EHS PROJECTS
Real about risk

UKBIC BAT Assessment

An assessment of alignment to the BAT conclusions that are applicable to the new FPL process.

Surface Treatment Using Organic Solvents (STS) BAT conclusions

Ref	Topic	Ref	Topic
BAT 1	Environmental Management System (EMS)	**BAT 13**	Emissions during abnormal operation
BAT 2	Reduce VOC and energy use	**BAT 14**	VOC emissions from production and storage
BAT 3	Impact of raw materials	**BAT 15**	VOC emission abatement
BAT 4	Techniques to reduce solvent consumption	**BAT 16**	Energy efficiency in VOC abatement
BAT 5	Fugitive VOC emissions: storage and handling	**BAT 17**	Reduce NO_X and CO in VOC abatement
BAT 6	Distribution of materials	***BAT 18***	*Not applicable to UKBIC*
BAT 7	Coating Techniques	**BAT 19**	Energy efficiency
BAT 8	Drying & Curing Techniques	***BAT 20***	*Not applicable to UKBIC*
BAT 9	Reduce VOCs in cleaning	***BAT 21***	*Not applicable to UKBIC*
BAT 10	Fugitive VOC emissions: Solvent Mass Balance	**BAT 22**	Reduce waste sent for disposal
BAT 11	Monitoring waste gasses	***BAT 23***	*Not applicable to UKBIC*
BAT 12	*Not applicable to UKBIC*		

BAT 1: Environmental Management System (EMS)

BAT is to elaborate and implement an Environmental Management System (EMS) that incorporates the generic BAT i – xx features and STS i – iii features.

UKBIC Alignment:

The new FPL process does not alter UKBICs existing alignment and obligations in relation to BAT 1.

The installation will continue to operate in accordance with a UKAS certified ISO14001:2015 Environmental Management System. The ISO standard incorporates the key features of BAT 1. This includes; statements of the SLTs commitment, leadership, and accountability for the EMS; the determination of the organisation's context and the scope of the EMS; stakeholder needs and expectations; an environmental policy, targets and objectives (including commitment to continuous improvement); relevant environmental processes (spills, materials handling and delivery, waste management etc); determination of the EMS relevant organisational roles and responsibilities; an aspects and impacts register; the appropriate provision of the financial and human resources that are relevant to the environmental aspects and objectives; a management manual; consideration of the environment when undertaking alterations to the site, in accordance with a change management process; monitoring and measurement programmes; internal and external EMS and environmental compliance auditing; systems for the raising and evaluating environmental nonconformities and the implementation of corrective actions; interactions with quality, health & safety systems; considerations of VOC use optimisation and energy efficiency; and the periodic review of environmental aspects, objectives, and incidents by senior management.

BAT 2: Overall environmental performance

BAT is to:

- **identify the process areas/sections/steps that represent the greatest contribution to the VOC emissions and energy consumption and the greatest potential for improvement (see also BAT 1);**
- **identify and implement actions to minimise VOC emissions and energy consumption;**
- **regularly (at least once every year) update the situation and follow up the implementation of the identified actions**

UKBIC Alignment:

The new FPL process does not alter UKBICs existing alignment and obligations in relation to BAT 2.

The installation will continue to operate in accordance with a UKAS certified ISO14001:2015 Environmental Management System. The system will continue to commit UKBIC to continuous improvement. This includes the ongoing consideration of actions to improve efficiency in terms of VOC usage and energy demand. As a component of the EMS, senior leadership undertake annual management meeting reviews of the installation's environmental performance. This will include the usage of hazardous materials and energy efficiency. UKBIC has limited control over the total energy usage and solvent consumption due to the organisation’s operational model. As the FPL facility will operate sporadically in accordance with client requests, the total consumptions of the process will largely depend on demand from clients.

BAT 3: Selection of raw materials

BAT is to use both of the techniques given.

Technique		Description	Applicability
(a)	Use of raw materials with a low environmental impact	As part of the EMS (see BAT 1), systematic evaluation of the adverse environmental impacts of the materials used (in particular substances that are carcinogenic, mutagenic and toxic to reproduction as well as substances of very high concern) and substitution by others with no or lower environmental and health impacts where possible, taking into consideration the product quality requirements or specifications.	Generally applicable. The scope (e.g. level of detail) and nature of the evaluation will generally be related to the nature, scale and complexity of the plant and the range of environmental impacts it may have, as well as to the type and quantity of materials used.
(b)	Optimisation of the use of solvents in the process	Optimisation of the use of solvents in the process by a management plan (as part of the EMS (see BAT 1)) that aims to identify and implement necessary actions (e.g. colour batching, optimising spray pulverisation).	Generally applicable.

UKBIC Alignment:

(a) The FPL cathode slurry liquid composition will be entirely made up of the solvent NMP (1-Methyl-2 pyrrolidinone). Currently, there is no substitute for NMP in the cathode cell manufacturing industry as a whole. This is an active area of research for the sector broadly. UKBIC have previously commissioned an academic study 'Report on the state of art for N-Methyl-2-pyrrolidone in the production of Lithium-ion battery cells', to address the elimination & substitution options. The report summary concludes that elimination or substitution of the substance NMP currently is not technically feasible. Furthermore, UKBIC has limited control over the solvent consumption due to the organisation's operational model. The FPL facility will operate in accordance with client plans for cell manufacture. The use of less harmful solvents may be within the remit of FPLs future operation. Therefore, the RTO has been scoped to be able to abate ethanol, methanol. isopropyl alcohol, propyl acetate, acetone and other organic solvents with lower environmental impact than NMP. This variation seeks authorisation to allow other organic solvents to be coated and abated (in accordance with a TVOC stack limit) within the FPL process, this will grant the operational capacity to test with lower harm materials (directly improving compliance with BAT 3(a)).

(b) The installation will continue to operate in accordance with a UKAS certified ISO14001:2015 Environmental Management System. The system will continue to commit UKBIC to continuous improvement. This includes the ongoing appraisals to optimise the use of solvents. As a component of the EMS, senior leadership undertake annual management meeting reviews of the installation's environmental performance. This will include the usage of solvents.

BAT 4: Selection of raw materials

BAT is to use one or a combination of the techniques given.

UKBIC Alignment

The new FPL process does not alter the applicability of BAT 4 to UKBIC's operations.

BAT 4 is mostly not applicable to the FPL process, techniques (a) – (g) are not applicable to the cell manufacturing process. The substitution with lower hazard materials (h) is generally applicable across the STS sector. UKBIC's opportunities for substitution are limited, as discussed in BAT 3.

Technique		Description	Applicability
(a)	Use of high-solids solvent-based paints/coatings/varnishes/inks/adhesives	Use of paints, coatings, liquid inks, varnishes and adhesives containing a low amount of solvents and an increased solids content.	The selection of the surface treatment techniques may be restricted by the activity type, the substrate type and shape, product quality requirements as well as the need to ensure that the materials used, coating application techniques, drying/curing techniques and off-gas treatment systems are mutually compatible.
(b)	Use of water-based paints/coatings/inks/varnishes/adhesives	Use of paints, coatings, liquid inks, varnishes and adhesives where organic solvent is partially replaced by water.	
(c)	Use of radiation-cured inks/coatings/paints/varnishes/adhesives	Use of paints, coatings, liquid inks, varnishes and adhesives suitable to be cured by the activation of specific chemical groups by UV or IR radiation, or fast electrons, without heat and without emission of VOCs.	
(d)	Use of solvent-free two-component adhesives	Use of solvent-free two-component adhesive materials consisting of a resin and a hardener.	
(e)	Use of hot-melt adhesives	Use of coating with adhesives made from the hot extrusion of synthetic rubbers, hydrocarbon resins and various additives. No solvents are used.	
(f)	Use of powder coatings	Use of solvent-free coating which is applied as a finely divided powder and cured in thermal ovens.	
(g)	Use of laminate film for web or coil coatings	Use of polymer films applied onto a coil or web in order to give aesthetic or functional properties, which reduces the number of coating layers needed.	
(h)	Use of substances which are not VOCs or are VOCs of a lower volatility	Substitution of high-volatility VOC substances with others containing organic compounds that are non-VOCs or VOCs of a lower volatility (e.g. esters).	

BAT 5: Storage and Handling of Raw Materials

BAT is to apply the principles of good housekeeping by using all of the techniques given:

UKBIC alignment

(a) As stated in BAT 1, installation will continue to operate in accordance with a UKAS certified ISO14001:2015 Environmental Management System. This system includes the following elements:

- Procedures, plans and training for handling pollution incidents including spills and emergency scenarios.
- Guidance for the storage and handling of waste.
- Containment standards.
- Schedules of inspections and containment maintenance activities.

Technique		Description	Applicability
Management techniques			
(a)	Preparation and implementation of a plan for the prevention and control of leaks and spillages	A plan for the prevention and control of leaks and spillages is part of the EMS (see BAT 1) and includes, but is not limited to: —site incident plans for small and large spillages; —identification of the roles and responsibilities of persons involved; —ensuring staff are environmentally aware and trained to prevent/deal with spillage incidents; —identification of areas at risk of spillage and/or leaks of hazardous materials and ranking them according to the risk; —in identified areas, ensuring suitable containment systems are in place, e.g. impervious floors; —identification of suitable spillage containment and clean-up equipment and regularly ensuring it is available, in good working order and close to points where these incidents may occur; —waste management guidelines for dealing with waste arising from spillage control; —regular (at least once every year) inspections of storage and operational areas, testing and calibration of leak detection equipment and prompt repair of leaks from valves, glands, flanges, etc. (see BAT 13).	Generally applicable. The scope (e.g. level of detail) of the plan will generally be related to the nature, scale and complexity of the installation, as well as to the type and quantity of materials used.

BAT 5: Storage and Handling of Raw Materials

(b) The existing sealed, locked, labelled and bunded areas for storing delivered and waste solvents will continue to be used. Within the new FPL area, the in use NMP will be stored in an IBC that is housed in a bunded (110% of the IBC capacity), sealed container that is then fixed piped out to the coating process.

(c) UKBIC will continue to manage stock within the limitations of the bunded storage capacity on site.

(d) Leaks and spillages are prevented by using pumps and seals suitable for the material handled and which ensure proper tightness.

(e) A mixture of automated and supervised pumping operations are utilised to prevent overflows.

(f) No change as a result of this variation. The existing NMP bulk tanker offloading will only occur where displaced vapour is back vented to the offloading vehicle.

(g) The solvent containers used in FPL will only be handled by appropriately trained operators. All primary containers will be bunded appropriately during handling, storage and solvent use.

Storage techniques			
(b)	Sealing or covering of containers and bunded storage area	Storage of solvents, hazardous materials, waste solvents and waste cleaning materials in sealed or covered containers, suitable for the associated risk and designed to minimise emissions. The containers' storage area is bunded and of adequate capacity.	Generally applicable.
(c)	Minimisation of storage of hazardous materials in production areas	Hazardous materials are present in production areas only in amounts that are necessary for production; larger quantities are stored separately.	
Techniques for pumping and handling liquids			
(d)	Techniques to prevent leaks and spillages during pumping	Leaks and spillages are prevented by using pumps and seals suitable for the material handled and which ensure proper tightness. This includes equipment 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 atmosphere, diaphragm pumps or bellow pumps.	Generally applicable.
(e)	Techniques to prevent overflows during pumping	This includes ensuring for example that: —the pumping operation is supervised; —for larger quantities, bulk storage tanks are fitted with acoustic and/or optical high-level alarms, with shut-off systems if necessary.	
(f)	Capture of VOC vapour during solvent-containing material delivery	When delivering solvent-containing materials in bulk (e.g. loading or unloading of tanks), the vapour displaced from receiving tanks is captured, usually by back-venting.	May not be applicable for solvents with low vapour pressure or due to cost considerations.
(g)	Containment for spills and/or rapid take-up when handling solvent-containing materials	When handling solvent-containing materials in containers, possible spills are avoided by providing containment, e.g. by using trolleys, pallets and/or stillages with built-in containment (e.g. 'catch pans') and/or rapid take-up by using absorbent materials.	Generally applicable.

BAT 6: Distribution of Raw Materials

BAT is to use one or a combination of the techniques

UKBIC Alignment:

(a) Solvent will be piped from a centralised supply through direct piping with ring lines. These systems can be cleaned in accordance with air flushing or pig cleaning.

(b) Any mixing will utilise computer controlled mixing techniques. No manual mixing will occur.

(c) Not directly applicable as solvent coating material will rarely change. All solvent coating will occur within a closed clean room environment.

(d) Not applicable.

(e) Not applicable.

(f) Not applicable.

Technique		Description	Applicability
(a)	Centralised supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents)	Supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents) to the application area by direct piping with ring lines, including system cleaning such as pig cleaning or air flushing.	May not be applicable in the case of frequent changes of inks/paints/coatings/adhesives or solvents.
(b)	Advanced mixing systems	Computer-controlled mixing equipment to achieve the desired paint/coating/ink/adhesive.	Generally applicable.
(c)	Supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents) at the point of application using a closed system	In the case of frequent changes of inks/paints/coatings/adhesives and solvents or for small-scale usage, supply of inks/paints/coatings/adhesives and solvents from small transport containers placed near the application area using a closed system.	
(d)	Automation of colour change	Automated colour changing and ink/paint/coating line purging with solvent capture.	
(e)	Colour grouping	Modification of the sequence of products to achieve large sequences with the same colour.	
(f)	Soft purge in spraying	Refilling the spray gun with new paint without intermediate rinsing.	

BAT 7: Coating application to reduce raw material consumption

BAT is to use one or a combination of the techniques given

UKBIC alignment

(a) Roller coating is used to transfer solvents to a moving flat substrate. The system is designed and operated to optimise the coating application to high degrees of precision and minimise wastage during coating.

Technique		Description	Applicability
Techniques for non-spraying application			
(a)	Roller coating	Application where rollers are used to transfer or meter the liquid coating onto a moving strip.	Only applicable to flat substrates (4).
(b)	Doctor blade over roller	The coating is applied to the substrate through a gap between a blade and a roller. As the coating and substrate pass, the excess is scraped off.	Generally applicable (4).
(c)	No-rinse (dry-in-place) application in the coating of coil	Application of conversion coatings which do not require a further water rinse using a roller coater (chemcoater) or squeegee rollers.	Generally applicable (4).
(d)	Curtain coating (casting)	Work-pieces are passed through a laminar film of coating discharged from a header tank.	Only applicable to flat substrates (4).
(e)	Electrocoating (e-coat)	Paint particles dispersed in a water-based solution are deposited on immersed substrates under the influence of an electric field (electrophoretic deposition).	Only applicable to metal substrates (4).
(f)	Flooding	The work-pieces are transported via conveyor systems into a closed channel, which is then flooded with the coating material via injection tubes. The excess material is collected and reused.	Generally applicable (4).
(g)	Co-extrusion	The printed substrate is coupled with a warm, liquefied plastic film and subsequently cooled down. This film replaces the necessary additional coating layer. It may be used between two different layers of different carriers acting as an adhesive.	Not applicable where high bond strength or resistance to sterilisation temperature is needed (4) .

BAT 8: Drying and curing energy efficiency

BAT is to use one or a combination of the techniques

UKBIC Alignment:

(e) & (f) The FPL drying system will utilise a convection drying oven to circulate heat and therefore conserve energy. The FPL process also has the capacity to undertake a pre-Convection IR drying stage. This can be operated to further increase efficiency when client formulations and the technical constraints of the production run allow. The applicability of technique (f) is dependent on client demands but will be implemented to improve efficiency wherever possible.

Technique		Description	Applicability
(a)	Inert gas convection drying/curing	The inert gas (nitrogen) is heated in the oven, enabling solvent loading above the LEL. Solvent loads of > 1 200 g/m^3 nitrogen are possible.	Not applicable where dryers need to be opened regularly ([5]).
(b)	Induction drying/curing	Online thermal curing or drying by electromagnetic inductors that generate heat inside the metallic work-piece by an oscillating magnetic field.	Only applicable to metal substrates ([5]).
(c)	Microwave and high-frequency drying	Drying using microwave or high-frequency radiation.	Only applicable to water-based coatings and inks and non-metallic substrates ([5]).
(d)	Radiation curing	Radiation curing is applied based on resins and reactive diluents (monomers) which react on exposure to radiation (infrared (IR), ultraviolet (UV)), or high-energy electron beams (EB).	Only applicable to specific coatings and inks ([5]).
(e)	Combined convection/IR radiation drying	Drying of a wet surface with a combination of circulating hot air (convection) and an infrared radiator.	Generally applicable ([5]).
(f)	Convection drying/curing combined with heat recovery	Heat from off-gases is recovered (see BAT 19 (e)) and used to preheat the input air of the convection dryer/curing oven.	Generally applicable ([5]).

BAT 9: Minimise VOC emissions from cleaning

BAT is to use one or a combination of the techniques

UKBIC Alignment:

(c) Where operational safety constraints allow, low or no solvent pre-impregnated wipes can be used in cleaning.

(e) Water based cleaning will be undertaken where technical constraints allow within FPL.

(f) An automated washing system will be utilised specifically in the Electrode Cleaning Area. This is a closed system to allow recovery and reuse of material.

(g) Wherever technical constraints and customer demands allow, collected solvent will be reused during purging.

Technique		Description	Applicability
(a)	Protection of spraying areas and equipment	Application areas and equipment (e.g. spray booth walls and robots) susceptible to overspray and drips, etc. are covered with fabric covers or disposable foils where foils are not subject to tearing or wear.	The selection of cleaning techniques may be restricted by the type of process, the substrate or equipment to be cleaned and the type of contamination.
(b)	Solids removal prior to complete cleaning	Solids are removed in a (dry) concentrated form, usually by hand, with or without the aid of small amounts of cleaning solvent. This reduces the amount of material to be removed by solvent and/or water in subsequent cleaning stages, and therefore the amount of solvent and/or water used.	
(c)	Manual cleaning with pre-impregnated wipes	Wipes pre-impregnated with cleaning agents are used for manual cleaning. Cleaning agents may be solvent-based, low-volatility solvents or solvent-free.	
(d)	Use of low-volatility cleaning agents	Application of low-volatility solvents as cleaning agents, for manual or automated cleaning, with high cleaning power.	
(e)	Water-based cleaning	Water-based detergents or water-miscible solvents such as alcohols or glycols are used for cleaning.	
(f)	Enclosed washing machines	Automatic batch cleaning/degreasing of press/machine parts in enclosed washing machines. This can be done using either: (a)organic solvents (with air extraction followed by VOC abatement and/or recovery of the used solvents) (see BAT 15); or (b)VOC-free solvents; or (c)alkaline cleaners (with external or internal waste water treatment).	
(g)	Purging with solvent recovery	Collection, storage and, if possible, reuse of the solvents used to purge the guns/applicators and lines between colour changes.	
(h)	Cleaning with high-pressure water spray	High-pressure water spray and sodium bicarbonate systems or similar are used for automatic batch cleaning of press/machine parts.	
(i)	Ultrasonic cleaning	Cleaning in a liquid using high-frequency vibrations to loosen the adhered contamination.	
(j)	Dry ice (CO_2) cleaning	Cleaning of machinery parts and metallic or plastic substrates by blasting with CO_2 chips or snow.	
(k)	Plastic shot-blast cleaning	Excess paint build-up is removed from panel jigs and body carriers by shot-blasting with plastic particles.	

BAT 10: Fugitive emissions monitoring: Solvent Mass Balance

BAT is to monitor total and fugitive VOC emissions by compiling, at least once every year, a solvent mass balance of the solvent inputs and outputs of the plant.

UKBIC alignment:

In accordance with the existing conditions of the Installation Permit, the operator will ensure that the solvent inputs and outputs from the new FPL process are incorporated into the site's solvent management plan (SMP). This SMP is developed in accordance with Part 7 of Annex VII of the Industrial Emissions Directive and STS BAT 10. The template of this SMP is provided within the permit variation application pack. Initially the operator will provide the regulator with an updated SMP following each manufacturing campaign (in line with existing requirements). Following the consistent demonstration that fugitive emissions are below 20% of solvent input, the operator will seek to agree with the regulator to reduce the SMP reporting to annually (in line with STS BAT 10).

The FPL relevant input to the SMP will utilise a number of conservative assumptions, these will be proportionate to the complexity of the process, and to the very low quantities of solvents used (relative to the STS sector generally). The installation has appropriate monitoring technology, and is operated in accordance with sufficient processes, to track and control both the used and unused quantities of solvents.

BAT 11: Waste Gas Monitoring

BAT is to monitor emissions in waste gases with at least the frequency, and in accordance with EN standards, given in STS BATc 11. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.

UKBIC alignment: Dust and DMF monitoring are not applicable at UKBIC as they are sector specific.

Parameter	Monitoring Standard	Process Description [1]
TVOC	BS EN 12619:2013	A flame ionization detector (FID) undertakes a continuous measurement for at least 60 minutes. The methodology measures the mass concentration of total gaseous organic carbon. Additional parameters including volumetric flow rate, flow velocity, temperature and moisture are also measured. Accredited analysis is used to present a TVOC result as Carbon, at reference conditions. All results will be certified MCERTS and UKAS.
NMP	BS EN 12619:2013	There is no available accredited methodology for the direct measurement of NMP. The BS EN 12619:2013 is used to determine TVOC. The stack emissions monitoring specialists undertake a calculation, based on the mass weight of NMP, to express TVOC as NMP. All results will be certified MCERTS and UKAS.
NO_X	BS EN 14792:2017	NO_X is measured in accordance with the chemiluminescence principle. A portable sampler is used to extract gas from the stack and measure NO_X using chemiluminescence in real time. The sampling duration will be a minimum of 60 minutes. Additional parameters including volumetric flow rate, flow velocity, temperature and moisture are also measured. NO_X is expressed at reference conditions as NO_2. All results will be certified MCERTS and UKAS.
CO	BS EN 15058:2017	CO is measured in accordance with the infrared (IR) absorption principle. A portable sampler is used to extract gas from the stack and measure CO using IR absorption in real time. The sampling duration will be a minimum of 60 minutes. Additional parameters including volumetric flow rate, flow velocity, temperature and moisture are also measured. CO is expressed at reference conditions as CO. All results will be certified MCERTS and UKAS.

[1] In all cases, the monitoring period will cover ‘normal’ operations. This is during the coating, drying and gas abatement window. Monitoring will not be conducted during start up or shut down of coating and drying operations, or during the start up and shut down of air emissions abatement technology.

BAT 13: Emissions during abnormal operation (OTNOC)

In order to reduce the frequency of the occurrence of abnormal operation, and to reduce emissions during these periods, BAT is to use both of the techniques given.

Abnormal operation refers to situations in industrial operations where conditions deviate from the standard, or "normal," operating parameters. These situations can include malfunctions, maintenance, start-up, shut-down, and other events that don't fit the typical operational profile.

UKBIC Alignment:

(a) Equipment critical to the protection of the environment ('critical equipment') within the new FPL process will be identified on the basis of a risk assessment. In principle, this concerns the storage and handling equipment for solvents, the coating equipment, drying equipment and the emissions abatement technology (the RTO).

(b) The existing prescriptive planned preventative maintenance (PPM) programme will be extended to include all new environmentally critical equipment applied for in this variation. Equipment will be maintained, monitored and operated in order to minimise both the occurrences of abnormal operations and the emissions generated during these periods.

Technique		Description
(a)	Identification of critical equipment	Equipment critical to the protection of the environment ('critical equipment') is identified on the basis of a risk assessment. In principle, this concerns all equipment and systems handling VOCs (e.g. off-gas treatment system, leak detection system).
(b)	Inspection, maintenance and monitoring	A structured programme to maximise critical equipment availability and performance which includes standard operating procedures, preventive maintenance, regular and unplanned maintenance. OTNOC periods, duration, causes and, if possible, emissions during their occurrence are monitored.

BAT 14: Reduce VOC emissions from production and storage

BAT is to use technique (a) and an appropriate combination of the other techniques given

UKBIC alignment

(a) The new FPL process has been designed and installed with due consideration to; efficiency in the removal of point source and fugitive gas emissions; a safety-first principle and energy efficiency. The systems selected have separate extraction for the highly concentrated VOC laden exhaust from the dryer (with end of pipe abatement), the low VOC extraction of the separate local exhaust ventilation. The RTO that will be used to abate the emissions from the drying process by capturing and reusing the heat generated during the oxidation of VOCs within an RTO system.

Technique		Description	Applicability
(a)	System selection, design and optimisation	An off-gas system is selected, designed and optimised taking into account parameters such as: —amount of extracted air; —type and concentration of solvents in extracted air; —type of treatment system (dedicated/centralised); —health and safety; —energy efficiency. The following order of priority for the system selection may be considered: —segregation of off-gases with high and low VOC concentrations; —techniques to homogenise and increase the VOC concentration (see BAT 16 (b) and (c)); —techniques for the recovery of solvents in off-gases (see BAT 15); —VOC abatement techniques with heat recovery (see BAT 15); —VOC abatement techniques without heat recovery (see BAT 15).	Generally applicable.

BAT 14: Reduce VOC emissions from production and storage

UKBIC alignment:

(b) The vast majority of extracted VOC from the FPL occurs within the oven during the drying process. This incorporates a fully enclosed extraction system, leading to the RTO for abatement.

(c) Not applicable

(d) As (b)

(e) As (b)

(f) Not applicable.

(g) Very low to negligible concentrations of VOC will be extracted by the LEV systems within the FPL area (including extraction adjacent to the IBC solvent store). This extraction system will pass air through a carbon scrubber located within the FPL area to remove any trace VOC loading.

(h) Not applicable.

(b)	Air extraction as close as possible to the point of application of VOC-containing materials	Air extraction as close as possible to the point of application with full or partial enclosure of solvent application areas (e.g. coaters, application machines, spray booths). Extracted air may be treated by an off-gas treatment system.	May not be applicable where enclosure leads to difficult machinery access during operation. Applicability may be restricted by the shape and size of the area to be enclosed.
(c)	Air extraction as close as possible to the point of preparing paints/coatings/adhesives/inks	Air extraction as close as possible to the point of preparing paints/coatings/adhesives/inks (e.g. mixing area). Extracted air may be treated by an off-gas treatment system.	Only applicable where paints/coatings/adhesives/inks are prepared.
(d)	Extraction of air from the drying/curing processes	The curing ovens/dryers are equipped with an air extraction system. Extracted air may be treated by an off-gas treatment system.	Only applicable to drying/curing processes.
(e)	Minimisation of fugitive emissions and heat losses from the ovens/dryers either by sealing the entrance and the exit of the curing ovens/dryers or by applying sub-atmospheric pressure in drying	The entrance to and the exit from curing ovens/dryers are sealed to minimise fugitive VOC emissions and heat losses. The sealing may be ensured by air jets or air knives, doors, plastic or metallic curtains, doctor blades, etc. Alternatively, ovens/dryers are kept under sub-atmospheric pressure.	Only applicable when curing ovens/dryers are used.
(f)	Extraction of air from the cooling zone	When substrate cooling takes place after drying/curing, the air from the cooling zone is extracted and may be treated by an off-gas treatment system.	Only applicable when substrate cooling takes place after drying/curing.
(g)	Extraction of air from storage of raw materials, solvents and solvent-containing wastes	Air from raw material stores and/or individual containers for raw materials, solvents and solvent-containing wastes is extracted and may be treated by an off-gas treatment system.	May not be applicable for closed containers or for storage of raw materials, solvents and solvent-containing wastes with a low vapour pressure and low toxicity.
(h)	Extraction of air from cleaning areas	Air from the areas where machine parts and equipment are cleaned with organic solvents, either by hand or automatically, is extracted and may be treated by an off-gas treatment system.	Only applicable to areas where machine parts and equipment are cleaned with organic solvents.

BAT 15, 16 & 17: VOC Abatement Technology Selection

In order to reduce VOC emissions in waste gases, increase resource efficiency and optimise energy efficiency, BAT is to use one or a combination of the techniques listed in BATc 15 and BATc 16.

UKBIC alignment:

Following consultation with air emissions abatement technology specialists, Airprotech and A.S.K Piearcey, the most appropriate abatement technology was determined as a combination of BAT 15 II (f) and (g) Regenerative Thermal Oxidation (RTO) and Catalytic oxidation (CATOX). The RTO is a 3 canister unit and this is a design requirement to meet ensure there is primary heat recovery to reduce fuel consumption at lower VOC levels and a high destruction efficiency to assist to meet the tight NMP emission limit value. The Regenerative technology provides 95% thermal efficiency and has a Hot Side Bypass (HSB) to mitigate against thermal runaway at higher VOC loadings. The CATOX system is a secondary VOC treatment stage.

The CATOX has its own dedicated burner. This is because the RTO is so thermally efficient that the exhaust temperature from the RTO is too low for the operation of the catalyst to be successful. The CATOX is designed to handle the relatively low concentration gas that will remain following the RTO phase and treat down to a very low NMP emission of 1mg/Nm^3.

These oxidation steps will cause the formation of NO_X and CO. The next step is the injection of Urea via a dispersion bank. This provides the ammonia required for the Selective Catalytic Reduction (SCR). The enriched gas then passes through the second catalyst bed where the NO_X reacts with the ammonia to form water and nitrogen. This technique is aligned to BATc 16 (a) and ensures that the NO_X emissions in waste gases meet relevant emission limit values while limiting CO emissions.

BAT 18: Dust emissions

Not applicable to UKBIC. The facility does not undertake any of the listed substrate surface preparation, cutting, coating application and finishing processes that generate dust emissions.

BAT 19: Energy efficiency measures

BAT is to use technique (a) and (b) and an appropriate combination of the other techniques given

UKBIC alignment

No change as a result of this variation. UKBIC will continue to operate in accordance with an energy management plan and record energy usage. Existing BAT obligations will continue to apply.

None of the techniques from (c) to (h) are applicable to the FPL installation.

Technique		Description	Applicability
Management techniques			
(a)	Energy efficiency plan	An energy efficiency plan is part of the EMS (see BAT 1) and entails defining and calculating the specific energy consumption of the activity, setting key performance indicators on an annual basis (e.g. MWh/tonne of product) and planning the periodic improvement targets and related actions. The plan is adapted to the specificities of the plant in terms of process(es) carried out, materials, products, etc.	The level of detail and nature of the energy efficiency plan and of the energy balance record will generally be related to the nature, scale and complexity of the installation and the types of energy sources used. It may not be applicable if the STS activity is carried out within a larger installation, provided that the energy efficiency plan and the energy balance record of the larger installation sufficiently cover the STS activity.
(b)	Energy balance record	The drawing up once every year of an energy balance record which provides a breakdown of the energy consumption and generation (including energy export) by the type of source (e.g. electricity, fossil fuels, renewable energy, imported heat and/or cooling). This includes: (i)defining the energy boundary of the STS activity; (ii)information on energy consumption in terms of delivered energy; (iii)information on energy exported from the plant; (iv)energy flow information (e.g. Sankey diagrams or energy balances) showing how the energy is used throughout the process. The energy balance record is adapted to the specificities of the plant in terms of process(es) carried out, materials, etc.	

BAT 20: Water use efficiency and wastewater generation

Not applicable to UKBIC. The facility does not undertake any of the listed aqueous processes described in BAT 20.

BAT 21: Techniques to reduce emissions to water

Not applicable to UKBIC. The facility does not undertake any of the listed aqueous processes described in BAT 21.

BAT 22: Waste Management

BAT is to use the techniques (a) and (b) and one or both of the techniques (c) and (d) given

UKBIC alignment

(a) & (b) No change as a result of this variation. UKBIC will continue to operate in accordance with a waste management plan and continue to monitor and analyse the tonnage data for waste uplift.. Existing BAT obligations will continue to apply.

(c) Any waste solvents recovered from the FPL process will utilise the existing waste storage areas for ISL. In alignment with the existing ISL process, licence waste carriers will uplift recovered solvent and transport them to a permitted energy from waste installation.

(d) Not applicable.

Technique		Description
(a)	Waste management plan	A waste management plan is part of the EMS (see BAT 1) and is a set of measures aiming to: 1) minimise the generation of waste, 2) optimise the reuse, regeneration and/or recycling of waste and/or the recovery of energy from waste, and 3) ensure the proper disposal of waste.
(b)	Monitoring of waste quantities	Annual recording of waste quantities generated for each type of waste. The solvent content in the waste is determined periodically (at least once every year) by analysis or calculation.
(c)	Recovery/recycling of solvents	Techniques may include: —recovering/recycling solvents from liquid waste by filtration or distillation on site or off site; —recovering/recycling the solvent content of wipes by gravitational draining, wringing or centrifugation.
(d)	Waste-stream-specific techniques	Techniques may include: —reducing the water content of the waste, e.g. by using a filter press for the sludge treatment; —reducing the sludge and waste solvent generated, e.g. by reducing the number of cleaning cycles (see BAT 9); —using reusable containers, reusing the containers for other purposes, or recycling the container material; —sending the spent limestone generated from dry scrubbing to a lime or cement kiln.

BAT 23: Odour Management Plan

The applicability is restricted to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated. Not applicable as UKBIC does not undertake odorous processes. There is no substantiated odour risk on site. and has generated odour nuisance issues.