 273 K and 101.3 kPa	Heavy fuel oil-fired engine plant	Miller-type engine, injection retard, water injection SCR	SCR can be applied to new and existing plants	Continuous	O ₂ reference point at 15 vol-%, Nm ³ at 273 K and 101.3 kPa	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
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6.5.5.5 BAT for liquid fuel-fired (diesel) engines – CO and hydrocarbon emissions	<p>For the minimisation of air emissions, good maintenance of the engine is regarded as BAT. A diesel engine has low CO and hydrocarbon (HC) emissions. CO emissions are often in opposite to NO_x emissions. CO can be reduced by primary measures aiming at complete combustion. Secondary measures such as oxidation catalysts for CO reduction can also be regarded as BAT. Oxidation catalysts are not recommended in context with liquid fuels containing sulphur. For engines, CO catalysts are available on the market and are regarded as part of the BAT conclusion.</p>					Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.																									
7.5 Best available techniques (BAT) for the combustion of gaseous fuels																																

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7.5.1 Supply and handling of gaseous fuels and additives	Table 7.34: BAT for the supply and handling of gaseous fuels. <table border="1"> <thead> <tr> <th>Material</th> <th>Environmental effect</th> <th>BAT</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Natural gas</td> <td>Fugitive emissions</td> <td> <ul style="list-style-type: none"> using fuel gas leak detection systems and alarms. </td> </tr> <tr> <td>Efficient use of natural resources</td> <td> <ul style="list-style-type: none"> using expansion turbines to recover the energy content of the pressurised fuel gases preheating the fuel gas by using waste heat from the boiler or gas turbine </td> </tr> <tr> <td>Pure liquified ammonia (if used)</td> <td>Health and safety risk according to ammonia</td> <td> <ul style="list-style-type: none"> for handling and storage of pure liquified ammonia, pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing process from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquified ammonia. </td> </tr> </tbody> </table>		Material	Environmental effect	BAT	Natural gas	Fugitive emissions	<ul style="list-style-type: none"> using fuel gas leak detection systems and alarms. 	Efficient use of natural resources	<ul style="list-style-type: none"> using expansion turbines to recover the energy content of the pressurised fuel gases preheating the fuel gas by using waste heat from the boiler or gas turbine 	Pure liquified ammonia (if used)	Health and safety risk according to ammonia	<ul style="list-style-type: none"> for handling and storage of pure liquified ammonia, pressure reservoirs for pure liquified ammonia >100 m³ should be constructed as double wall and should be located subterraneously; reservoirs of 100 m³ and smaller should be manufactured including annealing process from a safety point of view, the use of an ammonia-water solution is less risky than the storage and handling of pure liquified ammonia. 	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
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7.5.2 Thermal efficiency of gas-fired combustion plants	<p>A combined cycle operation and co-generation of heat and power is, therefore, to be considered as the first BAT option</p> <p>The use of an advanced computerised control system in order to achieve a high boiler performance with increased combustion conditions that support the reduction of emissions are also considered as BAT.</p> <p>The BAT associated total efficiencies are up to 60 – 70 % in low pressure steam generation. a total efficiency (fuel utilisation) of up to 90 % in gas fuel mode can be seen as BAT, although highly depending on the portion of the engine cooling water energy recovered in the application</p> <p>The BAT electrical efficiency (at alternator terminals) ranges from about 40 to 45 % (depending on the engine size) and is calculated on the lower heating value of the fuel.</p>		Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.											

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7.5.2 Thermal efficiency of gas-fired combustion plants	Table 7.35: Efficiency of gas-fired combustion plants associated to the use of BAT (based on ISO conditions). <table border="1"> <thead> <tr> <th rowspan="2">Plant type</th> <th colspan="2">Electrical efficiency (%)</th> <th>Fuel utilisation (%)</th> <th rowspan="2">Remarks</th> </tr> <tr> <th>New plants</th> <th>Existing plants</th> <th>New and existing plants</th> </tr> </thead> <tbody> <tr> <td colspan="5">Gas turbine</td> </tr> <tr> <td>Gas turbine</td> <td>36 – 40</td> <td>32 – 35</td> <td>-</td> <td></td> </tr> <tr> <td colspan="5">Gas engine</td> </tr> <tr> <td>Gas engine</td> <td>38 – 45</td> <td></td> <td>-</td> <td></td> </tr> <tr> <td>Gas engine with HRSG in CHP mode</td> <td>>38</td> <td>>35</td> <td>75 – 85</td> <td>The wide range of energy efficiency in CHP plants is very much dependent upon the specific situation and the local demand of electricity and heat</td> </tr> <tr> <td colspan="5">Gas-fired boiler</td> </tr> <tr> <td>Gas-fired boiler</td> <td>40 – 42</td> <td>38 – 40</td> <td></td> <td></td> </tr> <tr> <td colspan="5">CCGT</td> </tr> <tr> <td>Combined cycle with or without supplementary firing (HRSG) for electricity generation only</td> <td>54 – 58</td> <td>50 – 54</td> <td>-</td> <td></td> </tr> <tr> <td>Combined cycle without supplementary firing (HRSG) in CHP mode</td> <td><38</td> <td><35</td> <td>75 – 85</td> <td rowspan="2">The wide range of the electrical and energy efficiency of CHP plants very much depends on the specific local demand for electricity and heat. By operating the CCGT in the CHP mode, the energy efficiency includes the amount of the electrical efficiency and should always be seen together to achieve the best overall exergetic efficiency.</td> </tr> <tr> <td>Combined cycle with supplementary firing in CHP mode</td> <td><40</td> <td><35</td> <td>75 – 85</td> </tr> </tbody> </table>			Plant type	Electrical efficiency (%)		Fuel utilisation (%)	Remarks	New plants	Existing plants	New and existing plants	Gas turbine					Gas turbine	36 – 40	32 – 35	-		Gas engine					Gas engine	38 – 45		-		Gas engine with HRSG in CHP mode	>38	>35	75 – 85	The wide range of energy efficiency in CHP plants is very much dependent upon the specific situation and the local demand of electricity and heat	Gas-fired boiler					Gas-fired boiler	40 – 42	38 – 40			CCGT					Combined cycle with or without supplementary firing (HRSG) for electricity generation only	54 – 58	50 – 54	-		Combined cycle without supplementary firing (HRSG) in CHP mode	<38	<35	75 – 85	The wide range of the electrical and energy efficiency of CHP plants very much depends on the specific local demand for electricity and heat. By operating the CCGT in the CHP mode, the energy efficiency includes the amount of the electrical efficiency and should always be seen together to achieve the best overall exergetic efficiency.	Combined cycle with supplementary firing in CHP mode	<40	<35	75 – 85	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
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Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.3 Dust and SO ₂ emissions from gas fired combustion plants	BAT is to limit the H ₂ S content of the refinery gas to 20 – 150mg/Nm ³ leading to an emission of 5 – 20mg of SO ₂ /Nm ³ . Such gas do not create particulate emissions. In the case of natural gas refineries, also refer to the Mineral Oil and Gas Refinery BREF.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.4 NO _x and CO emissions from gas-fired combustion plants	In general, for gas turbines, gas engines and gas fired boilers, reduction of nitrogen oxides (NO _x) is considered to be BAT. The nitrogen compounds of interest are nitric oxide (NO) and nitrogen dioxide (NO ₂), collectively referred to as NO _x . For new gas turbines, dry low NO _x premix burners (DLN) are BAT. Most existing gas turbines can be converted to the dry low NO _x premix burner (DLN) technique, but sometimes the use of water and steam injection can be a better solution. This needs to be decided case by case. For existing gas turbines, water and steam injection or conversion to the DLN technique is BAT. For gas-fired stationary engine plants, the lean-burn approach is BAT analogous to the dry low NO _x technique used in gas turbines.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.4 NO _x and CO emissions from gas-fired combustion plants	The NMVOC emissions from spark ignited lean burn gas (SG) engines and dual fuel (DF) engines in gas mode depend on the composition of natural gas. NMVOC secondary emission reduction techniques might, in some cases, be needed and an oxidation catalyst for simultaneous CO and NMVOC reduction can be applied. CO values kept below 100 g/Nm ³ (15% O ₂) and formaldehyde values below 23mg/Nm ³ (15% O ₂) are considered as BAT for a gas-fired engine equipped with an oxidation catalyst.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.4 NO _x and CO emissions from gas-fired combustion plants	BAT for the minimisation of CO emissions is complete combustion, which goes along with good furnace design, the use of high performance monitoring and process control techniques and maintenance of the combustion system. Besides the combustion conditions, a well optimised system to reduce emissions of NO _x will also keep the CO levels below 100mg/Nm ³ . In addition, the application of an oxidation catalyst for CO can be seen as BAT when it is operated in densely populated urban areas.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.

Title of Document BAT for Large Combustion Plants, July 2006									
BAT ref Number	BAT Statement					Applicability	Proposed/ in place		
7.5.4 NO _x and CO emissions from gas- fired combustion plants	Table 7.36 BAT for the reduction of NO_x and CO emissions from some gas-fired combustion plants.					Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.		
	Plant type		Emission level associated with BAT (mg/Nm ³)		O ₂ level (%)			BAT options to reach these levels	Monitoring
			NO _x	CO					
	Gas turbines								
	New gas turbines		20 - 50	5 - 100	15			Dry low-NO _x premix burners (standard equipment for new gas turbines) or SCR	Continuous
	DLN for existing gas turbines		20 - 75	5 - 100	15			Dry low-NO _x premix burners as retrofitting packages if available	Continuous
	Existing gas turbines		50 - 90 ⁽¹⁾	30 - 100	15			Water and steam injection or SCR	Continuous
	Gas engines								
	New gas engines		20 - 75 ⁽²⁾	30 - 100 ⁽³⁾	15			Lean burn concept low-NO _x tuned and oxidation catalyst for CO or SCR and oxidation catalyst for CO	Continuous ⁽⁴⁾
New gas engine with HRSG in CHP mode		20 - 75 ⁽²⁾	30 - 100 ⁽³⁾	15	Lean burn concept low-NO _x tuned and oxidation catalyst for CO or SCR and oxidation catalyst for CO	Continuous ⁽⁴⁾			
Existing gas engines		20 - 100 ⁽²⁾	30 - 100 ⁽³⁾	15	Low-NO _x tuned	Continuous ⁽⁴⁾			

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.4 NO _x and CO emissions from gas- fired combustion plants	<p>Table 7.36 BAT for the reduction of NO_x and CO emissions from some gas-fired combustion plants. (Continued)</p> <p>1 Industry and one Member State claimed that the amount of water or steam that can be injected in an existing gas turbine is limited. Injection high amounts of water or steam may lead to damage of gas turbine components. Therefore, they claimed that the range needs to be substituted by 80 – 120 mg/Nm³.</p> <p>2 Industry claimed that these ranges are not according the BAT approach. The reason given was that the range given as BAT is the same as the one given by the American LAER approach (lowest achievable emission rate). Industry proposed an environmental quality driven approach taking the surrounding (urban/other areas) into account. That means that small plants situated in rural areas shall have leaner BAT levels than large plants in city areas. Industry claimed that levels of 190 mg/Nm³ (15 % O₂) in gas mode represented the overall emission optimum considering the lowest possible fuel consumption and unburned gaseous emission of CO, VOC etc. for spark-ignited (SG) and dual fuel engines (DF) in gas mode.</p> <p>3 Industry mentioned that due to technical reasons (fuel composition impact), CO should be at a level of 110 – 380 mg/Nm³ (15 % O₂) in order to represent BAT.</p> <p>Another Industry representative claimed that the ranges should be changed to:</p> <p>2 90 – 190 mg/Nm³ 3 100 mg/Nm³</p> <p>because the emission levels associated with BAT for gas engines are only applicable for burning natural gas and not for renewable gases like landfill gas, biogas or purification gas. Moreover, they claimed that such levels would create disadvantages for competitiveness in the market for such gases.</p> <p>4 One Industry representative proposed changing to discontinuous monitoring because continuous engine emission monitoring is not common practice for stationary internal combustion engines.</p>	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.

Title of Document BAT for Large Combustion Plants, July 2006									
BAT ref Number	BAT Statement					Applicability	Proposed/ in place		
7.5.4 NO _x and CO emissions from gas- fired combustion plants	Table 7.37 BAT for the reduction of NO_x and CO emissions from some gas-fired combustion plants					Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.		
	Plant type	Emission level associated with BAT (mg/Nm³)		O₂ level 1 (%)	BAT options to reach these levels			Monitoring	
		NO_x	CO						
	Gas-fired boilers								
	New gas-fired boilers	50 – 100 ⁽¹⁾	30 – 100	3	Low-NO _x burners or SCR or SNCR			Continuous	
	Existing gas-fired boiler	50 – 100 ⁽²⁾	30 – 100	3	Low-NO _x burners or SCR or SNCR			Continuous	
	CCGT								
	New CCGT without supplementary firing (HRSG)	20 – 50	5 – 100	15	Dry low-NO _x premix burners or SCR			Continuous	
Existing CCGT without supplementary firing (HRSG)	20 – 90 ⁽³⁾	5 – 100 ⁽⁵⁾	15	Dry low-NO _x premix burners or water and steam injection or SCR if the required space has already been foreseen in the HRSG	Continuous				
New CCGT with supplementary firing	20 - 50	30 – 100	Plant spec.	Dry low-NO _x premix burners and low-NO _x burners for the boiler part or SCR or SNCR	Continuous				
Existing CCGT with supplementary firing	20 – 90 ⁽⁴⁾	30 – 100 ⁽⁵⁾	Plant spec.	Dry low-NO _x premix burners or water and steam injection and low-NO _x burners for the boiler part or SCR if the required space has already been foreseen in the HRSG or SNCR	Continuous				

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.4 NO _x and CO emissions from gas- fired combustion plants	<p>Table 7.37 BAT for the reduction of NO_x and CO emissions from some gas-fired combustion plants (Continued)</p> <p>1,2 Industry claimed that the ranges need to be changed to: upper end to 120 mg/Nm³ 3 80 – 120 mg/Nm³ because gas fired boilers depend on the firing temperature, the type of burners, the size of the boiler, the heating surfaces, the air temperature and the load factor of the power plant. In case the boiler is equipped with flue-gas recycling it is possible to decrease the NO_x emission to a level of 100 mg/Nm³. However, retrofitting an existing boiler with flue-gas recycling will require high (not cost effective) investment costs.</p> <p>2 One Member State proposed that for existing gas fired boilers, which have been converted recently from heavy fuel oil to burn natural gas, after full modification with primary measures to reduce NO_x (flue-gas recirculation, fuel and air staging), the BAT achievable emission levels should be modified to 10 – 150 mg/Nm³.</p> <p>4 Industry mentioned that due to the large wall burners which are used for supplementary firing of the HRSG the NO_x emission of the gas turbine may increase in 10 – 20 mg/Nm³. This increase is caused by local high temperatures of these duct burners. Therefore, the level associated with BAT in the case of supplementary firing should be 80 – 140 mg/Nm³.</p> <p>3,4 One Member State claimed that the upper BAT levels for CCGT plants >50 MW cannot be over 80 mg/Nm³ and for plants over 200 MW the upper BAT level should be below 35 mg/Nm³ because these levels have already been fixed as ELVs in the Member State in question.</p> <p>5 One Member State claimed that the upper levels of CO for CCGT plants >50 MW cannot be over 35 mg/Nm³ because this level has already been fixed as ELV in the Member State in question.</p>	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.4.1 Water pollution	<p>Different waste water streams (see Chapter 1) are generated by gas-fired combustion plants. To reduce emissions to water and to avoid water contamination, all measures that have been presented in Section 7.4.4 are considered to be BAT.</p> <p>Small amounts of oil contaminated (washing) water cannot be prevented from occurring occasionally at a power plant. Oil separation wells are, in general, sufficient to avoid any environmental damage.</p> <p>The other techniques described for waste water treatment in Chapter 3 can, in general, also be considered as BAT for this sector.</p>	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.4.2 Combustion residues	<p>A lot of attention has already been paid by industry to the utilisation of combustion residues and by-products instead of depositing them in landfills. Utilisation and re-use is, therefore, the best available option.</p>	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.5 BAT for combustion installations operated on offshore platforms	<p>In general, for new gas turbines operated on offshore platforms, the reduction of nitrogen oxides (NO_x) by using primary measures such as dry low NO_x premix burners (DLN) is considered to be BAT as far as this technique is available.</p> <p>To reduce the environmental impact of offshore gas turbines, the following measures are part of the BAT conclusion:</p> <ul style="list-style-type: none"> • for new installations, selecting turbines which can achieve both a high thermal efficiency and a low emissions spectrum • using dual fuel turbines only where operationally necessary • minimising 'spinning reserve' • providing a fuel gas supply from a point in the topside oil and gas process which offers a minimum range of fuel gas combustion parameters, e.g. calorific value, etc. • providing a fuel gas supply from a point in the topside oil and gas process which offers minimum concentrations of sulphurous compounds – to minimise SO₂ formation • operating multiple generator or compressor sets at load points which minimise pollution • optimising the maintenance and refurbishment programmes • optimise and maintain inlet and exhaust systems in a way that keeps the pressure losses as low as possible • optimise the process in order to minimise the mechanical power requirements and pollution utilisation of gas turbine exhaust heat for platform heating purposes. 	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.5 BAT for combustion installations operated on offshore platforms	<p>Modern 'diesel' engines are available with high pressure fuel injection controlled by electronics. Additionally, optimised combustion chambers and portings have been developed. This technology can result in increased fuel economy, reduced NO_x and other gaseous emissions and reduced smoke, particularly during acceleration and start-up. Where available, it represents the BAT for minimising emissions such as SO₂ and NO_x.</p>	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.5 BAT for combustion installations operated on offshore platforms	To reduce the environmental impact of offshore engines, the following measures are part of the BAT conclusion: <ul style="list-style-type: none"> • for new engines, selecting diesels which achieve both high thermal efficiency and a low emissions spectrum • where process gas is used as fuel, providing a supply from a point in the topside process which will offer minimum emissions of, e.g. SO₂. For liquid distillate fuels, preference should be given to low sulphur types • for larger diesels, considering gas fuelling with a ' torch oil' ignition charge • optimising injection timing • operating multiple generator or compressor sets at load points which minimise pollution • optimising maintenance and refurbishment programmes. 	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
7.5.5 BAT for combustion installations operated on offshore platforms	Other measures to increase the energy efficiency of offshore installations and thus to reduce the emissions per unit of energy used, such as the application of CHP plants, are part of the BAT conclusion. Techniques that assist the optimised use of equipment such as those based on operational monitoring approaches are BAT. Other techniques, like PEMS (parametric emission monitoring system) are BAT for both new and existing combustion installations operating offshore. Power integration of multiple fields are BAT and, where applicable, needs to be decided on a platform by platform and field by field basis.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
8.5 Best available techniques (BAT) for co-combustion of waste and recovered fuels			
8.5.1 Acceptance and pre-acceptance criterias	BAT is to have complete pre-acceptance and acceptance criteria defined according to the BAT defined in the Waste Treatment BREF.	Not Applicable	SmartPly do not accept waste for combustion.

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
8.5.2 Storage and handling of secondary fuel	For the storage, unloading and handling of secondary fuel the measures and techniques presented as BAT in the fuel specific chapters and in Section 8.4.1 are all considered to be BAT for the use of co-combustion to reduce fugitive emission of dust and odorous substances. In addition, the use of suction equipment and subsequent cleaning devices for closed facilities storing sewage sludge (including the possibility of leading the polluted suction air directly to the combustion chamber or burner, where it might be used as combustion air) has been considered as BAT due to the reduced risk of explosion. Concerning health and safety, the described measures to protect the workers need to be taken into account (reference is made to national health and safety regulations). Apart from this, the BAT conclusion laid down in the BREF on the storage of bulk and dangerous substances and the waste treatment BREF also needs to be taken into account during the storage and handling of secondary fuel.	Not Applicable	SmartPly do not accept waste for combustion.
8.5.3 Pretreatment of secondary fuel	For the pretreatment of secondary fuel, all the measures and techniques presented as BAT in the fuel specific chapters are generally considered to be BAT in order to ensure stable combustion conditions and to separate contaminants from the waste, in order that these waste materials can be used as secondary fuel. In addition, some pretreatment measures listed in Chapter 8.4.2 can be considered as BAT. However, it also needs to be noted, that the detailed information on BAT for pretreatment techniques of waste, including secondary fuel, will be described in the dedicated waste treatment and incineration BREFs.	Not Applicable	SmartPly do not accept waste for combustion.
8.5.4 Introduction of secondary fuel into the combustion process	For feeding secondary fuel into the combustion chamber (boiler), the measures and techniques presented in Section 8.4.3 are all considered to be BAT in order to ensure stable combustion conditions.	Not Applicable	SmartPly do not accept waste for combustion.

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
8.5.5 Air emissions	<p>The BAT conclusion in this section is based on the concept that co-combustion of secondary fuel in large combustion plants should, according to the current EU legislation, not cause higher emissions of polluting substances in that part of the exhaust gas volume resulting from such co-combustion found in the incineration plants (see WI BREF). At this point, it is necessary to mention that plants co-combusting waste have to meet the requirements of the dedicated Waste Incineration Directive (EU Directive 2000/76/EC).</p> <p>Large combustion plants, designed and operated according to BAT as defined in this BREF document operate effective techniques and measures for the removal of dust (including partly heavy metals), SO₂ NO_x, HCl and HF. In general, these techniques can be seen as sufficient and can, therefore, also be considered as BAT for the co-combustion of secondary fuel.</p> <p>If the range of impurities of the waste, in particular the content of heavy metals, lies within the same range as that from the normally used conventional fuel, the fuel specific BAT applies also for the co-combustion of this secondary fuel. The first BAT choice in this respect is also the careful selection of the type and mass flow of the secondary fuel, together with limiting the percentage of the secondary fuel that can be co-combusted.</p>	Not Applicable	SmartPly do not accept waste for combustion.
8.5.5 Air emissions	<p>The following measures should be taken into account in this sense:</p> <ul style="list-style-type: none"> • screening secondary fuel according to acceptance criteria for critical parameters (see BAT for acceptance and pre-acceptance criterias). These are heating value, water content, ash content, chlorine and fluorine content, sulphur content, nitrogen content, PCB, metals (volatile (Hg, Tl, Pb, Co and Se) and non-volatile (e.g. V, Cu, Cd, Cr, Ni)) and phosphorus and alkaline content (when use animal by-products) • limiting the co-combustion rate of most polluted secondary fuel • pretreating the SF • avoiding Hg entering as an elevated component of the secondary fuel • using gasification of the secondary fuel and cleaning of the produced gas when there are large quantities of secondary fuel with high concentrations of heavy metals (especially Hg) to be used in the LCP • avoiding the introduction of chlorine compounds into the secondary fuel. <p>However, according to the waste used the co-combustion of secondary fuel can, as already explained, lead to increased emissions of heavy metals, in particular mercury, as well as to the emission of VOCs, halides and sometimes dioxins. In this case the adaptation of flue-gas cleaning systems and the additional injection of activated carbon with an associated reduction rate of 70 - 85 % is regarded as BAT.</p>	Not Applicable	SmartPly do not accept waste for combustion.

Title of Document BAT for Large Combustion Plants, July 2006			
BAT ref Number	BAT Statement	Applicability	Proposed/ in place
8.5.6 Water pollution	For the co-combustion of secondary fuel the measures and techniques presented as BAT in the fuel specific chapters and in Section 8.4.5 are all considered to be BAT in order to avoid an additional contamination of water and groundwater sources by the co-combustion of secondary fuel. In this respect, the proper storage and handling of secondary fuel as described earlier will help to achieve this aim. 'Good housekeeping' will prevent substances being spilled and transferred to drains. Because secondary fuel may contain higher levels of heavy metals and other substances, such as halides etc., BAT is to treat this waste water before it is discharged.	Not Applicable	SmartPly do not accept waste for combustion.
8.5.7 Combustion residues and by-products	In the co-combustion of secondary fuel the measures and techniques presented as BAT in the fuel specific chapters and in Section 8.4.6 also are all considered to be BAT for the co-combustion of secondary fuel. The main BAT issue is maintaining the quality of gypsum, ashes and slag and other residues and by-products at the same level as those occurring without the co-combustion of secondary fuel for the purpose of recycling.	Not Applicable	SmartPly do not accept waste for combustion.

2.2 BAT for Large Volume Organic Chemical Industry

Title of Document Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003								
BAT Ref Number	BAT Statement					Applicability	Proposed/ in place	
5 GENERIC TECHNIQUES TO CONSIDER IN THE DETERMINATION OF BAT								
5.3.1 Performance of air pollutant control techniques	Table 5.13: Emission levels associated with BAT							
	Sub sector	NO _x mg/m ³	SO ₂ mg/m ³	CO mg/m ³	Total C mg/m ³	Dust mg/m ³	PCDD/F ng/m ³	Specific compounds (mg/m ³)
	Aromatics	115 - 300	3	4 - 50	6	3		
	Olefins	80 - 200	5 - 35	10 - 180	10 (5 - 150) *			Butadiene 1 mg/m ³
	Halogenated compounds	30 - 200	-	5 - 50	4 - 35		0.07- 0.05	Inorganic Comp. 4 – 8 mg/m ³ HCl 10 mg/m ³ Chlorine 1 - 5 mg/m ³ Vinyl chloride < 1 mg/m ³ 1,2 - Dichloroethane < 1 mg/m ³ Ethylene chloride < 5 mg/m ³
	Oxygenated compounds	100 - 300	< 2 - 6 SO ₂ / SO ₃	< 5 - 100	3 - 100	1		Formaldehyde 0.2 – 0.4 mg/m ³ Acetic acid 1 - 22 mg/m ³ Acetaldehyde 6 - 20 mg/m ³ Ethylene oxide 0.5 – 5 mg/m ³ Propylene oxide 0.1 – 5** mg/m ³ Ethylene glycol 30 – 100 mg/m ³
Nitrogenated compounds	12 - 200	<20	< 2 - 130	< 1 - 35	< 1 - 5		Caprolactam 100 mg/m ³ HCN 1 - 3 mg/m ³ Nitrotoluene 0.7 mg/m ³ Toluenediamine (TDA) 0.6 mg/m ³ Toluene diisocyanate (TDI) 4 mg/m ³	
Note: NO _x , SO ₂ , CO, Total C, and dust measured as ½ hour averages. PCDD/F as single measurement Note: * after treatment by flare. ** after treatment by gas scrubber / cooling tower.								
6 GENERIC BAT (BEST AVAILABLE TECHNIQUES)								

Not Applicable

SmartPly do not produce any chemicals on-site which could be classified under any of the subsectors listed in table 5.13.

Note: no bulk chemicals are produced at the SmartPly site.

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.2 Management systems	<p>BAT for environmental management systems is an appropriate combination or selection of the following techniques:</p> <p>Policy:</p> <ol style="list-style-type: none"> 1. formulation of an environmental strategy by the highest management level of a company and a commitment to follow the strategy 2. clear organisational structures to ensure that the responsibility for environmental issues is fully integrated into the decision-making by all employees 3. written procedures or practices for all environmentally important aspects of plant design, operation, maintenance, commissioning (start-up) and decommissioning 4. internal audit systems to review the implementation of environmental policies and to verify compliance with procedures, standards and legal requirements 5. accounting practices that internalise the full costs of raw materials (including energy) and waste disposal / treatment 6. long term financial and technical planning for environmental investments 7. a consideration of 'Industrial Ecology', i.e. the impact of a process on its surroundings and the opportunities for better efficiency and environmental performance. <p>Process design:</p> <ol style="list-style-type: none"> 1. review of the environmental implications of all raw materials, intermediates and products 2. identification and characterisation of all planned and potential unplanned releases 3. segregation of wastes at source (to facilitate their re-use and treatment) 4. treatment of waste streams at source (to exploit high concentration / low flow streams) 5. provision of flow and load buffering 6. installation of back-up abatement systems (if required) 7. give provision to allow, or ease, the 'Process operation' techniques given below. 	<p>Policy:</p> <ol style="list-style-type: none"> 1. Applicable 2. Applicable 3. Applicable 4. Applicable 5. Applicable 6. Applicable 7. Applicable <p>Process design:</p> <ol style="list-style-type: none"> 1. Applicable 2. Applicable 3. Applicable 4. Applicable 5. Not Applicable 6. Applicable 7. See next cell 	<p>Policy:</p> <p>In Place</p> <p>SmartPly operates a documented EMS which includes the implementation of all of the points specified in section 6.2.</p> <p>Process design:</p> <ol style="list-style-type: none"> 1. The implications of all new raw materials are assessed prior to use on-site. 2. This was done as part of the license review application and ELRA preparation. 3. In place 4. In place where applicable. 6. In place where applicable. 7. See next cell

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.2 Management systems...cond.	<p>Process operation:</p> <ol style="list-style-type: none"> 1. use of control systems (hardware and software) for both the core process and pollution control equipment to ensure stable operations, high yields and good environmental performance under all operational modes 2. implementation of systems to ensure operator environmental awareness and training 3. defined response procedures to abnormal events 4. the availability of continuous process control checks / monitoring data on critical, environmental parameters to detect abnormal operating conditions / emissions, and the provision of associated systems to ensure their prompt remediation 5. the use of preventative and, when needed, reactive inspection and maintenance to optimise the performance of process plant and equipment 6. consider and evaluate the need to treat emissions from depressurising, emptying, purging and cleaning of equipment in air or water pollution abatement systems 7. implementation of a waste management system that includes ongoing waste minimisation to identify and implement techniques that reduce emissions and raw material consumption. 	<ol style="list-style-type: none"> 1. Applicable 2. Applicable 3. Applicable 4. Applicable 5. Applicable 6. Applicable 7. Applicable 	All in place
6.3 Pollution prevention and minimisation	<p>The selection of BAT for LVOC processes, for all environmental media, is to give sequential consideration to techniques according to the following hierarchy:</p> <ol style="list-style-type: none"> a) eliminate the arisings of all waste streams (gaseous, aqueous and solid) through process development and design, in particular by ensuring that the reaction step has high selectivity and the proper catalyst b) reduce waste streams at source through process-integrated changes to raw materials, equipment and operating procedures, with particular attention to the work-up step (minimise losses and degradation of valuable product) and smooth operating conditions c) recycle waste streams by direct re-use or reclamation / re-use d) recover any resource value from waste streams e) treat and dispose of waste streams using end-of-pipe techniques. 	Applicable	In place. The waste hierarchy is taken into account in relation to emissions as well as waste production on-site.

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.3 Pollution prevention and minimisation	<p>BAT for the design of new LVOC processes, and for the major modification of existing processes, is an appropriate combination or selection of the following techniques:</p> <ol style="list-style-type: none"> 1. to carry out chemical reactions and separation processes continuously, in closed equipment 2. to subject continuous purge streams from process vessels to the hierarchy of: re-use, recovery, combustion in air pollution control equipment, and combustion in non-dedicated equipment 3. to minimise energy use and to maximise energy recovery 4. to use compounds with low or lower vapour pressure 5. give consideration to the principles of 'Green Chemistry' as described in Section 5.2.1. 	<ol style="list-style-type: none"> 1. Not applicable 2. Not applicable 3. Applicable 4. Not applicable 5. Not applicable <p>Note: no bulk chemicals are produced at the SmartPly site.</p>	<ol style="list-style-type: none"> 3. Periodic energy audits take place on-site to help improve energy efficiency on-site.

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.2.1 Source reduction	<p>Green Chemistry has been summarised into twelve principles (Table 5.2). These should be incorporated into the design of any new LVOC process, and whenever major modifications of existing processes provide suitable opportunities.</p> <p>Table 5.2: Principles of Green Chemistry [Anastas & Warner, 1998 #44]</p> <ol style="list-style-type: none"> 1. It is better to prevent waste than to treat or clean up waste after it is formed. 2. Synthetic methods should be designed to maximise the incorporation of all materials used in the process into the final product. 3. Wherever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment. 4. Chemical products should be designed to preserve efficacy of function while reducing toxicity. 5. The use of auxiliary substances (e.g. solvents, separation agents) should be made unnecessary wherever possible and, innocuous when used. 6. Energy requirements should be recognised for the environmental and economic impacts and should be minimised. Synthetic methods should be conducted at ambient temperature and pressure. 7. A raw material feedstock should be renewable rather than depleting wherever technically and economically practicable. 8. Unnecessary derivatisation (use of derivatives) (blocking group, protection/de-protection, temporary modification or physical/chemical processes) should be avoided whenever possible. 9. Catalytic reagents (as selective as possible) are superior to un-catalysed reagents. 10. Chemical products should be designed so that at the end of their function they do not persist in the environment and (that they) break down into innocuous degradation products. 11. Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances. 12. Substances and the form of a substance used in the chemical process should be chosen so as to minimise the potential for chemical accidents, including releases, explosions, and fires. 	<p>Not Applicable</p> <p>Note: no bulk chemicals are produced at the SmartPly site.</p>	

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.3 Pollution prevention and minimisation	<p>BAT for the prevention and control of fugitive emissions is an appropriate combination or selection of the following techniques:</p> <ol style="list-style-type: none"> 1. Implement a formal Leak Detection and Repair (LDAR) programme to focus on the pipe and equipment leak points that provide the highest emission reduction per unit expenditure. 2. Repair pipe and equipment leaks in stages, carrying out immediate minor repairs (unless this is impossible) on points leaking above some lower threshold and, if leaking above some higher threshold, implement timely intensive repair. The exact threshold leak rate at which repairs are performed will depend on the plant situation and the type of repair required. 3. Replace existing equipment with higher performance equipment for large leaks that cannot otherwise be controlled. 4. Install new facilities built to tight specifications for fugitive emissions. 5. Where existing equipment is replaced, or new equipment installed, the BAT is: <ul style="list-style-type: none"> - valves: low leak rate valves that use double packing seals or equally efficient high performance equipment. For high-risk duty (e.g. toxic substances) the use of bellow seals or equally efficient high performance equipment. - pumps: double seals with liquid or gas barrier, or seal-less pumps (magnetically driven or canned) or equally efficient high performance equipment. - compressors and vacuum pumps: double seals with liquid or gas barrier, or seal-less pumps (magnetically driven or canned), or single seal technology with equivalent emission levels, or equally efficient high performance equipment. - flanges: minimise the number, use effective gaskets. - open ends: fit blind flanges, caps or plugs to infrequently used fittings; use closed loop flush on liquid sampling points; and, for sampling systems / analysers, optimise the sampling volume/frequency, minimise the length of sampling lines or fit enclosures. - safety valves: bearing in mind the top priority of safety, consider reduction measures (e.g. upstream rupture disk, discharge to air emission control system). 6. Adopt the following general measures as necessary: <ul style="list-style-type: none"> - double isolation at any points with high risk of leakage - obviate the need for vessel opening through design modifications or mode of operation - enclose effluent collection systems and tanks used for effluent storage / treatment - monitor cooling water for contamination with organics - depending on leak rate, convey compressor seal leaks and purges to a lower pressure system (closed network operated at lower pressure) for re-use or flaring. 	<ol style="list-style-type: none"> 1. Applicable 2. Applicable 3. Applicable 4. Applicable 5. Applicable 6. Applicable 	<p>In place, periodic checks, testing and preventative maintenance is undertaken on a regular basis on-site. New equipments is selected to ensure the minimisation of fugitive emissions.</p>

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.3 Pollution prevention and minimisation	<p>In addition to BAT in the Storage BREF [EIPPCB, Draft #49], BAT for storage, handling and transfer is an appropriate combination or selection of the following techniques:</p> <ol style="list-style-type: none"> 1. external floating roof with secondary seals (except for highly dangerous substances) 2. fixed roof tanks with internal floating covers and rim seals (for more volatile liquids) 3. fixed roof tanks with inert gas blanket (e.g. when needed for safety reasons) 4. pressurised storage (for highly dangerous or odorous substances) 5. minimise the storage temperature (although this may have impacts on viscosity or solidification) 6. instrumentation and procedures to prevent overfilling 7. impermeable secondary containment with a bund capacity of 110 % of the largest tank 8. recovery of VOCs (by condensation, absorption or adsorption) before recycling or destruction by combustion in an energy raising unit, incinerator or flare. 9. continuous monitoring of liquid level and changes in liquid level. 10. tank filling pipes that extend beneath the liquid surface 11. bottom loading to avoid splashing 12. vapour balance lines that transfer the displaced vapour from the container being filled to the one being emptied 13. back-venting to suitable abatement plant 14. sensing devices on loading arms to detect undue movement 15. self-sealing hose connections / dry break coupling 16. barriers and interlock systems to prevent damage to equipment from the accidental movement or drive-away of vehicles. 	<ol style="list-style-type: none"> 1. Not applicable 2. Not applicable 3. Not applicable 4. Applicable 5. Not applicable 6. Applicable 7. Applicable 8. Not applicable 9. Applicable 10. Applicable 11. Applicable 12. Not applicable 13. Applicable 14. Not applicable 15. Not Applicable 16. Not Applicable 	<ol style="list-style-type: none"> 4. LPG is stored in a pressured tank. 6. High level alarms are fitted to relevant tanks & procedures in place for off-loading resins & wax. 7. In place for all tanks. 9. Level sensors in place in relevant storage tanks. 10-11. In place for relevant tanks.

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.3 Pollution prevention and minimisation	<p>BAT for preventing and minimising the emission of water pollutants is an appropriate combination or selection of the following techniques:</p> <p>A. Identify all waste water arisings and characterise their quality, quantity and variability.</p> <p>B. Minimise water input to the process by the use of:</p> <ol style="list-style-type: none"> 1. water-free techniques for vacuum generation and cleaning 2. counter-current washing systems in preference to co-current systems 3. water sprays (rather than jets) 4. closed-loop cooling water cycles 5. roofing the installation to minimise storm-water ingress (when compatible with health and safety) 6. management tools such as water-use targets and transparent costing of water 7. water meters within the process to identify areas of high use. <p>C. Minimise process water contamination with raw material, product or wastes by the use of:</p> <ol style="list-style-type: none"> 1. plant equipment and effluent collection systems made from corrosion resistant materials to prevent leaks and reduce metal dissolution into waste water. 2. indirect cooling systems (unless required for process reasons) 3. purer raw materials and auxiliary reagents 4. non-toxic or lower toxicity cooling water additives 5. drum storage on concrete hard-standing that drains to a holding sump 6. spill clean-up material at strategic points around the installation 7. spill contingency plans 8. dry clean-up methods 9. regular checks for leaks and systems for prompt repair 10. separate collection systems for contaminated process effluent, sewage, uncontaminated water, and effluents containing mineral oil 11. uncontaminated drains 12. containment areas for fire-fighting water 13. concrete hard-standing in loading/unloading areas with kerbs / 'sleeping policemen' (lowlevel road humps for traffic calming) that drain to a sump 14. effluent collection systems (pipes and pumps) either placed above ground or placed in ducts accessible for inspection and repair, or leak-free sewers (e.g. welded HDPE, GRP) 15. buffer tank upstream of the effluent treatment plant. 	<p>A. Not Applicable B. Applicable C. Not applicable</p> <p>No industrial wastewater is produced from the site.</p>	<p>B. Water saving techniques are used on-site where possible including the reuse of water for WESPs.</p>

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.3 Pollution prevention and minimisation (continued)	D. Maximise waste water re-use by the use of: <ol style="list-style-type: none"> 1. defining the lowest water quality that can be used for each activity in the process 2. identifying options for the waste water re-use commensurate with the waste water quality 3. providing storage tanks for waste water to balance periods of generation and demand 4. utilising separators to facilitate the collection of water-insoluble materials. E. Maximise the recovery / retention of substances from mother liquors unfit for re-use by optimising processes and especially by improvement of mother liquor work-up.	D. Applicable E. Not Applicable	D. Water is reused in the WESPs on-site.
6.3 Pollution prevention and minimisation	The prevention of groundwater pollution is to be given special attention. BAT is an appropriate combination or selection of the following techniques: <ol style="list-style-type: none"> 1. storage tanks and loading/unloading facilities designed so as to prevent leaks and to avoid soil and water pollution caused by leaks 2. overflow detection systems (e.g. high-high level alarms and automatic cut-off) 3. use of impermeable ground materials in the process area with drainage to sump 4. no intentional discharges to ground or groundwater 5. collection facilities where leaks may occur (e.g. drip trays, catch pits) 6. equipment and procedures to ensure the full draining of equipment prior to opening 7. leak detection systems and maintenance programme for all vessels (especially underground tanks) and drains 8. monitoring of groundwater quality. 	Applicable	All in place.
6.3 Pollution prevention and minimisation	BAT for preventing and minimising the generation of residues and wastes is: <ol style="list-style-type: none"> 1. prevent waste arisings at source 2. minimise any unavoidable arisings of waste 3. maximise the recycling of waste. 	Applicable	In place

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.3 Pollution prevention and minimisation	BAT for energy efficiency is an appropriate combination or selection of the following techniques: 1. optimise energy conservation (e.g. by the thermal insulation of process equipment) 2. implement accounting systems that fully attribute the energy costs to each process unit 3. undertake frequent energy reviews 4. optimise heat integration at the inter-process and intra-process levels (and where possible beyond the site boundary) by reconciling heat sources and sinks 5. use cooling systems only when the re-use of energy sources from the process has been fully exploited 6. adopt Combined Heat and Power (CHP) systems where economically and technically viable.	1. Applicable 2. Applicable 3. Applicable 4. Applicable 5. Applicable 6. Not Applicable	1. In place 2. In place; Electrical monitoring system in place incorporating main meter and 3 sub meters covering process areas. 3. In place 4. In place 5. The capture and reuse of heat in the CAS cooling system was assessed however, this was not feasible.
6.3 Pollution prevention and minimisation	BAT for the prevention and minimisation of noise and vibration is an appropriate combination or selection of the following techniques: 1. consideration, at the design stage, of the proximity to potential receptors 2. selection of equipment with inherently low noise and vibration levels 3. anti-vibration mountings for process equipment 4. disconnection of vibration sources and surroundings 5. sound absorbers or encapsulation of the noise sources 6. periodic noise and vibration surveys.	1. Applicable 2. Applicable 3. Applicable 4. Applicable 5. Applicable 6. Applicable	1. In place 2. In place 3-5. In place where applicable 6. In place for noise
6.4 Air pollutant control	Generic BAT for air pollutants from LVOC processes is an appropriate combination or selection of the techniques given in Table 6.1 (for VOCs) and Table 6.2 (for other air pollutants). In the case of high inlet concentrations of pollutants or less efficient recovery / abatement systems, a combination of techniques may be necessary to achieve the emission levels associated with BAT.	See below	See below

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BAT Ref Number	BAT Statement		Applicability	Proposed/ in place	
6.4 Air pollutant control	Table 6.1: BAT-associated values for the recovery / abatement of VOCs		Not Applicable	None of these operations occur on the SmartPly site.	
	Technique	BAT-associated values ⁽¹⁾			Remark
	Selective membrane separation	90 - >99.9 % recovery VOC < 20 mg/m ³			Indicative application range 1 - >10g VOC/m ³ Efficiency may be adversely affected by, for example, corrosive products, dusty gas or gas close to its dew point.
	Condensation	Condensation: 50 - 98 % recovery + additional abatement. Cryo-condensation: ⁽²⁾ 95 - 99.95 % recovery			Indicative application range: flow 100 - >100000 m ³ /h, 50 - >100g VOC/m ³ . For cryo-condensation: flow 10 - 1000 m ³ /h, 200 - 1000 g VOC/m ³ , 20 mbar-6 bar
	Adsorption ⁽²⁾	95 - 99.99 % recovery			Indicative application range for regenerative adsorption: flow 100 - >100000 m ³ /h, 0.01 - 10g VOC/m ³ , 1 - 20 atm. Non regenerative adsorption: flow 10 - >1000 m ³ /h, 0.01 - 1.2g VOC/m ³
	Scrubber ⁽²⁾	95 - 99.9 % reduction			Indicative application range: flow 10 - 50000 m ³ /h, 0.3 - >5g VOC/m ³
	Thermal incineration	95 - 99.9 % reduction VOC ⁽²⁾ < 1 - 20 mg/m ³			Indicative application range: flow 1000 - 100000m ³ /h, 0.2 - >10g VOC/m ³ . Range of 1 - 20 mg/m ³ is based on emission limits & measured values. The reduction efficiency of regenerative or recuperative thermal incinerators may be lower than 95 - 99 % but can achieve < 20 mg/Nm ³ .
	Catalytic oxidation	95 - 99 % reduction VOC < 1 - 20 mg/m ³			Indicative application range: flow 10 - 100000 m ³ /h, 0.05 - 3 g VOC/m ³
Flaring	Elevated flares > 99 % Ground flares > 99.5 %				
<p>3. Unless stated, concentrations relate to half hour / daily averages for reference conditions of dry exhaust gas at 0 °C, 101.3 kPa and an oxygen content of 3 vol% (11 vol% oxygen content in the case of catalytic / thermal oxidation).</p> <p>4. The technique has cross-media issues that require consideration.</p>					

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BAT Ref Number	BAT Statement		Applicability	Proposed/ in place	
6.4 Air pollutant control	Table 6.2: BAT-associated values for the abatement of other LVOC air pollutants			Particulates = Applicable Odour = Not Applicable Sulphur Dioxide & acid gas = Not Applicable. Only applicable for combustion activities which are covered by LCP BREF. Nitrogen Oxides = Not applicable Dioxins = Not applicable Mercury = Not applicable Ammonia & Amines = Not applicable Hydrogen Sulphides = Not applicable	
	Pollutant	Technique	BAT-associated values⁽¹⁾		
	Particulates	Cyclone	Up to 95 % reduction		Strongly dependent on the particle size. Normally only BAT in combination with another technique (e.g. electrostatic precipitator, fabric filter).
		Electrostatic precipitator	5 – 15 mg/Nm ³ 99 – 99.9 % reduction		Based on use of the technique in different (non-LVOC) industrial sectors. Performance of is very dependent on particle properties.
		Fabric Filter	< 5 mg/Nm ³		
		Two stage dust filter	~ 1 mg/Nm ³		
		Ceramic filter	< 1 mg/Nm ³		
		Absolute Filter	< 0.1 mg/Nm ³		
		HEAF Filter	Droplets & aerosols up to 99 % reduction		
	Mist Filter	Dust & aerosols up to 99 % reduction			
	Odour	Adsorption Biofilter	95 - 99 % reduction for odour and some VOC		Indicative application range: 10000 - 200000 ou/Nm ³
	Sulphur dioxide & acid gases	Wet limestone scrubbing	90 – 97 % reduction SO ₂ < 50 mg/Nm ³		Indicative range of application for SO ₂ < 1000 mg/m ³ in the raw gas.
		Scrubbers	HCl ⁽²⁾ < 10 mg/Nm ³ HBr ⁽²⁾ < 5 mg/Nm ³		Concentrations based on Austrian permit limits.
		Semi Dry Sorbent Injection	SO ₂ < 100 mg/Nm ³ HCl < 10 - 20 mg/Nm ³ HF < 1 - 5 mg/Nm ³		Indicative range of application for SO ₂ < 1000 mg/m ³ in the raw gas.
Nitrogen oxides	SNCR	50 – 80 % NO _x reduction			
	SCR	85 to 95 % reduction NO _x < 50 mg/m ³ . Ammonia < 5 mg/m ³	May be higher where the waste gas contains a high hydrogen concentration.		
Dioxins	Primary measures + adsorption 3-bed catalyst	< 0.1 ng TEQ/Nm ³	Generation of dioxins in the processes should be avoided as far as possible		
Mercury	Adsorption	0.05 mg/Nm ³	0.01 mg/Nm ³ measured at Austrian waste incineration plant with activated carbon filter.		
Ammonia & amines	Scrubber	< 1 – 10 mg/Nm ³	Acid scrubber		
Hydrogen sulphide	Absorption (alkaline scrubber)	1 - 5 mg/Nm ³	Absorption of H ₂ S is 99 %+. An alternative is absorption in an ethanolamine scrubber followed by sulphur recovery.		
3. Unless stated, concentrations relate to half hour / daily averages for reference conditions of dry exhaust gas at 0 °C, 101.3 kPa and an oxygen content of 3 vol%.					
4. Daily mean value at standard conditions. The half hourly values are HCl < 30 mg/m ³ and HBr < 10 mg/m ³ .					

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.4 Air pollutant control	BAT for flaring is: <ul style="list-style-type: none"> • minimise the need for hydrocarbon disposal to flare through good plant design (e.g. high integrity trip systems, flare gas recovery systems) and good plant management (e.g. skilled operators, appropriate maintenance) • there is no BAT choice between ground flares or elevated flares because such decisions are made on the basis of safety • BAT for elevated flare design and operation includes the provision of permanent pilots and pilot flame detection, efficient mixing (usually by steam injection), ratio controlled to the hydrocarbon flow, and remote monitoring by Closed Circuit Television (CCTV) • destruction efficiency of > 99% for elevated flares and > 99.5% for ground flares. 	Not Applicable	
6.4 Air pollutant control	BAT for process furnaces is gas firing and low-NOx burner configuration. This can achieve NOx reduction down to 50 - 100 mg/Nm ³ (as an hourly average) for new and existing situations. Values towards the higher part of the range indicate the adverse effect of high temperatures (air preheat) and hydrogen-rich fuels. In exceptional situations, with little possibilities for retrofit, emissions up to 200 mg/Nm ³ may occasionally represent BAT.	Covered by LCP BREF review.	
6.4 Air pollutant control	The BAT for other combustion units (e.g. steam boilers, gas turbines) can be found in the BREF on Large Combustion Plant [EIPPCB, Draft #127].	Covered by LCP BREF review.	
6.4 Air pollutant control	BAT for carbon dioxide emissions is improved energy efficiency, but a switch to low-carbon (hydrogen-rich) fuels or sustainable non-fossil fuels may also be considered BAT.	Covered by LCP BREF review.	
6.5 Water pollutant control	The following BAT for water pollutants presume the optimisation of BAT for environmental management and prevention / minimisation (as given in Sections 6.2 and 6.3). BAT for water pollutants is:	See below	
6.5 Water pollutant control	Waste water streams containing heavy metals or toxic or non-biodegradable organic compounds (e.g. indicated by high COD/BOD ratios) are treated or recovered separately. Individual waste streams containing toxic or inhibitory organic compounds or having low biodegradability are treated separately e.g. by (chemical) oxidation, adsorption, filtration, extraction, (steam) stripping, hydrolysis (to improve bio-degradability) or anaerobic pretreatment. Effluent from individually treated waste streams are discharged to a combined biological treatment plant for further treatment. In particular metals and heavy metals are treated as individual waste streams before mixing with non-metal containing streams. BAT associated emission values (as daily averages) in individual waste streams are: <ul style="list-style-type: none"> Hg: 0.05 mg/l Cd: 0.2 mg/l Cu, Cr, Ni, Pb: 0.5 mg/l Zn, Sn: 2 mg/l 	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place								
6.5 Water pollutant control	Organic waste water streams not containing heavy metals or toxic or non-biodegradable organic compounds are potentially fit for combined biological waste water treatment (subject to an evaluation of biodegradability, inhibitory effects, sludge deterioration effects, volatility and residual pollutant levels in the effluent). In general, combined biological treatment can achieve an effluent BOD of < 20mg/l (as a daily average). A typical design for this treatment plant is a lowly loaded biological treatment plant, which in the case of an activated sludge plant is a COD load of ≤0.25kg COD/kg sludge (as dry solids) / day.	Not Applicable									
6.5 Water pollutant control	<p>Nevertheless, based on the expert judgement of the TWG, the following emission levels are associated with the use of BAT:</p> <p>Table 6.4: BAT-associated values for water emissions</p> <table border="1"> <thead> <tr> <th>Parameter</th> <th>BAT-associated values (as daily averages)</th> </tr> </thead> <tbody> <tr> <td>COD</td> <td>30 – 125 mg/l ⁽¹⁾</td> </tr> <tr> <td>AOX</td> <td>< 1 mg/l ⁽²⁾</td> </tr> <tr> <td>Total nitrogen</td> <td>10 - 25 mg/l ⁽³⁾</td> </tr> </tbody> </table> <p>(1) The lower end of this range is determined by values of 30 – 45 mg/l for Lower Olefin effluents. Lower Olefin data has been extrapolated from TOC data and may also have been back-calculated from the percentage contribution to a central WWTP.</p> <p>(2) Most LVOC processes can achieve an AOX value below 1 mg/l. In a few specific cases, such as the chlorohydrin process, a range of 1- 5 mg/l AOX is achievable. CEFIC assert that there is inadequate experience in the use of AOX and it is not possible to derive a BAT-associated level. If EOX is used as alternative for AOX, it should be noted that the analytical methods focus on different groups of halogenated hydrocarbons and that no universal correlation exist between AOX and EOX, except that AOX >or >> EOX.</p> <p>(3) The exact figure largely depends on the applied processes and type of biological treatment system (N-removal).</p>	Parameter	BAT-associated values (as daily averages)	COD	30 – 125 mg/l ⁽¹⁾	AOX	< 1 mg/l ⁽²⁾	Total nitrogen	10 - 25 mg/l ⁽³⁾	Not Applicable	
Parameter	BAT-associated values (as daily averages)										
COD	30 – 125 mg/l ⁽¹⁾										
AOX	< 1 mg/l ⁽²⁾										
Total nitrogen	10 - 25 mg/l ⁽³⁾										

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.6 Wastes and residues control	<p>The following BAT for wastes and residues pollutants presume the optimisation of BAT for environmental management and prevention / minimisation (as given in Sections 6.2 and 6.3).</p> <ul style="list-style-type: none"> • BAT for catalysts is regeneration / re-use and, when spent, to recover the precious metal content with landfilling of the catalyst support. • BAT for spent purification media is, where possible, to regenerate, and if not to landfill or incinerate under appropriate conditions. • BAT for organic process residues is, where possible, to maximise their use as feedstock or as fuel, and if not to incinerate under appropriate conditions. • BAT for spent reagents is, where possible, to maximise their recovery or use as fuel, and if not to incinerate under appropriate conditions. 	Not Applicable	
7 ILLUSTRATIVE PROCESS: LOWER OLEFINS			
7.5 Best Available Techniques	As explained in Chapter 6, BAT for a particular LVOC process is determined by considering the three levels of BAT in the following order of precedence: illustrative process BAT (where it exists); LVOC Generic BAT; and finally any relevant Horizontal BAT.	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.2 Plant design	<p>BAT for the design of steam crackers includes the following components:</p> <ul style="list-style-type: none"> • all equipment and piping systems are designed to ensure a high level of containment and to minimise fugitive emissions. This involves seal-less or double/tandem sealed machinery, low-loss valve packing, use of spiral-wound jointing materials, and minimum use of flange connections. Equipment that handles materials known to pose a health hazard (e.g. butadiene and benzene) shall be designed to limit the exposure risk to an acceptable level • there is an absence of hydrocarbon vents to atmosphere for normal operation (all vent and drain points for equipment maintenance are capped or blanked) • hydrocarbon flare collection system(s) are provided for the safe disposal of off specification and purge streams. The requirement for flaring may be minimised through selection of appropriate equipment pressure rating. The flare design allows for complete combustion and smokeless operation over a wide range of flaring conditions • highly integrated energy recovery systems, involving the use of multi-levels of energy, integrated with the aid of advanced pinch analysis to maximise recovery and reduce energy consumption • design for extended periods of continuous operation between planned overhauls (5 year intervals are common). Considerations include philosophy for holding spare parts, on-line equipment condition monitoring, maintenance and operating strategies • extensive automatic systems to allow safe shutdown of plant. Systems are often fully redundant, capable of on-line proof testing, and backed up against external power failure • several techniques are employed to minimise waste at source by recycling and reprocessing streams within the plant, including inventories of equipment being taken out of service for maintenance, recovery of off-specification streams, and provision of dilution steam generation systems to minimise aqueous effluent volume • segregated aqueous effluent collection systems are provided. This allows the effective treatment of process effluent water and potentially contaminated water from leaks and other sources prior to discharge with uncontaminated streams. Specific treatment facilities are required for the processing of the spent caustic stream. Sewer systems are made from corrosion resistant material and trapped to avoid emissions of volatile compounds • only very limited facilities are provided within the steam cracker for the storage of the various intermediate streams, and the design of this equipment is in line with the features described above. Feedstock and product storage are usually provided outside the cracker battery limits. 	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.3 Process control and operation	<p>BAT for the control and operation systems of steam cracker processes includes the following elements:</p> <ul style="list-style-type: none"> • advanced control and on-line optimisation is used extensively in steam crackers. Plants utilise multi-variable control techniques incorporating on-line analysers, performance controls, constraint controls, etc., often with on-line optimisation for maximising asset utilisation and performance • extensive use of permanent gas monitors, video surveillance and equipment health monitoring (such as on-line vibration monitoring) also provides early detection and warning of abnormal conditions, allowing appropriate action to be taken • an environmental management programme covering, as a minimum: <ul style="list-style-type: none"> - regular inspection and instrument monitoring to detect leaks and fugitive emissions to atmosphere, water and ground, and appropriate repair programmes (LDAR programme) - environment monitoring in the surrounding community - health monitoring of staff - procedures for dealing with non-routine and abnormal events, to ensure that emissions associated with depressurising, emptying, purging and cleaning of equipment are treated before discharge. 	Not Applicable	
7.5.4 Air emissions	The most important measures for controlling air emissions are based upon recycle and/or re-use techniques and these are BAT. Hydrocarbon waste streams may be used as fuel (for heat and steam generation), reprocessed within the installation, or recovered for sale. The extent of application of these options will depend on technical and economic considerations on each site.	Not Applicable	
7.5.4.1 Cracking furnaces	For new furnaces, BAT is the use of Ultra Low NOx burners (ULNBs) or, alternatively, the provision of a catalytic De-NOx (SCR) system. For existing furnaces, the BAT decision will depend on the feasibility of installing ULNBs or SCR considering the plant design and layout.	Not Applicable	
7.5.4.1 Cracking furnaces	Catalytic de-NOx may also give rise to ammonia emissions. In modern units, operating with new catalyst, the BAT-associated ammonia levels (as an hourly average) are <math><5\text{mg}/\text{m}^3</math> at high NOx reduction rates (> 80 %).	Not Applicable	
7.5.4.1 Cracking furnaces	BAT for carbon monoxide emissions is the use of advanced combustion control schemes utilising feedback from continuous flue gas analysers, usually installed as a standard package alongside the normal combustion control systems.	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place																		
7.5.4.1 Cracking furnaces	The BAT for gas-fired cracking furnaces and steam superheaters is: <ul style="list-style-type: none"> • modern firebox design with extensive energy recovery facilities giving a thermal efficiency of 92 - 95 % • use of sulphur-free methane or methane/hydrogen mixture as fuel, with combustion control to maintain excess oxygen level of 1 – 3 % • the minimisation of NOx emissions by the use of preventative techniques such as LNB or ULNB, possibly in combination with end-of-pipe SCR. 	Not Applicable																			
7.5.4.1 Cracking furnaces	BAT associated levels for gas-fired furnaces are given in Table 7.19: Table 7.19: BAT-associated levels for gas fired furnaces <table border="1"> <thead> <tr> <th>Pollutant</th> <th>Emission Level (mg/Nm³)</th> <th>Control Techniques</th> </tr> </thead> <tbody> <tr> <td>Sulphur dioxide</td> <td>Not relevant</td> <td>Fuel contains little or no sulphur</td> </tr> <tr> <td>Dust</td> <td>Not relevant</td> <td>Clean fuel</td> </tr> <tr> <td>NOx (as NO₂)</td> <td>75 - 100 60 - 80</td> <td>Ultra Low NOx Burners SCR</td> </tr> <tr> <td>CO</td> <td>20</td> <td>Advanced combustion control</td> </tr> <tr> <td>CO₂</td> <td>-</td> <td>Thermally efficient furnace Heat/energy integration</td> </tr> </tbody> </table> <p>Concentrations as 30 - 60 minute averages at normal temperature and pressure, 3 % oxygen, dry gas</p>	Pollutant	Emission Level (mg/Nm ³)	Control Techniques	Sulphur dioxide	Not relevant	Fuel contains little or no sulphur	Dust	Not relevant	Clean fuel	NOx (as NO ₂)	75 - 100 60 - 80	Ultra Low NOx Burners SCR	CO	20	Advanced combustion control	CO ₂	-	Thermally efficient furnace Heat/energy integration	Not Applicable	
Pollutant	Emission Level (mg/Nm ³)	Control Techniques																			
Sulphur dioxide	Not relevant	Fuel contains little or no sulphur																			
Dust	Not relevant	Clean fuel																			
NOx (as NO ₂)	75 - 100 60 - 80	Ultra Low NOx Burners SCR																			
CO	20	Advanced combustion control																			
CO ₂	-	Thermally efficient furnace Heat/energy integration																			
7.5.4.2 Decoking drum vent gas	BAT is to minimise the coke formation through process optimisation and the use of dry cyclones or wet scrubbing systems to abate emissions. Alternatively, the decoking effluent stream may be recycled to the furnace firebox where sufficient residence time permits total combustion of any coke particles. A particulates content of less than 50 mg/Nm ³ (as an hourly average) can be achieved.	Not Applicable																			
7.5.4.4 Point sources	BAT is the collection of point sources to a suitable purge gas system for recovery into fuel gas or to flare.	Not Applicable																			
7.5.4.4 Point sources	BAT for sampling systems is closed loop design.	Not Applicable																			
7.5.4.4 Point sources	For atmospheric storage tanks containing toxic compounds (e.g. benzene), BAT is to avoid the possibility of point source emissions through the routing of tank vents to a closed recovery system, within the process, or to a flare system.	Not Applicable																			
7.5.4.6 Fugitive emissions	The generic BAT for fugitives, as described in Section 6.3, is applicable to the production of lower olefins. BAT for equipment design on lower olefin installations is governed by the need to meet the fugitive emission standards for critical components such as benzene.	Not Applicable																			

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place																						
7.5.5.1 Process water	BAT is to recover the process water downstream of the cracking section and, after suitable treatment and vaporisation, to maximise recycling to the cracking furnaces. Except for the case of some heavy hydrocarbon feedstocks, typically some 90 % of process water may be recycled.	Not Applicable																							
7.5.5.1 Process water	Dilution Steam Generation (DSG) is BAT. This involves washing the condensed process water with a suitable gasoline component, separation via a coalescer or similar device, steam stripping to remove volatile hydrocarbons which are recovered in the process and finally boiling to recycle the water as dilution steam. Approximately 10 % of the water is purged from the system and is directed to final treatment (see 7.5.5.3).	Not Applicable																							
7.5.5.3 Final treatment	BAT for final effluent treatment includes physical separation (e.g. API separator, corrugated plate separator), followed by a polishing treatment (e.g. hydrogen peroxide oxidation or biotreatment)	Not Applicable																							
7.5.5.3 Final treatment	<p>The BAT levels for final water emissions from a central waste water treatment plant are given in Table 7.20.</p> <p>Table 7.20: BAT-associated levels for effluent from a central waste water treatment plant</p> <table border="1"> <thead> <tr> <th>Pollutant</th> <th>BAT-associated level ⁽¹⁾ (mg/l) as daily averages</th> </tr> </thead> <tbody> <tr> <td>Flowrate</td> <td>0.3 to 0.5 t/t ethylene ⁽²⁾</td> </tr> <tr> <td>pH</td> <td>7 - 8 pH units</td> </tr> <tr> <td>COD</td> <td>30 - 45 ⁽³⁾ ⁽⁴⁾</td> </tr> <tr> <td>TOC</td> <td>10 - 15 mg/l and 2 - 10 g/t ethylene ⁽⁴⁾</td> </tr> <tr> <td>Sulphide ions</td> <td>0.6</td> </tr> <tr> <td>Phosphate</td> <td>1.5</td> </tr> <tr> <td>Nitrogen</td> <td>25</td> </tr> <tr> <td>Phenols</td> <td>0.15</td> </tr> <tr> <td>Benzene</td> <td>0.05</td> </tr> <tr> <td>Total hydrocarbon content</td> <td>1.5</td> </tr> </tbody> </table> <p>1. Does not include cooling waters as these are not normally treated. 2. Possibly much larger flows with heavy feedstock. 3. Values assume a COD:TOC ratio of 3:1 4. Values may have been back calculated from the percentage contribution to a central WWTP.</p>	Pollutant	BAT-associated level ⁽¹⁾ (mg/l) as daily averages	Flowrate	0.3 to 0.5 t/t ethylene ⁽²⁾	pH	7 - 8 pH units	COD	30 - 45 ⁽³⁾ ⁽⁴⁾	TOC	10 - 15 mg/l and 2 - 10 g/t ethylene ⁽⁴⁾	Sulphide ions	0.6	Phosphate	1.5	Nitrogen	25	Phenols	0.15	Benzene	0.05	Total hydrocarbon content	1.5	Not Applicable	
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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
7.5.6 By-products and wastes	BAT for solid wastes includes the following techniques: <ul style="list-style-type: none"> • organic wastes that are periodically removed from the plant (e.g. heavy sludges in the bottom of API separators) are incinerated (e.g. by specialist waste disposal contractors) • spent catalyst is treated (e.g. by the supplier or a reclaimer) to recover precious metals • coke fines recovered from gas dedusting during decoking are disposed of in an immobilised form (e.g. by incineration, landfill) • spent adsorbents are disposed of by landfill or incineration. 	Not Applicable	
8 ILLUSTRATIVE PROCESS: AROMATICS			
8.5.2 Air emissions	Aromatics production units are fairly energy-intensive and although use of energy is essentially still cost-driven, there is a growing tendency to incorporate more and more energy integration into modern designs. Energy integration applies to both the aromatics plant and its surrounding units, and also the efficient generation of energy and utilities as part of the energy integration programme. This is commonly accepted as BAT as it addresses the root cause of one aspect of air pollution, namely combustion emissions.	Not Applicable	
8.5.2 Air emissions	For new furnaces, BAT is the use of Ultra Low NOx burners (ULNBs) or, alternatively for larger furnaces, a catalytic De-NOx (SCR) system. For existing furnaces, the BAT decision will depend on the feasibility of installing ULNBs or SCR considering the plant design, size and layout.	Not Applicable	
8.5.2 Air emissions	BAT is to minimise the VOC emissions at the design stage and due to the toxic properties of benzene particularly stringent controls are required.	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
8.5.2 Air emissions	<p>BAT is an appropriate selection or combination of the following techniques:</p> <ul style="list-style-type: none"> • BAT is to route routine process vents and safety valve discharges to gas recovery systems or, where this is not possible, to flare • BAT is to use closed loop sample systems to minimise operator exposure and to minimise emissions during the purging step prior to taking a sample. The best closed loop sample systems route the sample loop back into the process • BAT is to use 'heat-off' control systems to stop the heat input and shut down plants quickly and safely in order to minimise venting during plant upsets • BAT is the use of closed piping systems for draining and venting hydrocarbon containing equipment prior to maintenance, particularly when containing more than 1 wt% benzene or more than 25 wt% aromatics. Ideally permanent piping is used to minimise the risk of exposure during the breaking of containment • On systems where the process stream contains more than 1 wt% benzene or more than 25wt% total aromatics, BAT is preferably the use of canned pumps or, where they are not applicable, single seals with gas purge or double mechanical seals or magnetically driven pumps • When fugitive emissions are a particular concern (e.g. for occupational exposures reasons), the BAT for fugitive leaks from rising stem manual or control valves is fitting with bellows and stuffing box, or the use of high-integrity packing materials (e.g. carbon fibre) • BAT for compressors is double mechanical seals, or a process-compatible sealing liquid, or a gas seal, or to be sealless. 	Not Applicable	
8.5.2 Air emissions	BAT for the hydrogenation off-gases is combustion in a furnace with heat recovery facilities. Where there is a need or a market for pure hydrogen, the dealkylation off gases are to be subjected to hydrogen separation and use of methane as fuel.	Not Applicable	
8.5.2 Air emissions	<p>BAT for the bulk storage of aromatics is either[EC DGXI, 1990 #16]:</p> <ul style="list-style-type: none"> - double seal floating roof tanks (not for dangerous aromatics such as benzene), or in fixed roof tanks incorporating an internal floating roof with high integrity seals - fixed roof tanks which, for a given product or intermediate, have interconnected vapour spaces and vapour recovery or absorption at a single vent. 	Not Applicable	
8.5.2 Air emissions	BAT for the loading or discharging of aromatics (or aromatics-rich streams) from road tankers, rail tankers, ships and barges is the use of closed vent systems (which include the vehicle itself) and where feasible the bottom-loading of road / rail tankers.	Not Applicable	
8.5.2 Air emissions	BAT for the evolved vapours is connection to either a vapour recovery unit, burner or flare system.	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
8.5.3 Water emissions	BAT is to minimise waste water generation and to maximise waste water re-use.	Not Applicable	
8.5.3 Water emissions	Where high hydrocarbon levels still exist after full application of prevention and minimisation techniques, then BAT for waste water exiting the battery limits is the recovery of hydrocarbons using, for example, steam stripping.	Not Applicable	
8.5.3 Water emissions	BAT for the recovered hydrocarbons is either recycling to fuel or to other recovery systems in associated processes within the complex.	Not Applicable	
8.5.3 Water emissions	BAT for the water phase is routing via an oily water separator (to recover hydrocarbons that do leave the battery limits) followed by biological waste water treatment.	Not Applicable	
8.5.4 Wastes	BAT for spent catalysts is recovery and re-use of the precious metal content and landfill disposal of the residual catalyst support.	Not Applicable	
8.5.4 Wastes	BAT for oily sludges is incineration under carefully controlled conditions, with associated heat recovery.	Not Applicable	
8.5.4 Wastes	Landfill and incineration are both BAT disposal methods for spent clay adsorbents. Clay adsorbents may need pre-treatment to reduce the organic content before landfill disposal.	Not Applicable	
9 ILLUSTRATIVE PROCESS: ETHYLENE OXIDE & ETHYLENE GLYCOLS			
9.4.4.2 Inerts vent	the hydrocarbon content of the inerts vent gives it value as a fuel and it is often used as a fuel gas in site boilers. In these cases, the most significant potential emissions are NOx and CO, mainly dependent on the burner technology (Low NOx burners), and combustion control (advanced control systems). The use of the inerts vent as fuel gas is generally BAT	Not Applicable	
9.4.6.2 Heavy glycol liquid residues	The stream can be either sold as such, or fractionated to yield pure marketable glycols. BAT is either to sell this stream, or to maximise the recovery of glycols, in order to minimise the volume to be disposed off.	Not Applicable	
9.5.1 Process selection	Ethylene oxide process. The direct oxidation of ethylene by pure oxygen is BAT for the production of EO due to the lower ethylene consumption and lower off-gas production. The conversion of an existing air-based unit to pure oxygen feed is a major modification involving a large investment cost and may not be BAT.	Not Applicable	
9.5.1 Process selection	Ethylene glycol process. The process is based on the hydrolysis reaction of EO. BAT is to optimise the reaction conditions in order to maximise the production of valuable glycols while reducing the energy (essentially steam) consumption.	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
9.5.2 Raw material and energy consumption	The consumption of raw materials and the imports/exports of energy mainly depend on EO catalyst selectivity. Higher catalyst selectivity will result in lower raw material use but also in higher energy imports (or lower energy exports, depending on relative sizes of EO and EG sections of the plant) because less energy can be recovered from the combustion of ethylene. However, the benefits resulting from reduced raw material consumption outweigh the disadvantages of increased energy imports. This means that having the lowest energy import (or largest energy export) may not be BAT.	Not Applicable	
9.5.2 Raw material and energy consumption	BAT is to maximise the process selectivity by applying efficient oxidation catalysts and optimising the process parameters within the constraints given by plant design, local site conditions and economics and/or to find commercial outlet for the carbon dioxide product.	Not Applicable	
9.5.2 Raw material and energy consumption	BAT is to optimise internal heat integration, between the EO and EG production units, and externally between the EO/EG complex and the surrounding facility.	Not Applicable	
9.5.3 Plant design	BAT for those vent streams from normal operation that contain organics is connection to a recovery system or to a vent gas treatment (e.g. fuel gas network, flare, scrubber) to achieve an emission of <5 mg EO/Nm ³ . Such a connection would not be appropriate to emergency relief vents that, due to large flow, would overload the pollution control equipment.	Not Applicable	
9.5.3 Plant design	In addition to the generic BAT described in Section 6.3, BAT for the prevention of fugitive emissions from EO/EG production is particular consideration of the following components: <ul style="list-style-type: none"> • high integrity sealing systems for pumps, compressors and valves • selection of proper types of O-ring and gasket materials • number of flanged connections reduced as much as practicable. 	Not Applicable	
9.5.3 Plant design	BAT for the EO lean absorbing water (EO-free water from the EO stripper bottom) is indirect cooling.	Not Applicable	
9.5.3 Plant design	In cases where cooling is carried out in open cooling towers, BAT is to reduce the VOC emission by such means as minimising the organics content of the EO lean absorbing water.	Not Applicable	
9.5.3 Plant design	For BAT concerning storage and loading facilities reference is made to Section 6.3. For EO/EG storage and loading special attention shall be paid to designs that: <ul style="list-style-type: none"> • avoid any ingress of air or impurities likely to react dangerously with EO • prevent leaks and prevent soil / water pollution caused by leaks • a vapour return system on EO truck or railcar loading to minimise the gaseous streams requiring further treatment in, for example, a water scrubber. 	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
9.5.4 Air emissions	BAT for the carbon dioxide vent is minimisation of carbon dioxide, methane and ethylene generation by: <ul style="list-style-type: none"> • minimisation of the carbon dioxide generation at the reaction step by applying more efficient oxidation catalyst • removal of methane and ethylene from the fat carbonate solution before routing this solution to the carbon dioxide stripper • removal of methane and ethylene from the carbon dioxide vent by means of a thermal or catalytic oxidation unit. 	Not Applicable	
9.5.4 Air emissions	Where possible, it is also BAT to recover the carbon dioxide for sale as a product.	Not Applicable	
9.5.4 Air emissions	BAT for the inerts vent in the oxygen process is transfer to a fuel gas system for energy recovery in, for example, a boiler plant. At facilities where there is an energy excess and there is no outlet for energy re-use, then BAT for the inerts vent may be flaring. Under optimal conditions, fuel gas or flare systems can typically reduce EO emission levels to <1mg EO/Nm ³ (as an hourly average).	Not Applicable	
9.5.4 Air emissions	BAT for the inerts excess leaving EO recovery in the air process is transfer to a second oxidation reactor (to convert where most of the residual ethylene into EO) followed by a second absorber (collecting EO as an aqueous solution) and leaving an inerts vent for release to the atmosphere.	Not Applicable	
9.5.4 Air emissions	BAT for EO containing vent gases is: <ul style="list-style-type: none"> • for vent streams with a low content in methane and ethylene - water scrubbing with further release of the scrubber overheads to the atmosphere. The BAT-associated emission level (as an hourly average) from scrubbers is <5mg EO/Nm³. • for vent streams with a noticeable content in methane and ethylene - water scrubbing with further compression of the scrubber overheads for recycle to the process. Use of the compression and recycle technique (which has no emission to atmosphere) has to be justified on a case by case basis by a cost/benefit analysis • minimisation techniques such as pressure balancing and vapour return systems in storage and loading. 	Not Applicable	
9.5.4 Air emissions	BAT for the other small vent streams that occur on some plants is direction either to a fuel-gas system or to a common flare system for total destruction of the organics.	Not Applicable	
9.5.4 Air emissions	BAT for fugitive emissions is concomitant with minimising operator exposure to EO. This is demonstrated by observing threshold limits in ambient air of less than 1 ppm EO (1.8 mg/Nm ³) for an 8 hours/day exposure. The measures to minimise fugitive emissions are covered generically in Section 6.3.	Not Applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
9.5.5 Water emissions	BAT is to connect following contaminated water effluent streams to a treatment plant: <ul style="list-style-type: none"> • water bleed (whole EO/EG unit) • water seal flushes from pumps, if not recycled to the process • cleaning water from maintenance operations. 	Not Applicable	
9.5.5 Water emissions	BAT for reducing the flow and/or the organics contents of the water bleed can be concentration of partial contributor streams with recovery of a heavy organic stream (for sale or incineration).	Not Applicable	
9.5.5 Water emissions	BAT for the contaminated effluent stream is transfer to a dedicated, central or external waste water biological treatment plant to take advantage of the high biodegradability of the organic contaminants (mainly glycols). The application of BAT allows an emission level of 10-15g TOC/t EO ex-reactor to be achieved (assuming an organics destruction rate of 90%).	Not Applicable	
9.5.6 By-products and wastes	Ethylene oxide process. BAT to minimise the production of by-products is through optimisation of the oxidation reaction conditions.	Not Applicable	
9.5.6 By-products and wastes	BAT for the carbon dioxide by-product of the EO production process is minimising formation by the use of more efficient catalysts, or sale, or re-use (after purification) - depending on the local conditions.	Not Applicable	
9.5.6 By-products and wastes	BAT for the other main byproduct (ethylene glycol) is recovery or sale.	Not Applicable	
9.5.6 By-products and wastes	BAT for the spent EO catalyst is optimising catalyst life and then recovery of the silver content to leave an inert support for appropriate disposal (e.g. landfill).	Not Applicable	
9.5.6 By-products and wastes	Ethylene glycols process. BAT for the heavy glycol by-products is minimising their formation by optimising the hydrolysis conditions (e.g. water excess) or recovery / sale.	Not Applicable	
10 ILLUSTRATIVE PROCESS: FORMALDEHYDE			
10.5.1 Process selection	Formaldehyde is produced either by air oxidation of methanol on a metal oxide catalyst (oxide process) or by air oxy-dehydrogenation of methanol on a silver catalyst (silver process). For a new unit, both the oxide process and the silver process (with total conversion) can be BAT. The silver process (with partial conversion) has the same environmental performance as the other processes but delivers less steam excess due to the heat needed to separate and recycle the methanol. However, it produces high concentration solutions (above 60 %) which can be used on-site and save energy in the downstream products manufacturing. In this case, the silver process (with partial conversion) is also BAT.	Not Applicable Although formaldehyde is used on-site it is not produced by Smartply.	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
10.5.1 Process selection	The oxide process and silver process (with partial methanol conversion) can be BAT when a low methanol content in the formaldehyde solution is required (below 0.5 % by weight). This low content is also achieved with the silver process with total methanol conversion if additional equipment is provided.	Not applicable	
10.5.2 Consumption of energy and raw materials	BAT consists in managing efficiently the energy balance of the formaldehyde unit taking into account the surrounding site.	Not applicable	
10.5.2 Consumption of energy and raw materials	BAT consists in reusing aqueous waste streams to absorb and dilute formaldehyde (unless it would adversely affect finished product quality).	Not applicable	
10.5.3 Air emissions	BAT is to connect the vent streams from the absorber and from the storage and loading/unloading systems to a recovery system (e.g. condensation, water scrubber) and/or to a vent gas treatment (e.g. motor engine, thermal/catalytic oxidiser, central boiler plant). Such equipment can be designed to achieve a formaldehyde emission of <math><5\text{mg}/\text{Nm}^3</math> (daily average).	Not applicable	A limit of 9.4kg/hr of formaldehyde is in place at A2-1.
10.5.3 Air emissions	Silver process. BAT for abatement of the absorber off-gases in the silver process includes gas engines and dedicated thermal oxidation with steam generation. This can achieve emission concentrations (as dry exhaust gas at standard conditions and related to an oxygen content of 3 Vol. %) of: <ul style="list-style-type: none"> • carbon monoxide: $50\text{mg}/\text{Nm}^3$ as a daily average (0.1 kg/t formaldehyde 100 %) • nitrogen oxides (as NO_2): $150\text{ mg}/\text{Nm}^3$ as a daily average (0.3kg/t formaldehyde 100%). 	Not applicable	
10.5.3 Air emissions	The combustion of off-gases in a central boiler plant (mixed with other fuels) can also be BAT and may achieve similar emission standards.	Covered by LCP BREF review.	
10.5.3 Air emissions	Oxide process. BAT to treat the reaction off-gas from the oxide process consists of a dedicated catalytic oxidation system, preferably with steam generation for export (although the economic case may be more marginal than with the silver process). This can achieve emission concentrations (as dry exhaust gas at standard conditions and related to an oxygen content of 3% vol.) of: <ul style="list-style-type: none"> • carbon monoxide: $<20\text{mg}/\text{Nm}^3$ as a daily average (0.05kg/t formaldehyde 100%) • nitrogen oxides (as NO_2): $<10\text{mg}/\text{Nm}^3$ as a daily average. 	Not applicable	
10.5.3 Air emissions	BAT for the design of methanol tanks is to take account of the flammable properties of methanol in air and to reduce the vent streams by such techniques as back-venting on loading/unloading.	Not applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
10.5.3 Air emissions	BAT for the polluted streams from the storage of methanol and formaldehyde include: <ul style="list-style-type: none"> • thermal or catalytic oxidation • adsorption on activated carbon (only for methanol) • absorption in water, further recycled to the process • connection to the suction of the process air blower (only for formaldehyde storage) vents, and provided the necessary safety precautions. 	Applicable for formaldehyde storage only. It should be noted that pure formaldehyde is not stored on-site.	LPF (liquid phenol formaldehyde) tanks are vented through activated carbon drum & then to atmosphere.
10.5.4 Water emissions	BAT for the minor arisings of waste water is to maximise their re-use as dilution water for the product formaldehyde solution (unless this adversely affects product quality).	Not applicable	
10.5.4 Water emissions	When re-use is not possible, BAT is biological treatment in an on-site or off-site waste water treatment facility, taking necessary measures to ensure that the formaldehyde concentration does not inhibit biological degradation.	Not applicable	
10.5.5 By-products and wastes	BAT for catalyst waste is to first maximise the catalyst life by optimising reaction conditions and then to reclaim the metal (silver, iron or molybdenum) content of any spent catalyst to produce fresh catalyst for re-use in the reaction.	Not applicable	
10.5.5 By-products and wastes	BAT for the build-up of solid para-formaldehyde is to prevent its formation in process equipment by optimising heating, insulation and flow circulation. Any unavoidable arisings are to be re-dissolved either in hot water (for re-use in the process) or in ammonia (for re-use in other processes). Where this is not possible it can be drained-off and incinerated.	Not applicable	
11 ILLUSTRATIVE PROCESS: ACRYLONITRILE			
11.5.1 Process selection	The old acrylonitrile production process based on the addition of hydrogen cyanide to acetylene is no longer practised and is not BAT.	Not applicable	
11.5.1 Process selection	The BAT process is based on the ammoxidation of propylene in a fluid bed reactor, with subsequent recovery of acrylonitrile. Recovery for sale of the main co-products, hydrogen cyanide, acetonitrile, and ammonium sulphate may be BAT depending on local circumstances.	Not applicable	
11.5.1 Process selection	The BAT process may also make a choice between atmospheric air and oxygen-enriched air, and between chemical-grade and polymerisation-grade propylene feedstock.	Not applicable	
11.5.2 Plant design	BAT for acetonitrile is to recover and purify it when a market is available, or to burn it with heat recovery (current world market of acetonitrile is significantly smaller than its production during acrylonitrile manufacture).	Not applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
11.5.2 Plant design	Regardless of the presence of reliable downstream sinks, BAT for the pure, recovered hydrogen cyanide is to <ul style="list-style-type: none"> • re-use hydrogen cyanide on-site or to sell • provide adequately sized flare and/or incineration facilities to destroy hydrogen cyanide when it cannot be re-used • minimise the amount and duration of hydrogen cyanide storage (consistent with requirements of any downstream process or transportation). 	Not applicable	
11.5.2 Plant design	BAT for the ammonium sulphate resulting from the neutralisation of excess ammonia is either crystallisation and sale to the fertilisers industry, or treatment in a dedicated unit where sulphuric acid is regenerated. BAT for vent streams from normal operation that contain organics is: <ul style="list-style-type: none"> • Firstly; minimisation by, inter alia, vapour phase equilibrium during transfer and loading operations, closed sampling systems and proper operating procedures to clean the unit prior to maintenance. • And subsequently, connection to a recovery system, or to a vent gas treatment system (e.g. incinerator, thermal oxidiser, flare or scrubber). Emergency relief vents that, due to their large flow, would overload the pollution control equipment are not limited to the same emission limits as routine venting. 	Not applicable	
11.5.2 Plant design	Because of the hazardous nature of acrylonitrile and hydrogen cyanide, the following specific BAT measures are required in the design of storage and loading facilities for acrylonitrile production: <ul style="list-style-type: none"> • avoid the ingress of impurities likely to react dangerously with acrylonitrile • avoid the risks of fire in the gaseous phase of tanks and in shipping by considering the flammability of acrylonitrile, hydrogen cyanide, acetonitrile and any stored intermediate streams in the design of barges, road tankers or railcars used to transport these products (e.g. nitrogen blanketing) • minimise the amount and duration of hydrogen cyanide storage (consistent with requirements of any downstream process or transportation) and monitor for temperature, inhibitors and colour on any stored material • bund storage facilities to prevent soil and water pollution in the event of spillage • equip the acrylonitrile, acetonitrile and hydrogen cyanide (rail cars only) loading systems for trucks or railcars with a vapour return system to minimise the gaseous vents that require further treatment in an appropriate system (e.g. a water scrubber). 	Not applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
11.5.3 Air emissions	<p>BAT for the adsorber off-gas is minimisation followed by treatment:</p> <p>Minimisation of adsorber off-gas volume and pollutant load:</p> <ul style="list-style-type: none"> The priority consists in reducing the amount of the absorber off-gas per tonne of acrylonitrile by means of a more efficient catalyst and optimised reaction/operation conditions. The use of enriched air and/or of polymerisation grade propylene complies with this prerequisite, but must be judged after a full cost/benefit analysis (i.e. including the costs/benefits of oxygen generation). Although oxygen enrichment of the reaction air can reduce the off-gas volume, air-based and enriched-air based processes are both BAT. Catalysts are selected to maximise the yield of valuable products (i.e. acrylonitrile, hydrogen cyanide and acetonitrile) and minimise waste production. Where acrylonitrile is the sole product, then the BAT choice of catalyst can give a yield of >75% (acrylonitrile). <p>Treatment of adsorber off-gas:</p> <ul style="list-style-type: none"> BAT for the remaining absorber off-gas is destruction of the organics in a dedicated thermal or catalytic oxidiser, or in a common purpose incinerator or in a boiler plant. In all cases, BAT will include heat recovery (normally steam production). 	Not applicable	
11.5.3 Air emissions	BAT for the miscellaneous vent streams is treatment in either the absorber off-gas treatment system or a common flare system for total destruction of the organics. Other vent streams may be treated by other techniques, such as scrubbing, which will allow the recycling of the recovered components.	Not applicable	
11.5.3 Air emissions	The performance of the vent stream treatment systems should target acrylonitrile concentrations (as hourly averages) of <0.5 mg/Nm ³ (the detection limit in vents) for oxidation systems and <5mg/Nm ³ for scrubbing systems.	Not applicable	
11.5.3 Air emissions	BAT for fugitive emissions is concomitant with minimising operator exposure to acrylonitrile. This is demonstrated by observing threshold limits in ambient air of less than 2 ppm acrylonitrile for an 8 hours/day exposure. The measures to minimise fugitive emissions are covered generically in Section 6.3.	Not applicable	
11.5.4 Water emissions	BAT includes either the crystallisation of ammonium sulphate for sale as fertilisers, or its treatment in a dedicated unit for sulphuric acid regeneration.	Not applicable	
11.5.4 Water emissions	BAT for the water streams is pre-treatment by distillation to reduce the light hydrocarbons content and to concentrate or separate heavy hydrocarbons, with the aim of reducing the organics load prior to final treatment. BAT for the recovered light and heavy hydrocarbon streams is further treatment to recover useful components (e.g. acetonitrile) prior to combustion with energy recovery.	Not applicable	

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
11.5.4 Water emissions	BAT consists in transferring the contaminated effluent stream to a dedicated, central or external waste water treatment plant including biotreatment, to take advantage of the high biodegradability of the organic contaminants. When biotreatment facilities are not available at a location equivalent quality effluent can be produced using distillation techniques. The application of BAT allows an emission level of 0.4 kg Total Organic Carbon /t acrylonitrile to be achieved (based on an organics destruction rate of 90 %).	Not applicable	
11.5.5 By-products and wastes	BAT is to maximise the re-use of hydrogen cyanide, acetonitrile and ammonium sulphate byproducts, although local circumstances and markets may, at times, prevent this.	Not applicable	
11.5.5 By-products and wastes	When provided for at design step, BAT for the crude acetonitrile is recovery from the core unit, for further purification. Otherwise BAT for acetonitrile is burning the crude liquid acetonitrile stream (with energy recovery), or by mixing the crude acetonitrile with the absorber vent stream for burning (with energy recovery).	Not applicable	
11.5.5 By-products and wastes	BAT for ammonium sulphate is recovery as crystal, or, where recovery is not possible, conversion to sulphuric acid.	Not applicable	
11.5.5 By-products and wastes	BAT for the catalyst fines is separation by settling or filtration, and treatment by combustion or landfill disposal.	Not applicable	
11.5.5 By-products and wastes	BAT for heavy residues is firstly minimisation by: <ul style="list-style-type: none"> • reducing the formation of fines and catalyst losses • avoiding degradation of products by using mild operating conditions and addition of stabilisers • maximising the recovery of valuable product from waste streams • selection of catalyst. 	Not applicable	
11.5.5 By-products and wastes	BAT for the heavy residues that cannot be avoided by minimisation techniques is recovery from the stripper column bottoms and/or from the quench system (basic quench) together with the catalyst fines, followed by on-site or off-site incineration.	Not applicable	
12 ILLUSTRATIVE PROCESS: ETHYLENE DICHLORIDE / VINYL CHLORIDE MONOMER			
12.5.1 Process selection	The BAT route for the production of EDC and VCM is via the chlorination of ethylene. The chlorination of ethylene can be carried out by 'direct chlorination or 'oxychlorination', each route having its advantages and providing complementary components of the balanced EDC/VCM process, and so it is not possible to identify which one is BAT.	Not applicable	
12.5.1 Process selection	BAT is to optimise the process balancing so as to maximise the recycle of process streams. Where local circumstances do not permit full process balancing, attention is to be paid to optimising the sources and sinks of EDC/HCl.	Not applicable	

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003															
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place												
12.5.1 Process selection	When considering the direct chlorination of ethylene, both the low-temperature and high temperature variants (above the EDC boiling point) are BAT for new units. For existing 'cold' chlorination units the retrofitting of high temperature units is probably not justified.	Not applicable													
12.5.1 Process selection	In the ethylene oxychlorination step, there are choices between the source of oxidant (air or oxygen) and the reactor type (fixed or fluidised bed). <ul style="list-style-type: none"> • Source of oxidant: The use of oxygen is considered to be BAT for new plants, provided that there is an economically available source of oxygen. For an air-based unit, the retrofitting of oxygen may be justified by site specific, economic reasons (e.g. an increase in production capacity, limited capacity of a site incinerator). • Reactor type: Fixed bed and fluid bed reactors may both be BAT. 	Not applicable													
12.5.2 Plant design	Vent connection. BAT is to connect the vents from normal operation (that contain chlorinated hydrocarbons and/or ethylene or other organics) to a recovery system or to vent gas treatment if their concentrations exceed: <table border="0" style="margin-left: 20px;"> <tr> <td>VCM</td> <td>5 mg/Nm³</td> </tr> <tr> <td>EDC</td> <td>5 mg/Nm³</td> </tr> <tr> <td>Ethylene</td> <td>150 mg/Nm³</td> </tr> <tr> <td>HCl calculated as total chloride</td> <td>30 mg/Nm³</td> </tr> <tr> <td>Chlorine</td> <td>5 mg/Nm³</td> </tr> <tr> <td>Dioxin iTEQ</td> <td>0.1 ng/Nm³</td> </tr> </table> Where the mass emission of chlorinated hydrocarbons is below 0.02 kg/h and below 2kg/h for ethylene, the environmental benefits of connection may not be justified by the costs.	VCM	5 mg/Nm ³	EDC	5 mg/Nm ³	Ethylene	150 mg/Nm ³	HCl calculated as total chloride	30 mg/Nm ³	Chlorine	5 mg/Nm ³	Dioxin iTEQ	0.1 ng/Nm ³	Not applicable	
VCM	5 mg/Nm ³														
EDC	5 mg/Nm ³														
Ethylene	150 mg/Nm ³														
HCl calculated as total chloride	30 mg/Nm ³														
Chlorine	5 mg/Nm ³														
Dioxin iTEQ	0.1 ng/Nm ³														
12.5.2 Plant design	Storage. BAT for storage and handling facilities is: <ul style="list-style-type: none"> • tank vents passing to the thermal / catalytic oxidiser • the loading of VCM, EDC and by-products into trucks, railcars or ships that are equipped with a vapour return system on their tanks. In particular cases, where lower emissions are desirable, then BAT may also involve the activated carbon adsorption of low-flow vents (e.g. the loading of EDC into transport vessels).	Not applicable													

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
12.5.2 Plant design	<p>Reduction of chlorinated by-product formation. BAT for reduction of the chlorinated byproducts is the use of such techniques as:</p> <ul style="list-style-type: none"> • hydrogenation of the acetylene contaminant in HCl produced in the EDC cracking plant and recycling to oxychlorination. By effecting this hydrogenation it is possible to avoid the formation of dichloroethylenes, trichloroethylenes, tetrachloroethane and tetrachloroethylene. Without the trichloroethylene it is possible to carry out the distillation of the light ends, increasing in this way the EDC recovery • complete recycle of the raw materials and reaction intermediates. The ethyl chloride can be separated from the lights and recycled to the oxychlorination section; the ethylene contained in the purge gas can be converted in EDC in specific reactors • use of burners with flat flame in the cracking furnaces. The use of these burners allows to reduce the hot spots on the walls of the process tubes and consequently the production of by-products due to the high temperatures. 	Not applicable	
12.5.3 Treatment of air pollutants	<p>Recovery. BAT for the recovery of ethylene, EDC, VCM and other chlorinated organic compounds is:</p> <ul style="list-style-type: none"> • recycling directly to the process • refrigeration and condensation • absorption in solvents followed by stripping; or • adsorption on solids followed by desorption. <p>These techniques are BAT for the following sources (vents):</p> <ul style="list-style-type: none"> • direct chlorination reactor • oxychlorination reactor • distillation columns and dryers for by-products including light-and heavy-ends • VCM/EDC separation • VCM purification • vacuum pumps • sampling systems • tanks and pipelines for EDC, VCM and by-products • contaminated waste water collection and treatment system. 	Not applicable	
12.5.3 Treatment of air pollutants	<p>Treatment. BAT is to use efficient combustion techniques (either thermal or catalytic) to further reduce the off-gas concentrations of chlorinated compounds and ethylene, and to recover energy as steam.</p>	Not applicable	

Title of Document Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
12.5.3 Treatment of air pollutants	The BAT will depend on the content of chlorinated organic compounds in the vent gases: <ul style="list-style-type: none"> • for VOCs in the 'several hundreds' of ppm range - catalytic (flameless) combustion at 500-600°C with little or no fuel gas consumption • for VOC in the 'thousands' of ppm range – thermal oxidation at more than 750°C with rapid quenching through the temperature window for de novo PCDD/F formation. 	Not applicable	
12.5.3 Treatment of air pollutants	BAT is to combust all vents, except those that pose unacceptable explosive risks and those with such a large flow that they would overload the treatment system. Such combustion will normally invoke some of the requirements of the EC directive on the incineration of waste (2000/76/EC) even though the directive is not directly applicable to gaseous wastes. The oxidiser may be followed by activated carbon adsorption if dioxin levels are high.	Not applicable	
12.5.3 Treatment of air pollutants	BAT for the HCl formed from the combustion of chlorinated organic compounds is absorption in water/hydrochloric acid for recovery, and/or an alkaline solution. This combination of techniques can achieve the following emission concentrations (as daily averages)[PARCOM, 1996 #22]: <ul style="list-style-type: none"> Sum of EDC and VCM from point sources: <1mg/Nm³ Dioxin from point sources (I-TEQ): <0.1ng/Nm³ HCl from point sources: <10mg/Nm³ 	Not applicable	
12.5.3 Treatment of air pollutants	In particular cases (e.g. where incineration does not achieve the dioxin levels, or where lower dioxin emissions are desirable) then activated carbon adsorption of incinerator off-gases may be BAT.	Not applicable	
12.5.3 Treatment of air pollutants	Fugitives. BAT for fugitives is described in Section 6.3 and can achieve the following fugitive release levels: <ul style="list-style-type: none"> Volatile chlorinated hydrocarbons from fugitive sources: <5kg/h EDC in working atmosphere: <2ppm (8mg/Nm³) VCM in working atmosphere: <1ppm (2.6mg/Nm³) 	Not applicable	
12.5.3 Treatment of air pollutants	Monitoring. BAT for the monitoring of stack emissions is continuous on-line instrumental monitoring of O ₂ and CO and sampling at intervals for C ₂ H ₄ , VCM, EDC, Cl ₂ , HCl and Dioxin. BAT for the monitoring of installation ambient air is: <ul style="list-style-type: none"> • continuous, on-line instrumental monitoring of VCM and EDC at a number of appropriate points in the plant airspace • spot checks of VCM and EDC with hand held instruments, to detect leaks • personal monitors for VCM. 	Not applicable	

Title of Document		Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003													
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place												
12.5.4 Treatment of water pollutants	BAT is treatment of effluent streams arising from: <ul style="list-style-type: none"> • reaction water from oxychlorination • wash water and condensate from EDC purification • other condensates • water seal flushes from pumps, vacuum pumps • cleaning water from maintenance operations • water separated in wet EDC and light-end storage tanks. 	Not applicable													
12.5.4.1 Pre-treatment	BAT for chlorinated organic compounds that are dissolved in waste water (e.g. EDC, VCM, chloroform, carbon tetrachloride) is steam, or hot air, stripping to effluent concentrations of less than 1mg/l.	Not applicable													
12.5.4.1 Pre-treatment	BAT for the stripped material (EDC, VCM etc.) is condensation and recovery, or incineration.	Not applicable													
12.5.4.1 Pre-treatment	BAT for any semi-volatile or non-volatile chlorinated organic compounds that are adsorbed on particulate matter is removal by flocculation, settling and filtration.	Not applicable													
12.5.4.1 Pre-treatment	The BAT effluent concentration for copper is less than 1mg/l. This is achieved by alkaline precipitation and separation by settling or, where the effluent contains ammonia, by electrolysis.	Not applicable													
12.5.4.2 Final treatment	BAT for the pre-treated effluent is discharge to biological treatment that can achieve the following maximum effluent concentrations: <table border="1"> <tbody> <tr> <td>Total chlorinated hydrocarbons:</td> <td>1 mg/litre</td> <td>Copper (total):</td> <td>1 mg/litre</td> </tr> <tr> <td>Dioxins (iTEQ):</td> <td>0.1 ng/litre</td> <td>COD:</td> <td>125 mg/litre</td> </tr> <tr> <td>Sum of hexachlorobenzene and pentachlorobenzene</td> <td>1 µg/l</td> <td>Hexachlorobutadiene:</td> <td>1 µg/l</td> </tr> </tbody> </table>	Total chlorinated hydrocarbons:	1 mg/litre	Copper (total):	1 mg/litre	Dioxins (iTEQ):	0.1 ng/litre	COD:	125 mg/litre	Sum of hexachlorobenzene and pentachlorobenzene	1 µg/l	Hexachlorobutadiene:	1 µg/l	Not applicable	
Total chlorinated hydrocarbons:	1 mg/litre	Copper (total):	1 mg/litre												
Dioxins (iTEQ):	0.1 ng/litre	COD:	125 mg/litre												
Sum of hexachlorobenzene and pentachlorobenzene	1 µg/l	Hexachlorobutadiene:	1 µg/l												
12.5.4.2 Final treatment	On the basis of new data for a dual nitrification-de-nitrification waste water treatment plant, the BAT-associated emission is 50 to 100 mg COD/l. However, this treatment technique is probably not BAT for a EDC/VCM unit that stands isolated from PVC production.	Not applicable													
12.5.4.2 Final treatment	On sites where these concentrations cannot be achieved by biological treatment alone, or where there are site-specific reasons for lower emissions, then BAT may, in addition, be: <ul style="list-style-type: none"> • micro-filtration by membrane filter for particles down to 0.5 µm • adsorption of dissolved chlorinated organic compounds on activated carbon fixed bed filters. 	Not applicable													

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
12.5.4.2 Final treatment	BAT for monitoring of the treated effluent is: <ul style="list-style-type: none"> • continuous on-line monitoring of flow and pH • continuous flow proportional sampling for solids, EDC, an organic pollution parameter (for example TOC, COD or BOD) and copper • periodic sampling for VCM, dioxins, and other chlorinated organic compounds • continuous EDC monitors on potentially contaminated water outlets (with detection limit 1 mg EDC/l and connection to an alarm system). 	Not applicable	
12.5.5 By-products (residues)	The first component of BAT is the minimisation of by-products through the choice of catalysts and operating conditions.	Not applicable	
12.5.5 By-products (residues)	BAT also involves maximising the re-use of by-products as feedstock for manufacturing other organic chlorinated compounds (e.g. perchloroethylene) and, when reuse or recovery is not feasible, incinerating any remaining by-products (with recovery of heat and recycling or re-use of the hydrochloric acid).	Not applicable	
12.5.5 By-products (residues)	BAT for the incinerator is design according to the Directive on the incineration of waste (2000/76/EC).	Not applicable	
12.5.6 Wastes	The first component of BAT is waste minimisation and recycling to the process.	Not applicable	
12.5.6 Wastes	BAT for sludge from waste water treatment and coke from EDC cracking is incineration in a dedicated or multi-purpose hazardous waste incinerator that is designed according to the Directive on the incineration of waste (2000/76/EC).	Not applicable	
12.5.6 Wastes	If the waste has a small content of organo-halogenated compounds (typically less than 1000 mg/kg dry matter) then BAT may also be disposal to a chemical waste landfill.	Not applicable	
13 ILLUSTRATIVE PROCESS: TOLUENE DIISOCYANATE			
13.5 Best Available Techniques	All TDI plants in the world now use the process basing on toluene by the phosgene process route and this is BAT.	Not applicable	
13.5 Best Available Techniques	BAT for consumption and re-use: <ul style="list-style-type: none"> • BAT involves optimising the re-use of hydrogen chloride • BAT involves optimising the re-use of sulphuric acid (manufacture of DNT) • BAT is to reutilise the energy re-use potential of the exothermic reaction (without compromising yield optimisation) and of the waste gas incineration (e.g. recuperative incinerator). 	Not applicable	

Reference Document on Best Available Techniques in the Large Volume Organic Chemical Industry, February 2003			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
13.5 Best Available Techniques	<p>BAT for air emissions:</p> <ul style="list-style-type: none"> • BAT for waste gases is the treatment with scrubbers (in particular for phosgene, hydrogen chloride and VOC removal) or thermal incineration for the destruction of organic compounds and nitrogen oxides. Low concentrations of organics can be treated by other techniques such as activated carbon. Nitrogen oxides also can be minimised by partial oxidation. BAT is also every equivalent combination of treatment methods. • Emission concentrations (as hourly averages) associated with these techniques are <0.5mg/m³ phosgene, <10mg/m³ hydrogen chloride. Organic compounds measured as Total Carbon <20mg/m³ (hourly average) are associated with incineration techniques. 	Not applicable	
13.5 Best Available Techniques	<p>BAT for the waste water from nitration is:</p> <ul style="list-style-type: none"> • reduction of waste water and nitrate/nitrite emission by optimising the DNT process (waste water volume (process water) <1m³/t) • maximise the re-use of process water • removal of nitroaromatic compounds (DNT, Di/Tri-Nitrocresols) to reduce organic load (<1kg TOC/t DNT) and to ensure biodegradability (>80% elimination by Zahn-Wellens test). Final biological treatment to remove COD/TOC and nitrate • incineration (in lieu of waste water pre-treatment and biological treatment). 	Not applicable	
13.5 Best Available Techniques	<p>BAT for the waste water from hydrogenation is:</p> <ul style="list-style-type: none"> • removal of nitroaromatic compounds by stripping, distillation and/or extraction of aqueous effluents • re-use of pre-treated process water. Waste water volume (process water) <1m³/t TDA • incineration (in lieu of waste water pre-treatment and biological treatment). 	Not applicable	
13.5 Best Available Techniques	<p>BAT for the waste water from phosgenation is:</p> <ul style="list-style-type: none"> • optimisation of processes to ensure an organic load of TOC<0.5kg/t TDI prior to biological treatment. 	Not applicable	
13.5 Best Available Techniques	<p>BAT for plant safety is:</p> <ul style="list-style-type: none"> • partial containment of the most hazardous elements of the phosgenation process or mitigation measures (e.g. steam/ammonia curtain) is BAT as safety method in the case of accidental phosgene releases. 	Not applicable	

2.3 BAT for Energy Efficiency

Title of Document Energy Efficiency BREF, February 2009			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.2.1 Energy efficiency management (BAT 1)	<p>BAT is to implement and adhere to an energy efficiency management system (ENEMS) that incorporates, as appropriate to the local circumstances, all of the following features;</p> <ul style="list-style-type: none"> a. commitment of top management (commitment of the top management is regarded as a precondition for the successful application of energy efficiency management) b. definition of an energy efficiency policy for the installation by top management c. planning and establishing objectives and targets d. implementation and operation of procedures paying particular attention to: <ul style="list-style-type: none"> i) structure and responsibility ii) training, awareness and competence iii) communication iv) employee involvement v) documentation vi) effective control of processes vii) maintenance viii) emergency preparedness and response ix) safeguarding compliance with energy efficiency-related legislation and agreements (where such agreements exist). e. benchmarking: the identification and assessment of energy efficiency indicators over time and the systematic and regular comparisons with sector, national or regional benchmarks for energy efficiency, where verified data are available f. checking performance and taking corrective action paying particular attention to: <ul style="list-style-type: none"> i) monitoring and measurement ii) corrective and preventive action iii) maintenance of records iv) independent internal auditing in order to determine whether or not the energy efficiency management system conforms to planned arrangements and has been properly implemented and maintained. g. review of the ENEMS and its continuing suitability, adequacy and effectiveness by top management. 	Applicable	<p>SmartPly does not have a formal ENEMS but top management are committed to energy efficiency management practices on-site. This is evidenced through the completion of independent energy audits by external consultants and the subsequent completion of identified objectives and targets. SmartPly also has a continuous electricity usage monitoring system in place and partakes in an electrical demand reduction schemes where possible with an external body. Procedures for the scheme are documented and all relevant staff are trained in its implementation. Electrical consumption per production unit is used to assess energy efficiencies on an annual basis. The use of carbon fuels is also stringently monitored as part of SmartPly's GHG Permit. CO₂ emissions provide an annual indicator of fuel efficiencies.</p>

Title of Document Energy Efficiency BREF, February 2009			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.2.2 Planning and establishing objectives and targets (BAT 2)	BAT is to continuously minimise the environmental impact of an installation by planning actions and investments on an integrated basis and for the short, medium and long term, considering the cost-benefits and cross-media effects.	Applicable	In place as part of the company's continuous improvement plans & the EMP.
4.2.2.2 Identification of energy efficiency aspects of an installation and opportunities for energy savings (BAT 3)	BAT is to identify the aspects of an installation that influence energy efficiency by carrying out an audit. It is important that an audit is coherent with a systems approach.	Applicable	In place as part of periodic energy audits undertaken by SmartPly.
4.2.2.2 Identification of energy efficiency aspects of an installation and opportunities for energy savings (BAT 4)	When carrying out an audit, BAT is to ensure that the audit identifies the following aspects: a. energy use and type in the installation and its component systems and processes b. energy-using equipment, and the type and quantity of energy used in the installation c. possibilities to minimise energy use, such as: <ul style="list-style-type: none"> • controlling/reducing operating times, e.g. switching off when not in use • ensuring insulation is optimised, optimising utilities, associated systems, processes and equipment d. possibilities to use alternative sources or use of energy that is more efficient, in particular energy surplus from other processes and/or systems e. possibilities to apply energy surplus to other processes and/or systems, f. possibilities to upgrade heat quality	Applicable	In place as part of periodic energy audits undertaken by SmartPly.
4.2.2.2 Identification of energy efficiency aspects of an installation and opportunities for energy savings (BAT 5)	BAT is to use appropriate tools or methodologies to assist with identifying and quantifying energy optimisation, such as: <ul style="list-style-type: none"> • energy models, databases and balances (see Section 2.15) • a technique such as pinch methodology (see Section 2.12) exergy or enthalpy analysis (see Section 2.13), or thermoeconomics (see Section 2.14) • estimates and calculations (see Sections 1.5 and 2.10.2). 	Applicable	In place as part of periodic energy audits undertaken by SmartPly. Electricity consumption quantified & optimised through the continuous electrical monitoring system & fuel usage as part of Emissions Trading Scheme.

Title of Document Energy Efficiency BREF, February 2009			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.2.2.2 Identification of energy efficiency aspects of an installation and opportunities for energy savings (BAT 6)	BAT is to identify opportunities to optimise energy recovery within the installation (see BAT 7), between systems within the installation and/or with a third party (or parties), such as those described in Sections 3.2, 3.3 and 3.4.	Applicable	In place as part of periodic energy audits undertaken by SmartPly.
4.2.2.3 A systems approach to energy management (BAT 7)	BAT is to optimise energy efficiency by taking a systems approach to energy management in the installation. Systems to be considered for optimising as a whole are, for example: <ul style="list-style-type: none"> • process units (see sector BREFs) • heating systems such as: <ul style="list-style-type: none"> ○ steam (see Section 3.2) ○ hot water • cooling and vacuum (see the ICS BREF) • motor driven systems such as: <ul style="list-style-type: none"> ○ compressed air (see Section 3.7) ○ pumping (see Section 3.8) • lighting (see Section 3.10) • drying, separation and concentration (see Section 3.11). 	Applicable	In place as part of periodic energy audits undertaken by SmartPly.
4.2.2.4 Establishing and reviewing energy efficiency objectives and Indicators (BAT 8)	BAT is to establish energy efficiency indicators by carrying out all of the following: <ol style="list-style-type: none"> a. identifying suitable energy efficiency indicators for the installation, and where necessary, individual processes, systems and/or units, and measure their change over time or after the implementation of energy efficiency measures b. identifying and recording appropriate boundaries associated with the indicators c. identifying and recording factors that can cause variation in the energy efficiency of the relevant process, systems and/or units. 	Applicable	In place as part of periodic energy audits undertaken by SmartPly. Also, electrical consumption per production unit & CO ₂ emissions provide annual indicators of energy efficiencies.
4.2.2.5 Benchmarking (BAT 9)	BAT is to carry out systematic and regular comparisons with sector, national or regional benchmarks, where validated data are available.	Applicable	Where possible benchmarking & comparisons are made as part of periodic energy audits and where possible through Wood-panel Industry published data.

Title of Document Energy Efficiency BREF, February 2009			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.2.3 Energy efficient design (EED) (BAT 10)	BAT is to optimise energy efficiency when planning a new installation, unit or system or a significant upgrade (see Section 2.3) by considering all of the following: a. the energy efficient design (EED) should be initiated at the early stages of the conceptual design/basic design phase, even though the planned investments may not be well-defined. The EED should also be taken into account in the tendering process b. the development and/or selection of energy efficient technologies c. additional data collection may need to be carried out as part of the design project or separately to supplement existing data or fill gaps in knowledge d. the EED work should be carried out by an energy expert e. the initial mapping of energy consumption should also address which parties in the project organisations influence the future energy consumption, and should optimise the energy efficiency design of the future plant with them. For example, the staff in the (existing) installation who may be responsible for specifying design parameters	Applicable	In place, energy efficiency considerations have been taken into account during the design and implementation phase of the current plant upgrade to the Smartply facility.
4.2.4 Increased process integration (BAT 11)	BAT is to seek to optimise the use of energy between more than one process or system within the installation or with a third party.	Applicable	Optimisation of energy use between processes and systems is in place where possible.
4.2.5 Maintaining the impetus of energy efficiency initiatives (BAT 12)	BAT is to maintain the impetus of the energy efficiency programme by using a variety of techniques, such as: a. implementing a specific energy efficiency management system b. accounting for energy usage based on real (metered) values, which places both the obligation and credit for energy efficiency on the user/bill payer c. the creation of financial profit centres for energy efficiency d. benchmarking (see Section 2.16 and BAT 9) e. a fresh look at existing management systems, such as using operational excellence f. using change management techniques	Applicable	Internal & external energy audits have been conducted periodically at SmartPly resulting in the implementation of an on-line metered electricity monitoring system and several energy saving initiatives including low energy usage lighting upgrade, air compressor efficiency upgrade, air leak maintenance project & conversion of electric motors to variable speed drives.

Title of Document Energy Efficiency BREF, February 2009			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.2.6 Maintaining expertise (BAT 13)	BAT is to maintain expertise in energy efficiency and energy-using systems by using techniques such as: a. recruitment of skilled staff and/or training of staff. Training can be delivered by in-house staff, by external experts, by formal courses or by self-study/development b. taking staff off-line periodically to perform fixed term/specific investigations c. sharing in-house resources between sites d. use of appropriately skilled consultants for fixed term investigations e. outsourcing specialist systems and/or functions	Applicable	SmartPly maintains a highly skilled Electrical Dept. which includes an Electrical Engineer, Electrical Process Automation Technician & 9 industry experienced Electricians. External consultants are also utilised for energy auditing purposes & analysis of specific energy-using systems.
4.2.7 Effective control of processes (BAT 14)	BAT is to ensure that the effective control of processes is implemented by techniques such as: a. having systems in place to ensure that procedures are known, understood and complied with (see Sections 2.1(d)(vi) and 2.5) b. ensuring that the key performance parameters are identified, optimised for energy efficiency and monitored (see Sections 2.8 and 2.10) c. documenting or recording these parameters (see Sections 2.1(d)(vi), 2.5, 2.10 and 2.15).	Applicable	In place as part of SmartPly's documented SOPs and internal training.
4.2.8 Maintenance (BAT 15)	BAT is to carry out maintenance at installations to optimise energy efficiency by applying all of the following: a. clearly allocating responsibility for the planning and execution of maintenance b. establishing a structured programme for maintenance based on technical descriptions of the equipment, norms, etc. as well as any equipment failures and consequences. Some maintenance activities may be best scheduled for plant shutdown periods c. supporting the maintenance programme by appropriate record keeping systems and diagnostic testing d. identifying from routine maintenance, breakdowns and/or abnormalities possible losses in energy efficiency, or where energy efficiency could be improved e. identifying leaks, broken equipment, worn bearings, etc. that affect or control energy usage, and rectifying them at the earliest opportunity.	Applicable	a. A dedicated maintenance team are responsible for maintenance on site. b. Both preventative and reactive maintenance programs are place. c, d & e. In place as part of maintenance program.

Title of Document Energy Efficiency BREF, February 2009			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.2.9 Monitoring and measurement (BAT 16)	BAT is to establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of operations and activities that can have a significant impact on energy efficiency. Some suitable techniques are given in Section 2.10.	Applicable	Electricity consumption is monitored continuously by the on-line metered electrical monitoring system. Fuel usage & other plant consumables are analysed weekly & compared to standards & targets.
4.3.1 Combustion (BAT 17)	BAT is to optimise the energy efficiency of combustion by relevant techniques such as: <ul style="list-style-type: none"> those specific to sectors given in vertical BREFs those given in Table 4.1. 	Applicable Not Applicable as Smartply fall under the LCP BREF	See LCP BREF review
4.3.2 Steam systems (BAT 18)	BAT for steam systems is to optimise the energy efficiency by using techniques such as: <ul style="list-style-type: none"> those specific to sectors given in vertical BREFs those given in Table 4.2 	Not applicable as Smartply do not operate a steam system.	
4.3.1 Combustion (BAT 19)	19. BAT is to maintain the efficiency of heat exchangers by both: <ol style="list-style-type: none"> monitoring the efficiency periodically, and preventing or removing fouling 	Applicable	Radiation & convection heater in Geka Biomass furnace. Efficiency monitored through pressure differentiator. Annual & opportunity maintenance carried out to remove/prevent fouling.
4.3.4 Cogeneration (BAT 20)	BAT is to seek possibilities for cogeneration, inside and/or outside the installation (with a third party).	Applicable	The feasibility of a CHP plant has been carried out but not implemented to-date.

Title of Document Energy Efficiency BREF, February 2009													
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place										
4.3.5 Electrical power supply (BAT 21)	<p>BAT is to increase the power factor according to the requirements of the local electricity distributor by using techniques such as those in Table 4.3, according to applicability (see Section 3.5.1).</p> <p>Table 4.3: Electrical power factor correction techniques to improve energy efficiency</p> <table border="1"> <thead> <tr> <th>Technique</th> <th>Applicability</th> </tr> </thead> <tbody> <tr> <td>Installing capacitors in the AC circuits to decrease the magnitude of reactive power</td> <td>All cases. Low cost and long lasting, but requires skilled application</td> </tr> <tr> <td>Minimising the operation of idling or lightly loaded motors</td> <td>All cases</td> </tr> <tr> <td>Avoiding the operation of equipment above its rated voltage</td> <td>All cases</td> </tr> <tr> <td>When replacing motors, using energy efficient motors (see Section 3.6.1)</td> <td>At time of replacement</td> </tr> </tbody> </table>	Technique	Applicability	Installing capacitors in the AC circuits to decrease the magnitude of reactive power	All cases. Low cost and long lasting, but requires skilled application	Minimising the operation of idling or lightly loaded motors	All cases	Avoiding the operation of equipment above its rated voltage	All cases	When replacing motors, using energy efficient motors (see Section 3.6.1)	At time of replacement	Applicable	In place where applicable.
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4.3.5 Electrical power supply (BAT 22)	BAT is to check the power supply for harmonics and apply filters if required (see Section 3.5.2).	Applicable	Harmonic measurements monitored in real time through ION meter on power supply.										

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Energy Efficiency BREF, February 2009																		
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place															
4.3.5 Electrical power supply (BAT 23)	BAT is to optimise the power supply efficiency by using techniques such as those in Table 4.4, according to applicability: Table 4.4: Electrical power supply techniques to improve energy efficiency	Applicable	In place where applicable.															
	<table border="1"> <thead> <tr> <th>Technique</th> <th>Applicability</th> <th>Section in this document</th> </tr> </thead> <tbody> <tr> <td>Ensure power cables have the correct dimensions for the power demand</td> <td>When the equipment is not in use, e.g. at shutdown or when locating or relocating equipment</td> <td>3.5.3</td> </tr> <tr> <td>Keep online transformer(s) operating at a load above 40 – 50 % of the rated power</td> <td> <ul style="list-style-type: none"> for existing plants: when the present load factor is below 40 %, and there is more than one transformer on replacement, use a low loss transformer and with a loading of 40 – 75 % </td> <td>3.5.4</td> </tr> <tr> <td>Use high efficiency/low loss transformers</td> <td>At time of replacement, or where there is a lifetime cost benefit</td> <td>3.5.4</td> </tr> <tr> <td>Place equipment with a high current demand as close as possible to the power source (e.g. transformer)</td> <td>When locating or relocating equipment</td> <td>3.5.4</td> </tr> </tbody> </table>	Technique	Applicability	Section in this document	Ensure power cables have the correct dimensions for the power demand	When the equipment is not in use, e.g. at shutdown or when locating or relocating equipment	3.5.3	Keep online transformer(s) operating at a load above 40 – 50 % of the rated power	<ul style="list-style-type: none"> for existing plants: when the present load factor is below 40 %, and there is more than one transformer on replacement, use a low loss transformer and with a loading of 40 – 75 % 	3.5.4	Use high efficiency/low loss transformers	At time of replacement, or where there is a lifetime cost benefit	3.5.4	Place equipment with a high current demand as close as possible to the power source (e.g. transformer)	When locating or relocating equipment	3.5.4		
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4.3.6 Electric motor driven sub-systems (BAT 24)	<p>BAT is to optimise electric motors in the following order (see Section 3.6):</p> <ol style="list-style-type: none"> 1. optimise the entire system the motor(s) is part of (e.g. cooling system, see Section 1.5.1) 2. then optimise the motor(s) in the system according to the newly-determined load requirements, by applying one or more of the techniques in Table 4.5, according to applicability <p>Table 4.5: Electric motor techniques to improve energy efficiency</p> <table border="1"> <thead> <tr> <th>Driven system energy savings measure</th> <th>Applicability</th> <th>Section in this document¹</th> </tr> </thead> <tbody> <tr> <td colspan="3">SYSTEM INSTALLATION or REFURBISHMENT</td> </tr> <tr> <td>Using energy efficient motors (EEM)</td> <td>Lifetime cost benefit</td> <td>3.6.1</td> </tr> <tr> <td>Proper motor sizing</td> <td>Lifetime cost benefit</td> <td>3.6.2</td> </tr> <tr> <td>Installing variable speed drives (VSD)</td> <td>Use of VSDs may be limited by security and safety requirements. According to load. Note in multi-machine systems with variable load systems (e.g. CAS) it may be optimal to use only one VSD motor</td> <td>3.6.3</td> </tr> <tr> <td>Installing high efficiency transmission/reducers</td> <td>Lifetime cost benefit</td> <td>3.6.4</td> </tr> <tr> <td>Use: • direct coupling where possible • synchronous belts or cogged V-belts in place of V belts • helical gears in place of worm gears</td> <td>All</td> <td>3.6.4</td> </tr> <tr> <td>Energy efficient motor repair (EEMR) or replacement with an EEM</td> <td>At time of repair</td> <td>3.6.5</td> </tr> <tr> <td>Rewinding: avoid rewinding and replace with an EEM, or use a certified rewinding contractor (EEMR)</td> <td>At time of repair</td> <td>3.6.6</td> </tr> <tr> <td>Power quality control</td> <td>Lifetime cost benefit</td> <td>3.5</td> </tr> <tr> <td colspan="3">SYSTEM OPERATION and MAINTENANCE</td> </tr> <tr> <td>Lubrication, adjustments, tuning</td> <td>All cases</td> <td>2.9</td> </tr> <tr> <td colspan="3">Note¹: Cross-media effects, Applicability and Economics are given in Section 3.6.7</td> </tr> </tbody> </table>	Driven system energy savings measure	Applicability	Section in this document ¹	SYSTEM INSTALLATION or REFURBISHMENT			Using energy efficient motors (EEM)	Lifetime cost benefit	3.6.1	Proper motor sizing	Lifetime cost benefit	3.6.2	Installing variable speed drives (VSD)	Use of VSDs may be limited by security and safety requirements. According to load. Note in multi-machine systems with variable load systems (e.g. CAS) it may be optimal to use only one VSD motor	3.6.3	Installing high efficiency transmission/reducers	Lifetime cost benefit	3.6.4	Use: • direct coupling where possible • synchronous belts or cogged V-belts in place of V belts • helical gears in place of worm gears	All	3.6.4	Energy efficient motor repair (EEMR) or replacement with an EEM	At time of repair	3.6.5	Rewinding: avoid rewinding and replace with an EEM, or use a certified rewinding contractor (EEMR)	At time of repair	3.6.6	Power quality control	Lifetime cost benefit	3.5	SYSTEM OPERATION and MAINTENANCE			Lubrication, adjustments, tuning	All cases	2.9	Note ¹ : Cross-media effects, Applicability and Economics are given in Section 3.6.7			Applicable	In place where applicable.
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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
4.3.6 Electric motor driven sub-systems (BAT 24) continued...	3. when the energy-using systems have been optimised, then optimise the remaining (non-optimised) motors according to Table 4.5 and criteria such as: <ul style="list-style-type: none"> i. prioritising the remaining motors running more than 2000 hrs per year for replacement with EEMs ii. electric motors driving a variable load operating at less than 50 % of capacity more than 20% of their operating time, and operating for more than 2000 hours a year should be considered for equipping with variable speed drives. 	Applicable	Reviewed as part of the preventative maintenance program.

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4.3.7 Compressed air systems (CAS) (BAT 25)	BAT is to optimise compressed air systems (CAS) using the techniques such as those in Table 4.6, according to applicability. Table 4.6: Compressed air system techniques to improve energy efficiency	Applicable	The Smartply the CAS has been upgraded & external system leak audit carried out on whole system. Where applicable and feasible the techniques included in Table 4.6 were taken into account and implemented.																																																			
	<table border="1"> <thead> <tr> <th>Technique</th> <th>Applicability</th> <th>Section in this document</th> </tr> </thead> <tbody> <tr> <td colspan="3">SYSTEM DESIGN, INSTALLATION or REFURBISHMENT</td> </tr> <tr> <td>Overall system design, including multi-pressure systems</td> <td>New or significant upgrade</td> <td>3.7.1</td> </tr> <tr> <td>Upgrade compressor</td> <td>New or significant upgrade</td> <td>3.7.1</td> </tr> <tr> <td>Improve cooling, drying and filtering</td> <td>This does not include more frequent filter replacement (see below)</td> <td>3.7.1</td> </tr> <tr> <td>Reduce frictional pressure losses (for example by increasing pipe diameter)</td> <td>New or significant upgrade</td> <td>3.7.1</td> </tr> <tr> <td>Improvement of drives (high efficiency motors)</td> <td>Most cost effective in small (<10 kW) systems</td> <td>3.7.2, 3.7.3, 3.6.4</td> </tr> <tr> <td>Improvement of drives (speed control)</td> <td>Applicable to variable load systems. In multi-machine installations, only one machine should be fitted with a variable speed drive</td> <td>3.7.2</td> </tr> <tr> <td>Use of sophisticated control systems</td> <td></td> <td>3.7.4</td> </tr> <tr> <td>Recover waste heat for use in other functions</td> <td>Note that the gain is in terms of energy, not of electricity consumption, since electricity is converted to useful heat</td> <td>3.7.5</td> </tr> <tr> <td>Use external cool air as intake</td> <td>Where access exists</td> <td>3.7.8</td> </tr> <tr> <td>Storage of compressed air near highly-fluctuating uses</td> <td>All cases</td> <td>3.7.10</td> </tr> <tr> <td colspan="3">SYSTEM OPERATION and MAINTENANCE</td> </tr> <tr> <td>Optimise certain end use devices</td> <td>All cases</td> <td>3.7.1</td> </tr> <tr> <td>Reduce air leaks</td> <td>All cases. Largest potential gain</td> <td>3.7.6</td> </tr> <tr> <td>More frequent filter replacement</td> <td>Review in all cases</td> <td>3.7.7</td> </tr> <tr> <td>Optimise working pressure</td> <td>All cases</td> <td>3.7.9</td> </tr> </tbody> </table>	Technique	Applicability	Section in this document	SYSTEM DESIGN, INSTALLATION or REFURBISHMENT			Overall system design, including multi-pressure systems	New or significant upgrade	3.7.1	Upgrade compressor	New or significant upgrade	3.7.1	Improve cooling, drying and filtering	This does not include more frequent filter replacement (see below)	3.7.1	Reduce frictional pressure losses (for example by increasing pipe diameter)	New or significant upgrade	3.7.1	Improvement of drives (high efficiency motors)	Most cost effective in small (<10 kW) systems	3.7.2, 3.7.3, 3.6.4	Improvement of drives (speed control)	Applicable to variable load systems. In multi-machine installations, only one machine should be fitted with a variable speed drive	3.7.2	Use of sophisticated control systems		3.7.4	Recover waste heat for use in other functions	Note that the gain is in terms of energy, not of electricity consumption, since electricity is converted to useful heat	3.7.5	Use external cool air as intake	Where access exists	3.7.8	Storage of compressed air near highly-fluctuating uses	All cases	3.7.10	SYSTEM OPERATION and MAINTENANCE			Optimise certain end use devices	All cases	3.7.1	Reduce air leaks	All cases. Largest potential gain	3.7.6	More frequent filter replacement	Review in all cases	3.7.7	Optimise working pressure	All cases	3.7.9		
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BAT Ref Number	BAT Statement			Applicability	Proposed/ in place	
4.3.8 Pumping systems (BAT 26)	BAT is to optimise pumping systems by using the techniques in Table 4.7, according to applicability (see Section 3.8): Table 4.7: Pumping system techniques to improve energy efficiency			Applicable	In place where applicable.	
	Technique	Applicability	Section in this document			Additional information
	DESIGN					
	Avoid oversizing when selecting pumps and replace oversized pumps	For new pumps: all cases For existing pumps: lifetime cost benefit	3.8.1 3.8.2			Largest single source of pump energy wastage
	Match the correct choice of pump to the correct motor for the duty	For new pumps: all cases For existing pumps: lifetime cost benefit	3.8.2 3.8.6			
	Design of pipework system (see Distribution system, below)		3.8.3			

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BAT Ref Number	BAT Statement				Applicability	Proposed/ in place
4.3.8 Pumping systems (BAT 26) continued.	CONTROL and MAINTENANCE				Applicable	In place where applicable.
	Control and regulation system	All cases	3.8.5			
	Shut down unnecessary pumps	All cases	3.8.5			
	Use of variable speed drives (VSDs)	Lifetime cost benefit. Not applicable where flows are constant	3.8.5	See BAT 24, in Section 4.3.6		
	Use of multiple pumps (staged cut in)	When the pumping flow is less than half the maximum single capacity	3.8.5			
	Regular maintenance. Where unplanned maintenance becomes excessive, check for:	All cases. Repair or replace as necessary	3.8.4			
		<ul style="list-style-type: none"> • cavitation • wear • wrong type of pump 				
	DISTRIBUTION SYSTEM					
Minimise the number of valves and bends commensurate with keeping ease of operation and maintenance	All cases at design and installation (including changes). May need qualified technical advice	3.8.3				
Avoiding using too many bends (especially tight bends)	All cases at design and installation (including changes). May need qualified technical advice	3.8.3				
Ensuring the pipework diameter is not too small (correct pipework diameter)	All cases at design and installation (including changes). May need qualified technical advice	3.8.3				

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place																														
4.3.9	Heating, ventilation and air conditioning (HVAC) systems (BAT 27) BAT is to optimise heating, ventilation and air conditioning systems by using techniques such as: <ul style="list-style-type: none"> for ventilation, space heating and cooling, techniques in Table 4.8 according to applicability 	Applicable	In place where applicable and feasible.																														
Table 4.8: Heating, ventilation and air conditioning system techniques to improve energy efficiency																																	
<table border="1"> <thead> <tr> <th>Energy savings measure</th> <th>Applicability</th> <th>Section in this document</th> </tr> </thead> <tbody> <tr> <td colspan="3">DESIGN and CONTROL</td> </tr> <tr> <td>Overall system design. Identify and equip areas separately for: <ul style="list-style-type: none"> general ventilation specific ventilation process ventilation </td> <td>New or significant upgrade. Consider for retrofit on lifetime cost benefit</td> <td>3.9.1 3.9.2.1</td> </tr> <tr> <td>Optimise the number, shape and size of intakes</td> <td>New or upgrade</td> <td>3.9.2.1</td> </tr> <tr> <td>Use fans: <ul style="list-style-type: none"> of high efficiency designed to operate at optimal rate </td> <td>Cost effective in all cases</td> <td>3.9.2.1 3.9.2.2</td> </tr> <tr> <td>Manage airflow, including considering dual flow ventilation</td> <td>New or significant upgrade</td> <td>3.9.2.1</td> </tr> <tr> <td>Air system design: <ul style="list-style-type: none"> ducts are of a sufficient size circular ducts avoid long runs and obstacles such as bends, narrow sections </td> <td>New or significant upgrade</td> <td>3.9.2.1</td> </tr> <tr> <td>Optimise electric motors, and consider installing a VSD</td> <td>All cases. Cost effective retrofit</td> <td>3.9.2.1, 3.9.2.2, 3.6, 3.6.3, 3.6.7 and BAT 24</td> </tr> <tr> <td>Use automatic control systems. Integrate with centralised technical management systems</td> <td>All new and significant upgrades. Cost effective and easy upgrade in all cases</td> <td>3.9.2.1 3.9.2.2</td> </tr> <tr> <td>Integration of air filters into air duct system and heat recovery from exhaust air (heat exchangers)</td> <td>New or significant upgrade. Consider for retrofit on lifetime cost benefit. The following issues need to be taken into account: the thermal efficiency, the pressure loss, and the need for regular cleaning</td> <td>3.9.2.1 3.9.2.2</td> </tr> </tbody> </table>		Energy savings measure	Applicability	Section in this document	DESIGN and CONTROL			Overall system design. Identify and equip areas separately for: <ul style="list-style-type: none"> general ventilation specific ventilation process ventilation 	New or significant upgrade. Consider for retrofit on lifetime cost benefit	3.9.1 3.9.2.1	Optimise the number, shape and size of intakes	New or upgrade	3.9.2.1	Use fans: <ul style="list-style-type: none"> of high efficiency designed to operate at optimal rate 	Cost effective in all cases	3.9.2.1 3.9.2.2	Manage airflow, including considering dual flow ventilation	New or significant upgrade	3.9.2.1	Air system design: <ul style="list-style-type: none"> ducts are of a sufficient size circular ducts avoid long runs and obstacles such as bends, narrow sections 	New or significant upgrade	3.9.2.1	Optimise electric motors, and consider installing a VSD	All cases. Cost effective retrofit	3.9.2.1, 3.9.2.2, 3.6, 3.6.3, 3.6.7 and BAT 24	Use automatic control systems. Integrate with centralised technical management systems	All new and significant upgrades. Cost effective and easy upgrade in all cases	3.9.2.1 3.9.2.2	Integration of air filters into air duct system and heat recovery from exhaust air (heat exchangers)	New or significant upgrade. Consider for retrofit on lifetime cost benefit. The following issues need to be taken into account: the thermal efficiency, the pressure loss, and the need for regular cleaning	3.9.2.1 3.9.2.2		
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Title of Document Energy Efficiency BREF, February 2009				Applicability	Proposed/ in place	
BAT Ref Number	BAT Statement					
4.3.9 Heating, ventilation and air conditioning (HVAC) systems (BAT 27) (continued)	Reduce heating/cooling needs by:	Consider in all cases and implement according to cost benefit		Applicable	In place where applicable and feasible.	
	<ul style="list-style-type: none"> building insulation efficient glazing air infiltration reduction automatic closure of doors destratification lowering of temperature set point during non-production period (programmable regulation) reduction of the set point for heating and raising it for cooling 		3.9.1			
	Improve the efficiency of heating systems through:	Consider in all cases and implement according to cost benefit				3.9.1
	<ul style="list-style-type: none"> recovery or use of wasted heat (Section 3.3.1) heat pumps radiative and local heating systems coupled with reduced temperature set points in the non occupied areas of the buildings 					
	Improve the efficiency of cooling systems through the use of free cooling	Applicable in specific circumstances				3.9.3
	MAINTENANCE					
	Stop or reduce ventilation where possible	All cases				3.9.2.2
	Ensure system is airtight, check joints	All cases				3.9.2.2
	Check system is balanced	All cases				3.9.2.2
	Manage airflow: optimise	All cases				3.9.2.2
Air filtering, optimise:	All cases		3.9.2.2			
<ul style="list-style-type: none"> recycling efficiency pressure loss regular filter cleaning/replacement regular cleaning of system 						
<ul style="list-style-type: none"> for heating, see Sections 3.2 and 3.3.1, and BAT 18 and 19 for pumping, see Section 3.8 and BAT 26 for cooling, chilling and heat exchangers, see the ICS BREF, as well as Section 3.3 and BAT 19 (in this document). 				See corresponding BAT		

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Energy Efficiency BREF, February 2009																			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place																
4.3.10 (BAT 28)	Lighting BAT is to optimise artificial lighting systems by using the techniques such as those in Table 4.9 according to applicability Table 4.9: Lighting system techniques to improve energy efficiency <table border="1"> <thead> <tr> <th>Technique</th> <th>Applicability</th> </tr> </thead> <tbody> <tr> <td colspan="2" style="text-align: center;">ANALYSIS and DESIGN OF LIGHTING REQUIREMENTS</td> </tr> <tr> <td>Identify illumination requirements in terms of both intensity and spectral content required for the intended task</td> <td>All cases</td> </tr> <tr> <td>Plan space and activities in order to optimise the use of natural light</td> <td>Where this can be achieved by normal operational or maintenance rearrangements, consider in all cases. If structural changes, e.g. building work, is required, new or upgraded installations</td> </tr> <tr> <td>Selection of fixtures and lamps according to specific requirements for the intended use</td> <td>Cost benefit on lifetime basis</td> </tr> <tr> <td colspan="2" style="text-align: center;">OPERATION, CONTROL, and MAINTENANCE</td> </tr> <tr> <td>Use of lighting management control systems including occupancy sensors, timers, etc.</td> <td>All cases</td> </tr> <tr> <td>Train building occupants to utilise lighting equipment in the most efficient manner</td> <td>All cases</td> </tr> </tbody> </table>	Technique	Applicability	ANALYSIS and DESIGN OF LIGHTING REQUIREMENTS		Identify illumination requirements in terms of both intensity and spectral content required for the intended task	All cases	Plan space and activities in order to optimise the use of natural light	Where this can be achieved by normal operational or maintenance rearrangements, consider in all cases. If structural changes, e.g. building work, is required, new or upgraded installations	Selection of fixtures and lamps according to specific requirements for the intended use	Cost benefit on lifetime basis	OPERATION, CONTROL, and MAINTENANCE		Use of lighting management control systems including occupancy sensors, timers, etc.	All cases	Train building occupants to utilise lighting equipment in the most efficient manner	All cases	Applicable	Lighting was a significant consideration during the design stage of Smartply's development. Following an energy audit focused on plant lighting, a significant upgrade to energy efficient lighting was completed in the production plant and office areas by 2012 including occupancy sensors where possible and signage in other areas.
Technique	Applicability																		
ANALYSIS and DESIGN OF LIGHTING REQUIREMENTS																			
Identify illumination requirements in terms of both intensity and spectral content required for the intended task	All cases																		
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Train building occupants to utilise lighting equipment in the most efficient manner	All cases																		
4.3.11 (BAT 29)	Drying, separation and concentration processes BAT is to optimise drying, separation and concentration processes by using techniques such as those in Table 4.10 according to applicability, and to seek opportunities to use mechanical separation in conjunction with thermal processes: <table border="1"> <thead> <tr> <th>Technique</th> <th>Applicability</th> <th>Additional information</th> <th>Section in this document</th> </tr> </thead> <tbody> <tr> <td colspan="4" style="text-align: center;">DESIGN</td> </tr> <tr> <td>Select the optimum separation technology or combination of techniques (below) to meet the specific process equipments</td> <td>All cases</td> <td></td> <td>3.11.1</td> </tr> </tbody> </table>	Technique	Applicability	Additional information	Section in this document	DESIGN				Select the optimum separation technology or combination of techniques (below) to meet the specific process equipments	All cases		3.11.1	Applicable	In place where applicable.				
Technique	Applicability	Additional information	Section in this document																
DESIGN																			
Select the optimum separation technology or combination of techniques (below) to meet the specific process equipments	All cases		3.11.1																

Title of Document Energy Efficiency BREF, February 2009						
BAT Ref Number	BAT Statement			Applicability	Proposed/ in place	
4.3.11 Drying, separation and concentration processes (BAT 29) continued.	OPERATION				Applicable	In place where applicable. Directly heated dryers are used to dry wood flake for the production process. The drying system utilises surplus heat from the Geka biomass furnace.
	Use of surplus heat from other processes	Depends on the availability of surplus heat in the installation (or from third party)	Drying is a good use for surplus heat	3.11.1		
	Use a combination of techniques	Consider in all cases	May have production benefits, e.g. improved product quality, increased throughput	3.11.1		
	Mechanical processes, e.g. filtration, membrane filtration	Process dependent. To achieve high dryness at lowest energy consumption, consider these in combination with other techniques	Energy consumption can be several orders of magnitude lower, but will not achieve high % dryness	3.11.2		
	Thermal processes, e.g. <ul style="list-style-type: none"> • directly heated dryers • indirectly heated dryers • multiple effect 	Widely used, but efficiency can be improved by considering other options in this table	Convective (direct) heat dryers may be the option with the lowest energy efficiency	3.11.3 3.11.3.1 3.11.3.2 3.11.3.3 3.11.3.6		
	Direct drying	See thermal and radiant techniques, and superheated steam	Convective (direct) heat dryers may be the option with the lowest energy efficiency	3.11.3.2		
	Superheated steam	Any direct dryers can be retrofitted with superheated steam. High cost, needs lifetime cost benefit assessment. High temperature may damage product	Heat can be recovered from this process	3.11.3.4		
	Heat recovery (including MVR and heat pumps)	Consider for almost any continuous hot air convective dryers	3.	11.1 3.11.3.5 3.11.3.6		
	Optimise insulation of the drying system	Consider for all systems. Can be retrofitted		3.11.3.7		
	Radiation processes e.g. <ul style="list-style-type: none"> • infrared (IR) • high frequency (HF) • microwave (MW) 	Can be easily retrofitted. Direct application of energy to component to be dried. They are compact and Reduce the need for air extraction. IR limited by substrate dimensions. High cost, needs lifetime cost benefit assessment	More efficient heating. Can boost production throughput coupled with convection or conduction	3.11.4		

Title of Document Energy Efficiency BREF, February 2009						
BAT Ref Number	BAT Statement				Applicability	Proposed/ in place
4.3.11 Drying, separation and concentration processes (BAT 29) continued.	CONTROL				Applicable	In place
	Process automation in thermal drying processes	All cases	Savings of between 5 and 10 % can be achieved compared with using traditional empirical controllers	3.11.5		

2.4 BAT for Emissions from Storage

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1. Storage of liquids and liquefied gases			
5.1.1.1. General principles to prevent and reduce emissions	<p>Tank design</p> <p>BAT for a proper design is to take into account at least the following:</p> <ul style="list-style-type: none"> the physico-chemical properties of the substance being stored how the storage is operated, what level of instrumentation is needed, how many operators are required, and what their workload will be how the operators are informed of deviations from normal process conditions (alarms) how the storage is protected against deviations from normal process conditions (safety instructions, interlock systems, pressure relief devices, leak detection and containment, etc.) what equipment has to be installed, largely taking account of past experiences of the product (construction materials, valve quality, etc.) which maintenance and inspection plan needs to be implemented and how to ease the maintenance and inspection work (access, layout, etc.) how to deal with emergency situations (distances to other tanks, facilities and to the boundary, fire protection, access for emergency services such as the fire brigade, etc.). See Annex 8.19 for a typical checklist. 	Applicable	<p>In place:</p> <p>All of these design factors are taken into account when designing tank storage at Smartply.</p>
5.1.1.1. General principles to prevent and reduce emissions	<p>Inspection and maintenance</p> <p>BAT is to apply a tool to determine proactive maintenance plans and to develop risk-based inspection plans such as the risk and reliability based maintenance approach; see Section 4.1.2.2.1.</p> <p>Inspection work can be divided into routine inspections, in-service external inspections and out of service internal inspections and are described in detail in Section 4.1.2.2.2.</p>	Applicable	<p>In place:</p> <p>Tank storage bunds inspected weekly. Site also has a detailed Preventative Maintenance and monitoring programmes which include assignment of personnel, records of preventative maintenance and completed fixes.</p>

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.1. General principles to prevent and reduce emissions	<p>Location and layout</p> <p>For building new tanks it is important to select the location and the layout with care, e.g. water protection areas and water catchment areas should be avoided whenever possible. See Section 4.1.2.3.</p> <p>BAT is to locate a tank operating at, or close to, atmospheric pressure aboveground. However, for storing flammable liquids on a site with restricted space, underground tanks can also be considered. For liquefied gases, underground, mounded storage or spheres can be considered, depending on the storage volume.</p>	Applicable	<p>In place:</p> <p>This is taken into account when designing tank storage at Smartply.</p> <p>Tanks are located above ground at atmospheric pressure.</p>
5.1.1.1. General principles to prevent and reduce emissions	<p>Tank colour</p> <p>BAT is to apply either a tank colour with a reflectivity of thermal or light radiation of at least 70%, or a solar shield on aboveground tanks which contain volatile substances. See Section 4.1.3.6 and 4.1.3.7 respectively.</p>	Applicable for outdoor fuel tanks only.	LPG tanks are white, process gas oil tanks are moorland green & the mobile diesel tank is a dark red.
5.1.1.1. General principles to prevent and reduce emissions	<p>Emissions minimisation principle in tank storage</p> <p>BAT is to abate emissions from tank storage, transfer and handling that have a significant negative environmental effect, as described in Section 4.1.3.1. This is applicable to large storage facilities allowing a certain time frame for implementation.</p>	Not Applicable	Although the scale of storage is not large MDI, LPF and Wax storage tanks are vented to atmosphere through activated carbon.
5.1.1.1. General principles to prevent and reduce emissions	<p>Monitoring of VOC</p> <p>On sites where significant VOC emissions are to be expected, BAT includes calculating the VOC emissions regularly. The calculation model may occasionally need to be validated by applying a measurement method. See Section 4.1.2.2.3. There is a split view from three Member States, because in their view, on sites where significant VOC emissions are to be expected (e.g. refineries, petrochemical plants and oil terminals), BAT is to calculate the VOC emissions regularly with validated calculation methods, and because of uncertainties in the calculation methods, emissions from the plants should be monitored occasionally in order to quantify the emissions and to give basic data for refining calculation methods. This can be carried out by using DIAL techniques. The necessity and frequency of emission monitoring needs to be decided on a case-by-case basis.</p>	Not Applicable	Storage tank vents are minor emission points.
5.1.1.1. General principles to prevent and reduce emissions	<p>Dedicated systems</p> <p>BAT is to apply dedicated systems; see Section 4.1.4.4. Dedicated systems are generally not applicable on sites where tanks are used for short to medium-term storage of different products.</p>	Applicable	In place where applicable.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.2. Tank specific considerations	<p>Open top tanks</p> <p>Open top tanks are used for the storage of, e.g. manure slurry in agricultural premises and water and other non-flammable or non-volatile liquids in industrial facilities, see Section 3.1.1.</p> <p>If emissions to air occur, BAT is to cover the tank by applying:</p> <ul style="list-style-type: none"> • a floating cover, see Section 4.1.3.2 • a flexible or tent cover, see Section 4.1.3.3, or • a rigid cover, see Section 4.1.3.4. <p>Additionally, with an open top tank covered with a flexible, tent or a rigid cover, a vapour treatment installation can be applied to achieve an additional emission reduction, see Section 4.1.3.15. The type of cover and the necessity for applying the vapour treatment system depend on the substances stored and must be decided on a case-by-case basis. To prevent deposition that would call for an additional cleaning step, BAT is to mix the stored substance (e.g. slurry), see Section 4.1.5.1.</p>	Not applicable	There are no emissions to air associated with open top tanks at Smartply.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.2. Tank specific considerations	<p>External floating roof tank</p> <p>External floating roof tanks are used for the storage of, e.g. crude oil; see Section 3.1.2.</p> <p>The BAT associated emission reduction level for a large tank is at least 97 % (compared to a fixed roof tank without measures), which can be achieved when over at least 95 % of the circumference the gap between the roof and the wall is less than 3.2 mm and the seals are liquid mounted, mechanical shoe seals. By installing liquid mounted primary seals and rim mounted secondary seals, a reduction in air emissions of up to 99.5 % (compared to a fixed roof tank without measures) can be achieved. However, the choice of seal is related to reliability, e.g. shoe seals are preferred for longevity and, therefore, for high turnovers. See Section 4.1.3.9.</p> <p>BAT is to apply direct contact floating roofs (double-deck), however, existing non-contact floating roofs (pontoon) are also BAT. See Section 3.1.2. Additional measures to reduce emissions are (see Section 4.1.3.9.2):</p> <ul style="list-style-type: none"> • applying a float in the slotted guide pole • applying a sleeve over the slotted guide pole, and/or • applying 'socks' over the roof legs. A dome can be BAT for adverse weather conditions, such as high winds, rain or snowfall. See Section 4.1.3.5. • For liquids containing a high level of particles (e.g. crude oil), BAT is to mix the stored substance to prevent deposition that would call for an additional cleaning step, see Section 4.1.5.1. 	Not Applicable	There are no external floating roof tanks on-site.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.2. Tank specific considerations	<p>Fixed roof tanks</p> <p>Fixed roof tanks are used for the storage of flammable and other liquids, such as oil products and chemicals with all levels of toxicity, see Section 3.1.3. For the storage of volatile substances which are toxic (T), very toxic (T+), or carcinogenic, mutagenic and reproductive toxic (CMR) categories 1 and 2 in a fixed roof tank, BAT is to apply a vapour treatment installation. There is a split view from industry, that this technique is not BAT because in their view:</p> <ul style="list-style-type: none"> a) there is no definition of 'volatile' in this BREF b) there is no test of environmental significance c) products which may be dangerous to the environment, but not classed as toxic, are not captured d) it can be demonstrated that other emission control measures may provide a higher level of environmental protection taking into account the costs and advantages of the various techniques e) there are no commonly understood performance criteria for a vapour treatment installation f) this does not take into account the cost, or advantages of other techniques g) this does not provide the flexibility to take into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions h) there is no proportionality in this conclusion. <p>For other substances, BAT is to apply a vapour treatment installation, or to install an internal floating roof (see Sections 4.1.3.15 and 4.1.3.10 respectively). Direct contact floating roofs and non-contact floating roofs are BAT. In the Netherlands, the condition for when to apply these BAT is when the substance has a vapour pressure (at 20 °C) of 1 kPa and the tank has a volume of 50m³. In Germany, the condition for when to apply these BAT is when the substance has a vapour pressure (at 20 °C) of 1.3 kPa and the tank has a volume of 300 m³. For tanks <50m³, BAT is to apply a pressure relief valve set at the highest possible value consistent with the tank design criteria.</p>	Applicable	MDI, LDF and wax tanks are vented through activated carbon drums.
5.1.1.2. Tank specific considerations	For liquids containing a high level of particles (e.g. crude oil) BAT is to mix the stored substance to prevent deposition that would call for an additional cleaning step, see Section 4.1.5.1.	Not Applicable	Large quantities of liquids containing high levels of particulates are not stored on site.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.2. Tank specific considerations	<p>Atmospheric horizontal tanks</p> <p>Atmospheric horizontal tanks are used for the storage of flammable and other liquids, such as oil products and chemicals in all levels of flammability and toxicity, see Section 3.1.4. Horizontal tanks are different to vertical tanks, e.g. since they can inherently operate under higher pressures. For the storage of volatile substances which are toxic (T), very toxic (T+), or CMR categories 1 and 2 in an atmospheric horizontal tank, BAT is to apply a vapour treatment installation.</p> <p>There is a split view from industry, that this technique is not BAT because in their view:</p> <ol style="list-style-type: none"> there is no definition of 'volatile' in this BREF there is no test of environmental significance products which may be dangerous to the environment, but not classed as toxic, are not captured it can be demonstrated that other emission control measures may provide a higher level of environmental protection taking into account the costs and advantages of the various techniques there are no commonly understood performance criteria for a vapour treatment installation this does not take into account the costs or advantages of other techniques this does not provide the flexibility to take into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions there is no proportionality in this conclusion. <p>For other substances, BAT is to do all, or a combination, of the following techniques, depending on the substances stored:</p> <ul style="list-style-type: none"> apply pressure vacuum relief valves; see Section 4.1.3.11 up rate to 56 mbar; see Section 4.1.3.11 apply vapour balancing; see Section 4.1.3.13 apply a vapour holding tank, see Section 4.1.3.14, or apply vapour treatment; see Section 4.1.3.15. <p>The selection of the vapour treatment technology has to be decided on a case-by-case basis.</p>	Applicable	<p>In Place:</p> <p>A small volume of gas oil is stored on-site for mobile equipment. This would not warrant the installation of vapour treatment on this small volume which is stored in an atmospheric horizontal tank.</p>

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.2. Tank specific considerations	<p>Pressurised storage</p> <p>Pressurised storage is used for storing all categories of liquefied gases, from non-flammable up to flammable and highly toxic. The only significant emissions to air from normal operation are from draining.</p> <p>BAT for draining depends on the tank type, but may be the application of a closed drain system connected to a vapour treatment installation, see Section 4.1.4. The selection of the vapour treatment technology has to be decided on a case-by-case basis.</p>	Applicable	Pressurised tanks are only used for LPG on-site, there are no emissions associated with these tanks during normal operation.
5.1.1.2. Tank specific considerations	<p>Lifter roof tanks</p> <p>For emissions to air, BAT is to (see Sections 3.1.9 and 4.1.3.14):</p> <ul style="list-style-type: none"> • apply a flexible diaphragm tank equipped with pressure/vacuum relief valves, or • apply a lifter roof tank equipped with pressure/vacuum relief valves and connected to a vapour treatment installation. <p>The selection of the vapour treatment technology has to be decided on a case-by-case basis.</p>	Not applicable	There are no lifter roof tanks in use on site
5.1.1.2. Tank specific considerations	<p>Refrigerated tanks</p> <p>There are no significant emissions from normal operation, see Section 3.1.10.</p>	Not applicable	There are no refrigerated tanks on-site.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.2. Tank specific considerations	<p>Underground and mounded tanks are used especially for flammable products, see Sections 3.1.11 and 3.1.8 respectively.</p> <p>For the storage of volatile substances which are toxic (T), very toxic (T+), or CMR categories 1 and 2 in an underground or mounded tank, BAT is to apply a vapour treatment installation.</p> <p>There is a split view from industry, that this technique is not BAT because in their view:</p> <ol style="list-style-type: none"> there is no definition of 'volatile' in this BREF there is no test of environmental significance products which may be dangerous to the environment, but not classed as toxic, are not captured it can be demonstrated that other emission control measures may provide a higher level of environmental protection taking into account the costs and advantages of the various techniques there are no commonly understood performance criteria for a vapour treatment installation this does not take into account the costs or advantages of other techniques this does not provide the flexibility to take into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions there is no proportionality in this conclusion. <p>For other substances, BAT is to do all, or a combination, of the following techniques, depending on the substances stored:</p> <ul style="list-style-type: none"> apply pressure vacuum relief valves; see Section 4.1.3.11 apply vapour balancing; see Section 4.1.3.13 apply a vapour holding tank, see Section 4.1.3.14, or apply vapour treatment; see Section 4.1.3.15. <p>The selection of the vapour treatment technology has to be decided on a case-by-case basis.</p>	Not applicable	There are no underground storage tanks on-site.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.3. Preventing incidents and (major) accidents	Safety and risk management The Seveso II Directive (Council Directive 96/82/EC of 9 December 1996 on the control of major accident hazards involving dangerous substances) requires companies to take all measures necessary to prevent and limit the consequences of major accidents. They must, in any case, have a major accident prevention policy (MAPP) and a safety management system to implement the MAPP. Companies holding large quantities of dangerous substances, the so called upper tiered establishments, must also draw up a safety report and an on-site emergency plan and maintain an up-to-date list of substances. However, plants that do not fall under the scope of the Seveso II Directive can also cause emissions from incidents and accidents. Applying a similar, maybe less detailed, safety management system is the first step in preventing and limiting these. BAT in preventing incidents and accidents is to apply a safety management system as described in Section 4.1.6.1.	Not Applicable	The site does not fall under the remit of the Seveso II Directive. However, the site does have a safety management system (SMS).
5.1.1.3. Preventing incidents and (major) accidents	Operational procedures and training BAT is to implement and follow adequate organisational measures and to enable training and instruction of employees for safe and responsible operation of the installation as described in Section 4.1.6.1.1.	Applicable	In Place: Safety and environmental training is carried out both on-site and off-site in accordance with the site EMS and SMS.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.1.3. Preventing incidents and (major) accidents	<p>Instrumentation and automation to detect leakage</p> <p>The four different basic techniques that can be used to detect leaks are:</p> <ul style="list-style-type: none"> • release prevention barrier system • inventory checks • acoustic emission method • soil vapour monitoring. <p>BAT is to apply leak detection on storage tanks containing liquids that can potentially cause soil pollution. The applicability of the different techniques depends on the tank type and is discussed in detail in Section 4.1.6.1.7</p>	Applicable	<p>In place:</p> <p>Bund integrity testing is carried out every 3 years</p> <p>Raw material inventories are carried out weekly.</p>
5.1.1.3. Preventing incidents and (major) accidents	<p>Risk-based approach to emissions to soil below tanks</p> <p>The risk-based approach to emissions to soil from an aboveground flat-bottom and vertical, storage tank containing liquids with a potency to pollute soil, is that soil protection measures are applied at such a level that there is a 'negligible risk' for soil pollution because of leakage from the tank bottom or from the seal where the bottom and the wall are connected. See Section 4.1.6.1.8 where the approach and the risk levels are explained.</p> <p>BAT is to achieve a 'negligible risk level' of soil pollution from bottom and bottom-wall connections of aboveground storage tanks. However, on a case-by-case basis, situations might be identified where an 'acceptable risk level' is sufficient.</p>	Applicable	<p>On-going:</p> <p>There is an on-going risk identification and reduction program in place on-site. This has been incorporated into the annual review of the Smartply ELRA. For storage tanks, bund integrity testing is carried out every 3 years.</p>
5.1.1.3. Preventing incidents and (major) accidents	<p>Soil protection around tanks – containment</p> <p>BAT for aboveground tanks containing flammable liquids or liquids that pose a risk for significant soil pollution or a significant pollution of adjacent watercourses is to provide secondary containment, such as:</p> <ul style="list-style-type: none"> • tank bunds around single wall tanks; see Section 4.1.6.1.11 • double wall tanks; see Section 4.1.6.1.13 • cup-tanks; see Section 4.1.6.1.14 • double wall tanks with monitored bottom discharge; see Section 4.1.6.1.15. <p>For building new single walled tanks containing liquids that pose a risk for significant soil pollution or a significant pollution of adjacent watercourses, BAT is to apply a full, impervious, barrier in the bund, see Section 4.1.6.1.10.</p>	Applicable	<p>In Place:</p> <p>All tanks and the chemical storage areas are bunded and integrity tested every 3 years or more frequently if necessary.</p> <p>All new tanks that pose a risk for significant pollution will have fully impervious barriers in the bund.</p>

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.2. Storage of packaged dangerous substances	<p>Training and responsibility</p> <p>BAT is to appoint a person or persons who is or are responsible for the operation of the store. BAT is to provide the responsible person(s) with specific training and retraining in emergency procedures as described in Section 4.1.7.1 and to inform other staff on the site of the risks of storing packaged dangerous substances and the precautions necessary to safely store substances that have different hazards.</p>	Applicable	<p>In Place:</p> <p>Training is given to all individuals involved in handling/storing chemicals on the site. Storage of chemicals is checked regularly by the Environmental & Safety Departments.</p>
5.1.2. Storage of packaged dangerous substances	<p>Storage area</p> <p>BAT is to apply a storage building and/or an outdoor storage area covered with a roof, as described in Section 4.1.7.2. For storing quantities of less than 2500 litres or kilograms dangerous substances, applying a storage cell as described in Section 4.1.7.2 is also BAT.</p>	Applicable	<p>In Place:</p> <p>There are banded, covered chemical stores on-site where smaller volumes of chemicals are stored.</p>
5.1.2. Storage of packaged dangerous substances	<p>Separation and segregation</p> <p>BAT is to separate the storage area or building of packaged dangerous substances from other storage, from ignition sources and from other buildings on- and off-site by applying a sufficient distance, sometimes in combination with fire-resistant walls. MSs apply different distances between the (outdoor) storage of packaged dangerous substances and other objects on- and offsite; see Section 4.1.7.3 for some examples.</p> <p>BAT is to separate and/or segregate incompatible substances. For the compatible and incompatible combinations see Annex 8.3. MSs apply different distances and/or physical partitioning between the storage of incompatible substances; see Section 4.1.7.4 for some examples.</p>	Applicable	<p>In Place:</p> <p>The chemical stores are separated from all other sections by sufficient distances and potential ignition source areas are compartmented by walls with a higher than standard fire rating where applicable.</p> <p>In Place:</p> <p>Incompatible substances are not stored next to each other.</p>

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.2. Storage of packaged dangerous substances	Containment of leakage and contaminated extinguishant BAT is to install a liquid-tight reservoir according to Section 4.1.7.5, that can contain all or a part of the dangerous liquids stored above such a reservoir. The choice whether all or only a part of the leakage needs to be contained depends on the substances stored and on the location of the storage (e.g. in a water catchment area) and can only be decided on a case-by-case basis. BAT is to install a liquid-tight extinguishant collecting provision in storage buildings and storage areas according to Section 4.1.7.5. The collecting capacity depends on the substances stored, the amount of substances stored, the type of package used and the applied fire-fighting system and can only be decided on a case-by-case basis.	Applicable	In Place: All dangerous liquids are stored over bunds which can contain a minimum of 110% of the volume of the largest related tank.
5.1.2. Storage of packaged dangerous substances	Fire-fighting equipment BAT is to apply a suitable protection level of fire prevention and fire-fighting measures as described in Section 4.1.7.6. The appropriate protection level has to be decided on a case-by case basis in agreement with the local fire brigade.	Applicable	In Place: All of the measure described in Section 4.1.7.6. are in place.
5.1.2. Storage of packaged dangerous substances	Preventing ignition BAT is to prevent ignition at source as described in Section 4.1.7.6.1.	Applicable	In Place: All of the measure described in Section 4.1.7.6. are in place where applicable.
5.1.3. Basins and lagoons	Basins and lagoons are used for the storage of, e.g. manure slurry in agricultural premises and water and other non-flammable or volatile liquids in industrial facilities. Where emissions to air from normal operation are significant, e.g. with the storage of pig slurry, BAT is to cover basins and lagoons using one of the following options: <ul style="list-style-type: none"> • a plastic cover; see Section 4.1.8.2 • a floating cover; see Section 4.1.8.1, or • only small basins, a rigid cover; see Section 4.1.8.2. Additionally, where a rigid cover is used, a vapour treatment installation can be applied to achieve an extra emission reduction, see Section 4.1.3.15. The need for and type of vapour treatment must be decided on a case-by-case basis. To prevent overflowing due to rainfall in situations where the basin or lagoon is not covered, BAT is to apply a sufficient freeboard, see Section 4.1.11.1. Where substances are stored in a basin or lagoon with a risk of soil contamination, BAT is to apply an impervious barrier. This can be a flexible membrane, a sufficient clay layer or concrete, see Section 4.1.9.1.	Not applicable	There are no storage basins or lagoons on-site except for fire water storage and storm water attenuation.

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.4. Atmospheric mined caverns	<p>Emissions to air from normal operation</p> <p>Where a number of caverns with a fixed waterbed storing liquid hydrocarbons are present, BAT is to apply vapour balancing, see Section 4.1.12.1.</p>	Not applicable	There is no cavern storage on-site.
5.1.4. Atmospheric mined caverns	<p>Emissions from incidents and (major) accidents</p> <p>By their intrinsic nature, caverns are by far the safest way of storing large quantities of hydrocarbon products. BAT for storing large quantities of hydrocarbons is, therefore, to apply caverns wherever the site geology is suitable, see Sections 3.1.15 and 4.1.13.3.</p> <p>BAT, in preventing incidents and accidents, is to apply a safety management system as described in Section 4.1.6.1. BAT is to apply, and then regularly evaluate, a monitoring programme which at least includes the following (see Section 4.1.13.2):</p> <ul style="list-style-type: none"> • monitoring of the hydraulic flow pattern around the caverns by means of groundwater measurements, piezometers and/or pressure cells, seepage water flowrate metering • assessment of cavern stability by seismic monitoring • water quality follow-up procedures by regular sampling and analysis • corrosion monitoring, including periodic casing evaluation. <p>For preventing the stored product from escaping out of the cavern, BAT is to design the cavern in such a way that at the depth at which it is situated, the hydrostatic pressure of the groundwater surrounding the cavern is always greater than that of the stored product, see Section 4.1.13.5.</p> <p>For preventing seepage water entering the cavern, BAT is, apart from a proper design, to additionally apply cement injection, see Section 4.1.13.6. If seepage water that enters the cavern is pumped out, BAT is to apply waste water treatment before discharge, see Section 4.1.13.3.</p> <p>BAT is to apply automated overfill protection, see Section 4.1.13.8.</p>	Not applicable	There is no cavern storage on-site.

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.5. Pressurised mined caverns	<p>Emissions from incidents and (major) accidents</p> <p>By their intrinsic nature, caverns are by far the safest way of storing large quantities of hydrocarbon products. BAT for storing large quantities of hydrocarbons is, therefore, to apply caverns wherever the site geology is suitable, see Sections 3.1.16 and 4.1.14.3.</p> <p>BAT, in preventing incidents and accidents, is to apply a safety management system as described in Section 4.1.6.1.</p> <p>BAT is to apply, and then regularly evaluate a monitoring programme which at least includes the following (see Section 4.1.14.2):</p> <ul style="list-style-type: none"> • monitoring of the hydraulic flow pattern around the caverns by means of groundwater measurements, piezometers and/or pressure cells, seepage water flowrate metering • assessment of cavern stability by seismic monitoring • water quality follow-up procedures by regular sampling and analysis • corrosion monitoring, including periodic casing evaluation. <p>For preventing the stored product from escaping out of the cavern, BAT is to design the cavern in such a way that at the depth at which it is situated, the hydrostatic pressure of the groundwater surrounding the cavern is always greater than that of the stored product, see Section 4.1.14.5.</p> <p>For preventing seepage water entering the cavern, BAT is, apart from a proper design, to additionally apply cement injection, see Section 4.1.14.6</p> <p>If seepage water that enters the cavern is pumped out, BAT is to apply waste water treatment before discharge, see Section 4.1.14.3.</p> <p>BAT is to apply automated overfill protection, see Section 4.1.14.8.</p> <p>BAT is to apply fail-safe valves in the event of a surface emergency event, see Section 4.1.14.4</p>	Not applicable	There is no cavern storage on-site.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.1.6. Salt leached caverns	<p>Emissions from incidents and (major) accidents By their intrinsic nature, caverns are by far the safest way of storing large quantities of hydrocarbon products. BAT for storing large quantities of hydrocarbons is, therefore, to apply caverns wherever the site geology is suitable. For more detail see Sections 3.1.17 and 4.1.15.3.</p> <p>BAT, in preventing incidents and accidents, is to apply a safety management system as described in Section 4.1.6.1.</p> <p>BAT is to apply, and then regularly evaluate a monitoring programme which at least includes the following (see Section 4.1.15.2):</p> <ul style="list-style-type: none"> • assessment of cavern stability by seismic monitoring • corrosion monitoring, including periodic casing evaluation • carrying out of regular sonar evaluations to monitor eventual shape variations, particularly if undersaturated brine is used. <p>Small traces of hydrocarbons may be present at the brine/hydrocarbon interface due to filling and emptying the caverns. If this is the case, BAT is to separate these hydrocarbon products in a brine treatment unit and to collect and dispose of them safely.</p>	Not applicable	There is no cavern storage on-site.
5.1.7. Floating storage	Floating storage is not BAT, see Section 3.1.18.	Not applicable	There is no floating storage on-site.
5.2. Transfer and handling of liquids and liquefied gases			
5.2.1. General principles to prevent and reduce emissions	<p>Inspection and maintenance</p> <p>BAT is to apply a tool to determine proactive maintenance plans and to develop risk-based inspection plans such as, the risk and reliability based maintenance approach; see Section 4.1.2.2.1.</p>	Applicable	A planned preventative maintenance plan is in place on site.
5.2.1. General principles to prevent and reduce emissions	<p>Leak detection and repair programme</p> <p>For large storage facilities, according to the properties of the products stored, BAT is to apply a leak detection and repair programme. Focus needs to be on those situations most likely to cause emissions (such as gas/light liquid, under high pressure and/or temperature duties). See Section 4.2.1.3.</p>	Not applicable	Smartply is not a large storage facility
5.2.1. General principles to prevent and reduce emissions	<p>Emissions minimisation principle in tank storage</p> <p>BAT is to abate emissions from tank storage, transfer and handling that have a significant negative environmental effect, as described in Section 4.1.3.1. This is applicable to large storage facilities, allowing a certain time frame for implementation.</p>	Applicable	Smartply is not a large storage facility

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.2.1. General principles to prevent and reduce emissions	Safety and risk management BAT in preventing incidents and accidents is to apply a safety management system as described in Section 4.1.6.1.	Applicable	In Place: A Safety Management System (SMS) is in place on-site.
5.2.1. General principles to prevent and reduce emissions	Operational procedures and training BAT is to implement and follow adequate organisational measures and to enable the training and instruction of employees for safe and responsible operation of the installation as described in Section 4.1.6.1.1. <ul style="list-style-type: none"> • emergency response plans and communication plans for internal purposes... • operating instructions are available and followed ... • the company has, in its possession, relevant records and documentation on the storage mode (e.g. design data/drawings, inspection and maintenance records, etc. • training and instruction of employees are both carried out on a regular basis. 	Applicable	All in place.

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.2.2.1. Piping	<p>BAT is to apply aboveground closed piping in new situations, see Section 4.2.4.1. For existing underground piping it is BAT to apply a risk and reliability based maintenance approach as described in Section 4.1.2.2.1. Bolted flanges and gasket-sealed joints are an important source of fugitive emissions.</p> <p>BAT is to minimise the number of flanges by replacing them with welded connections, within the limitation of operational requirements for equipment maintenance or transfer system flexibility, see Section 4.2.2.1.</p> <p>BAT for bolted flange connections (see Section 4.2.2.2.) include:</p> <ul style="list-style-type: none"> • fitting blind flanges to infrequently used fittings to prevent accidental opening • using end caps or plugs on open-ended lines and not valves • ensuring gaskets are selected appropriate to the process application • ensuring the gasket is installed correctly • ensuring the flange joint is assembled and loaded correctly • where toxic, carcinogenic or other hazardous substances are transferred, fitting high integrity gaskets, such as spiral wound, kammprofile or ring joints. Internal corrosion may be caused by the corrosive nature of the product being transferred, see Section 4.2.3.1. BAT is to prevent corrosion by: <ul style="list-style-type: none"> ○ selecting construction material that is resistant to the product ○ applying proper construction methods ○ applying preventive maintenance, and ○ where applicable, applying an internal coating or adding corrosion inhibitors. <p>To prevent the piping from external corrosion, BAT is to apply a one, two, or three layer coating system depending on the site-specific conditions (e.g. close to sea). Coating is normally not applied to plastic or stainless steel pipelines. See Section 4.2.3.2.</p>	Applicable	<p>In place:</p> <p>All new piping for transport of chemicals, industrial effluent and hydrocarbons will be aboveground. Where practical below ground pipes are replaced by above ground pipes when maintenance is required.</p> <p>Where practically possible pipe joints are welded rather than connected by flanges.</p> <p>All BAT for bolted flanges is in place where practical.</p> <p>External pipes are either stainless steel, galvanised pipe or insulated & cladded to prevent external corrosion.</p>
5.2.2.2. Vapour treatment	<p>BAT is to apply vapour balancing or treatment on significant emissions from the loading and unloading of volatile substances to (or from) trucks, barges and ships. The significance of the emission depends on the substance and the volume that is emitted, and has to be decided on a case-by-case basis. For more detail see Section 4.2.8. For example, according to Dutch regulations, the emission of methanol is significant when over 500 kg/yr is emitted.</p>	Not Applicable	No significant emissions from substances stored on site.

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.2.2.3. Valves	<p>BAT for valves include:</p> <ul style="list-style-type: none"> • correct selection of the packing material and construction for the process application • with monitoring, focus on those valves most at risk (such as rising stem control valves in continual operation) • applying rotating control valves or variable speed pumps instead of rising stem control valves • where toxic, carcinogenic or other hazardous substances are involved, fit diaphragm, bellows, or double walled valves • route relief valves back into the transfer or storage system or to a vapour treatment system. See Sections 3.2.2.6 and 4.2.9. 	Applicable	In place where applicable
5.2.2.4. Pumps and compressors	<p>Installation and maintenance of pumps and compressors</p> <p>The design, installation and operation of the pump or compressor heavily influence the life potential and reliability of the sealing system. The following are some of the main factors which constitute BAT:</p> <ul style="list-style-type: none"> • proper fixing of the pump or compressor unit to its base-plate or frame • having connecting pipe forces within producers' recommendations • proper design of suction pipework to minimise hydraulic imbalance • alignment of shaft and casing within producers' recommendations • alignment of driver/pump or compressor coupling within producers' recommendations when fitted • correct level of balance of rotating parts • effective priming of pumps and compressors prior to start-up • operation of the pump and compressor within producers' recommended performance range (The optimum performance is achieved at its best efficiency point.) • the level of net positive suction head available should always be in excess of the pump or compressor • regular monitoring and maintenance of both rotating equipment and seal systems, combined with a repair or replacement programme. 	Applicable	In place where applicable
5.2.2.4. Pumps and compressors	<p>Sealing system in pumps</p> <p>BAT is to use the correct selection of pump and seal types for the process application, preferably pumps that are technologically designed to be tight such as canned motor pumps, magnetically coupled pumps, pumps with multiple mechanical seals and a quench or buffer system, pumps with multiple mechanical seals and seals dry to the atmosphere, diaphragm pumps or bellow pumps. For more details see Sections 3.2.2.2, 3.2.4.1 and 4.2.9.</p>	Applicable	<p>In place:</p> <p>The pump type most applicable to the application is used in each situation on-site.</p>

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.2.2.4. Pumps and compressors	<p>Sealing systems in compressors</p> <p>BAT for compressors transferring non-toxic gases is to apply gas lubricated mechanical seals. BAT for compressors, transferring toxic gases is to apply double seals with a liquid or gas barrier and to purge the process side of the containment seal with an inert buffer gas.</p> <p>In very high pressure services, BAT is to apply a triple tandem seal system. For more detail see Sections 3.2.3 and 4.2.9.13.</p>	Applicable	In place: Appropriate seals are in place for the compressor systems on-site.
5.2.2.5. Sampling connections	BAT, for sample points for volatile products, is to apply a ram type sampling valve or a needle valve and a block valve. Where sampling lines require purging, BAT is to apply closed-loop sampling lines. See Section 4.2.9.14.	Applicable	Closed-loop sampling lines for resin sampling.
5.3. Storage of solids			

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BAT Ref Number	BAT Statement		Applicability	Proposed/ in place																																						
5.3.1. Open storage	<p>BAT is to eliminate the influence of wind and to prevent the formation of dust by wind as far as possible by primary measures. See Table 4.12 for these primary measures with cross-references to the relevant sections. However, although large volume silos and sheds are available, for (very) large quantities of not or only moderately drift sensitive and wettable material, open storage might be the only option. Examples are the long-term strategic storage of coal and the storage of ores and gypsum.</p> <p>Table 4.12: Approaches and techniques to reduce dust emission from storage and cross-reference</p> <table border="1"> <thead> <tr> <th colspan="2">Approaches and techniques to reduce dust emissions</th> <th>Section</th> </tr> </thead> <tbody> <tr> <td rowspan="13">Primary</td> <td rowspan="4">Organisational</td> <td>• monitoring</td> <td>4.3.3.1</td> </tr> <tr> <td>• layout and operation of storage places (by planning and operating personnel)</td> <td></td> </tr> <tr> <td>• maintenance (of prevention/reduction techniques)</td> <td></td> </tr> <tr> <td>• reduction of wind attack areas</td> <td></td> </tr> <tr> <td rowspan="6">Constructional</td> <td>• large volume silos</td> <td>4.3.4.1</td> </tr> <tr> <td>• sheds or roofs</td> <td>4.3.4.2</td> </tr> <tr> <td>• domes</td> <td>4.3.4.3</td> </tr> <tr> <td>• self-erecting covers</td> <td>4.3.4.4</td> </tr> <tr> <td>• silos and hoppers</td> <td>4.3.4.5</td> </tr> <tr> <td>• wind protection mounds, fences and/or plantings</td> <td>4.3.5</td> </tr> <tr> <td rowspan="3">Technical</td> <td>• use of wind protection</td> <td>4.3.5; 4.3.6.2</td> </tr> <tr> <td>• covering of open storage</td> <td>4.3.5; 4.3.6.3</td> </tr> <tr> <td>• moistening of open storage</td> <td>4.3.6.1</td> </tr> <tr> <td rowspan="2">Secondary</td> <td>• water spraying/water curtains and jet spraying</td> <td>4.4.6.8; 4.4.6.9</td> </tr> <tr> <td>• extraction of storage sheds and silos</td> <td>4.3.7</td> </tr> </tbody> </table> <p><i>Note: The boundary between primary and secondary approaches is not always clear; e.g. a water curtain limits the spread of dust emissions and is – at the same time – a means of dust binding.</i></p>		Approaches and techniques to reduce dust emissions		Section	Primary	Organisational	• monitoring	4.3.3.1	• layout and operation of storage places (by planning and operating personnel)		• maintenance (of prevention/reduction techniques)		• reduction of wind attack areas		Constructional	• large volume silos	4.3.4.1	• sheds or roofs	4.3.4.2	• domes	4.3.4.3	• self-erecting covers	4.3.4.4	• silos and hoppers	4.3.4.5	• wind protection mounds, fences and/or plantings	4.3.5	Technical	• use of wind protection	4.3.5; 4.3.6.2	• covering of open storage	4.3.5; 4.3.6.3	• moistening of open storage	4.3.6.1	Secondary	• water spraying/water curtains and jet spraying	4.4.6.8; 4.4.6.9	• extraction of storage sheds and silos	4.3.7	Applicable	In place: Measures set out in table 4.12 are used on site where applicable.
Approaches and techniques to reduce dust emissions		Section																																								
Primary	Organisational	• monitoring	4.3.3.1																																							
		• layout and operation of storage places (by planning and operating personnel)																																								
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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.3.1. Open storage	BAT for open storage is to carry out regular or continuous visual inspections to see if dust emissions occur and to check if preventive measures are in good working order. Following the weather forecast by, e.g. using meteorological instruments on site, will help to identify when the moistening of heaps is necessary and will prevent unnecessary use of resources for moistening the open storage. See Section 4.3.3.1.	Applicable	Regular visual inspections are carried out and ambient dust levels monitored monthly.
5.3.1. Open storage	BAT for long-term open storage are one, or a proper combination, of the following techniques: <ul style="list-style-type: none"> moistening the surface using durable dust-binding substances, see Section 4.3.6.1 covering the surface, e.g. with tarpaulins, see Section 4.3.4.4 solidification of the surface, see Table 4.13 grassing-over of the surface, see Table 4.13. 	Applicable	In place where appropriate. Outdoor storage areas are also compartmented by high retaining walls.
5.3.1. Open storage	BAT for short-term open storage are one, or a proper combination, of the following techniques: <ul style="list-style-type: none"> moistening the surface using durable dust-binding substances, see Section 4.3.6.1 moistening the surface with water, see Sections 4.3.6.1 covering the surface, e.g. with tarpaulins, see Section 4.3.4.4. 	Applicable on occasion.	In place where appropriate. Outdoor storage areas are also compartmented by high retaining walls.
5.3.1. Open storage	Additional measures to reduce dust emissions from both long and short-term open storage are: <ul style="list-style-type: none"> placing longitudinal axis of the heap parallel with the prevailing wind applying protective plantings, windbreak fences or upwind mounds to lower the wind velocity applying only one heap instead of several heaps as far as possible; with two heaps storing the same amount as one, the free surface increases with 26 % applying storage with retaining walls reduces the free surface, leading to a reduction of diffuse dust emissions; this reduction is maximised if the wall is placed upwind of the heap placing retaining walls close together. See Table 4.13 for more details. 	Applicable	In place where appropriate. Outdoor storage areas are also compartmented by high retaining walls.
5.3.2. Enclosed storage	BAT is to apply enclosed storage by using, for example, silos, bunkers, hoppers and containers. Where silos are not applicable, storage in sheds can be an alternative. This is, e.g. the case if apart from storage, the mixing of batches is needed.	Applicable	Bark chipping and wood flake for the process are stored in enclosed storage. Outdoor storage areas are compartmented by high retaining walls.
5.3.2. Enclosed storage	BAT for silos is to apply a proper design to provide stability and prevent the silo from collapsing. See Sections 4.3.4.1 and 4.3.4.5.	Not applicable	There are no open silos within the plant.

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.3.2. Enclosed storage	BAT for sheds is to apply proper designed ventilation and filtering systems and to keep the doors closed. See Section 4.3.4.2.	Applicable	In place.
5.3.2. Enclosed storage	BAT is to apply dust abatement and a BAT associated emission level of 1 – 10 mg/m ³ , depending on the nature/type of substance stored. The type of abatement technique has to be decided on a case-by-case basis. See Section 4.3.7.	Not applicable	Dust is not emitted from enclosed storage areas of the site so abatement is not necessary.
5.3.2. Enclosed storage	For a silo containing organic solids, BAT is to apply an explosion resistant silo (see Section 4.3.8.3), equipped with a relief valve that closes rapidly after the explosion to prevent oxygen entering the silo, as described in Section 4.3.8.4.	Applicable	Explosion suppression systems in place for baghouse filters.
5.3.3. Storage of packaged dangerous solids	For details regarding BAT for the storage of packaged dangerous solids, see Section 5.1.2.	Not applicable	There are no dangerous solids stored on-site.
5.3.4. Preventing incidents and (major) accidents	Safety and risk management The Seveso II Directive (Council Directive 96/82/EC of 9 December 1996 on the control of major accident hazards involving dangerous substances) requires companies to take all measures necessary to prevent and limit the consequences of major accidents. They must in any case have a major accident prevention policy (MAPP) and a safety management system to implement the MAPP. Companies holding large quantities of dangerous substances, so-called upper tiered establishments, must also draw up a safety report and an on-site emergency plan and maintain an up-to-date list of substances. However, plants that do not fall under the scope of the Seveso II Directive can also cause emissions from incidents and accidents. Applying a similar, maybe less detailed, safety management system is the first step in preventing and limiting these. BAT in preventing incidents and accidents is applying a safety management system as described in Section 4.1.7.1.	Applicable	The site does not fall under the remit of the Seveso II Directive. However, the site does have a safety management system (SMS).
5.4. Transfer and handling of solids			
5.4.1. General approaches to minimise dust from transfer and handling	BAT is to prevent dust dispersion due to loading and unloading activities in the open air, by scheduling the transfer as much as possible when the wind speed is low. However, and taking into account the local situation, this type of measure cannot be generalised to the whole EU and to any situation irrespective of the possible high costs. See Section 4.4.3.1. Discontinuous transport (e.g. shovel or truck) generally generates more dust emissions than continuous transport such as conveyors.	Applicable on occasion	Continuous transport methods are used to transfer fuel biomass into the plant. Discontinuous transport methods use enclosed trucks or are covered with tarpaulin for the movement of bark or flake/fines.

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5.4.1. General approaches to minimise dust from transfer and handling	BAT is to make transport distances as short as possible and to apply, wherever possible, to continuous transport modes. For existing plants, this might be a very expensive measure. See Section 4.4.3.5.1.	Applicable	This has been taken into account during the design of the facility expansion.
5.4.1. General approaches to minimise dust from transfer and handling	When applying a mechanical shovel, BAT is to reduce the drop height and to choose the best position during discharging into a truck; see Section 4.4.3.4.	Applicable	In place
5.4.1. General approaches to minimise dust from transfer and handling	While driving, vehicles might swirl up dust from solids spread on the ground. BAT then is to adjust the speed of vehicles on-site to avoid or minimise dust being swirled up; see Section 4.4.3.5.2. BAT for roads that are used by trucks and cars only, is applying hard surfaces to the roads of, for example, concrete or asphalt, because these can be cleaned easily to avoid dust being swirled up by vehicles, see Section 4.4.3.5.3. However, applying hard surfaces to the roads is not justified when the roads are used just for big shovel vehicles or when a road is temporary.	Applicable	A speed limit is in place on site and where possible roads are sealed.
5.4.1. General approaches to minimise dust from transfer and handling	BAT is to clean roads that are fitted with hard surfaces according to Section 4.4.6.12.	Applicable	This is only necessary on occasion e.g. during construction works.
5.4.1. General approaches to minimise dust from transfer and handling	Cleaning of vehicle tyres is BAT. The frequency of cleaning and type of cleaning facility applied (see Section 4.4.6.13) has to be decided on a case-by-case basis.	Applicable	A wheel wash is in place on exit for all deliveries to the logyard.
5.4.1. General approaches to minimise dust from transfer and handling	Where it neither compromises product quality, plant safety, nor water resources, BAT for loading/unloading drift sensitive, wettable products is to moisten the product as described in Sections 4.4.6.8, 4.4.6.9 and 4.3.6.1. Risk of freezing of the product, risk of slippery situations because of ice forming or wet product on the road and shortage of water are examples when this BAT might not be applicable.	Applicable	Biomass materials can be moistened if required. .

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BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.4.1. General approaches to minimise dust from transfer and handling	For loading/unloading activities, BAT is to minimise the speed of descent and the free fall height of the product; see Sections 4.4.5.6 and 4.4.5.7 respectively. Minimising the speed of descent can be achieved by the following techniques that are BAT: <ul style="list-style-type: none"> • installing baffles inside fill pipes • applying a loading head at the end of the pipe or tube to regulate the output speed • applying a cascade (e.g. cascade tube or hopper) • applying a minimum slope angle with, e.g. chutes. 	Applicable	Speed of loading / unloading activities is optimised on a case by case basis.
5.4.1. General approaches to minimise dust from transfer and handling	To minimise the free fall height of the product, the outlet of the discharger should reach down onto the bottom of the cargo space or onto the material already piled up. Loading techniques that can achieve this, and that are BAT, are: <ul style="list-style-type: none"> • height adjustable fill pipes • height adjustable fill tubes, and • height adjustable cascade tubes. 	Applicable	In place where relevant.
5.4.1. General approaches to minimise dust from transfer and handling	These techniques are BAT, except when loading/unloading non drift sensitive products, for which the free fall height is not that critical. Optimised discharged hoppers are available and described in Section 4.4.6.7	Applicable	In place where relevant.
5.4.2. Considerations on transfer techniques	Grabs For applying a grab, BAT is to follow the decision diagram as shown in Section 4.4.3.2 and to leave the grab in the hopper for a sufficient time after the material discharge. BAT for new grabs, is to apply grabs with the following properties (see Section 4.4.5.1): <ul style="list-style-type: none"> • geometric shape and optimal load capacity • the grab volume is always higher than the volume that is given by the grab curve • the surface is smooth to avoid material adhering, and • a good closure capacity during permanent operation. 	Not Applicable	Not Applicable.
5.4.2. Considerations on transfer techniques	Conveyors and transfer chutes For all types of substances, BAT is to design conveyor to conveyor transfer chutes in such a way that spillage is reduced to a minimum. A modelling process is available to generate detail designs for new and existing transfer points. For more details see Section 4.4.5.5.	Applicable	Conveyors & chutes for transport of materials around the site are all designed to ensure spillage is minimised.

Title of Document Emissions from Storage BREF, July 2006.			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.4.2. Considerations on transfer techniques	For non or very slightly drift sensitive products (S5) and moderately drift sensitive, wettable products (S4), BAT is to apply an open belt conveyor and additionally, depending on the local circumstances, one or a proper combination of the following techniques: <ul style="list-style-type: none"> • lateral wind protection, see Section 4.4.6.1 • spraying water and jet spraying at the transfer points, see Sections 4.4.6.8 and 4.4.6.9, • and/or belt cleaning, see Section 4.4.6.10. 	Not Applicable	Conveyors are closed for these materials.
5.4.2. Considerations on transfer techniques	For highly drift sensitive products (S1 and S2) and moderately drift sensitive, not wettable products (S3) BAT for new situations, is to apply closed conveyors, or types where the belt itself or a second belt locks the material (see Section 4.4.5.2), such as: <ul style="list-style-type: none"> • pneumatic conveyors • trough chain conveyors • screw conveyors • tube belt conveyor • loop belt conveyor • double belt conveyor or to apply enclosed conveyor belts without support pulleys (see Section 4.4.5.3), such as: <ul style="list-style-type: none"> • aerobelt conveyor • low friction conveyor • conveyor with diabolos. The type of conveyor depends on the substance to be transported and on the location and has to be decided on a case-by-case basis.	Applicable	Conveyors are closed for drift sensitive products.
5.4.2. Considerations on transfer techniques	For existing conventional conveyors, transporting highly drift sensitive products (S1 and S2) and moderately drift sensitive, not wettable products (S3), BAT is to apply housing; see Section 4.4.6.2. When applying an extraction system, BAT is to filter the outgoing air stream; see Section 4.4.6.4.	Applicable	Closed conveyors are used for these materials. No conveyors require extraction on-site.
5.4.2. Considerations on transfer techniques	To reduce energy consumption for conveyor belts (see Section 4.4.5.2), BAT is to apply: <ul style="list-style-type: none"> • a good conveyor design, including idlers and idler spacing • an accurate installation tolerance, and • a belt with low rolling resistance. See Annex 8.4 for the disperseveness classes (S1 – S4) of solid bulk materials.	Applicable	These are taken into account when designing new conveyors at the site.

2.5 BAT for Monitoring of Emissions from IED Installations

Title of Document			
JRC Reference Report on Monitoring (ROM) of emissions from IED-installations, Final Draft October 2013			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
3.3.3	BAT is to monitor emissions to (...) in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards which ensure the provision of data of an equivalent scientific quality.	Applicable	In Place: Where applicable EN standards are used for monitoring of emissions at SmartPly. Monitoring is done in accordance with the site IE licence. Suitably accredited laboratories /contractors are also utilised.

2.6 BAT for the Energy Sector

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.2.1.1 Process Selection	The selection of process for LCP will depend on fuel type, the scale of the plant and also on the expected operating regime. As such no particular process is considered BAT, however, the selected process should maximise energy efficiency and minimise emissions as per the following discussions.	Applicable	See following sections
5.2.1.2 Energy Efficiency	The general techniques to be considered in determining BAT for thermal power plants are as follows: <ul style="list-style-type: none"> • Minimising the heat loss due to unburned gases and elements in solid wastes and residues from combustion • Optimising steam cycle efficiency through achieving the highest possible steam pressure and temperature and the repeated superheating of the steam. • Minimising cooling water temperature • Reducing energy losses via flue gases through preheating feed water and combustion air • Minimising the heat loss through slag and ashes • Minimising the internal energy consumption by taking appropriate measures (e.g. high efficiency pumps and fans) • Preheating the boiler feed-water with steam • Use of more efficient turbines with improved blade geometry. 	Applicable	In place
5.2.1.2 Energy Efficiency	For gas turbines and combined cycle gas turbine (CCGT) plant the use of efficient gas turbines and an efficient steam cycle, incorporating the above techniques, is considered BAT.	Not Applicable	SmartPly do not use gas turbines or CCGT.
5.3.1 Minimisation of Emissions to Air – Coal Fired Plant (see BREF-LCP Section 4.5)	BAT for the control of particulate emissions is the use of electro-static precipitators (ESP) or fabric filters (FF).	Not Applicable	SmartPly do not use coal as a fuel.
5.3.1 Minimisation of Emissions to Air – Coal Fired Plant (see BREF-LCP Section 4.5)	For coal fired combustion plant Flue Gas Desulphurisation (FGD) and the use of low sulphur fuel are considered to be BAT for the control of SO ₂ emissions. The use of low sulphur fuel can be a supplementary technique (particularly for plants over 100 MWth), but generally is not itself sufficient to reduce SO ₂ emissions.	Not Applicable	SmartPly do not use coal as a fuel.

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.3.1 Minimisation of Emissions to Air – Coal Fired Plant (see BREF-LCP Section 4.5)	The techniques that are considered to be BAT for pulverised coal fired combustion plants are: wet scrubbers, spray dry scrubbers and, for smaller applications below approximately 250 MWth, dry sorbent injection (i.e. dry FGD with an adjacent fabric filter).	Not Applicable	SmartPly do not use coal as a fuel.
5.3.1 Minimisation of Emissions to Air – Coal Fired Plant (see BREF-LCP Section 4.5)	For Pulverised Combustion, the use of primary measures such as low NOx burners and Overfire Air (OFA) in conjunction with secondary measures, i.e. Selective Catalytic reduction (SCR) or Selective Non-Catalytic Reduction (SNCR) is BAT for the control of NOx.	Not Applicable	SmartPly do not use coal as a fuel.
5.3.1 Minimisation of Emissions to Air – Coal Fired Plant (see BREF-LCP Section 4.5)	For fluidised bed combustion, staged combustion and effective combustion control is considered BAT for NOx abatement.	Not Applicable	SmartPly do not use coal as a fuel.
5.3.1 Minimisation of Emissions to Air – Coal Fired Plant (see BREF-LCP Section 4.5)	Effective combustion control is BAT for CO emission control.	Not Applicable	SmartPly do not use coal as a fuel.
5.3.2 Minimisation of Emissions to Air – Peat Fired Plant (see BREF-LCP Section 5.5)	BAT for the control of particulate emissions is the use of electro-static precipitators (ESP) or fabric filters (FF) (see BREF section 5.5.5).	Not Applicable	SmartPly do not use peat as a fuel.
5.3.2 Minimisation of Emissions to Air – Peat Fired Plant (see BREF-LCP Section 5.5)	As for coal fired plant, BAT for SO2 control depends on the type of plant. For grate or pulverised combustion a combination of low sulphur fuel and FGD is BAT.	Not Applicable	SmartPly do not use peat as a fuel.
5.3.2 Minimisation of Emissions to Air – Peat Fired Plant (see BREF-LCP Section 5.5)	For fluidised bed combustion, the use of in bed desulphurisation through limestone injection is BAT for plants less than 300 MWth. For larger plants the use of FGD should be considered in determining BAT, dependant on the sulphur content of the fuel and the reduction potential using in bed techniques.	Not Applicable	SmartPly do not use peat as a fuel.

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.3.2 Minimisation of Emissions to Air – Peat Fired Plant (see BREF-LCP Section 5.5)	For fluidised bed combustion, staged combustion and effective combustion control is considered BAT for NOx abatement.	Not Applicable	SmartPly do not use peat as a fuel.
5.3.3 Minimisation of Emissions to Air – Liquid Fuel Fired Plant (see BREF-LCP Section 6.5)	BAT for the reduction of particulate and heavy metal emissions is the use of high efficiency ESPs or fabric filters. For larger scale plant, nominally greater than 300 MWth, the use of ESP or FF in conjunction with wet FGD is BAT.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
5.3.3 Minimisation of Emissions to Air – Liquid Fuel Fired Plant (see BREF-LCP Section 6.5)	For plant smaller plant (nominally <100 MWth) the use of low sulphur fuel, or the co-combustion of liquid fuels with gas is BAT for the reduction of SO2 emissions. Dry sorbent injection (DSI) or wet FGD should be considered in determining BAT for larger plant.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
5.3.3 Minimisation of Emissions to Air – Liquid Fuel Fired Plant (see BREF-LCP Section 6.5)	For plant smaller plant (nominally <100 MWth) the use of low sulphur fuel, or the co-combustion of liquid fuels with gas is BAT for the reduction of SO2 emissions. Dry sorbent injection (DSI) or wet FGD should be considered in determining BAT for larger plant.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
5.3.3 Minimisation of Emissions to Air – Liquid Fuel Fired Plant (see BREF-LCP Section 6.5)	For liquid fuel fired gas turbines, water or steam injection is BAT for NOx control.	Not Applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.
5.3.4 Minimisation of Emissions to Air – Gas Fired Plant (see BREF-LCP Section 7.5)	BAT for the control of NOx emissions in gas boilers is the use of primary measures in conjunction with SCR/SNCR.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
5.3.4 Minimisation of Emissions to Air – Gas Fired Plant (see BREF-LCP Section 7.5)	For existing gas turbines BAT for the control of NOx is steam or water injection or retrofitting with Dry Low NOx (DLN) combustors. DLN is BAT for new gas turbines.	Not Applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
5.3.5 Minimisation of Waste Water Emissions (see BREF-LCP Section 4.3)	BAT is to provide storage areas and unloading areas with appropriate containment and bunding.	Applicable	In place
5.3.5 Minimisation of Waste Water Emissions (see BREF-LCP Section 4.3)	The effluent from wet scrubbing needs chemical treatment, neutralisation and settlement before discharge. The acidity of the water can be adjusted by the addition of lime or other alkali. Treatment methods for removing cadmium and mercury include precipitating the metals either as hydroxides or sulphides followed by appropriate solids separation.	Not Applicable	SmartPly do not emit any industrial wastewater
5.3.5 Minimisation of Waste Water Emissions (see BREF-LCP Section 4.3)	Wastewater from cooling systems should be controlled through primary measures addressing the dosing regime for the cooling water.	Not Applicable	SmartPly do not emit any industrial wastewater

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008								
BAT Ref Number	BAT Statement						Applicability	Proposed/ in place
6.1 Emission Levels for Discharges to Air	Table 6.1 – Range of BAT associated emissions for coal fired plant and similar biomass material						Applicable	The following ELVs are currently in place at A2-1 on site: NOx (as NO ₂)= 141.00kg/hr SOx = 4.70kg/hr* *In the event of emergency fuel uses only, 0.1% w/w Particulates = 9.4kg/hr Volume to be emitted from combined Maximum in any one day: stack at 55m sampling point = 14,880,000m ³ /day
	Size (MW _{th})	Combustion Technique	NO _x		SO ₂		Particulate Matter	
			New	Existing	New	Existing	New	Existing
	50-100	Grate	200 - 400	200 - 600	200 - 850 ⁴	200 - 2000	5 - 50	5 - 100
		PC & Fluidised Bed	90 - 400	90 - 600	150 - 850 ⁴	150 - 2000	5 - 50	5 - 100
	100 – 300	PC	90 - 200*	90 - 600	100 - 200 ⁴	100 to 400 - 2000 ¹	5 - 30	5 - 100
		Fluidised Bed	100 - 200*	100 - 600	100 - 200 ⁴	100 to 400 - 2000	5 - 30	5 - 100
	300 - 500	PC	90 - 200	90 - 600	20 - 200 ³	20 to 400 - 2000	5 - 30	5 - 100
		Fluidised Bed	50 - 200	50 - 600	100 - 200 ³	100 to 400 - 2000	5 - 30	5 - 100
	> 500	PC	90 - 200	90 to 200 - 500 ²	20 - 200 ³	20 - 400	5 - 30	5
		Fluidised Bed	50 - 200	50 to 200 - 500 ²	100 - 200 ³	100 - 400	5 - 30	5
	<p>* The upper level may be 300mg/m³ where biomass is used. Note 1: Linear reduction from 2,000 mg/m³ for 100 MW to 400 mg/m³ for 500 MW Note 2: 500 mg/m³ applies until 1st January 2016 after which time the limit of 200 mg/m³ will apply. Note 3: In the case of plants with a rated thermal input greater than 300 MWth a rate of desulphurisation of at least 95% together with a maximum permissible emission limit value of 400 mg/Nm³ shall apply. Note 4: Where the emission limit values above cannot be met due to the characteristics of the fuel, installations shall achieve 300 mg/Nm³, or a rate of desulphurisation of at least 92% shall be achieved in the case of plants with a rated thermal input of less than or equal to 300 MWth.</p>							

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008											
BAT Ref Number	BAT Statement							Applicability	Proposed/ in place		
6.1 Emission Levels for Discharges to Air	Table 6.2 – Range of BAT associated emissions for peat fired plant and similar biomass material							Not applicable	SmartPly do not use peat as a fuel.		
	Size (MW _{th})	Combustion Technique	NO _x		SO ₂		Particulate Matter				
			New	Existing	New	Existing	New			Existing	
	50 - 100	All types	150 - 400	150 - 600	200 - 850*	200 - 2000	5 - 50			5 - 100	
	100 - 300	PC	150 - 200*	150 - 600	200	200 to 400 - 2000 ¹	5 - 30			5 - 100	
		Fluidised bed	150 - 200*	150 - 600	150 - 200	150 to 400 - 2000 ¹	5 - 30			5 - 100	
300 - 500	All types	50 - 200	50 - 600	50 - 200	50 to 400 - 2000 ¹	5 - 30	5 - 100				
> 500	All types	50 - 200	50 to 200 - 500 ²	50 - 200	50 - 400	5 - 30	5 - 50				
<p>Note 1: Linear reduction from 2,000 mg/m³ for 100 MW to 400 mg/m³ for 500 MW. Note 2: 500 mg/m³ applies until 1st January 2016 after which time the limit of 200 mg/m³ will apply. * 150 – 300mg/m³ in the case of biomass.</p>											
6.1 Emission Levels for Discharges to Air	Table 6.3 – Range of BAT associated emissions for liquid fuel fired plant							Not applicable	SmartPly only use liquid fuel for on-site mobile equipment, back up and emergency equipment.		
	Size (MW _{th})	Combustion Technique	NO _x		SO ₂		PM			CO	
			New	Existing	New	Existing	New			Existing	All Plants
	50 - 100	All types (excl GTs)	50 - 400	150 - 450	100 - 850	100 - 1700	5 - 50			5 - 100	30 - 150
	100 - 300	All types (excl GTs)	50 - 200	50 - 450	100 to 200 - 400 <small>Note 1</small>	100 to 400 - 1700 ²	5 - 30			5 - 100	
		All types (excl GTs)	50 - 200	50 - 450	50 - 200	50 to 400 - 1700 ^{2,3}	5 - 30			5 - 100	
> 500	All types (excl GTs)	50 - 200	50 - 400	50 - 200	50 - 400	5 - 30	5 - 50				
All sizes	Gas Turbines (OCGT & CCGT)	120	125	120	120	-	-	100			
<p>Note 1: Linear reduction from 400 mg/m³ for 100 MW to 200 mg/m³ for 300 MW. Note 2: Linear reduction from 1,700 mg/m³ for 100 MW to 400 mg/m³ for 500 MW. Note 3: Plants, of a rated thermal input equal to or greater than 400 MW, which do not operate more than 2,000 hours per annum until 31 December 2015 and 1,500 hours per annum thereafter are subject to a limit value of 800 mg/Nm³ for sulphur dioxide emissions.</p>											

Title of Document											
BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008											
BAT Ref Number	BAT Statement								Applicability	Proposed/ in place	
6.1 Emission Levels for Discharges to Air	Table 6.4 – Range of BAT associated emissions for gas fired plant									Not applicable	SmartPly only use LPG gaseous fuel for dryer start up, office heating and forklifts.
	Size (MW _{th})	Combustion Technique	NO _x		SO ₂		Particulate Matter				
			New	Existing	New	Existing	New	Existing			
	50 - 100	All types (excl GTs)	50 - 400	50 - 450	10 - 35	10 - 35	5	5			
	100 - 300	All types (excl GTs)	50 - 200	50 - 450	10 - 35	10 - 35	5	5			
	300 - 500	All types (excl GTs)	50 - 200	50 - 450	10 - 35	10 - 35	5	5			
> 500	All types (excl GTs)	50 - 200	50 - 400	10 - 35	10 - 35	5	5				
All Sizes	Gas Turbines (OCGT and CCGT)	50	50 - 120	10 - 35	10 - 35	5	5				

Title of Document				BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008																																																																									
BAT Ref Number	BAT Statement			Applicability	Proposed/ in place																																																																								
6.2 Emission Levels for Discharges to Water	Table 6.5 BAT Associated Emission Levels for Discharges to Water * <table border="1"> <thead> <tr> <th>Constituent Group or Parameter</th> <th>Emission Levels</th> <th>Percentage Reduction⁵</th> <th>Notes</th> </tr> </thead> <tbody> <tr> <td>pH</td> <td>6 - 9</td> <td>-</td> <td></td> </tr> <tr> <td>Toxicity</td> <td>5 - 10 TU</td> <td></td> <td>1</td> </tr> <tr> <td>BOD₅</td> <td>20mg/l</td> <td>>91-99%</td> <td></td> </tr> <tr> <td>COD</td> <td>30 - 250mg/l</td> <td>>75%</td> <td></td> </tr> <tr> <td>Suspended Solids</td> <td>10 - 35mg/l</td> <td></td> <td></td> </tr> <tr> <td>Total Ammonia (as N)</td> <td>10mg/l</td> <td></td> <td></td> </tr> <tr> <td>Total Nitrogen (as N)</td> <td>5 - 25mg/l</td> <td>>80%</td> <td>2, 4</td> </tr> <tr> <td>Total Phosphorus (as P)</td> <td>2mg/l</td> <td>>80%</td> <td>4</td> </tr> <tr> <td>Oils Fats and Greases</td> <td>10mg/l</td> <td></td> <td></td> </tr> <tr> <td>Mineral Oil (from Interceptor)</td> <td>20mg/l</td> <td></td> <td></td> </tr> <tr> <td>Mineral Oil (from biological treatment)</td> <td>1.0mg/l</td> <td></td> <td></td> </tr> <tr> <td>Phenols</td> <td></td> <td></td> <td>5</td> </tr> <tr> <td>Metals</td> <td></td> <td></td> <td>5</td> </tr> <tr> <td>Organohalogenes</td> <td></td> <td></td> <td>5</td> </tr> <tr> <td>Priority Substances (as per Water Framework Directive)</td> <td></td> <td></td> <td>5</td> </tr> <tr> <td>Cyanides</td> <td></td> <td></td> <td>5</td> </tr> <tr> <td>Other</td> <td></td> <td></td> <td>5, 6</td> </tr> </tbody> </table>			Constituent Group or Parameter	Emission Levels	Percentage Reduction ⁵	Notes	pH	6 - 9	-		Toxicity	5 - 10 TU		1	BOD ₅	20mg/l	>91-99%		COD	30 - 250mg/l	>75%		Suspended Solids	10 - 35mg/l			Total Ammonia (as N)	10mg/l			Total Nitrogen (as N)	5 - 25mg/l	>80%	2, 4	Total Phosphorus (as P)	2mg/l	>80%	4	Oils Fats and Greases	10mg/l			Mineral Oil (from Interceptor)	20mg/l			Mineral Oil (from biological treatment)	1.0mg/l			Phenols			5	Metals			5	Organohalogenes			5	Priority Substances (as per Water Framework Directive)			5	Cyanides			5	Other			5, 6	Not applicable	SmartPly do not emit any industrial wastewater
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<p>* All values refer to daily averages based on a 24-hour flow proportional composite sample, except where stated to the contrary and for pH, which refers to continuous values. Levels apply to effluent prior to dilution by uncontaminated streams, e.g. storm water, cooling water, etc.</p> <p>* Temperature measured downstream of a point of thermal discharge must not exceed the unaffected temperature by more than 1.5°C in salmonid waters and 3°C in cyprinid waters (Freshwater Fish Directive 79/659/EEC).</p>																																																																													

Title of Document BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
6.2 Emission Levels for Discharges to Water (continued)	<p>Note 1: The number of toxic units (TU) = 100/x hour EC/LC50 in percentage vol/vol so that higher TU values reflect greater levels of toxicity. For test regimes where species death is not easily detected, immobilisation is considered equivalent to death.</p> <p>Note 2: Total Nitrogen means the sum of Kjeldahl Nitrogen, Nitrate N and Nitrite N.</p> <p>Note 3: Reduction in relation to influent load.</p> <p>Note 4: Limits will depend on the sensitivity of the receiving waterbody.</p> <p>Note 5: BAT associated emissions levels are highly dependent on production process, wastewater matrix and treatment. These parameters shall be considered on a site-specific basis when setting emission limit values.</p> <p>Note 6: Any relevant polluting substances as specified in Schedule to S.I. No. 394 of 2004: EPA (Licensing)(Amendment) Regulations, 2004.</p>	Not applicable	SmartPly do not emit any industrial wastewater
7.1.1 Selection of Parameters	<p>Continuous monitoring of the following parameters may be required:</p> <ul style="list-style-type: none"> • NO_x • SO₂ • Particulate matter (including PM10 and PM2.5) • CO 	Not applicable	SmartPly undertake quarterly monitoring in accordance with their licence.
7.1.1 Selection of Parameters	Monitoring of the pressure, temperature and water and oxygen content to allow measured emission concentrations to be adjusted to reference conditions is also required.	Applicable	This is included as part of regular monitoring.
7.2 Monitoring of Aqueous Emissions	<ul style="list-style-type: none"> • For uncontaminated cooling waters, continuous monitoring of temperature and flow. • Continuous monitoring of flow, volume, pH, temperature and any other relevant parameters deemed necessary by the Agency, taking account of the nature, magnitude and variability of the emissions and the reliability of the control technique. • Establish existing conditions prior to start-up of key emission constituents and salient flora and fauna. • Monitoring of influent and effluent for the waste water treatment plant to establish % BOD and COD reduction and early warning of any difficulties in waste water treatment, or unusual loads. • The potential for the treated effluent to have tainting and toxic effects should be assessed and if necessary measured by established laboratory techniques. • Periodic biodegradability checks where appropriate on effluents to municipal waste treatment plants, both prior to start-up and thereafter. 	Not applicable	SmartPly do not emit any industrial wastewater.
7.3 Monitoring of Emissions to Groundwater	There should be no direct emissions to groundwater, including during extraction and treatment of groundwater.	Applicable	In place

Title of Document			
BAT Guidance Note on Best Available Techniques for the Energy Sector (Large Combustion Plant Sector), EPA 2008			
BAT Ref Number	BAT Statement	Applicability	Proposed/ in place
7.4 Monitoring Of Solid Waste	<ul style="list-style-type: none"> The recording in a register of the types, quantities, date and manner of disposal/recovery of all wastes. Leachate testing of sludges and other material as appropriate being sent for landfilling. Annual waste minimisation report showing efforts made to reduce specific consumption together with material balance and fate of all waste materials. 	Applicable	In place