Additional Data in Support of LAPPC Part A2 Environmental Permit Application for the AESC UK No 2 Plant

Battery Manufacturing Facility

AESC UK Plant 2 Limited

Washington Road, Sunderland, Tyne, SR5 3NS

Prepared by:

SLR Consulting Limited

3rd Floor, Brew House, Jacob Street, Tower Hill,
Bristol, BS2 0EQ

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Basis of Report

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Appendices

1.0 Introduction

This report presents additional data in support of the application for a Part A2 Environmental Permit submitted to Sunderland City Council for the AESC UK No 2 Plant in Sunderland.

The report presents clarifications on:

- The process activities;
- The site management and control systems;
- The potential sources of emissions to air from the process;
- The air emissions abatement systems;
- Proposed monitoring of emissions to air;
- A revised Air Emissions Risk Assessment to align with changes in the plant design;
- Additional discussion on the selection of NMP as the solvent for Cathode costing; and
- An updated assessment of compliance with Best Available Techniques (BAT).

In addition to this, responses to specific questions raised by the Local Authority are also provided.

1.1 Project Timeline and Availability of Data

The Battery Plant is still within the detailed design phase, and as such there are certain aspects of the proposed design and operation of the plant that are still to be finalised.

In particular the detailed design data in relation to the south part of the plant has not yet been finalised and released by the engineering contractor.

As a result, many of the specific detailed items of technical information outlined as being required in the BAT guidance have not yet been issued for use.

At this stage in the design process, all of the site operational aspects have yet to be prepared for the Battery Plant including:

- Development of the overall site management systems including the Environmental Management System (EMS);
- Development of specific operating manuals and operating procedures;
- Development of inspection and maintenance routines and scheduling;
- Development of data monitoring and reporting plans; and
- Staff training.

All of the above design and operational management aspects will be in place prior to commencement of operation.

2.0 Additional Data in Support of the Environmental Permit Application

2.1 Management Systems

The EMS will be prepared in accordance with the requirements of ISO14001, and it is envisaged that AESC will seek to get the system formally accredited and certified to the standard at the earliest appropriate time.

The management system will include protocols to implement the compliance requirements of the Environmental Permit and to ensure that the required assessments and reporting are undertaken. The EMS will be developed to incorporate all the requirements of BATc 1 in the STS BREF note – See Section 3 and Appendix A.

The EMS will include details on:

- Management structure and staff roles and responsibilities;
- Key operating procedures;
- Preventative inspection and maintenance;
- Emissions monitoring and reporting;
- Performance and efficiency monitoring and reporting;
- Competence and training;
- Accidents, incidents and Non-conformance – prevention, incident response etc.;
- Auditing;
- Reporting; and
- Record keeping.

The management systems will be applied to the commissioning and operational phases of the site activities.

In addition to the core EMS requirements, the EMS will also be developed to incorporate the additional requirements under BATC 1 for surface treatment using organic solvents as outlined in Table 1.

Table 1: Additional EMS Requirements under BATC 1 for Surface Treatment Using Organic Solvents.

Additional Requirement	AESC Response
(i) Interaction with quality control and assurance as well as health and safety considerations.	The EMS will be developed to incorporate quality control and health and safety considerations
(ii) Planning to reduce the environmental footprint of an installation. In particular, this involves the following: a) assessing the overall environmental performance of the plant (see BAT 2); b) taking into account cross-media considerations, especially the maintenance of a proper balance between solvent emissions reduction and consumption of	The EMS will include requirements to (a) benchmark and review the plant environmental performance and to identify and implement improvement programmes to reduce overall impacts. (b) to ensure that the cross -media implications of proposed improvements is considered to achieve the optimum overall environmental performance; and

Additional Requirement	AESC Response
energy (see BAT 19), water (see BAT 20) and raw materials (see BAT 6); c) (c) reducing VOC emissions from cleaning processes (see BAT 9).	(c) to optimise cleaning processes and the materials used for cleaning to minimise VOC usage and emission
(iii) The inclusion of: a) a plan for the prevention and control of leaks and spillages (see BAT 5 (a)); b) a raw material evaluation system to use raw materials with low environmental impact and a plan to optimise the use of solvents in the process (see BAT 3); c) a solvent mass balance (see BAT 10); d) a maintenance programme to reduce the frequency and environmental consequences of OTNOC (see BAT 13); (e) an energy efficiency plan (see BAT 19 (a)); e) a water management plan (see BAT 20 (a)); f) a waste management plan (see BAT 22 (a)); g) (h) an odour management plan (see BAT 23).	The EMS will include specific site plans / protocols to implement each of the items listed under (iii).

2.2 Emissions to Air and Abatement Systems

The site air emission points are all linked to extraction systems from specific plant areas within which processing activities are undertaken that involve the use of substances which could credibly pose a risk to the health and safety of the operational staff.

These extraction systems are designed to extract from enclosed areas of the plant such as glove box, fume cupboard, enclosed room / clean room etc. in which specific process activities are undertaken.

These extraction systems have been designed to ensure that operator workplace exposure levels and other relevant standards for the protection of the workforce from exposure to potentially harmful materials are not exceeded.

The only exception to this is the emissions from the cathode coater systems (Emission Points A13 and A33) which are emissions direct from the process via appropriate VOC abatement systems.

In defining target emission limit values for each emission point the following EU BAT Reference documents have been considered:

- Best Available Techniques (BAT) Reference Document on Surface Treatment Using Organic Solvents including Preservation of Wood and Wood Products with Chemicals 2020 – (STS BREF); and
- Best Available Techniques (BAT) Reference Document for Common Waste Gas Management and Treatment Systems in the Chemical Sector 2023 – (WGC BREF).

A full list of the proposed process emission points to air and associated emissions data is provided in the Excel Spreadsheet presented as Appendix A.

The key emission point sources are reviewed in the following sections:

2.2.1 Areas Handling Powdered Materials

2.2.1.1 Anode Coating – Mixing

Emission Points A7, A8 and A27, A28

The preparation of the anode coating involves the mixing of powdered materials with deionised water to prepare the paste for application. Dry powder is only present at the commencement of mixing when it is added into a mixing vessel prior to water addition.

The powdered materials present include Graphite, Carboxy Methyl Cellulose and Carbon Black Powder

There is no direct extraction from the coating mixing and preparation process, as these systems are closed systems. The general operational areas around these systems are extracted using local area LEV extraction for operator protection and humidity control which is then routed via a HEPA filter for abatement of particulate emissions prior to venting to atmosphere. These operational areas of the plant are not expected to have significant levels of particulate materials present, but the HEPA filters are installed as a precautionary measure to ensure that no particulate materials are released to atmosphere.

The HEPA filters are understood to achieve an abatement efficiency of around 99.99%.

The BAT-AEL for emissions of such dust / particulate is:

- <1 – 5 mg/Nm³ (when the dust mass flow is above 50 g/h) as published in the WGC BREF; and
- <1 – 3 mg/Nm³ as published in the STS BREF.

However, as no particulate dust is expected to be present in the air emitted, no BAT-AEL is expected to be applied, and no monitoring is proposed.

Emissions of particulate dusts from this area have not been included in the revised air emissions risk assessment.

2.2.1.2 Cathode Coating – Mixing

Emission Points A10, A12 and A30, A32

The preparation of the cathode coating involves the mixing of powdered metal oxides with NMP to prepare the paste for application. Dry powder is only present at the commencement of mixing when it is added into a mixing vessel prior to NMP addition.

The powdered material present is a mixture of lithium, nickel, cobalt and aluminium oxides, with nickel monoxide or lithium oxide typically being the primary constituents.

There is no direct extraction from the coating mixing and preparation process, as these systems are closed systems. The general operational areas around these systems are extracted using local area LEV extraction for operator protection and humidity control which is then routed via a HEPA filter for abatement of particulate emissions prior to venting to atmosphere. These operational areas of the plant are not expected to have significant levels of particulate materials present, but the HEPA filters are installed as a precautionary measure to ensure that no particulate materials are released to atmosphere.

The HEPA filters are understood to achieve an abatement efficiency of around 99.99%.

The BAT-AEL for emissions of such dust / particulate is:

- <1 – 5 mg/Nm³ (when the dust mass flow is above 50 g/h) as published in the WGC BREF; and

- <1 – 3 mg/Nm³ as published in the STS BREF.

The BAT AEL for emission of Nickel and its compounds is:

- <0.02 – 0.1 mg/Nm³ (when the Nickel mass flow is above 0,15 g/h) as published in the WGC BREF.

However, as no particulate dust is expected to be present in the air emitted, no BAT-AEL is expected to be applied, and no monitoring is proposed.

Emissions of particulate dusts from this area have not been included in the revised air emissions risk assessment.

2.2.2 Areas Handling Solvents or Volatile Organic Compounds (VOC's)

2.2.2.1 Emissions from Sources using Electrolyte, or Diethyl Carbonate

Emission Points A20, A21 and A40, A41 and possibly A15 and A35

Activities which include handling of battery electrolyte, or use diethyl carbonate for cleaning, include local area extraction which is then routed via the extraction system to an emission point outside the factory.

AESC has historically undertaken emission monitoring from such areas in the existing nearby plant on the nearby Nissan site, and the results of these monitoring assessments has shown that the emission levels are typically very low, with no abatement being required to ensure that emissions of the VOC's present within the electrolyte are below published BAT-AEL's or target emission limits. Hence no abatement of these emission sources is proposed.

The electrolyte is typically made up of a number of components as presented in Table 2:

Table 2: Typical Composition of Electrolyte

Component of Electrolyte	%	GHS Risk Phrases	Vapour Pressure	VOC?
Ethyl Methyl Carbonate (EMC) Carbonic acid, ethyl methyl ester	50 - 60	Flam. Liq. 2, H225	4300 Pa @25°C	Yes
Ethylene carbonate	20 - 30	Acute Tox. 4 (oral), H302 Eye Irrit. 2, H319 STOT RE 2, H373	1 hPa @20°C	Yes
Lithium hexafluorophosphate (1-)	10 - 20	Acute Tox. 3 (Oral), H301 Skin Corr. 1A, H314 Eye Dam. 1, H318 STOT RE 1, H372	No Data - (will be in solution)	No
Diethyl carbonate	3 - 10	Flam. Liq. 2 H226	14.4 hPa @25°C	Yes
Lithium bis(fluorosulfonyl)amide	0.5 - 4	Acute Tox. 4 (oral), H302 Skin Irrit. 2, H315 Eye Dam. 1, H318 Repr. 2, H361	27.2 Pa @20°C	Yes
1,3-Propanesultone	0.1 - 0.8	Acute Tox. 4(oral),H302 Acute Tox. 4(dermal),H312 Carc. 1B,H350 CMR 1	0.0001 Pa @25°C	No
1,3,2-Dioxathiolane, 2,2-dioxide	0.1 - 3	Acute Tox. 4 (Oral), H302 Skin Corr. 1, H314 Skin Sens. 1B, H317 Eye Dam. 1, H318 Carc. 2, H351 CMR 2	0.91 Pa @20°C	No

Component of Electrolyte	%	GHS Risk Phrases	Vapour Pressure	VOC?
Vinylene carbonate	0.1 - 3	Acute Tox. 3 (dermal), H311 Skin Irrit. 2, H315 Eye Dam. 1, H318 Skin Sens. 1, H317 STOT RE 2, H373 Aquatic Chronic 2, H411	335 Pa @25°C	Yes

The BAT-AEL for emissions of electrolyte vapour as Total VOC is:

- 20 mgC/Nm³ - as published in the WGC BREF and the STS BREF.

Whilst it is acknowledged that electrolyte does contain CMR substances, these are present in low quantities (CMR1 @<1% and CMR2 @ <3% respectively) the particular CMR substances are not considered to be VOC due to their relatively low vapour pressure hence a specific emission limit for CMR substances is not proposed.

2.2.2.2 Emissions from Sources using N-Methyl-2-pyrrolidone (NMP)

Emission Points A10, A12 and A13 and A30, A32 and A33.

Activities which include handling of NMP are split into two types:

- Extraction from areas where NMP is utilised at ambient temperature within enclosed systems; and
- Extraction from cathode coater drying systems where the NMP will be evaporated from the coating.

Areas where NMP is used at ambient temperature are as follows:

- Mixing / preparation of the cathode coating paste (Emission Points A10, A12 and A30, A32).

See Section 2.2.1.2 for detail on the mixing process.

There is no direct extraction from the coating mixing and preparation process, as these systems are closed systems, and hence NMP is not expected to be present in the process area in any significant quantities.

The general operational areas around these systems are extracted using local area extraction for operator protection which is then routed via a HEPA filter prior to venting to atmosphere. Again, there are not anticipated to be any significant concentrations of NMP present in the air extracted by the LEV from the processing area, hence there is no abatement of NMP proposed on these emission points as they are expected to comply with the BAT-AEL without requiring abatement.

Whilst little or no NMP is expected to be present in the air extracted via these emission points, the Air Emissions Risk Assessment has been undertaken using an emissions concentration of 2mg/m³ for NMP for these emission points as a precautionary approach.

Areas where NMP is used at increased temperature are as follows:

- Cathode coating application and drying (Emission Points A13, A33).

N-Methyl-2-pyrrolidone (NMP) is used in the preparation of the cathode coating paste and is then released to air during the coating and drying processes. These activities present the highest potential for release of NMP and hence the system is operated with a dedicated air extraction and abatement system which ensures that a slight negative pressure is maintained on the system to prevent uncontrolled egress of fugitive NMP. The details of the air emissions control system are presented in a separate section below.

N-methyl-2-pyrrolidone is included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)

The BAT-AEL for this as a CMR 1 substance is therefore:

- <1.0 – 5.0 mg/Nm³ - as published in the WGC BREF.

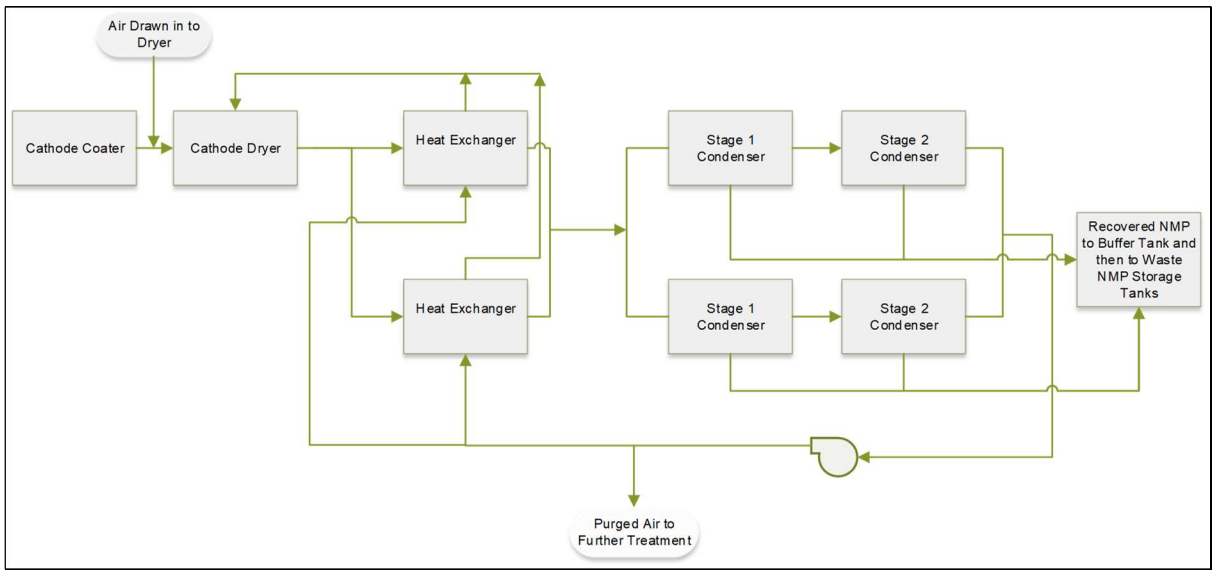
The plant abatement systems have been guaranteed to achieve a maximum emission concentration of 2mg/m³ and will therefore be compliant with the BAT-AEL.

The Air Emissions Risk Assessment has been undertaken using an emissions concentration of 2mg/m³ for NMP for these emission points.

Abatement of Potential NMP Emissions from the Cathode Coater Drier Units

There are 2 cathode coater lines in the North side of the plant, and 1 cathode coater line in the south side of the site. The cathode coater dryers each have a dedicated hot air recirculation system which has been designed to provide NMP emissions abatement and heat recovery. A simplified process flow diagram is presented in Figure 1.

Figure 1: Primary NMP Abatement Flow Diagram



Each of these systems operates as follows:

NMP laden air (at approximately 2,000 ppm) from within the coater dryer is drawn into the air handing system, it leaves the coater dryers at around 150°C and then passed through a pair of heat exchangers which transfer heat to the warm air being returned to the oven after NMP removal.

The cooled NMP laden air around 66°C is then split into two streams, and the air within each stream then passing through a pair of condensers in series (i.e. there are 4 condensers per coater dryer system). The primary condenser on each stream is cooled using cooling water at between 20-25°C, and the secondary condenser is cooled using chilled water at between 7-12°C.

Each of these cooling stages will generate condensed NMP which is transferred to a closed buffer tank from where it is pumped to storage tanks for later collection via ISO tankers for treatment and recovery off site.

The air exiting the secondary condenser is at approximately 12°C and contains around 250ppm of NMP. This air then passes through an in-line fan which then returns the majority of the air to the two heat exchangers mentioned previously, where the heat recovered from the air leaving the coater dryer is used to reheat the treated air to around 114°C which is then returned to the coater dryer i.e. heat integration to minimise the energy demand for heating the coater dryer.

Around 10% (76 Nm³/min) of the treated air is purged from the system prior to its return to the heat exchanger, and this purged air is sent for further abatement prior to being vented to atmosphere.

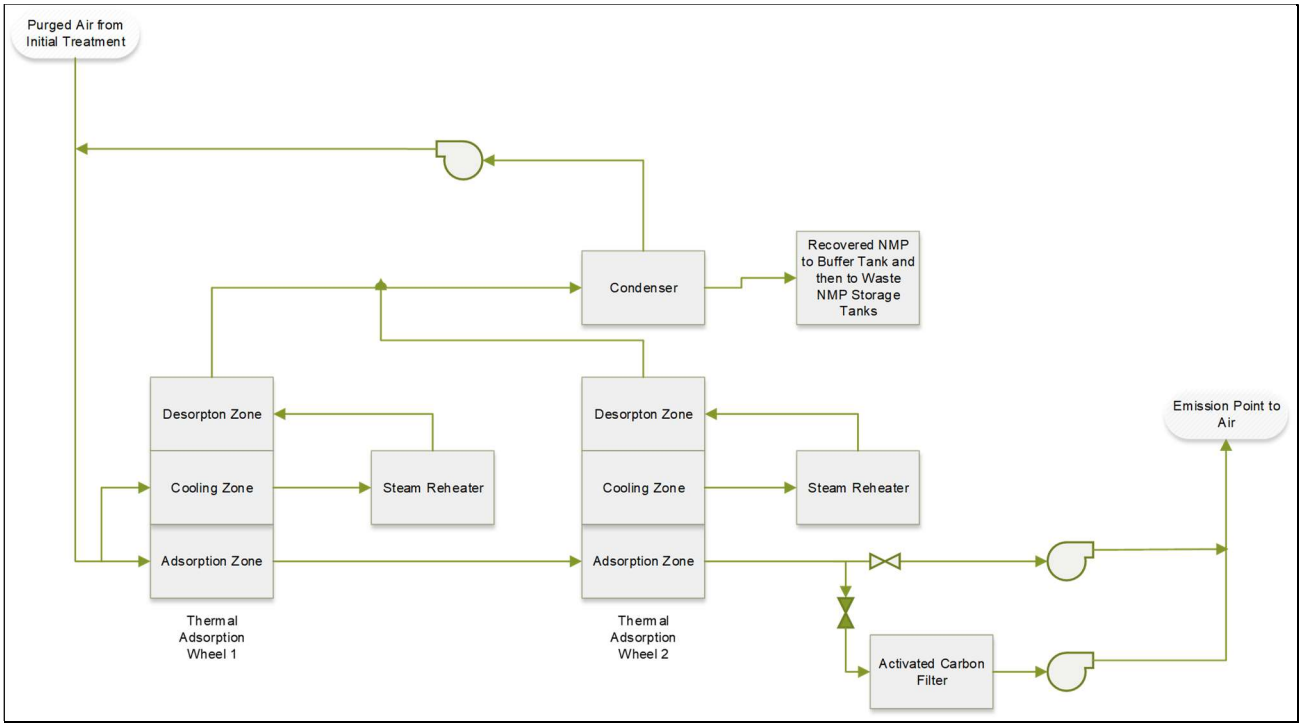
The purged air from the 2 coater dryers in the North Plant connects into a single system for further abatement of NMP content and eventual discharge to atmosphere.

The purged air from the single coater dryer in the South Plant connects into separate dedicated system for further abatement of NMP content and eventual discharge to atmosphere.

These 2 systems for further abatement will be of similar design as follows:

The purged air containing around 250ppm of NMP is fed into two thermal adsorption wheels in series, with a condensation recovery loop, before passing through an in-line fan and being routed to the final emission vent to atmosphere. A simplified process flow diagram is presented in Figure 2.

Figure 2: Secondary NMP Abatement Flow Diagram



The thermal adsorption wheels each operate using a zeolite based adsorption coating in a rotating column with associated cooling and heating to improve NMP removal.

Within the first thermal adsorption wheel unit, the incoming purge air is spilt into 2 streams:

The main flow (around 90%) passes over the adsorption media where NMP is removed prior to the air progressing on to the second thermal adsorption wheel unit. The first thermal

adsorption wheel is expected to reduce the NMP content within the air leaving the unit to around 6ppm.

The smaller air flow (around 10%) passes over a cooling section of the adsorption wheel to further increase NMP adsorption. This air stream then passes through an air reheater (steam heated) which raises the temperature of the air to around 140°C. This reheated air is then fed back to the desorption section of the thermal adsorption wheel, where the NMP is desorbed from the adsorption wheel into the hot air stream.

The second thermal adsorption wheel unit operates in a similar manner and is expected to further reduce the NMP content to around 0.1ppm prior to venting to atmosphere, although a design guarantee value of 2 mg/m³ has been provided.

The NMP laden hot air streams from both the first and second thermal adsorption wheels then combine and are sent to a condenser which is cooled using chilled water at between 7-12°C where the NMP is condensed out and collected for transfer to the closed buffer tank mentioned previously. The air with any trace NMP exiting the condenser then passes through an in-line fan and is returned to the inlet air feed to the first thermal adsorption wheel.

The treated air exiting the second thermal adsorption wheel is normally vented to atmosphere via Emission Points A13 (North Plant Area), and A33 (South Plant Area).

However, there is the option to divert the treated air exiting the second thermal adsorption wheel via an optional 'bypass' tertiary treatment system which is an activated carbon filter. This carbon filter is provided as an additional abatement system that could be used in an emergency event, or should problems arise in the operation of the condensers or the thermal adsorption wheels to ensure that emissions from the process remain compliant with relevant BAT-AEL's and associated permit emission limits. The emission from this carbon filter will be routed to the same emission points.

2.3 Air Emissions Risk Assessment (AERA)

The design of the plant has developed significantly from the conceptual design used to develop the original air emissions risk assessment.

As a result of the changes to the expected number of emission points to air, their locations, and the composition of the air emission streams, a revised air emissions risk assessment has been undertaken.

The assessment has followed the methodology set out in the Environment Agency's guidance on 'Risk Assessments for you Environmental Permit'[1].

The full details of this assessment are presented in the Air Emissions Risk Assessment Report presented in Appendix B.

The assessment has been based upon the details of the emission points to air and the materials potentially present in those air emissions streams as detailed in Appendix A.

It is noted that the detailed design of the South Plant has not yet been fully completed, and AESC engineering have not been able to provide any data on the specific plant layout, stack location, stack dimensions or emissions profiles, as they are still awaiting such data from the design contractor. So the data for the emissions from the South Plant has been prepared as a reasonable estimate of the likely emissions based on the data available.

[1] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit

The emissions data for the South plant has been prepared subject to the following assumptions:

1) The South Plant is assumed to be broadly identical to the North Plant in terms of the activities undertaken and the likely emission sources.
2) AESC has advised that the South Plant is likely to produce around 35% of the overall site output with 65% generated by the North Plant. However, to provide a conservative assessment of potential air quality impacts, it has been assumed that the emissions to air from the South Plant will be equivalent to the North Plant i.e. an overestimate of total emissions of around 30%.
3) The number of emission points and their dimensions, the emissions flow and concentrations and the plant systems they serve, have been assumed to be identical to those for the North Plant.
4) The locations for the emission points on the South Plant have been assumed to mirror across from the North Plant, with minor adjustments made when other structures would require the location to be slightly adjusted.
5) The locations of the vents from the glue modules on the South Plant (A36 - A39) have been estimated.

Once the detailed design data has been received from the contractor, and prior to commencement of operation of the plant, AESC will review the emissions data and provide the Local Authority with and updated table detailing all the emission points and the emissions profiles. An updated site layout plan will also be provided.

If required, a revised air quality assessment will be undertaken and submitted to the Local Authority. However, it is envisaged that the approach taken in the attached AERA should include sufficiently conservative assumptions that the emissions from the final plant design, and the associated air quality impacts will be equal to or less than those assessed in the attached AERA report.

The assessment has reviewed the potential offsite air quality impacts associated with the emissions from the plant during normal operation.

An initial screening assessment has been undertaken using N-methyl-2-pyrrolidone (NMP) as the exemplar substance for assessment of potential impacts. NMP has been selected as it is known to be the most hazardous of the VOC's in use at the site, having a H360D risk phrase indicating that it is a CMR 1 substance. There are also published long and short-term Environmental Assessment levels (EAL's) for NMP within the Environment Agency's guidance.

Whilst it is acknowledged that there will be emissions of other VOC's from the process, Table 3 presents a comparison of the main VOC species in use in the process and a comparison of the available published exposure and toxicity data on each substance.

It is noted that in addition to the main process VOC materials, acetone and isopropyl alcohol are used as cleaning solvents in the plant, however, emissions to air of these VOC's will be much lower that the VOC's used within the main production processes, and both materials are significantly less hazardous than the VOC materials in use in the main processes. These materials have therefore been excluded from the assessment.

As can be clearly seen, NMP is the only substance for which EAL's have previously been in place, and for which published UK workplace exposure data is available.

The ECHA REACH registration published data also indicates that NMP is the most hazardous of the substances in use at the site.

The DNEL data published in the MSDS documents published by Carl Roth indicates that NMP has a slightly lower DNEL than Ethylene Carbonate (EC), and that Diethyl Carbonate (DEC) has a significantly higher DNEL.

However, the DNEL for Ethyl Methyl Carbonate (EMC) presented on the MSDS documents is slightly lower than that for NMP. However, in the absence of additional supporting data in relation to Workplace Exposure Limits, or Environmental Assessment Levels for EMC, NMP has been selected as the exemplar substance for the initial screening assessment of potential air quality impacts.

As the DNEL for EMC is 10.3 mg/m^3, and the DNEL for NMP is 14.4 mg/m^3, i.e. approximately 30% lower, a sensitivity review of the modelling output data has been undertaken to determine whether a 30% reduction in the EAL applied would have any implication on the findings of the assessment.

The assessment has concluded that the proposed emissions from the AESC plant will not lead to any significant air quality or human health impacts.

Table 3: Comparison of VOC's Emitted from the Plant

Substance	N-methyl-2-pyrrolidone (NMP)	Diethyl Carbonate (DEC)	Ethylene Carbonate (EC)	Ethyl Methyl Carbonate (EMC)
CAS	872-50-4	105-58-8	96-49-1	623-53-0
Source of Emission	Cathode Coating	Volatile component of Battery Electrolyte (3 – 10%) And also used in small quantities for cleaning	Volatile component of Battery Electrolyte (20 – 30%)	Volatile component of Battery Electrolyte (50 -60%)
Published EAL's within Current EA Risk Assessment Guidance	None	None	None	None
Published EAL's within Previous EA H1 Guidance	ST 30,900 µg/m³ LT 1,030 µg/m³ (Ref. H1 – 2003)	None	None	None
Published workplace exposure limits – UK EH40	LT (8hr TWA) 40 mg/m³ ST (15 min) 80 mg/m³	None	None	None
ECHA Published Data	H360D - Repr.1B H335 - STOT SE3 H319 - Eye Irrit.2 H315 - Skin Irrit.2 Acute Toxicity Inhalation LC50 > 5.1mg/l Repeat Dose Toxicity Inhalation NOAEC – Systemic Toxicity 1.0 mg/l NOAEC - Upper Respiratory Tract 0.5 mg/l	H226 – Flam liq. 3 Acute Toxicity Inhalation NOEC 19.5 mg/l Repeat Dose Toxicity Inhalation NOAEC 18.995 mg/l	H302 - Acute Tox. 4 (oral) H319 - Eye Irrit. 2 H373 - STOT RE 2 Acute Toxicity Inhalation No mortality at 730 mg/m³ Repeat Dose Toxicity Inhalation No signs of Toxicity – no limits derived	H225 - Flam Liq. 2 No Toxicity data

Substance	N-methyl-2-pyrrolidone (NMP)	Diethyl Carbonate (DEC)	Ethylene Carbonate (EC)	Ethyl Methyl Carbonate (EMC)
Other Data Sources. **DNEL from UK MSDS for each substance published by Carl Roth**	DNEL Chronic – Systemic effects 14.4 mg/m³ DNEL Chronic - Local effects 40 mg/m³	DNEL Chronic – Systemic effects 69.79 mg/m³	DNEL Chronic – Systemic effects 15 mg/m³	DNEL Chronic – Systemic effects 10.3 mg/m³

2.4 Emissions Monitoring – Emissions to Air

The proposed monitoring of emissions from the plant will be undertaken in compliance with the requirements of:

- EU BAT Reference Document – Monitoring of Emissions to Air and Water from Industrial Emissions Directive Installations (ROM)- July 2008.
- Environment Agency Monitoring Stack Emissions: Environmental Permits (19 December 2019) (the formerly the EA's M1 and M5 guidance notes).
- BS EN 15259

This will include provision of suitable access routes and platforms as required and the siting and installation of suitable sample ports.

Prior to undertaking stack emissions monitoring a Site-Specific Protocol (SSP) will be prepared to ensure the monitoring is carried out in accordance with the EA guidance, referenced note outlined above, to ensure that representative samples are taken. Specifically, the SSP will consider the following aspects:

- Selection of the sampling position, sampling plan and sampling points.
- Access, facilities and services required.
- Safety considerations.

The SSP will ensure that a representative sample is obtained from the stack.

The sampling approach, technique, method, and equipment that are chosen will ensure:

- A safe means of access to the sampling position.
- A means of entry for sampling equipment into the stack.
- Adequate space for the equipment and personnel.
- Provision of essential services such as electricity.

Monitoring will be undertaken by an appropriately accredited third-party stack monitoring company, in compliance with the requirements of MCERTS as a minimum standard.

All of the emission points are anticipated to have VOC emission levels of below 1kg of VOC as carbon per hour. And so continuous monitoring of emissions is not required.

Emission Points A10, A12, A13 and A30, A32, A33 will only emit one VOC species i.e. NMP, and hence rather than undertaking speciated VOC testing to specifically test for NMP, it is proposed to analyse for Total VOC with the results generated being assumed to be 100% NMP i.e. Total VOC analysis will be used as a surrogate to provide an assessment of NMP concentrations.

Emission Points A15 and A35 have been included in the application as having the potential to have emissions linked to the presence of the volatile components of the battery electrolyte i.e. Diethyl Carbonate (DEC), Ethylene Carbonate (EC) and Ethyl Methyl Carbonate (EMC). However, The de-gas roll press does not use these materials and it is suspected that they will not be present in the air emitted. It is therefore proposed to undertake a one-off set of confirmatory testing for Total VOC on these emission points. If no VOC is identified, it is then proposed that no further monitoring be undertaken. If VOC is identified, then periodic monitoring in line with the BAT requirements will be undertaken.

Emission points A15, A20, A21 and A35, A40, A41 are expected to emit air containing the volatile components of the battery electrolyte i.e. Diethyl Carbonate (DEC), Ethylene

Carbonate (EC) and Ethyl Methyl Carbonate (EMC). The proposed monitoring on these emission points will be for Total VOC. No speciated assessment of VOC content is proposed.

Details of the proposed monitoring and emission limits for all emission points is presented in the Excel Spreadsheet presented as Appendix A.

Table 4 presents a summary of the proposed monitoring of emissions to air.

Table 4: Proposed Monitoring

Substance	Monitoring Required	Frequency Of Monitoring	Monitoring Test Method (Periodic Monitoring)	Data to be Reported
Total Volatile Organic Compounds (TVOC)	The predicted mass emissions of TVOC from all of the emission points will be <1kg/h per emission point. There is no requirement for continuous monitoring of any of the emission points, and periodic monitoring is therefore proposed.	Periodic monitoring will be undertaken at least once every year for emission points with emissions of TVOC >0.1 kg/hour, and every 3 years for emission points with emissions of TVOC <0.1 kg/hour Emission points for annual monitoring: A10, A12, A13, A20, A21 and A30, A32, A33, A40, A41 Emission points for 3 yearly monitoring: A15, A16, A17, A18, A19 and A35, A36, A37, A38, A39.	EN 12619 extractive sampling and FID analyser. or EN ISO 13199. extractive sampling and a NDIR analyser equipped with a catalytic converter for the oxidation of VOCs to carbon dioxide.	Daily Average / Average over the monitoring period

No monitoring of other emission points is proposed.

Table 5 presents the BAT-AEL's to be applied as emission limits to each emission point.

Table 5: Proposed BAT-AEL's

Emission Points	Substances Present	Emission Limit	Justification
A10, A12, A13, and A30, A32, A33,	NMP to be assessed as: Total Volatile Organic Compounds (TVOC)	5 mg/Nm³	NMP is a CMR 1 substance
A20, A21 and A40, A41	VOC vapours from electrolyte use comprising: Diethyl Carbonate (DEC) Ethylene Carbonate (EC) Ethyl Methyl Carbonate (EMC) To be assessed as: Total Volatile Organic Compounds (TVOC)	20 mgC /Nm³	There are no CMR substances expected to be emitted. VOC mass emission rate is >100g/h
A15 and A35	Possible trace VOC vapours from the presence of electrolyte comprising: Diethyl Carbonate (DEC) Ethylene Carbonate (EC) Ethyl Methyl Carbonate (EMC) To be assessed as: Total Volatile Organic Compounds (TVOC)	No BAT AEL applies	There are no CMR substances expected to be emitted. VOC mass emission rate is <100g/h Hence no BAT-AEL applies
A16, A17, A18, A19 and A36, A37, A38, A39.	Possible VOC Emissions from Glue Modules To be assessed as: Total Volatile Organic Compounds (TVOC)	No BAT AEL applies	There are no CMR substances expected to be emitted. VOC mass emission rate is <100g/h Hence no BAT-AEL applies

3.0 Justification for the Selection of NMP as the Solvent for Use in Cathode Coating

NMP is proposed for use in the cathode coating process.

At the current time AESC is not aware of any less harmful solvent that is proven and commercially available for use in this process.

This position is supported by the following published report:

- Report on the state of the art for N-Methyl-2-pyrrolidone in the production of lithium-ion battery cells. RWTH Aachen University / PEM Motion 2020.

This report is included as Appendix C to this report.

Section 2.2.2.2 of this report presents a more detailed explanation of the potential sources of NMP emissions from the site activities, and the abatement systems proposed. These systems have been developed to minimise potential NMP emissions and ensure that any emissions are compliant with the appropriate BAT-AEL's for CMR 1 substances.

As can be seen within this section, the NMP emissions abatement systems will be installed with a back-up VOC abatement system in the form of an activated carbon filter which would be used to ensure that the NMP emissions from the cathode coater process would be suitably abated in the event of a process upset (OTNOC) or operating issues or failure of the abatement plant.

An updated air emissions risk assessment is under preparation in order to demonstrate that the emissions of VOC's (including NMP) from the process will not lead to any significant air quality or human health impacts.

4.0 Demonstration of BAT Compliance

This Section presents a demonstration of compliance with the specific BAT requirements of the sector guidance and applicable BREF Notes / BAT Conclusions as requested by the Local Authority. The detailed Assessments are presented in Appendices D and E as outlined in Table 6.

Table 6: BAT Conclusion Compliance Assessments

EU BAT Conclusions	Applicability to the Installation Activities	Location of Assessment
Surface Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals (STS) - 2020	Applicable	Appendix D
Surface Treatment of Metals and Plastics (STM) - 2006	Applicable to the coating of other metal and plastic surfaces	Appendix E

In addition to the EU BAT conclusions listed above, consideration has also been given to the requirements of the Common Waste Gas Management and Treatment Systems in the Chemical Sector (WGC) BREF and associated BAT conclusions which include certain requirements in relation to the emission of volatile organic compounds (VOC) as presented below:

BATC 9 *- In order to increase resource efficiency and to reduce the mass flow of organic compounds sent to the final waste gas treatment, BAT is to recover organic compounds from process off-gases by using one or a combination of the techniques given below and to reuse them.*

Techniques		Description
a.	*Absorption (regenerative)*	*See Section 1.4.1. of BATc*
b.	*Adsorption (regenerative)*	*See Section 1.4.1. of BATc*
c.	*Condensation*	*See Section 1.4.1. of BATc*

BATC 11 *- In order to reduce channelled emissions to air of organic compounds, BAT is to use one or a combination of the techniques given below.*

Technique		Description	Applicability
a.	*Adsorption*	*See Section 1.4.1. of BATc*	*Generally applicable.*
b.	*Absorption*	*See Section 1.4.1. of BATc*	*Generally applicable.*
c.	*Catalytic oxidation*	*See Section 1.4.1. of BATc*	*Applicability may be restricted by the presence of catalyst poisons in the waste gases.*
d.	*Condensation*	*See Section 1.4.1. of BATc*	*Generally applicable.*
e.	*Thermal oxidation*	*See Section 1.4.1. of BATc*	*Applicability of recuperative and regenerative thermal oxidation to existing plants may be restricted by design and/or operational constraints. Applicability may be restricted where the energy demand is excessive due to the low concentration of the compound(s) concerned in the process off-gases.*
f.	*Bioprocesses*	*See Section 1.4.1. of BATc*	*Only applicable to the treatment of biodegradable compounds.*

BAT-associated emission levels (BAT-AELs) for channelled emissions to air of organic compounds.

Substance / Parameter	BAT-AEL (mg/Nm^3) Daily average or average over the sampling period (1)
Total volatile organic carbon (TVOC)	*< 1 – 20 (2)(3)(4)(5)*
Sum of VOCs classified as CMR 1A or 1B	*< 1 - 5 (6)*
Sum of VOCs classified as CMR 2	*< 1 - 10 (7)*

(2) TVOC is expressed in mg C/Nm^3.

(3) In the case of polymer production, the BAT-AEL may not apply to emissions from the finishing steps (e.g., extrusion, drying, blending) and from polymer storage.

(4) The BAT-AEL does not apply to minor emissions (i.e., when the TVOC mass flow is below e.g., 100 g C/h) if no CMR substances are identified as relevant in the waste gas stream based on the inventory given in BAT 2.

(5) The upper end of the BAT-AEL range may be higher and up to 30 mg C/Nm^3 when using techniques to recover materials (e.g., solvents, see BAT 9), if both of the following conditions are fulfilled:

- *the presence of substances classified as CMR 1A/1B or CMR 2 is identified as not relevant (see BAT 2);*
- *the TVOC abatement efficiency of the waste gas treatment system is ≥ 95 %.*

(6) The BAT-AEL does not apply to minor emissions (i.e., when the mass flow of the sum of the VOCs classified as CMR 1A or 1B is below e.g., 1 g/h).

(7) The BAT-AEL does not apply to minor emissions (i.e., when the mass flow of the sum of the VOCs classified as CMR 2 is below e.g., 50 g/h).

The only channelled emissions to air from a process activity at the site are from the Cathode coater and drying units. All other emission points are from area LEV systems provided for operator protection and humidity control.

The proposed abatement techniques for the use of NMP in each of the cathode coaters and a comparison against the BATc of the WGC BREF are summarised in Table 7.

Table 7: Summary of NMP Emissions Abatement and BAT Demonstration

Layer of Abatement	NMP Concentration Achieved	Technique	BAT Compliance
1	250ppm	2 Stage Condensation - Stage 1 using cooling water at 20°C - Stage 2 using chilled water at 7°C	BATC 9c and 11d. Condensation with recovery of NMP
2	6ppm	Thermal Adsorption Wheel 1 - Adsorption with integrated desorption and NMP separation via condensation	BATC 9b and 11a – Adsorption (regenerative) using zeolites; and BATc 9c and 11d – Condensation with recovery of NMP
3	0.1ppm	Thermal Adsorption Wheel 2 - Adsorption with integrated desorption and NMP separation via condensation	BATC 9b and 11a – Adsorption (regenerative) using zeolites; and BATc 9c and 11d – Condensation with recovery of NMP Total VOC and NMP (CMR1) emissions below required BAT-AEL
4 Emergency / OTNOC use only	0.1ppm	Adsorption Carbon Filter	BATC 9b and 11a – Adsorption using activated carbon. Total VOC and NMP (CMR1) emissions below required BAT-AEL

NMP has a relatively low vapour pressure for a VOC, at 0.032Kpa @ 20°C, and hence is ideally suited for abatement techniques involving condensation for treatment of air containing higher concentrations of NMP, with subsequent treatment using adsorption for treatment of air containing lower concentrations of NMP.

The proposed abatement measures will achieve compliance with the BAT-AEL's for emissions for Total VOC, and also for CMR1 substances (NMP).

In addition to this the process has been designed to allow the recovery and storage of NMP. Whilst currently it is not possible to re-use the NMP directly within the process (due to product quality requirements) the NMP will be collected and sent offsite either for direct re-

use, treatment to allow it to be returned to site and re-used, or other treatment / disposal options. The specific route by which the NPM will be processed offsite, has not yet been selected, however, it will be selected with due consideration of the waste hierarchy so as to minimise potential environmental burdens / impacts.

The proposed NMP abatement system discussed in Section 2.2.2.2 is therefore considered to be representative of BAT for this duty.

Appendix A Air Emissions Data

Additional Data in Support of LAPPC Part A2 Environmental Permit Application for the AESC UK No 2 Plant

Battery Manufacturing Facility

AESC UK Plant 2 Limited

SLR Project No.: 416.065272.00001

15 March 2024

Appendix B Air Emissions Risk Assessment (AERA)

Additional Data in Support of LAPPC Part A2 Environmental Permit Application for the AESC UK No 2 Plant

Battery Manufacturing Facility

AESC UK Plant 2 Limited

SLR Project No.: 416.065272.00001

15 March 2024

Appendix C Report on the state of the art for N-Methyl-2-pyrrolidone in the production of lithium-ion battery cells – RWTH Aachen University

Additional Data in Support of LAPPC Part A2 Environmental Permit Application for the AESC UK No 2 Plant

Battery Manufacturing Facility

AESC UK Plant 2 Limited

SLR Project No.: 416.065272.00001

15 March 2024

SLR

Appendix D BAT Justification against the Surface Water Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals Sector BATc

Additional Data in Support of LAPPC Part A2 Environmental Permit Application for the AESC UK No 2 Plant

Battery Manufacturing Facility

AESC UK Plant 2 Limited

SLR Project No.: 416.065272.00001

15 March 2024

Table A: Assessment of Indicative BAT for the Surface Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals

The following table references the BAT conclusions associated with the EU BAT reference note on: Surface Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals (STS BREF). The table presents the BATc requirements, and the recent response from the Local Authority – with additional clarification and further data on BAT compliance presented in the final column.

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data
Scope	These BAT conclusions concern the following activities specified in Annex I to Directive 2010/75/EU: • 6.7: Surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating, with an organic solvent consumption capacity of more than 150 kg per hour or more than 200 tonnes per year. • 6.10: Preservation of wood and wood products with chemicals with a production capacity exceeding 75 m3 per day other than exclusively treating against sapstain. • 6.11: Independently operated treatment of waste water not covered by Directive 91/271/EEC provided that the main pollutant load originates from activities specified in point 6.7 or 6.10 of Annex I to Directive 2010/75/EU. These BAT conclusions also cover the combined treatment of waste water from different origins provided that the main pollutant load originates from the activities specified in point 6.7 or 6.10 of Annex I to Directive 2010/75/EU and that the waste water treatment is not covered by Council Directive 91/271/EEC (1). These BAT conclusions do not address the following: For surface treatment of substances, objects or products using organic solvents: — Waterproofing of textiles by means other than the use of a solvent-based continuous film. This may be covered by the BAT conclusions for the textiles industry (TXT). — Printing, sizing and impregnation of textiles. This may be covered by the BAT conclusions for the textiles industry (TXT). — Lamination of wood-based panels. — Conversion of rubber. — Manufacturing of coating mixtures, varnishes, paints, inks, semiconductors, adhesives or pharmaceutical products. — On-site combustion plants unless the hot gases generated are used for direct contact heating, drying or any other treatment of objects or materials. These may be covered by the BAT conclusions for large combustion plants (LCP) or by Directive 2015/2193/EU of the European Parliament and of the Council (2).		Whilst the battery manufacturing process does include the preparation and application of a paste coating to the anode and cathode components with subsequent drying, AESN notes that this EU BREF document does not mention or reference the manufacture of batteries, or the specific processes undertaken as part of the manufacturing processes at any point. Hence it is considered that certain aspects of this BREF and the associated BAT conclusions are not relevant to or applicable to the AESC processes. However, in order to demonstrate that the proposed activities and operations will be representative of BAT, a review of BAT compliance against the published BAT conclusions are presented below, with areas of variance identified, and where alternative methods better suited to the battery manufacturing processes are to be utilised in preference to the methods defined within the BAT Conclusions, then these will be identified and the justification for their selection provided.
Environmental Management Systems			
BATc 1	In order to improve the overall environmental performance, BAT is to elaborate and implement an Environmental Management System (EMS). that incorporates all of the following features: (i) commitment, leadership, and accountability of the management, including senior management, for the implementation of an effective EMS; (ii) an analysis that includes the determination of the organisation's context, the identification of the needs and expectations of interested parties, the identification of characteristics of the installation that are associated with possible risks for the environment (or human health) as well as of the applicable legal requirements relating to the environment; (iii) development of an environmental policy that includes the continuous improvement of the environmental performance of the installation; (iv) establishing objectives and performance indicators in relation to significant environmental aspects, including safeguarding compliance with applicable legal requirements; (v) planning and implementing the necessary procedures and actions (including corrective and preventive actions where needed), to achieve the environmental objectives and avoid environmental risks; (vi) determination of structures, roles and responsibilities in relation to environmental aspects and objectives and provision of the financial and human resources needed;	The site is an ISO 14001 certified plant. Please confirm the site status in relation to ISO 14001 certification. Is it possible from site commissioning or does an audit have to be undertaken first? Please confirm that the EMS will contain additional features in (i) to (iii) p12 of IG. More information needed – What documentation exists to evidence the EMS?	See Section 2.1 of this Report The site management systems have not yet been developed. The EMS will be prepared in accordance with the requirements of ISO14001, and will be in place prior to commencement of operation of the site permitted activities. It is envisaged that AESC will seek to get the EMS formally accredited and certified to the standard at the earliest appropriate time. The EMS will be developed to ensure that the requirements of BATC1 are all incorporated.

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data
	(vii) ensuring the necessary competence and awareness of staff whose work may affect the environmental performance of the installation (e.g. by providing information and training); (viii) internal and external communication; (ix) fostering employee involvement in good environmental management practices; (x) establishing and maintaining a management manual and written procedures to control activities with significant environmental impact as well as relevant records; (xi) effective operational planning and process control; (xii) implementation of appropriate maintenance programmes; (xiii) emergency preparedness and response protocols, including the prevention and/or mitigation of the adverse (environmental) impacts of emergency situations; (xiv) when (re)designing a (new) installation or a part thereof, consideration of its environmental impacts throughout its life, which includes construction, maintenance, operation and decommissioning; (xv) implementation of a monitoring and measurement programme; if necessary, information can be found in the Reference Report on Monitoring of Emissions to Air and Water from IED Installations; (xvi) application of sectoral benchmarking on a regular basis; (xvii) periodic independent (as far as practicable) internal auditing and periodic independent external auditing in order to assess the environmental performance and to determine whether or not the EMS conforms to planned arrangements and has been properly implemented and maintained; (xvii) evaluation of causes of nonconformities, implementation of corrective actions in response to nonconformities, review of the effectiveness of corrective actions, and determination of whether similar nonconformities exist or could potentially occur; (xix) periodic review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness; (xx) following and taking into account the development of cleaner techniques. Specifically for surface treatment using organic solvents, BAT is also to incorporate the following features in the EMS: (i) Interaction with quality control and assurance as well as health and safety considerations. (ii) Planning to reduce the environmental footprint of an installation. In particular, this involves the following: (a) assessing the overall environmental performance of the plant (see BAT 2); (b) taking into account cross-media considerations, especially the maintenance of a proper balance between solvent emissions reduction and consumption of energy (see BAT 19), water (see BAT 20) and raw materials (see BAT 6); (c) reducing VOC emissions from cleaning processes (see BAT 9). (iii) The inclusion of: (a) a plan for the prevention and control of leaks and spillages (see BAT 5 (a)); (b) a raw material evaluation system to use raw materials with low environmental impact and a plan to optimise the use of solvents in the process (see BAT 3); (c) a solvent mass balance (see BAT 10); (d) a maintenance programme to reduce the frequency and environmental consequences of OTNOC (see BAT 13); (e) an energy efficiency plan (see BAT 19 (a)); (f) a water management plan (see BAT 20 (a)); (g) a waste management plan (see BAT 22 (a)); (h) an odour management plan (see BAT 23). *Note* Regulation (EC) No 1221/2009 establishes the European Union eco-management and audit scheme (EMAS), which is an example of an EMS consistent with this BAT. *Applicability* The level of detail and the degree of formalisation of the EMS will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have.		
Overall Environmental Performance			

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td>BATc 2</td><td>In order to improve the overall environmental performance of the plant, in particular concerning VOC emissions and energy consumption, 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.</td><td>No evidence in application for a plan to minimise VOC emissions. Methodology for a solvent management plan is contained in Envision AESC Solvent Management Plan p15, but this needs to be updated to reflect IG Appendix 3.
Please update the Solvent Management Plan to reflect Appendix 3 of the IG. Are there calculations to prove the efficiency of the collection and abatement separately for NMP EC and DEC?
From Bat Assessment; Energy Consumption is to be monitored on a monthly basis and annual report generated.
This is a new factory and best practice will be used during the design process to minimise energy consumption.
PPM/Daily Checks (CMMS) burner efficiency checks on an annual basis Grid electricity consumption forecast Appendix 5 of Process Description</td><td>See Section 2.1 of this Report for details on the EMS and the development of associated procedures and plans.
A revised Solvent Management Plan (SMP) will be developed for the site activities which will be updated to reflect the requirements of Appendix 3 of the IG. This SMP will be in place prior to commencement of operation of the plant, and will be subject to periodic review and update.
Section 2.2 of this report presents a more detailed explanation of the potential sources of VOC emissions from the site activities, and the abatement systems proposed. These systems have been developed to minimise potential VOC emissions and ensure that VOC emissions are compliant with the appropriate BAT-AEL’s. Where appropriate emissions abatement systems have been incorporated into the design e.g. NMP emissions from the Cathode Coater systems.
As part of the development of the EMS, plant efficiency monitoring, reporting and target setting protocols will be established and undertaken which will include assessment of energy use, efficient use of raw materials, and minimisation of VOC emissions.</td></tr>
<tr><td colspan="4">Selection of Raw Materials</td></tr>
<tr><td>BATc 3</td><td>In order to prevent or reduce the environmental impact of the raw materials used, BAT is to use both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Use of raw materials with a low environmental impact</td><td>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.</td><td>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.</td></tr>
<tr><td>(b)</td><td>Optimisation of the use of solvents in the process</td><td>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 ne-cessary actions (e.g. colour batching, optimising spray pulverisation).</td><td>Generally applicable.</td></tr>
</table></td><td>Discussion of substitution of NMP within Envision AESC Solvent Management Plan p11.

Comments from LAU to consider
I think their argument to continue to use NMP is weak, and it isn’t entirely clear their reasons. They refer to UKBIC but it’s not clear in what context and given UKBIC operations are considerable smaller operating under a part B permit I want to see more justification. You may wish to note that in UKBIC application submission their risk assessment and the limit of acceptability was taken as the Derived No Effect Limit (DNEL) for the general population in the Reach Dossier published by the European Chemicals Agency. The key finding was that using the predicted rate of solvent emission from the cathode coating process after abatement, assuming the worst possible case with effective chimney height of 0 and worst possible atmospheric conditions for dispersion, the predicted ground level concentration beyond the boundary was four orders of magnitude below the DNEL.
More information needed
Envision need to describe in greater depth what steps are being made (by either operator or industry sector) to evaluate less harmful alternatives e.g annual report on progress, industry or company research Further details should be provided to explain how emissions of VOC’s (NMP in particular) will be contained or rendered harmless to the local environment if abatement plant should fail or the site is other than normal operating conditions (OTNOC). What is the concentration of NMPEC/DC pre-abatement in each stack.

Please clarify the technical arrangements for collecting NMP and EC/DEC (eg position of the chillers and adsorbents. Is each stack provided with separate abatement? What is the estimated efficiency of each element of abatement?.</td><td>NMP is proposed for use in the cathode coating process.
At the current time AESC is not aware of any less harmful solvent that is proven and commercially available for use in this process.
This position is supported by the following published report:
• Report on the state of the art for N-Methyl-2-pyrrolidone in the production of lithium-ion battery cells. RWTH Aachen University / PEM Motion 2020.
This report is included as Appendix C to this report.

Section 2.2 of this report presents a more detailed explanation of the potential sources of VOC emissions from the site activities, and the abatement systems proposed. These systems have been developed to minimise potential VOC emissions and ensure that VOC emissions are compliant with the appropriate BAT-AEL’s. Where appropriate emissions abatement systems have been incorporated into the design e.g. NMP emissions from the Cathode Coater systems.
As can be seen within this section, the NMP emissions abatement systems will be installed with a back-up VOC abatement system in the form of an activated carbon filter which would be used to ensure that the NMP emissions from the cathode coater process would be suitably abated in the event of a process upset (OTNOC) or operating issues or failure of the abatement plant.

An updated air emissions risk assessment is under preparation in order to demonstrate that the emissions of VOC’s (including NMP, EC and DEC) from the process will not lead to any significant air quality impacts.</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td></td><td></td><td>Maintenance arrangements for this plant/equipment? Point of final discharge appears to be 33m above ground level.

Some discussion in the solvent management plan, p14.
“Envision AESC UK LTD is ISO14001 certified. The environmental management system will incorporate solvent monitoring and management requirements with the objective to comply with the regulation. Records of purchases of solvent and solvent containing materials will be maintained, to inform the total input of solvent. A solvent monitoring system will be put in place to inform the solvent outputs of the facility from the activities.”</td><td></td></tr>
<tr><td>BATc 4</td><td>In order to reduce solvent consumption, VOC emissions and the overall environmental impact of the raw materials used, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Use of high-solids solvent-based paints/coatings/ varnishes/inks/adhesives</td><td>Use of paints, coatings, liquid inks, varnishes and adhesives containing a low amount of solvents and an increased solids content.</td><td rowspan="8">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.</td></tr>
<tr><td>(b)</td><td>Use of water-based paints/coatings/inks/ varnishes/adhesives</td><td>Use of paints, coatings, liquid inks, varnishes and adhesives where organic solvent is partially replaced by water.</td></tr>
<tr><td>(c)</td><td>Use of radiation-cured inks/coatings/paints/ varnishes/adhesives</td><td>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.</td></tr>
<tr><td>(d)</td><td>Use of solvent-free two component adhesives</td><td>Use of solvent-free two-component adhesive materials consisting of a resin and a hardener.</td></tr>
<tr><td>(e)</td><td>Use of hot-melt adhesives</td><td>Use of coating with adhesives made from the hot extrusion of synthetic rubbers, hydrocarbon resins and various additives. No solvents are used.</td></tr>
<tr><td>(f)</td><td>Use of powder coatings</td><td>Use of solvent-free coating which is applied as a finely divided powder and cured in thermal ovens.</td></tr>
<tr><td>(g)</td><td>Use of laminate film for web or coil coating</td><td>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.</td></tr>
<tr><td>(h)</td><td>Use of substances which are not VOCs or are VOCs of a lower volatility</td><td>Substitution of high-volatility VOC substances with others containing organic compounds that are non-VOCs or VOCs of a lower volatility (e.g. esters).</td></tr>
</table></td><td>None of the techniques appear to be relevant to the site.
Possibly h) is relevant as NMP has low volatility, what are the volatility of other VOc’s used on the site. Where other techniques are used, operators should indicate how these techniques achieve at least an equivalent level of environmental performance.
Where techniques are not used, operators should give their reasoning. Some of the techniques in BAT 4 may not be applicable to some activities. Where other techniques are used, operators should indicate how these techniques achieve at least an equivalent level of environmental performance. Once complete, a summary of the review should be included as an operating technique in the permit.
More information needed Please provide further information to demonstrate how this BAT conclusion will be complied with.</td><td>This BAT conclusion and the techniques listed do not relate to the activities proposed at the site and therefore are not applicable.

The BAT measures identified all relate to activities undertaken in the more traditional surface treatment processes e.g. painting, degreasing etc. and do not align with the specific processes undertaken in the application of paste coatings to anodes and cathodes as proposed under this battery manufacturing activity.

The anode coating process is water based and does not utilise VOC materials.

The cathode coating process utilises NMP as the solvent for the preparation of a paste which is then applied to the metallic cathodes.

As outlined in the response to BATc 3, there is no alternative to the use of NMP in this process, and hence the process has been designed to minimise VOC emissions and recover NMP in so far as it reasonably possible – a detailed explanation of the measures proposed is provided in Section 2.2 of this report.</td></tr>
<tr><td colspan="4">Storage and Handling of Raw Materials</td></tr>
<tr><td>BATc 5</td><td>In order to prevent or reduce fugitive VOC emissions during storage and handling of solvent-containing materials and/or hazardous materials, BAT is to apply the principles of good housekeeping by using all of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="3">Management Techniques</td></tr>
</table></td><td>From BAT assessment
All solvents are controlled, and spill kits are available. Solvents are managed in accordance with HSG51 - Storage of flammable liquids in containers HSG140 - Safe use and handling of flammable liquids HSG 176 - The storage of flammable liquids in tanks.
All flammable liquids are stored in bunded areas with a capacity of 110% or more of largest container or greater than 25% of total as per HSG176 and HSG51. Solid materials are contained within a sealed system (Dust etc) A</td><td>Preparation and implementation of a plan for the prevention and control of leaks and spillages
(a) The site will be a COMAH Establishment and as such a full set of Site Emergency response (including spill and major incident response) procedures will be developed and implemented at the site.
The COMAH documentation and assessments is still under development but will be in place prior to commencement of operations of the site processes.</td></tr>
</table>

BATc No.	BAT Requirements				Response from the Local Authority	AESC Additional Data
	(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.	COMAH safety report has been prepared for the installation, procedures will include Emergency action to be taken in the event of a Chemical Spill. Is this finalised and can we now have a copy? Raw materials and Waste Inventory details storage locations Appendix 4 of process description There are 4 fresh NMP storage tanks each with a maximum capacity of 25 m3. The tanks are located within the NMP canopy within a shared bunded area with the Waste NMP tanks. NMP is discharged into the Fresh NMP tanks from road tankers at a flowrate of 480 lpm and a maximum temperature of 30 °C, p9 of process description. Bat Assessment section on Delivery Storage and Handling of Raw materials, p27 of process description lists the following: Displaced air vents are sited to prevent offensive odour beyond the site boundary. More information needed why not vent back to delivery vehicle or to NMP condensing system to be recovered? Displaced contaminated air (containing NMP or other VOCs ie fugitive emissions) should be captured and routed to abatement plant or otherwise dealt with. Where are fugitive emissions from materials transfer and storage routed to?	• The site management systems will include a plan for the prevention and control of leaks and spillages. • Leak prevention will be managed through a pre-planned maintenance and inspection programme. This will include 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. • Spill control and clean-up will be managed through a spill response procedure. • Major site incidents will be managed through an emergency response procedure. • These procedures will be developed as part of the site EMS and COMAH compliance requirements which are still under development – see Section 2.1 of this report. These procedures will incorporate: o site incident response plans for small and large spillages; o identification of the roles and responsibilities of the persons involved in managing and responding to the incident; o Key contact details for the offsite Emergency Services, Environment Agency and Local authority Regulator; o Identification of the site areas where materials are handled or present and an assessment of the credible risk of loss of in each area to allow prioritisation of the risk and incident response; o Identification of site containment systems (e.g. bunding / impermeable hardstanding) and additional systems that may be used to contain losses should they occur e.g. drainage systems with isolation valves, sumps etc. o Identification of the spillage containment and clean-up equipment available on site, where they are located and how to access and use them; o A schedule for checking the quantity and condition of spill control equipment; o Guidelines on how to handle any waste arising from spill clean-up – this will be linked into the site waste management plan. • Site staff will receive periodic competency training on incident, and in particular, spill response, including how to use spill kits etc.
	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.	All solvent storage tanks shall be stainless steel. Pressure vacuum relief valves are examined at a minimum of at least once every six months for signs of corrosion, contamination, incorrect seating and be cleaned and/or corrected as required - this is recorded on the relief valve register. All delivery connections to bulk storage tanks are located within a bunded/contained area, in accordance with HSG 176 The hose will be inaccessible when not in use due to drive away prevention, Please clarify this sentence. All fixed storage tanks should will be fitted with audible and/ or visual high-level alarms or volume indicators to warn of overfilling and will be interlocked to prevent an overfill. Which substances are stored in fixed storage tanks? Only NMP?	**Storage Techniques** (b) All hazardous materials and solvents will be stored in fully contained primary containment systems e.g. bulk tanks, IBS's Drums etc. These will be located within impermeable secondary containment e.g. bunded storage areas which will be of suitable capacity to contain losses of the materials stored therein, and constructed of materials resistant to the materials being stored. • Bulk storage of solvents will be in compliance with HSG 176 • Storage of flammable liquids in containers will be in accordance with HSG 51. • Secondary containment provisions will be designed in compliance with the CIRIA C736 guidance. (c) All hazardous materials will be stored in dedicated materials storage areas and smaller containers of materials will be transferred to the production areas on an as required basis. Bulk solvents / liquids will be transferred to production areas via fixed pipework systems.
	(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.	Spill Response/Training section within the Solvent Management Plan p14. Bat assessment - Accidents section see a) above. A COMAH safety report has been prepared for the installation, procedures will include Emergency action to be taken in the event of a Chemical Spill	**Techniques For Pumping and Handling Liquids** (d) The process plant has been through a full detailed design process which has included HAZID and HAZOP review and review of materials compatibility and leak prevention. The pumping systems have been selected to match the risks posed by the materials being handled and pumps and their associated seal systems have been selected to minimise the potential for losses. (e) Overflow during pumping will be prevented through a combination of automated process controls e.g. level controls on tanks with high level alarms and automated shut off systems where appropriate; and operator supervision and
	(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	May not be applicable for solvents with low vapour		

BATc No.	BAT Requirements				Response from the Local Authority	AESC Additional Data
			displaced from receiving tanks is captured, usually by back-venting.	pressure or due to cost considerations.		awareness. Deliveries of liquids in bulk (e.g. solvents) would be managed through a dedicated delivery control procedure, and tank ullage checks would be undertaken prior to commencing offloading to ensure that sufficient capacity exists to receive the delivery. (f) During delivery of NMP into the bulk storge tanks, all displaced vapours will be back vented to the delivery vehicle. (g) See the response to item (a) in relation to the spill response procedures. Should solvents need to be handled in drums or IBC's the use of bunded stillages / bunded pallets would be implemented. Spill kits will also be available to deal with spillages. **Response to Other Local Authority Queries** • *COMAH safety report - Is this finalised and can we now have a copy?* The COMAH documentation and assessments is still under development but will be in place prior to commencement of operations of the site processes. It is not possible to provide a copy at this time. • *More information needed why not vent back to delivery vehicle or to NMP condensing system to be recovered?* *Displaced contaminated air (containing NMP or other VOCs ie fugitive emissions) should be captured and routed to abatement plant or otherwise dealt with. Where are fugitive emissions from materials transfer and storage routed to?* During delivery of NMP into the bulk storge tanks, all displaced vapours will be back vented to the delivery vehicle. • *All delivery connections to bulk storage tanks are located within a bunded/contained area, in accordance with HSG 176 The hose will be inaccessible when not in use due to drive away prevention, Please clarify this sentence.* All delivery connections to bulk storage tanks are fixed connections which will be located within a bunded / contained area, the connection points will be locked shut when not in use. Delivery hoses (if required to be provided by the site) will be stored within the bunded area when not in use. All offloading area systems will be designed and managed to prevent drive away risk. • *Which substances are stored in fixed storage tanks? Only NMP?* The following bulk storage tanks will be present on site: o 4 No. 25m³ tanks for Fresh NMP. o 2 No. 50m³ tanks for Waste / recovered NMP. o 4 No. 22m³ ISO tankers containing electrolyte which will be delivered by road to site. o 1 No. 10m³ Electrolyte Waste Tank (also used to collect waste DEC) All other liquid materials are stored in smaller quantities and containers e.g. IBC's, Drums or smaller containers. All materials storage areas include appropriate impermeable secondary containment provisions.
	(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.		
Distribution of Raw Materials						

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr>
<td>BATc 6</td>
<td>In order to reduce raw material consumption and VOC emissions, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Centralised supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents)</td><td>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.</td><td>May not be applicable in the case of frequent changes of inks/paints/ coatings/adhesives or solvents.</td></tr>
<tr><td>(b)</td><td>Advanced mixing systems</td><td>Computer-controlled mixing equipment to achieve the desired paint/coating/ink/adhesive.</td><td rowspan="5">Generally applicable</td></tr>
<tr><td>(c)</td><td>Supply of VOC-containing materials (e.g. inks, coatings, adhesives, cleaning agents) at the point of application using a closed system</td><td>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.</td></tr>
<tr><td>(d)</td><td>Automation of colour change</td><td>Automated colour changing and ink/paint/coating line purging with solvent capture.</td></tr>
<tr><td>(e)</td><td>Colour grouping</td><td>Modification of the sequence of products to achieve large sequences with the same colour.</td></tr>
<tr><td>(f)</td><td>Soft purge in spraying</td><td>Refilling the spray gun with new paint without intermediate rinsing</td></tr>
</table>
</td>
<td>Raw materials and Waste Inventory details storage locations Appendix 4 of process description
a) b) and c) may be applicable to site Please confirm if this is correct

NMP using direct piping “Any condensed NMP/deionised water is transported through pipework to Waste NMP/deionised water tanks” “The electrolyte is transferred from the isotankers by nitrogen at 3 barg through a discharge hose and stainless-steel pipework rated for 10 barg. Barg (Gauge Pressure)” from process description.

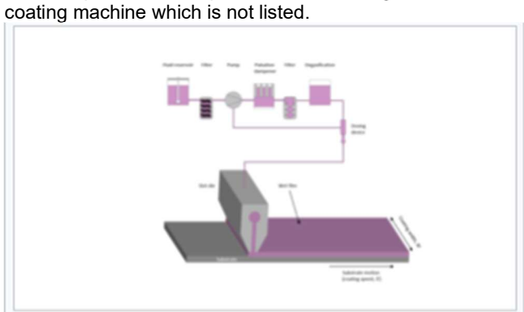
The electrolyte is transferred from the isotankers by nitrogen at 3 barg through a discharge hose and stainless-steel pipework rated for 10 barg. The electrolyte then passes through a heat exchanger and multiple filters (PTFE and PP) before filling the electrolyte day tanks in the injection machine rooms. To maintain raw material quality, by reducing the precipitation of lithium salts, the electrolyte isotankers operate at a temperature of 0 °C using an onboard cooling system and a pressure of 3 barg. The electrolyte day tanks are kept in injection machine rooms within the main clean room. Within the main clean room there are four electrolyte injection machines with their own individual rooms. The main clean room and injection rooms are Class 10000 with a ventilation rate of 30 ACH, the ventilation system is in the main clean room. Each injection machine room contains 4 electrolyte day tanks each capable of storing 20 L of electrolyte. The filling rate for the electrolyte day tanks is 20 lpm at 3 barg transfer pressure. Each electrolyte day tank has its own 750 x 880 x 30 mm bunded area., p10 of process description.

? ventilation of clean room with 30 ACH- what would happen if spill occurred? Where would ventilation discharge to?</td>
<td>(a) Supply of NMP and electrolyte is via a hard piped connection between the bulk storage tanks and the point of use. These are centralised supply systems.
(b) The only mixing systems in use are for the preparation of the anode and cathode coating pastes. These are fully contained mixing systems with associated PLC / digital control systems to ensure that the mixing process is correctly controlled to achieve the desired material quality and composition and to effectively manage all safety risks.
(c) Frequent change over in the feed to processes handling VOC containing materials is not envisaged. Each process stage will be solely supplied by the specific materials required for the task being undertaken. Supply of VOC containing materials will either be from centralised bulk supply and distribution systems (NMP / Electrolyte) or from local supply systems from smaller containers which will be brought to point of use as and when required.
(d) Automation of colour change - does not apply to the battery manufacturing processes.
(e) Colour Grouping - does not apply to the battery manufacturing processes.
(f) Soft purge in spraying - does not apply to the battery manufacturing processes.

Response to Other Local Authority Queries
• Ventilation of clean room with 30 ACH- what would happen if spill occurred? Where would ventilation discharge to?

The ventilation system is an LEV extraction system which extracts air from the main clean room, and also from each of the injection machine rooms.
In the event of a spillage VOC vapour would potentially be drawn into the LEV system and vented to atmosphere.
The emission points associated with the electrolyte injection areas are Emission points: A20, A21 and A40, A41.
However, it should be noted that each injection room contains only a small number of electrolyte day tanks (typically <4) each capable of storing <50 litres of electrolyte which is filled from the centralised electrolyte distribution system. The electrolyte tank top-up and the injection filling machines are both heavily automated, with integrated loss prevention systems as well as operator interface to minimise the potential for spillage of electrolyte, which include:
○ Overfill prevention on the day tanks which would cease filling on high level.
○ The injection machines are also controlled to ensure that the injection lance is correctly aligned with the battery before filling commences, and incorporate systems to ensure that the battery cells are not overfilled
Hence, the likelihood of a significant spillage of electrolyte with associated risk of larger quantities of VOC vapour is relatively low.

It is noted from the findings of the AERA (Appendix B to this submission) that there is considerable headroom (a factor of 2,945 for short term impacts) in the predicted offsite air quality impacts before any risk of exceedance of the environmental assessment levels would occur, so small spillages of electrolyte within the injection machine rooms (which would be cleaned up promptly) are not expected to pose any significant risk to offsite air quality or human health.</td>
</tr>
<tr><td colspan="4">Coating Application</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr>
<td>BATc 7</td>
<td>In order to reduce raw material consumption and the overall environmental impact of the coating application processes, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="4">Techniques For Non-Spraying Application</td></tr>
<tr><td>(a)</td><td>Roller coating</td><td>Application where rollers are used to transfer or meter the liquid coating onto moving strip.</td><td>Only applicable to flat substrates (1).</td></tr>
<tr><td>(b)</td><td>Doctor blade over roller</td><td>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.</td><td>Generally applicable (1).</td></tr>
<tr><td>(c)</td><td>No-rinse (dry-in-place) application in the coating of coil</td><td>Application of conversion coatings which do not require a further water rinse using a roller coater (chemcoater) or squeegee rollers.</td><td>Generally applicable (1).</td></tr>
<tr><td>(d)</td><td>Curtain coating (casting)</td><td>Work-pieces are passed through a laminar film of coating discharged from a header tank</td><td>Only applicable to flat substrates (1).</td></tr>
<tr><td>(e)</td><td>Electrocoating (e-coat)</td><td>Paint particles dispersed in a water-based solution are deposited on immersed substrates under the influence of an electric field electrophoretic deposition).</td><td>Only applicable to metal substrates (1).</td></tr>
<tr><td>(f)</td><td>Flooding</td><td>The workpieces 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.</td><td>Generally applicable (1).</td></tr>
<tr><td>(g)</td><td>Co-extrusion</td><td>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.</td><td>Not applicable where high bond strength or resistance to sterilisation temperature is needed (1) .</td></tr>
<tr><td colspan="4">Spraying Atomisation Techniques</td></tr>
<tr><td>(h)</td><td>Air-assisted airless spraying</td><td>An airflow (shaping air) is used to modify the spray cone of an airless spray gun.</td><td>Generally applicable (1).</td></tr>
<tr><td>(i)</td><td>Pneumatic atomisation with inert gases</td><td>Pneumatic paint application with pressurised inert gases (e.g. nitrogen, carbon dioxide).</td><td>May not be applicable to coating of wooden surfaces (1).</td></tr>
<tr><td>(j)</td><td>High-volume low-pressure (HVLP) atomisation</td><td>Atomisation of paint in a spray nozzle by mixing paint with high volumes of air with a low pressure (max. 1,7 bar). HVLP guns have a paint transfer efficiency of > 50 %.</td><td>Generally applicable (1).</td></tr>
<tr><td>(k)</td><td>Electrostatic atomisa-tion (fully automated)</td><td>Atomisation by high-speed rotational discs and bells and shaping the spray jet with electrostatic fields and shaping air.</td><td></td></tr>
<tr><td>(l)</td><td>Electrostatically assisted air or airless spraying</td><td>Shaping the spray jet of pneumatic or airless atomisation with an electrostatic field. Electrostatic paint guns have a transfer efficiency of > 60 %. Fixed electrostatic methods have a transfer efficiency of up to 75 %.</td><td></td></tr>
<tr><td>(m)</td><td>Hot spraying</td><td>Pneumatic atomisation with hot air or heated paint.</td><td>May not be applicable for frequent colour changes (1).</td></tr>
</table>
</td>
<td>Techniques for non-spraying application a) to g)
Envision process description describes using a slot die coating machine which is not listed.
 
A schematic of a typical slot-die coating system.

Spray atomisation techniques h) to n) unlikely to be used by Envision but clarification from process engineers needed. More information needed

Automation of spray application o) and p) unlikely to be used by Envision but clarification from process engineers needed. More information needed</td>
<td>The techniques for non- spraying application listed in (a) to (g) of the BATc relate to processes utilised on the more typical surface coatings application sectors e.g. paint application / protective plastic coating application etc. These techniques are not applicable for the activities proposed at the site.
The only coating application activities undertaken at the site are the application of the paste coatings to the anodes and cathodes.
These processes are the application of a paste using a slot die coating system which is in effect a machine that extrudes a thin layer of the paste directly onto the surface of the anode / cathode metal structure in a thin layer.
This paste coating application process is an established BAT technique for the battery manufacturing industry.

The techniques for spraying atomisation listed in (h) to (n) of the BATc are not applicable – there are no spray application processes at the site.

The techniques for automation of spray application listed in (o) to (p) of the BATc are not applicable – there are no spray application processes at the site.</td>
</tr>
</table>

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data

(n)	‘Spray, squeegee and rinse’ application in the coating of coil	Sprays are used for application of cleaners, pretreatments and for rinsing. After spraying, squeegees are used to minimise solution dragout, which is followed by rinsing.	Generally applicable (1).
Automation of Spray Application			
(o)	Robot application	Robot application of coatings and sealants to internal and external surfaces.	Generally applicable (1).
(p)	Machine application	Use of paint machines for the handling of the spray head/spray gun/nozzle.	
(1) The selection of the application techniques may be restricted at plants with low throughput and/or high product variety as well as by the substrate type and shape, product quality requirements and the need to ensure that the materials used, coating application techniques, drying/curing techniques and off-gas treatment systems are mutually compatible.			

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td colspan="4">Drying / Curi</td></tr>
<tr><td>BATc 8</td><td>In order to reduce energy consumption and the overall environmental impact from drying/curing processes, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Inert gas convection drying/curing</td><td>The inert gas (nitrogen) is heated in the oven, enabling solvent loading above the LEL. Solvent loads of > 1 200 g/m3 nitrogen are possible.</td><td>Not applicable where dryers need to be opened regularly (1).</td></tr>
<tr><td>(b)</td><td>Induction drying/curing</td><td>Online thermal curing or drying by electromagnetic inductors that generate heat inside the metallic work-piece by an oscillating magnetic field.</td><td>Only applicable to metal substrates (1).</td></tr>
<tr><td>(c)</td><td>Microwave and high-frequency drying</td><td>Drying using microwave or high-frequency radiation</td><td>Only applicable to water-based coatings and inks and non-metallic sub-strates (1).</td></tr>
<tr><td>(d)</td><td>Radiation curing</td><td>Radiation curing is applied based on resins and reactive diluents (monomers) which react on ex-posure to radiation (infrared (IR), ultraviolet (UV)), or high-energy electron beams (EB).</td><td>Only applicable to specific coatings and inks (1).</td></tr>
<tr><td>(e)</td><td>Combined convection/IR radiation drying</td><td>Drying of a wet surface with a combination of circulating hot air (convection) and an infrared radiator.</td><td>Generally applicable (1).</td></tr>
<tr><td>(f)</td><td>Convection drying/curing combined with heat recovery</td><td>Heat from off-gases is recovered (see BAT 19 (e)) and used to preheat the input air of the convection dryer/curing oven.</td><td>Generally applicable (1).</td></tr>
<tr><td colspan="4">(1) The selection of the drying/curing techniques may be restricted by the substrate type and shape, product quality requirements and the need to ensure that the materials used, coating application techniques, drying/curing techniques and off-gas treatment systems are mutually compatible.</td></tr>
</table></td><td>From the information provided in the application we are unsure which technique is to
be used. Possibly e) and f)?
e) Combined convection / IR radiation drying of a wet surface with a combination of circulating hot air (convection) and an infrared radiator
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.
Clarification needed from Envision as to which technique is used More information needed</td><td>The drying and curing processes undertaken on site are the drying of the Anode and cathode coatings following in from their application.
The dryers operate using a combination of the following techniques:
(e) Combined convection/IR radiation drying i.e. a radiative heater with circulating hot air ; and
(f) Convection drying/curing combined with heat recovery – air exiting the dryers is passed through a number of heat exchangers and the heat recovered is used to re-heat air being returned to the dryer, or to pre-heat incoming air.
No other techniques are in use at the site.</td></tr>
<tr><td colspan="4">Cleaning</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr>
<td>BATc 9</td>
<td>In order to reduce VOC emissions from cleaning processes, BAT is to minimise the use of solvent-based cleaning agents and to use a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Protection of spraying areas and equipment</td><td>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.</td><td rowspan="11">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.</td></tr>
<tr><td>(b)</td><td>Solids removal prior to complete cleaning</td><td>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.</td></tr>
<tr><td>(c)</td><td>Manual cleaning with pre-impregnated wipes</td><td>Wipes pre-impregnated with cleaning agents are used for manual cleaning. Cleaning agents may be solvent-based, low-volatility solvents or solvent free.</td></tr>
<tr><td>(d)</td><td>Use of low-volatility cleaning agents</td><td>Application of low-volatility solvents as cleaning agents, for manual or automated cleaning, with high cleaning power.</td></tr>
<tr><td>(e)</td><td>Water-based cleaning</td><td>Water-based detergents or water-miscible solvents such as alcohols or glycols are used for cleaning.</td></tr>
<tr><td>(f)</td><td>Enclosed washing machines</td><td>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).</td></tr>
<tr><td>(g)</td><td>Purging with solvent recovery</td><td>Collection, storage and, if possible, reuse of the solvents used to purge the guns/applicators and lines between colour changes.</td></tr>
<tr><td>(h)</td><td>Cleaning with high-pressure water spray</td><td>High-pressure water spray and sodium bicarbonate systems or similar are used for automatic batch cleaning of press/machine parts.</td></tr>
<tr><td>(i)</td><td>Ultrasonic cleaning</td><td>Cleaning in a liquid using high-frequency vibrations to loosen the adhered contamination.</td></tr>
<tr><td>(j)</td><td>Dry ice (CO_2) cleaning</td><td>Cleaning of machinery parts and metallic or plastic substrates by blasting with CO_2 chips or snow.</td></tr>
<tr><td>(k)</td><td>Plastic shot-blast cleaning</td><td>Excess paint build-up is removed from panel jigs and body carriers by shot-blasting with plastic particles.</td></tr>
</table>
</td>
<td>Unsure which technique is used from the list a) to k)? Please clarify which cleaning operations are undertaken using solvent. Extraction from the areas to abatement ?</td>
<td>(a) Not applicable there are no spraying activities undertaken at the site
(b) In areas where solid materials may require removal, these would be removed in a (dry) concentrated form, usually by hand, with or without the aid of small amounts of cleaning solvent prior to further cleaning of the work area.
(c) Manual cleaning with pre-impregnated wipes – Manual cleaning will be undertaken using localised spray application of cleaning agents (acetone / IPA) using spray bottles, and cleaning undertaken using a cloth which can be re-used. There is no current intention to use pre-impregnated disposable wipes.
(d) Use of low-volatility cleaning agents – the main cleaning materials used at the site will be IPA and Acetone with DEC being used to clean plant areas typically handling electrolyte. Due to the nature of the site activities substitution of these cleaning materials with alternatives is not possible.
(e) Water-based cleaning - Due to the nature of the site activities water based cleaning of process areas is not possible.
(f) Enclosed washing machines – only applies to the cleaning/degreasing of press/machine parts – so not applicable to the activities proposed at the site.
(g) Purging with solvent recovery – only applies to solvents used to purge the guns/applicators and lines between colour changes - so not applicable to the activities proposed at the site.
(h) Cleaning with high-pressure water spray - Due to the nature of the site activities water based cleaning of process areas is not possible.
(i) Ultrasonic cleaning – not proposed
(j) Dry ice (CO_2) cleaning – Applies to cleaning of machinery parts and metallic or plastic substrates - not proposed
(k) Plastic shot-blast cleaning – applies solely to the removal of excess paint build up from panel jigs and body carriers - so not applicable to the activities proposed at the site.

Response to Other Local Authority Queries
• Please clarify extraction from the areas to abatement

Each process area has its own LEV ventilation system, and hence any solvent vapours released during cleaning processes would be drawn into the local area LEV system and vented to atmosphere.
The details on the emission points to air and the areas they serve is presented in Section 2.2 of this report.</td>
</tr>
<tr><td colspan="4">Monitoring</td></tr>
<tr><td colspan="4">Solvent Mass Balance</td></tr>
<tr>
<td>BATc 10</td>
<td>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, as defined in Part 7(2) of Annex VII to Directive 2010/75/EU and to minimise the uncertainty of the solvent mass balance data by using all of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>(a)</td><td>Full identification and quantification of the relevant solvent inputs and outputs,</td><td>This includes:</td></tr>
</table>
</td>
<td>Methodology quoted in the solvent management plan is based on the British Coatings Federations (BCF) guidance as recommended in PG6/44. – Not applicable, see Annex II
Annex II of IG needs to be used. Please update the Solvent Management Plan to reflect Annex II.</td>
<td>See Section 2.1 of this Report for details on the EMS and the development of associated procedures and plans.
A revised Solvent Management Plan (SMP) will be developed for the site activities which will be updated to reflect the requirements of Appendix 3 of the IG, and to comply with the requirements of BATc10.
This SMP will be in place prior to commencement of operation of the plant, and will be subject to periodic review and update.</td>
</tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><td></td><td>including the associated uncertainty</td><td>— identification and documentation of solvent inputs and outputs (e.g. emissions in waste gases, emissions from each fugitive emission source, solvent output in waste);
— substantiated quantification of each relevant solvent input and output and recording of the methodology used (e.g. measurement, calculation using emission factors, estimation based on operational parameters);
— identification of the main sources of uncertainty of the forementioned quantification, and implementation of corrective actions to reduce the uncertainty;
— regular update of solvent input and output data.</td></tr>
<tr><td>(b)</td><td>Implementation of a solvent tracking system</td><td>A solvent tracking system aims to keep control of both the used and unused quantities of solvents (e.g. by weighing unused quantities returned to storage from the application area).</td></tr>
<tr><td>(c)</td><td>Monitoring of changes that may influence the uncertainty of the solvent mass balance data</td><td>Any change that could influence the uncertainty of the solvent mass balance data is recorded, such as:
— malfunctions of the off-gas treatment system: the date and duration are recorded;
— changes that may influence air/gas flow rates, e.g. replacement of fans, drive pulleys, motors; the date and type of change are recorded.</td></tr>
</table>
Applicability
The level of detail of the solvent mass balance will be proportionate to the nature, scale and complexity of the installation, and the range of environmental impacts it may have, as well as to the type and quantity of materials used.
</td>
<td></td>
<td>Section 2.2 of this report presents a more detailed explanation of the potential sources of VOC emissions from the site activities, and the abatement systems proposed. These systems have been developed to minimise potential VOC emissions and ensure that VOC emissions are compliant with the appropriate BAT-AEL's. Where appropriate emissions abatement systems have been incorporated into the design e.g. NMP emissions from the Cathode Coater systems.
As part of the development of the EMS, plant efficiency monitoring, reporting and target setting protocols will be established and undertaken which will include assessment of solvent use and minimisation of VOC emissions.</td>
</tr>
<tr><td colspan="4">Emissions in Waste Gases</td></tr>
<tr>
<td>BATc 11</td>
<td>BAT is to monitor emissions in waste gases with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><th>Substance / Parameter</th><th>Sectors / Sources</th><th>Standard(s)</th><th>Minimum Monitoring Frequency</th><th>Monitoring Associated With</th></tr>
<tr><td rowspan="5">Dust</td><td>Coating of vehicles – Spray coating</td><td rowspan="5">EN 13284-1</td><td rowspan="5">Once every year (1)</td><td rowspan="5">BAT 18</td></tr>
<tr><td>Coating of other metal and plastic surfaces – Spray coating</td></tr>
<tr><td>Coating of aircraft – Preparation (e.g. sanding, blasting) and coating</td></tr>
<tr><td>Coating and printing of metal packaging – Spray application</td></tr>
<tr><td>Coating of wooden surfaces – Preparation and coating</td></tr>
</table>
</td>
<td>Section 5 of process description is on Monitoring p15. "Frequency and type of testing will be agreed with the regulator".
BAT assessment monitoring section states "Monitoring and reporting will be undertaken in accordance with requirements of the environmental permit and inline with BAT.
Monitoring of emissions to air and water will be completed where required by environmental permit and in accordance with BAT.
A solvent management plan has been prepared and will be updated upon commission to monitor VOCs."

Need for additional information..
Envision should review UK IG for VOC's to determine monitoring frequency for each stack. In the case of any stack with a TVOC load of 10 Kg C/h or more, continuous monitoring is required. Has a contractor been approached who will undertake monitoring? Clarification of Emission limits for EC and DEC why are they different?

It is important to understand expected stack concentrations of NMP in the context of the Derived No Effect Level. Also to understand the emissions of EC/DEC after abatement (are they subject to the same abatement approach?)</td>
<td>See Section 2.4 of this report for details on the proposed emissions monitoring arrangements.
All monitoring will be undertaken in accordance with the requirements of BATc 11.</td>
</tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td></td><td>
<table>
<tr><td>TVOC</td><td>All sectors</td><td>Any stack with a TVOC load < 10 kg C/h</td><td>EN 12619</td><td>Once every year (1) (2) (3)</td><td>BAT 14, BAT 15</td></tr>
<tr><td></td><td></td><td>Any stack with a TVOC load ≥ 10 kg C/h</td><td>Generic EN standards (4)</td><td>Continuous</td><td></td></tr>
<tr><td>DMF</td><td colspan="2">Coating of textiles, foils and paper (5)</td><td>No EN standard available (6)</td><td>Once every three months (1)</td><td>BAT 15</td></tr>
<tr><td>NOX</td><td colspan="2">Thermal treatment of off gases</td><td>EN 14792</td><td>Once every year (7)</td><td>BAT 17</td></tr>
<tr><td>CO</td><td colspan="2">Thermal treatment of off-gases</td><td>EN 15058</td><td>Once every year (7)</td><td>BAT 17</td></tr>
</table>
(1) To the extent possible, the measurements are carried out at the highest expected emission state under normal operating conditions.
(2) In the case of a TVOC load of less than 0,1 kg C/h, or in the case of an unabated and stable TVOC load of less than 0,3 kg C/h, the monitoring frequency may be reduced to once every 3 years or the measurement may be replaced by calculation provided that it ensures the provision of data of an equivalent scientific quality.
(3) For the thermal treatment of off-gases, the temperature in the combustion chamber is continuously measured. This is combined with an alarm system for temperatures falling outside the optimised temperature window.
(4) Generic EN standards for continuous measurements are EN15267-1, EN15267-2, EN15267-3 and EN 14181.
(5) The monitoring only applies if DMF is used in the processes.
(6) In the absence of an EN standard, the measurement includes the DMF contained in the condensed phase.
(7) In the case of a stack with a TVOC load of less than 0,1 kg C/h, the monitoring frequency may be reduced to once every 3 years.</td><td>Are there any other emissions of product or by-products from the process – to air or to water? Any particulate emissions from the electrode coating operation?</td><td></td></tr>
<tr><td colspan="4">Emissions to Water</td></tr>
<tr><td>BATc 12</td><td>BAT is to monitor emissions to water with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><th>Substance / Parameter</th><th>Sectors</th><th>Standard(s)</th><th>Minimum Monitoring Frequency</th><th>Monitoring Associated With</th></tr>
<tr><td>TSS (1)</td><td>Coating of vehicles
Coil coating
Coating and printing of metal packaging (only for DWI cans)</td><td>EN 872</td><td>Once every month (2) (3)</td><td>BAT 21</td></tr>
<tr><td>COD (1) (4)</td><td>Coating of vehicles
Coil coating</td><td>No EN standard available</td><td></td><td></td></tr>
</table></td><td>There will be no intentional process wastewater emissions to the nearby surface water body, p12 of process description.

The remaining process water (e.g. condensate) and domestic sewage from the Installation will be discharged to public sewer. Envision AESC are currently in discussions with Northumbrian Water regarding the requirement for a discharge consent for this.

Update required – is this agreed with NWL? Are process-related liquors treated to remove VOCs and metals – eg the slurry mix used to coat the cathode – what happens to any waste mix? Management during any incident or fire fighting water control. COMAH plan can this be referred to on the permit? In the accident management plan- The potential environmental impacts resulting from an incident should be identified together with measures to prevent or minimise those impacts, including any raw products and compounds resulting from any combustion and fire fighting.</td><td>Not applicable – there are no emissions to water from the plant.</td></tr>
</table>

BATc No.	BAT Requirements					Response from the Local Authority	AESC Additional Data
		Coating and printing of metal packaging (only for DWI cans)					
	TOC (1) (4)	Coating of vehicles	EN 1484				
		Coil coating					
		Coating and printing of metal packaging (only for DWI cans)					
	Cr(VI) (5) (6)	Coating of aircraft	EN ISO 10304-3 or EN ISO 23913				
		Coil coating					
	Cr (6) (7)	Coating of aircraft	Various EN standards available (e.g. EN ISO 1885, EN ISO 17294-2, EN ISO 15586)				
		Coil coating					
	Ni (6)	Coating of aircraft					
		Coil coating					
	Zn (6)	Coating of aircraft					
		Coil coating					
	AOX (6)	Coating of vehicles	EN ISO 9562				
		Coil coating					
		Coating and printing of metal packaging (only for DWI cans)					
	F- (6) (8)	Coating of vehicles	EN ISO 10304-1				
		Coil coating					
		Coating and printing of metal packaging (only for DWI cans)					
	(1) The monitoring only applies in the case of direct discharge to a receiving water body. (2) The monitoring frequency may be reduced to once every 3 months if the emission levels are proven to be sufficiently stable. (3) In the case of batch discharge that is less frequent than the minimum monitoring frequency, monitoring is carried out once per batch. (4) TOC monitoring and COD monitoring are alternatives. TOC monitoring is the preferred option because it does not rely on the use of very toxic compounds. (5) Monitoring of Cr(VI) only applies if chromium(VI) compounds are used in the processes. (6) In the case of indirect discharge to a receiving water body, the monitoring frequency may be reduced if the downstream waste water treatment plant is designed and equipped appropriately to abate the pollutants concerned. (7) Monitoring of Cr only applies if chromium compounds are used in the processes. (8) Monitoring of F- only applies if fluorine compounds are used in the processes.						
Emissions During OTNOC							

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td>BATc 13</td><td>In order to reduce the frequency of the occurrence of OTNOC and to reduce emissions during OTNOC, BAT is to use both of the techniques given below.

<table><tr><th colspan="2">Technique</th><th>Description</th></tr><tr><td>(a)</td><td>Identification of critical equipment</td><td>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).</td></tr><tr><td>(b)</td><td>Inspection, maintenance, and monitoring</td><td>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</td></tr></table></td><td>Possible to refer to COMAH plans?
BAT Assessment Management Section – operations and maintenance states equipment listed in COMAH report Register will be set up upon commission and will be reviewed on a periodic basis to ensure applicable. Environmental Aspect
Register which will be reviewed periodically as part of EMS audits Significant Aspects/Zone Instructions - Operational Status Reports/ PPM/Daily Checks (CMMS)
Measures to address consequences of plant breakdown – ie any impacts upon the environment?
Bespoke permit condition on Appendix3 of IG.</td><td></td></tr>
<tr><td colspan="4">Emissions in Waste Gases</td></tr>
<tr><td colspan="4">VOC Emissions</td></tr>
<tr><td>BATc 14</td><td>In order to reduce VOC emissions from the production and storage areas, BAT is to use technique (a) and an appropriate combination of the other techniques given below.

<table><tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr><tr><td>(a)</td><td>System selection, design and optimisation</td><td>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).</td><td>Generally applicable.</td></tr><tr><td>(b)</td><td>Air extraction as close as possible to the point of application of VOC-containing materials</td><td>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.</td><td>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.</td></tr></table></td><td>d) refers to extraction of air from the drying/ curing processes.
Need for additional information. Envision to confirm which techniques they use.</td><td></td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td></td><td>
<table>
<tr><td>(c)</td><td>Air extraction as close as possible to the point of preparing paints/coatings/adhesives/inks</td><td>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</td><td>Only applicable where paints/coatings/adhesives/inks are prepared</td></tr>
<tr><td>(d)</td><td>Extraction of air from the drying/curing processes</td><td>The curing ovens/dryers are equipped with an air extraction system. Extracted air may be treated by an off-gas treatment system.</td><td>Only applicable to drying/curing processes.</td></tr>
<tr><td>(e)</td><td>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</td><td>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.</td><td>Only applicable when curing ovens/dryers are used.</td></tr>
<tr><td>(f)</td><td>Extraction of air from the cooling zone</td><td>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.</td><td>Only applicable when substrate cooling takes place after drying/curing.</td></tr>
<tr><td>(g)</td><td>Extraction of air from storage of raw materials, solvents and solvent-containing wastes</td><td>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.</td><td>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.</td></tr>
<tr><td>(h)</td><td>Extraction of air from cleaning areas</td><td>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.</td><td>Only applicable to areas where machine parts and equipment are cleaned with organic solvents.</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>BATc 15</td><td>In order to reduce VOC emissions in waste gases and increase resource efficiency, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th>Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="3">I. Capture and recovery of solvents in off-gases</td></tr>
<tr><td>(a) Condensation</td><td>A technique for removing organic compounds by reducing the temperature below their dew points so that the vapours liquefy. Depending on the operating temperature range required, different refrigerants are used, e.g. cooling water, chilled water (temperature typically around 5 °C), ammonia or propane.</td><td>Applicability may be restricted where the energy demand for recovery is excessive due to the low VOC content.</td></tr>
<tr><td>(b) Adsorption using activated carbon or zeolites</td><td>VOCs are adsorbed on the surface of activated carbon, zeolites or carbon fibre paper. Adsorbate is subsequently desorbed, e.g. with steam (often on site), for reuse or disposal and the adsorbent is reused. For continuous operation, typically more than two adsorbers are operated in parallel, one of them in desorption mode. Adsorption is also commonly applied as a concentration step to increase the subsequent oxidation efficiency.</td><td>Applicability may be restricted where the energy demand for recovery is
excessive due to the low VOC content.</td></tr>
</table>
</td><td>Technique described in process description to recover NMP.

Technique described in process description to recover NMP.</td><td>See Section 2.2.2.2 of this report for further details.

Abatement of NMP emissions within the direct process emissions from the cathode coater units is undertaken using a combination of the following techniques:
(a) Condensation; and
(b) Adsorption using activated carbon or zeolites.

The following techniques are not applied:

(c) Absorption using a suitable liquid is not used.

(d) to (g) Not applicable – there is no thermal treatment of solvents in off-gases with energy recovery.

(h) and (i) Not Applicable – There is no treatment of solvents in off-gases without solvent or energy recovery.

All other emission points are from process area LEV systems.</td></tr>
</table>

BATc No.	BAT Requirements				Response from the Local Authority	AESC Additional Data
	(c)	Absorption using a suitable liquid	Use of a suitable liquid to remove pollutants from the off-gas by absorption, in particular soluble compounds and solids (dust). Solvent recovery is possible, for example, using distillation or thermal desorption. (For dust removal, see BAT 18.)	Generally applicable.		
	II. Thermal treatment of solvents in off-gases with energy recovery					
	(d)	Sending off-gases to a combustion plant	Part or all of the off-gases are sent as combustion air and supplementary fuel to a combustion plant (including CHP (combined heat and power) plants) used for steam and/or electricity production.	Not applicable for off- gases containing substances referred to in IED Article 59(5). Applicability may be restricted due to safety considerations.		
	(e)	Recuperative thermal oxidation	Thermal oxidation using the heat of the waste gases, e.g. to preheat the incoming off-gases.	Generally applicable.		
	(f)	Regenerative thermal oxidation with multiple beds or with a valveless rotating air distributor	An oxidiser with multiple beds (three or five) filled with ceramic packing. The beds are heat exchangers, alternately heated by flue-waste gases from oxidation, then the flow is reversed to heat the inlet air to the oxidiser. The flow is reversed on a regular basis. In the valveless rotating air distributor, the ceramic medium is held in a single rotating vessel divided into multiple wedges.	Generally applicable.		
	(g)	Catalytic oxidation	Oxidation of VOCs assisted by a catalyst to reduce the oxidation temperature and reduce the fuel consumption. Exhaust heat can be recovered with recuperative or regenerative types of heat exchangers. Higher oxidation temperatures (500–750 °C) are used for the treatment of off-gas from the manufacturing of winding wire.	Applicability may be restricted by the presence of catalyst poisons		
	III. Treatment of solvents in off-gases without solvent or energy recovery					
	(h)	Biological off-gas treatment	Off-gas is dedusted and sent to a reactor with biofilter substrate. The biofilter consists of a bed of organic material (such as peat, heather, compost, root, tree bark, softwood and different combinations) or some inert material (such as clay, activated carbon, and polyurethane), where the off-gas stream is biologically oxidised by naturally occurring microorganisms into carbon dioxide, water, inorganic salts and biomass. The biofilter is sensitive to dust, high temperatures or high variations in the off-gas, e.g. of the inlet temperature or the VOC concentration. Supplementary nutrient feeding may be needed.	Only applicable to the treatment of biodegradable solvents.		
	(i)	Thermal oxidation	Oxidation of VOCs by heating off-gases with air or oxygen to above their auto-ignition point in a combustion chamber and maintaining a high temperature long enough to complete the combustion of VOCs to carbon dioxide and water.	Generally applicable.		
	BAT-associated emission levels (BAT-AELs) are given in Tables 11, 15, 17, 19, 21, 24, 27, 30, 32 and 35 of these BAT conclusions.					

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td>BATc 16</td><td>In order to reduce the energy consumption of the VOC abatement system, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Maintaining the VOC concentration sent to the off-gas treatment system by using variable-frequency drive fans</td><td>Use of a variable-frequency drive fan with centralised off-gas treatment systems to modulate the airflow to match the exhaust from the equipment that may be in operation.</td><td>Only applicable to central thermal off-gas treatment systems in batch processes such as printing.</td></tr>
<tr><td>(b)</td><td>Internal concentration of solvents in the off gases</td><td>Off-gases are recirculated within the process (internally) in the curing ovens/dryers and/or in spray booths, so the VOC concentration in the off-gases increases and the abatement efficiency of the off-gas treatment system increases.</td><td>Applicability may be limited by health and safety factors such as the LEL, and product quality requirements or specifications.</td></tr>
<tr><td>(c)</td><td>External concentration of solvents in the off-gases through adsorption</td><td>The concentration of solvent in off-gases is increased by a continuous circular flow of the spray booth process air, possibly combined with curing oven/dryer off-gases, through adsorption equipment. This equipment can include:
— fixed bed adsorber with activated carbon or zeolite;
— fluidised bed adsorber with activated carbon;
— rotor adsorber with activated carbon or zeolite;
— molecular sieve.</td><td>Applicability may be restricted where the energy demand is excessive due to the low VOC content.</td></tr>
<tr><td>(d)</td><td>Plenum technique to reduce waste gas volume</td><td>Off-gases from curing ovens/dryers are sent to a large chamber (plenum), and partly recirculated as inlet air in the curing ovens/dryers. The surplus air from the plenum is sent to the off-gas treatment system. This cycle increases the VOC content of the curing ovens/dryers' air and decreases the waste gas volume.</td><td>Generally applicable.</td></tr>
</table></td><td>Possible B and C are being used?
Envision to confirm
IG mentions BAT-AEL tables</td><td>Details on the NMP emissions abatement plant is presented in Section 2.2.2.2 of this document.
(a) The abatement system is designed to operate using fixed speed drives to maintain a steady flowrate through the abatement and NMP recovery system.
(b) Off gases from the coater ovens are passed through the primary and secondary condensers for NMP recovery, and then reheated and returned to the dryer, so recycling of off-gases to increase the efficiency of NMP recovery (and associated abatement) is undertaken.
(c) Final abatement is undertaken using two zeolite based thermal adsorption wheels in series. A back up carbon filter adsorption system is also provided to provide additional abatement under OTNOC or emergency scenarios.
(d) Plenum technique is not applied.</td></tr>
<tr><td colspan="4">NOx and CO Emissions</td></tr>
<tr><td>BATc 17</td><td>In order to reduce NOX emissions in waste gases while limiting CO emissions from the thermal treatment of solvents in off-gases, BAT is to use technique (a) or both of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Optimisation of thermal treatment conditions (design and operation)</td><td>Good design of the combustion chambers, burners and associated equipment/devices is combined with optimisation of combustion conditions (e.g. by controlling combustion parameters such as temperature and residence time) with or without the use of automatic systems and the regular planned maintenance of the combustion system according to suppliers' recommendations.</td><td>Design applicability may be restricted for existing plants.</td></tr>
<tr><td>(b)</td><td>Use of low-NOX burners</td><td>The peak flame temperature in the combustion chamber is reduced, delaying but completing the combustion and increasing the heat transfer (increased emissivity of the flame). It is combined with increased residence time in order to achieve the desired VOC destruction.</td><td>Applicability may be restricted at existing plants by design and/or operational constraints.</td></tr>
</table></td><td>N/A</td><td>Not applicable – there is no thermal treatment of off-gases.</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td></td><td>Table 1
BAT-associated emission level (BAT-AEL) for NOX emissions in waste gases and indicative emission level for CO emissions in waste gases from the thermal treatment of off-gases
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT-AEL (1)
(Daily average or average over the sampling period)</th><th>Indicative emission level (1)
(Daily average or average over the sampling period)</th></tr>
<tr><td>NOx</td><td rowspan="2">mg/Nm3</td><td>20–130 (2)</td><td>No indicative level</td></tr>
<tr><td>CO</td><td>No BAT-AEL.</td><td>20–150</td></tr>
<tr><td colspan="4">(1) The BAT-AEL and indicative level do not apply where off-gases are sent to a combustion plant.
(2) The BAT-AEL may not apply if nitrogen-containing compounds (e.g. DMF or NMP (N-methylpyrrolidone)) are present in the off-gas.</td></tr>
</table>
The associated monitoring is given in BAT 11.</td><td></td><td></td></tr>
<tr><td colspan="4">Dust Emissions</td></tr>
<tr><td>BATc 18</td><td>In order to reduce dust emissions in waste gases from substrate surface preparation, cutting, coating application, and finishing processes for the sectors and processes listed in Table 2, BAT is to use one or a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th></tr>
<tr><td>(a)</td><td>Wet separation spray booth flushed impact panel)</td><td>A water curtain cascading vertically down the spray cabin rear panel captures paint particles from overspray. The water-paint mixture is captured in a reservoir and the water is recirculated.</td></tr>
<tr><td>(b)</td><td>Wet scrubbing</td><td>Paint particles and other dust in the off-gas are separated in scrubber systems by intensive mixing of the off-gas with water. (For VOC removal, see BAT 15 (c).)</td></tr>
<tr><td>(c)</td><td>Dry overspray separation with pre-coated material</td><td>A dry paint overspray separation process using membrane filters combined with limestone as pre-coating material to prevent fouling of the membranes.</td></tr>
<tr><td>(d)</td><td>Dry overspray separation using filters</td><td>Mechanical separation system, e.g. using cardboard, fabric or sinter.</td></tr>
<tr><td>(e)</td><td>Electrostatic precipitator</td><td>In electrostatic precipitators, particles are charged and separated under the influence of an electrical field. In a dry electrostatic precipitator (ESP), the collected material is mechanically removed (e.g. by shaking, vibration, compressed air). In a wet ESP, it is flushed with a suitable liquid, usually a water-based separation agent.</td></tr>
</table>
Table 2
BAT-associated emission levels (BAT-AELs) for dust emissions in waste gases
<table>
<tr><th>Parameter</th><th>Sector</th><th>Process</th><th>Unit</th><th>BAT-AEL
(Daily average or average over the sampling period)</th></tr>
<tr><td rowspan="3">Dust</td><td>Coating of vehicles</td><td>Spray coating</td><td rowspan="3">mg/Nm3</td><td rowspan="3">< 1–3</td></tr>
<tr><td>Coating of other metal and plastic surfaces</td><td>Spray coating</td></tr>
<tr><td>Coating of aircraft</td><td>Preparation (e.g. sanding, blasting), coating</td></tr>
</table></td><td>Noted in BAT 11 above – Company to clarify.</td><td>Not applicable
There are no surface preparation, cutting or finishing processes as defined in the BREF undertaken at the site.

Coating application is undertaken via the application of a wet paste using a slot die coating system which is in effect a machine that extrudes a thin layer of the paste directly onto the surface of the anode / cathode metal structure in a thin layer. As a result, there are no dust emissions from this process.
Preparation of the paste coatings is undertaken by mixing powdered substances with either water (anode) or NMP (cathode) within a sealed mixing system – no emissions of particulate dusts are expected from these systems.

HEPA filters have been installed in the LEV extraction systems from these area as a precautionary measure to ensure than no particulate dust is emitted to the environment.
See Section 2.2 of this report for further details on these systems.</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>Coating and printing of metal packaging</td><td>Spray application</td><td></td><td></td></tr>
<tr><td></td><td>Coating of wooden surface</td><td>Preparation, coating</td><td></td><td></td></tr>
</table>

The associated monitoring is given in BAT 11.</td><td></td><td></td></tr>
<tr><td colspan="4">Energy Efficiency</td></tr>
<tr><td>BATc 19</td><td>In order to use energy efficiently, BAT is to use techniques (a) and (b) and an appropriate combination of the techniques (c) to (h) given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="4">Management Techniques</td></tr>
<tr><td>(a)</td><td>Energy efficiency plan</td><td>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.</td><td rowspan="2">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.</td></tr>
<tr><td>(b)</td><td>Energy balance record</td><td>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) carriedout, materials, etc.</td></tr>
<tr><td colspan="4">Process-Related Techniques</td></tr>
<tr><td>(c)</td><td>Thermal insulation of tanks and vats containing cooled or heated liquids, and of combustion and steam systems</td><td>This may be achieved for example by:
— using double-skinned tanks;
— using pre-insulated tanks;
— applying insulation to combustion equipment, steam pipes and pipes containing cooled or heated liquids.</td><td>Generally applicable.</td></tr>
<tr><td>(d)</td><td>Heat recovery by co-generation – CHP (combined heat and power) or CCHP combined cooling, heat and power)</td><td>Recovery of heat (mainly from the steam system) for producing hot water/steam to be used in industrial processes/activities. CCHP (also called trigeneration) is a cogeneration system with an absorption chiller that uses low-grade heat to produce chilled water.</td><td rowspan="2">Applicability may be restricted by the plant layout, the characteristics of the hot gas streams (e.g. flow rate, temperature) or the lack of a suitable heat demand.</td></tr>
<tr><td>(e)</td><td>Heat recovery from hot gas streams</td><td>Energy recovery from hot gas streams (e.g. from dryers or cooling zones), e.g. by their recirculation as process air, through the use of heat exchangers, in processes, or externally.</td></tr>
</table></td><td>Yes standard measures in A and B
D and E possibly being used
C relating to pipes containing cooled liquids – Ammonia for chiller.</td><td>Management Techniques
See Section 2.1 of this Report for details on the EMS and the development of associated procedures and plans.
(a) An Energy Efficiency Plan (EEP) will be developed for the site activities .This EEP will be in place prior to commencement of operation of the plant, and will be subject to periodic review and update.
The EEP will be developed to ensure that the requirements of BATc 19 are met.
Energy use and performance will be reviewed periodically (at least on an annual basis), and targets for improvements set and performance against these targets monitored.
Energy use KPI’s will be established and will include appropriate BAT-associated environmental performance levels, and performance against these targets reviewed at least annually.

(b) An energy balance record will be prepared annually in line with the BAT requirements and will feed into the revision of the EEP..

Process Related Techniques
(c) Thermal insulation of tanks and vats containing cooled or heated liquids, and of combustion and steam systems -
○ Electrolyte is stored at the site in insulated ISO tankers with an on-board cooling system to keep it at 0°C.
○ The chiller units supplying chilled water will be suitably insulated.
○ Chilled water pipework (from the chiller units to point of use and back again will be insulated.
○ Electrode dryer units and associated hot pipework will also be insulated to retain heat.
○ Steam pipework and hot water pipework from the site boiler systems will also be insulated to minimise heat losses.
○
(d) No co-generation or CHP units are proposed at the site. Steam is generated on demand from 6 boiler units.

(e) Heat recovery from hot gas streams is applied to the air exiting the cathode coater units, this heat is then used to reheat air sent back to the dryer to improve energy efficiency.

(f) Not applied – all systems operate using fixed rate extraction systems.

(g) Not applicable – there are no spray booths in use at the site

(h) Not applicable – Spray coating is not used at the site.</td></tr>
</table>

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data

(f)	Flow adjustment of process air and off-gases	Adjustment of the flow of process air and off-gases according to the need. This includes reduction of air ventilation during idle operation or maintenance.	Generally applicable.
(g)	Spray booth off-gas recirculation	Capture and recirculation of the off-gas from the spray booth in combination with efficient paint overspray separation. Energy consumption is less than in the case of fresh air use.	Applicability may be restricted by health and safety considerations.
(h)	Optimised circulation of warm air in a large-volume curing booth using an air turbulator	Air is blown into a single part of the curing booth and distributed using an air turbulator which turns the laminar airflow into the desired turbulent flow	Only applicable to spray coating sectors

The associated monitoring is in BAT5

Table 3
BAT-associated environmental performance levels (BAT-AEPLs) for specific energy consumption

Sector	Product Type	Unit	BAT-AEPL (Yearly average)
Coating of vehicles	Passenger cars	MWh/vehicle coated	0,5–1,3
	Vans		0,8–2
	Truck Cabins		1–2
	Trucks		0,3–0,5
Coil coating	Steel and/or aluminium coil	kWh/m2 of coated coil	0,2–2,5 (1)
Coating of textiles, foils and paper	Coating of textiles with polyurethane and/or polyvinyl chloride	kWh/m2 of coated surface	1-5
Manufacturing of winding wires	Wires with an average diameter > 0,1 mm	kWh/kg of coated wire	< 5
Coating and printing of metal packaging	All product types	kWh/m2 of coated surface	0,3–1,5
Heatset web offset printing	All product types	Wh/m2 of printed area	4–14
Flexography and non-publication rotogravure printing	All product types	Wh/m2 of printed area	50–350
Publication rotogravure printing	All product types	Wh/m2 of printed area	10–30
(1) The BAT-AEPL may not apply where the coil coating line is part of a larger manufacturing installation (e.g. steelworks) or for combilines.			

The associated monitoring is given in BAT 19 (b).

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td colspan="4">Water Use and Wastewater Generation</td></tr>
<tr><td>BATc 20</td><td>In order to reduce water consumption and wastewater generation from aqueous processes (e.g. degreasing, cleaning, surface treatment, wet scrubbing), BAT is to use technique (a) and an appropriate combination of the other techniques given below.

<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td>(a)</td><td>Water management plan and water audits</td><td>A water management plan and water audits are part of the EMS (see BAT 1) and include:
— flow diagrams and a water mass balance of the plant;
— establishment of water efficiency objectives;
— implementation of water optimisation techniques (e.g. control of water usage, water recycling, detection and repair of leaks). Water audits are carried out at least once every year.</td><td>The level of detail and nature of the water management plan and water audits will generally be related to the nature, scale. and complexity of the plant. It may not be applicable if the STS activity is carried out within a larger installation, provided that the water management plan and the water audits of the larger installation sufficiently cover the STS activity.</td></tr>
<tr><td>(b)</td><td>Reverse cascade rinsing</td><td>Multiple stage rinsing in which the water flows in the opposite direction to the workpieces/substrate. It allows a high degree of rinsing with a low water consumption</td><td>Applicable where rinsing processes are used.</td></tr>
<tr><td>(c)</td><td>Reuse and/or recycling of water</td><td>Water streams (e.g. spent rinse water, wet scrubber effluent) are reused and/or recycled, if necessary after treatment, using techniques such as ion exchange or filtration (see BAT 21). The degree of water reuse and/or recycling is limited by the water balance of the plant, the content of impurities and/or the characteristics of the water streams.</td><td>Generally applicable.</td></tr>
</table>

Table 4
BAT-associated environmental performance levels (BAT-AEPLs) for specific water consumption
<table>
<tr><th>Sector</th><th>Product Type</th><th>Unit</th><th>BAT-AEPL
(Yearly average)</th></tr>
<tr><td rowspan="4">Coating of vehicles</td><td>Passenger cars</td><td rowspan="4">m3/vehicle coated</td><td>0,5–1,3</td></tr>
<tr><td>Vans</td><td>1–2,5</td></tr>
<tr><td>Truck Cabins</td><td>0,7–3</td></tr>
<tr><td>Trucks</td><td>1-5</td></tr>
<tr><td>Coil coating</td><td>Steel and/or aluminium coils</td><td>l/m2 of coated coil</td><td>0,2–1,3 (1)</td></tr>
<tr><td>Coating and printing of metal packaging</td><td>Two-piece DWI beverage cans</td><td>l/1 000 cans</td><td>90–110</td></tr>
<tr><td colspan="4">(1) The BAT-AEPL may not apply where the coil coating line is part of a larger manufacturing installation (e.g. steelworks) or for combilines.</td></tr>
</table>

The associated monitoring is given in BAT 20 (a).</td><td>Potential use of mains water? – fire fighting.
De ionised water purchased</td><td>Water use at the factory for process related activities will be relatively limited.

Deionised water for use in preparing the paste coating for the anode coating process will be purchased and brought to site – there will be no water de-ionisation process on site.

Process area cleaning will not utilise water.

Towns water will be used to provide a top-up to the site cooling water system, with the purge from the cooling water system being discharged to sewer under a trade effluent consent with NWL. Cooling water purge will be minimised, with optimisation of the purge rate being undertaken during commissioning and monitored during the operation of the plant.

Towns water will also be used to top-up the site firefighting water tank; however, it is not expected that this would be routinely used.

BAT-associated environmental performance levels for water use at the factory are not proposed to be applied.</td></tr>
</table>

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td colspan="4">Emissions to Water</td></tr>
<tr><td>BATc 21</td><td>In order to reduce emissions to water and/or to facilitate water reuse and recycling from aqueous processes (e.g. degreasing, cleaning, surface treatment, wet scrubbing), BAT is to use a combination of the techniques given below.
<table>
<tr><th colspan="2">Technique</th><th>Description</th><th>Applicability</th></tr>
<tr><td colspan="4">Preliminary, primary, and general treatment</td></tr>
<tr><td>(a)</td><td>Equalisation</td><td>Balancing of flows and pollutant loads by using tanks or other management techniques.</td><td>All pollutants.</td></tr>
<tr><td>(b)</td><td>Neutralisation</td><td>The adjustment of the pH of wastewater to a neutral value (approximately 7).</td><td>Acids, alkalis.</td></tr>
<tr><td>(c)</td><td colspan="2">Physical separation, for example, by using screens, sieves, grit separators, primary settlement tanks and magnetic separation</td><td>Gross solids, suspended solids, metal particles.</td></tr>
<tr><td colspan="4">Physico-chemical treatment</td></tr>
<tr><td>(d)</td><td>Adsorption</td><td>The removal of soluble substances (solutes) from the wastewater by transferring them to the surface of solid, highly porous particles (typically activated carbon).</td><td>Adsorbable dissolved non-biodegradable or inhibitory pollutants, e.g. AOX.</td></tr>
<tr><td>(e)</td><td>Vacuum distillation</td><td>The removal of pollutants by thermal waste water treatment under reduced pressure.</td><td>Dissolved non-biodegradable or inhibitory pollutants that can be distilled, e.g. some solvents.</td></tr>
<tr><td>(f)</td><td>Precipitation</td><td>The conversion of dissolved pollutants into insoluble compounds by adding precipitants. The solid precipitates formed are subsequently separated by sedimentation, flotation or filtration</td><td>Precipitable dissolved non-biodegradable or inhibitory pollutants, e.g. metals.</td></tr>
<tr><td>(g)</td><td>Chemical reduction</td><td>Chemical reduction is the conversion of pollutants by chemical reducing agents into similar but less harmful or hazardous compounds.</td><td>Reducible dissolved non-biodegradable or inhibitory pollutants, e.g. hexavalent chromium (Cr(VI)).</td></tr>
<tr><td>(h)</td><td>Ion exchange</td><td>The retention of ionic pollutants from wastewater and their replacement by more acceptable ions using an ion exchange resin. The pollutants are temporarily retained and afterwards released into a regeneration or backwashing liquid.</td><td>Ionic dissolved non-biodegradable or inhibitory pollutants, e.g. metals.</td></tr>
<tr><td>(i)</td><td>Stripping</td><td>The removal of purgeable pollutants from the aqueous phase by a gaseous phase (e.g. steam nitrogen or air) that is passed through the liquid removal efficiency may be enhanced by increasing the temperature or reducing the pressure.</td><td>Purgeable pollutants, e.g. some adsorbable organically bound halogens (AOX).</td></tr>
<tr><td colspan="4">Biological treatment</td></tr>
<tr><td>(j)</td><td>Biological treatment</td><td>Use of microorganisms for wastewater treatment (e.g. anaerobic treatment, aerobic treatment).</td><td>Biodegradable organic compounds</td></tr>
<tr><td colspan="4">Final solids removal</td></tr>
<tr><td>(k)</td><td>Final solids removal</td><td>Coagulation and flocculation are used to separate suspended solids from wastewater and are often</td><td>Suspended solids and particulate-bound metals.</td></tr>
</table></td><td>May not be applicable
Query use of deionised water - any treatment before it is put into containers.

If there is waste slurry from the application to the electrodes, is it treated (e.g. dewatered with water to sewer and particulates to filter and dry waste collection?)</td><td>There will be no emissions to controlled waters or sewer from the process, and no wastewater treatment processes on site.
All liquid wastes will be collected for appropriate offsite treatment / disposal with appropriate consideration of the waste hierarchy being applied to the selection of the disposal route.
Waste pastes from the anode / cathode coatings processes would be collected either for re-use, or for disposal as hazardous waste. The generation of such wastes will be minimised through effective management of the plant and processes.
Therefore this BATc is not applicable

See response to BATc 22 for details on expected waste arisings from the site activities. No dewatering of waste slurry is proposed.</td></tr>
</table>

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data

		carried out in successive steps. Coagulation is carried out by adding coagulants with charges opposite to those of the suspended solids. Flocculation is a gentle mixing stage so that collisions of micro-floc particles cause them to bond to produce larger flocs. It may be assisted by adding polymers.	
(l)	Sedimentation	The separation of suspended particles by gravitational settling.	
(m)	Filtration	The separation of solids from wastewater by passing them through a porous medium, e.g. sand filtration, nano-, micro- and ultrafiltration	
(n)	Flotation	The separation of solid or liquid particles from wastewater by attaching them to fine gas bubbles, usually air. The buoyant particles accumulate at the water surface and are collected with skimmers.	

Table 5
BAT-associated emission levels (BAT-AELs) for direct discharges to a receiving water body

Substance / Parameter	Sector	BAT-AEL (1)
Total suspended solids (TSS)	Coating of vehicles Coil coating Coating and printing of metals packaging (only for DWI cans)	5–30 mg/l
Chemical oxygen demand (COD) (2)		30–150 mg/l
Adsorbable organically bound halogens (AOX)		0,1–0,4 mg/l
Fluoride (F-) (3)		2–25 mg/l
Nickel (expressed as Ni)	Coating of vehicles Coil coating	0,05–0,4 mg/l
Zinc (expressed as Zn)		0,05–0,6 mg/l (4)
Total chromium (expressed as Cr) (5)	Coating of aircraft Coil coating	0,01–0,15 mg/l
Hexavalent chromium (expressed as Cr(VI)) (6)		0,01–0,05 mg/l

(1) The averaging period is given in the general considerations.
(2) The BAT-AEL for COD may be replaced by a BAT-AEL for TOC. The correlation between COD and TOC is determined on a case-by-case basis. The BAT-AEL for TOC is the preferred option because TOC monitoring does not rely on the use of very toxic compounds.
(3) The BAT-AEL only applies if fluorine compounds are used in the processes.
(4) The upper end of the BAT-AEL range may be 1 mg/l in the case of zinc-containing substrates or of substrates pretreated using zinc.
(5) The BAT-AEL only applies if chromium compounds are used in the processes.
(6) The BAT-AEL only applies if chromium(VI) compounds are used in the processes.

The associated monitoring is given in BAT 20 (a).

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data

Table 6
BAT-associated emission levels (BAT-AELs) for indirect discharges to a receiving water body

Substance / Parameter	Sector	BAT-AEL (1)
Adsorbable organically bound halogens (AOX)	Coating of vehicles Coil coating Coating and printing of metals packaging (only for DWI cans)	0,1–0,4 mg/l
Fluoride (F-) (3)		2–25 mg/l
Nickel (expressed as Ni)	Coating of vehicles Coil coating	0,05–0,4 mg/l
Zinc (expressed as Zn)		0,05–0,6 mg/l (4)
Total chromium (expressed as Cr) (5)	Coating of aircraft Coil coating	0,01–0,15 mg/l
Hexavalent chromium (expressed as Cr(VI)) (6)		0,01–0,05 mg/l
(1) The BAT-AELs may not apply if the downstream wastewater treatment plant is designed and equipped appropriately to abate the pollutants concerned, provided this does not lead to a higher level of pollution in the environment. (2) The averaging period is given in the general considerations. (3) The BAT-AEL only applies if fluorine compounds are used in the processes. (4) The upper end of the BAT-AEL range may be 1 mg/l in the case of zinc-containing substrates or of substrates pretreated using zinc. (5) The BAT-AEL only applies if chromium compounds are used in the processes. (6) The BAT-AEL only applies if chromium (VI) compounds are used in the processes.		

The associated monitoring is given in BAT 12.

Waste Management

<table>
<tr><th>BATc No.</th><th>BAT Requirements</th><th>Response from the Local Authority</th><th>AESC Additional Data</th></tr>
<tr><td>BATc 22</td><td>In order to reduce the quantity of waste sent for disposal, BAT is to use the techniques (a) and (b) and one or both of the techniques (c) and (d) given below.

<table><tr><th colspan="2">Technique</th><th>Description</th></tr><tr><td>(a)</td><td>Waste management plan</td><td>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.</td></tr><tr><td>(b)</td><td>Monitoring of waste quantities</td><td>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.</td></tr><tr><td>(c)</td><td>Recovery/recycling of solvent</td><td>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.</td></tr><tr><td>(d)</td><td>Waste-stream-specific techniques</td><td>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.</td></tr></table></td><td>Waste management plan in the EMS
C is used on site
Any hazardous waste? Electrolyte, any waste slurry? Any metals?</td><td>See Section 2.1 of this Report for details on the EMS and the development of associated procedures and plans.
A Waste Management Plan (WMP) will be developed for the site activities which will include the requirements specified in BATc 22.
This WMP will be in place prior to commencement of operation of the plant, and will be subject to periodic review and update.
The site will establish key performance targets in relation to wastes generated at the site and implement measures to reduce and minimise waste accordingly.
All waste arisings will be monitored and recorded, and the data fed back into the periodic review against the performance targets.
AESC will ensure that they comply with their ‘Duty of Care’ in ensuring that all wastes are sent offsite for appropriate reuse, recycling, treatment or disposal at appropriately licenced facilities, and that appropriate records of all waste removed from site are retained e.g. waste transfer notes.
The selection of the waste disposal route for each material will be selected with due consideration of the waste hierarchy.
Waste solvents generated by the site will be sent offsite, there will be no onsite recovery or recycling of waste solvents. Again, where possible such solvents will be sent offsite for re-use or for treatment so that they can be re-used, with other options for solvent disposal only being considered when a suitable recovery or re-use option is not available. The specific arrangements for such solvent waste disposal / recycling have not yet been put in place.

Full details of the expected waste streams, how they will be stored, and the expected quantities were presented in Slide 13 of the materials report included on Page 44 of: Envision AESC- Installation Details & Process Description-300168590-ES-001.pdf, as submitted with the original application – see below.

Materials Storage - Waste
<table><tr><th>Material</th><th>Abbreviation</th><th>Store Location</th><th>Container</th><th>Area Controls/Containment</th><th>Total Quantity</th></tr><tr><td>Wet Cell Waste (Cell filled with electrolyte)</td><td></td><td>Waste Compound</td><td>220 L UN Barrel 144 @ 181kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage. Bunded Area.</td><td>26,160 kg</td></tr><tr><td>Waste Anode</td><td></td><td>Waste Compound</td><td>0.85mx0.85mx0.85m dumpy bag with waste in plastic bags 36 @ 424kgs</td><td>Marked bags, generally unmanned area and segregated locked storage.</td><td>15,270 kg</td></tr><tr><td>Waste Cathode</td><td></td><td>Waste Compound</td><td>0.85mx0.85mx0.85m dumpy bag with waste in plastic bags 36 @ 300Kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage.</td><td>10,800 kg</td></tr><tr><td>Waste Slurry (An & Ca)</td><td></td><td>Waste Compound</td><td>220L Blue UN Barrel 144 @ 174Kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage. Bunded Area.</td><td>25,000 kg</td></tr><tr><td>Mixed Cell Waste</td><td></td><td>Waste Compound</td><td>220 L UN Barrel 144 @ 178kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage. Bunded,</td><td>25,680 kg</td></tr><tr><td>Powder Waste (An & Ca)</td><td></td><td>Waste Compound</td><td>220L Blue UN Barrel 144 @ 174Kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage.</td><td>25,000 kg</td></tr><tr><td>Powder packaging/PPE Waste</td><td></td><td>Waste Compound</td><td>220L Blue UN Barrel 144 @ 104Kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage.</td><td>15,000 kg</td></tr><tr><td>Electrolyte Waste</td><td></td><td>Waste Compound</td><td>Steel Barrel 25L 40 @ 20Kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage. Bunded</td><td>800kg</td></tr><tr><td>Electrolyte Waste</td><td></td><td>Waste Tank</td><td>Dedicated Waste Tank</td><td>Dedicated waste tank with self bunded.</td><td>4,000 kg</td></tr><tr><td>Misc Lab Waste</td><td></td><td>Waste Compound</td><td>220L Blue UN Barrel 144 @ 104Kgs</td><td>Sealed marked containers, generally unmanned area and segregated locked storage.</td><td>15,000 kg</td></tr></table></td></tr>
<tr><td colspan="4">Odour Emissions</td></tr>
<tr><td>BATc 23</td><td>In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1), that includes all of the following elements:
— a protocol containing actions and timelines;
— a protocol for response to identified odour incidents, e.g. complaints;
— an odour prevention and reduction programme designed to identify the source(s), to characterise the contributions of the source(s), and to implement prevention and/or reduction measures.

Applicability</td><td>Is odour expected? No

What is the odour threshold for NMP ? or EC/DEC</td><td>See Section 2.1 of this Report for details on the EMS and the development of associated procedures and plans.
If required (i.e. if a credible risk of potential offsite odour impacts exists), an Odour Management Plan (OMP) will be developed for the site activities which will include the requirements specified in BATc 23.
If required, this OMP will be in place prior to commencement of operation of the plant, and will be subject to periodic review and update.</td></tr>
</table>

BATc No.	BAT Requirements	Response from the Local Authority	AESC Additional Data
	The applicability is restricted to cases where an odour nuisance at sensitive receptors is expected and/or has been substantiated.		Materials Safety Data sheets and other online sources have been reviewed in order to try and provide odour threshold data for NMP and the volatile components within the electrolyte (DEC, EC, EMC). We have been able to find the following data on NMP: Odour threshold data varying between Low: 2ppm (8mg/m³) and High: 10ppm (40 mg/m³). We have been unable to find odour threshold data on DEC, EC, EMC. However, the following odour descriptors have been identified: DEC – a mild pleasant odour / mild odour. EC – odourless. EMC – a sweet, ether-like odour / a mild fruity odour.

Appendix E BAT Justification against the Coating of Other Metal's and Plastic Surfaces Sector BATc

Additional Data in Support of LAPPC Part A2 Environmental Permit Application for the AESC UK No 2 Plant

Battery Manufacturing Facility

AESC UK Plant 2 Limited

SLR Project No.: 416.065272.00001

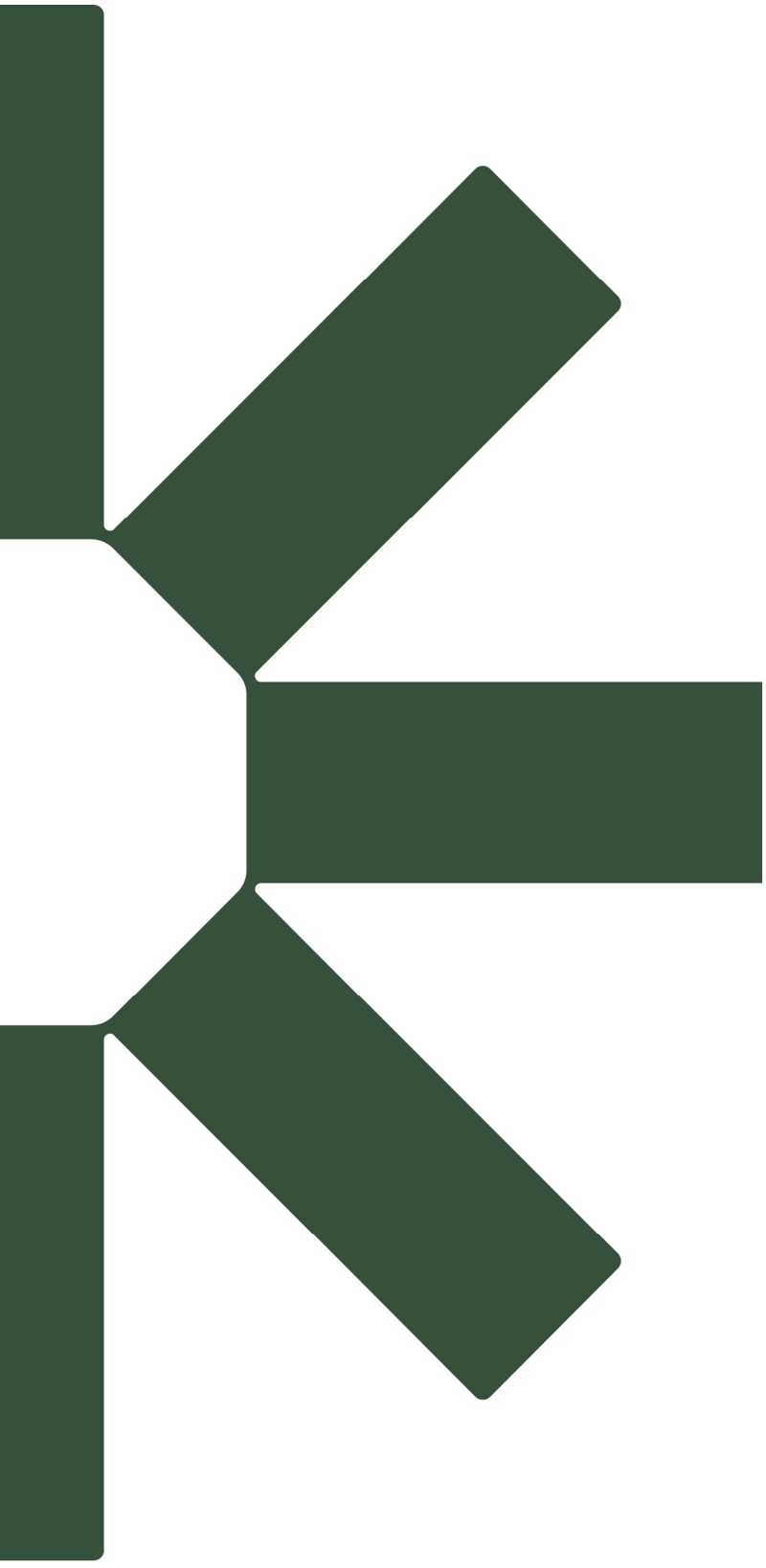
15 March 2024

Table B: Assessment of BAT Compliance – Best Available Techniques Reference Document for Coating of Metals and Plastic Surfaces

<table>
<tr><th>BATc No.</th><th>BAT Justification</th><th>Response From Local Authority</th><th>AESC Additional Information</th></tr>
<tr><td>Scope</td><td></td><td>There are 2 routes to compliance for this industry sector. Operators and Regulators should talk through these options to see which is most appropriate for the installation in question. Compliance with a total emissions ELV is likely to be the more appropriate route in cases where the operator is following a strategy to minimise its overall solvent use through the selection of low solvent or high solids coating and cleaning materials that are used. Compliance with both a fugitive emissions ELV and waste gas ELVs is likely to be the more appropriate where a strategy to capture and recover or treat solvent emissions is being followed.</td><td></td></tr>
<tr><td></td><td>Table 9
BAT-associated emission level (BAT-AEL) for total emissions of VOCs from the coating of other metal and plastic surfaces
<table>
<tr><th>Parameter</th><th>Process</th><th>Unit</th><th>BAT-AEL (yearly average)</th></tr>
<tr><td rowspan="2">Total VOC emissions as calculated by the solvent mass balance</td><td>Coating of metal surfaces</td><td rowspan="2">Kg VOCs emitted per kg of solid mass input</td><td>< 0.005 - 2</td></tr>
<tr><td>Coating of plastic surfaces</td><td>< 0.05 – 0.3</td></tr>
</table>
The associated monitoring is given in BAT 10</td><td>Table 9 may not be applicable</td><td>See Section 2.1 of this Report for details on the EMS and the development of associated procedures and plans.
A revised Solvent Management Plan (SMP) will be developed for the site activities which will be updated to reflect the requirements of Appendix 3 of the IG. This SMP will be in place prior to commencement of operation of the plant, and will be subject to periodic review and update.

As part of the SMP, specific performance targets which are appropriate for the site activities will be set which may include the selection of BAT-AEL's for:
Total emissions of VOC's from the site (as Kg VOCs emitted per kg of solid mass input (or similar))
Fugitive emissions of VOC from the site (as a percentage (%) of the solvent input (or similar))
TVOC emissions from fugitive emission sources (as a concentration – expected to be 20 mgC /Nm³ - where such emissions can be accurately measured)
Performance against these performance targets will be reviewed at least annually and recorded as part of the SMP requirements.</td></tr>
<tr><td></td><td>Table 10
BAT-associated emission level (BAT-AEL) for fugitive emissions of VOCs from the coating of other metal and plastic surfaces
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT-AEL (yearly average)</th></tr>
<tr><td>Fugitive VOC emissions as calculated by the solvent mass balance</td><td>Percentage (%) of the solvent input</td><td>< 1 -10</td></tr>
</table>
The associated monitoring is given in BAT 10</td><td>Compliance with the ELV is through mass balance, see BAT 10. Because this is a very diverse group of activities, Regulators will need to come to a site-specific decision on where within the BAT-AEL range to set the ELV, based the activities being carried out</td><td>As above</td></tr>
<tr><td></td><td>Table 11
BAT-associated emission level (BAT-AEL) for fugitive emissions of VOCs in waste gases from the coating of other metal and plastic surfaces
<table>
<tr><th>Parameter</th><th>Unit</th><th>BAT-AEL (yearly average)</th></tr>
<tr><td>TVOC</td><td>Mg C/Nm3</td><td>1 -20 (1) (2)</td></tr>
<tr><td colspan="3">(1) The upper end of the BAT AEL range is 35 mg C/Nm3 if techniques are used which allow the reuse / recycling of the recovered solvent
(2) For plants using BAT a6 © in combination with an off-gas treatment technique, an additional BAT-AEL of less than 50 mg C/Nm3 applies to the waste gas of the concentrator</td></tr>
</table></td><td>The ELV for emissions in waste gases applies to each emission point where monitoring takes place – see BAT 11. The ELV should be set at 20 mg/Nm3 , except in the circumstances set out in the footnotes.</td><td>As above</td></tr>
</table>

BATc No.	BAT Justification	Response From Local Authority	AESC Additional Information
	The associated monitoring is given in BAT 11		



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