Operating Techniques & Technical Standards for the Proposed Changes

For each of the permitted activities, a technical description of the proposed changes/new plant is provided below (along with emission control measures) followed by a demonstration of how the proposed activity changes will achieve the Best Available Technique (BAT) within the appropriate technical standard (LVOC and CWW BREF's).

Note that this BAT demonstration is already the subject of an Improvement Condition (IC9) on the existing EPR permit. The compliance of existing and ongoing plant/equipment (not modified by Project Summer) was already provided to the Environment Agency as part of the LVOC permit review process and will not be repeated in this variation report.

Please refer to the EDC Production Process Block Flow Diagram, which represents the HPE plant following implementation of these changes (document reference: VRL_HPEBlockDiagram).

The different permitted activities are highlighted in different colours on the diagram and the various sections (blocks) are numbered to match the Technical Description sections in the report below

e.g.

AR1 Wash system numbered (6) on the diagram and denoted 1.1.6 in the report below

AR3 Residues Incineration numbered (2) on the diagram and denoted 3.1.2 in the report below.

Detailed Piping & Instrumentation Drawings (P&IDs) are available on request.

Also, please refer to plant layout photos showing locations of existing permit air emission points and the proposed permit air emission points for HPE plant (document reference: VRL_AirEmissions).

There are some common site-wide changes that will improve emission control, as described below:-

a) The various existing plant control and safety shutdown systems will be replaced with a modern Emerson Delta-V system which has been designed with emphasis on automatic protections to minimise human factors/interventions, for increased reliability of normal operating conditions e.g. automatic ramp-down of reactor rates if EDC content in off-gas becomes too high (measured by temperature).

b) The new plant equipment will be powered via new 11kV and 415V boards, installed to modern standards. Critical supplies will be powered from UPS (Un-interruptible Power Supply) via automatic changeover panels, for increased reliability of normal operating conditions e.g. to prevent vent diversion/emissions to atmosphere due to critical pumps tripping off-line on the incinerator flue gas treatment train.

c) The Hygiene Monitoring mass spectrometer system is being replaced and upgraded to serve the new HPE plant, which will be used to provide local surrounding air analysis for the purpose of fugitive emissions recording (as part of the LDAR programme).

AR1 – Section 4.1A(1)(a)(vi) – Production of Ethylene dichloride (1,2-dichloroethane)

1.1 Technical Description

1.1.1 Raw Materials

There is no change to the types and overall quantities of raw materials used, being chlorine and ethene gas.

Due to the new Oxy Vinyls licensed reactor technology and different basis of safety from previous reactors, air addition is no longer required to the chlorine gas at the Runcorn Membrane Chlorine Plant (MCP) hence the chlorine feed is of higher purity, minimising the amount of reactor off-gas.

The project will be installing new ethene pipework from the existing DC3 letdown system to feed the new LTDC EDC reactors with associated new feed control and shutdown systems. Also a new common 14" NB chlorine main will be installed that runs from a tie-in point downstream of the Runcorn MCP (Membrane Chlorine Plant) intermediate letdown, to the new LTDC reactor structure, along with new feed control and shutdown systems. These pipeline designs have applied the principles of minimising flanges, high integrity joints and fittings used to minimise potential leak paths and fugitive emissions.

1.1.2 EDC Reaction

The 2 x new LTDC reactors, R2101 and R2501, produce EDC from the reaction of ethene and chlorine. The gases are sparged into the reaction vessels, each contains approximately 100 tonnes of EDC and the reaction occurs in the liquid phase between the dissolved feed gases. Control of the feed gases is by flow ratio controllers, and a trim ethene controller to maintain a small excess of chlorine in the bulk liquid EDC. This is to minimise the quantity of unreacted ethene in the vent gas and hence the amount of reactor off-gas.

The chemical reactions remain unchanged, although the choice of the OxyVinyls licensed LTDC reactor technology should result in reduced side reactions, higher yield of EDC and therefore less impurities/residues produced in the process.

The reaction is exothermic and the temperature is maintained at the desired set point, normally 55°C, by thermosyphon, circulating EDC around the reactor through the integral water-cooled shell and tube heat exchanger. The liquid EDC is maintained below its

boiling point. High temperature trips shutdown the reactor feed system if a temperature excursion occurs. A low level trip is present to ensure a thermosyphon is maintained. Crude EDC formed by the chemical reaction is continuously taken as a side stream from above the exchanger where it is pumped to the new Wash system.

To facilitate the required cooling duty for the new reactors, a new cooling tower cell, X133, is installed adjacent to the existing X102A/B cells, along with new pumps and mostly new distribution pipework across the plant which is now above-ground for ease of inspection/maintenance and early detection of leaks. New chemical dosing tanks for the cooling towers are being installed which are double walled vessels but they are also contained within additional external bunds. The cooling towers will continue to purge/drain into the Outfall 56 drainage system.

The new reactors/structure will be contained within a dedicated bund which will drain under gravity to the plant primary effluent collection pit.

1.1.3 Vents Condensation and recovery

Despite the stopping of addition of air in the chlorine feed at the Runcorn MCP plant, the chlorine feed stream still contains some non-condensable impurities (e.g. oxygen, hydrogen, CO2) and therefore there is a vent stream from each of the two chlorination reactors. The entrained EDC is recovered in refrigerant-cooled exchangers, E2102 and E2502. The liquid EDC flows by gravity back to the respective reactor.

The resulting uncondensed gas mixture is flammable. It is diluted with nitrogen (in the reactor to account for start-up conditions) to reduce the oxygen concentration below the minimum concentration for flammability.

Instrument systems shut down the ethene and chlorine feeds to the reactor if high oxygen, chlorine or ethene levels are detected in the vent gas, or there is a low nitrogen flow.

Normally, the vent gases will pass to the existing Vents incinerator (Thermal oxidiser) but if it is unavailable, the gases will be diverted automatically to a scrubbing tower with recirculating caustic soda solution to absorb any HCl or chlorine gases present, before finally venting to atmosphere via a 60 metre high stack. The caustic scrubbing tower is maintained on permanent standby.

To facilitate the required cooling duty for the new vent gas condensers, a new refrigeration package is installed, which is designed to cool the vent streams down to -18 degC. A primary

circuit containing a small amount of propylene is to be used within the refrigeration package to cool a secondary circuit containing Syltherm heat transfer fluid (which will be re-used from the existing DC3 and EDC1/2 plant systems).

The main equipment in the primary circuit includes two 50% duty refrigerant compressors, two oil separators, a common propylene condenser, and a common refrigerant evaporator separator.

The main equipment in the secondary circuit includes the Syltherm expansion vessel, a duty/standby pair of centrifugal pumps (2 x 100% duty), Syltherm drier, and the evaporator separator. The standby Syltherm pump is designed to auto-start upon trip of the duty pump (to avoid loss of cooling of the reactor vent and subsequent higher organics loading).

1.1.4 Dry Vents Scrubber

In the event that the normal dry vent header route is not available to the vents incinerator from each reactor, then new diversion valves/pipework and a new caustic scrubber (C2350) will be installed to ensure the reactor vent gases are stripped of residual chlorine and HCl before discharge to the atmosphere via a new 60m high vent pipe which runs up the Stack 49 structure (new air emission point HPE-22, functionally replacing DC-14b).

The scrubber is also designed for an emergency case of chlorine breakthrough from a single LTDC reactor in the event of mal-operation during reactor start up.

1.1.5 Vents Incinerator

The Incinerator itself is unchanged, however, some reliability improvements are being made by the project due to previous years' experience, as described below.

Steam condensate from the existing distillation train, along with high grade water supplied by INEOS Inovyn from the Runcorn Boiler Plant are fed to the existing Deaerator, X104, to provide boiler feed water of sufficient quality to supply the Waste Heat Boiler on the existing Vents Incinerator. Prior to shutdown of the plant, reliability improvements had been constantly applied to the Vents Incinerator but in the recent years, poor performance was almost solely caused by the failure of the Boiler Feed Water Pumps. These pumps were oversized and ultimately not fit for purpose for the current plant duty. Hence, these pumps have been re-designed accordingly and installed as a major improvement to vents incinerator reliability going forward.

Also, modifications are being made to the vent header collections system, including provision of new Incinerator Knock Out Pots, to handle the revised Dry and Wet vent streams from the new Reactor/Wash area. This will ensure condensate/liquid does not build-up in the headers which can lead to trips of the incinerator and therefore minimise the amount of vent diversions/emissions to atmosphere.

1.1.6 Wash

The reaction of chlorine & ethene to produce EDC is catalysed by the presence of corrosion derived iron in the reactors. This means that the product EDC contains ferric chloride and is therefore pumped from the reactors to a new 3-stage EDC Washing process based on licensed OxyVinyls design/technology.

The first stage is a new acid wash (D2320) to remove the ferric chloride by direct contact with mildly acidic water and then separation of the aqueous layer from the crude EDC by decantation in the simple horizontal vessel containing weirs. Part of the aqueous phase is recycled and mixed with the EDC feed. The surplus aqueous material is pumped to the new Effluent Treatment Plant (ETP). The EDC is pumped onto the next stage of washing.

The second stage is a caustic wash (D2330) to remove excess chlorine and neutralise any residual acid from the crude EDC. This stage also accepts recovered EDC from the existing distillation units and the new ETP plant for recycle back into the process. The EDC/aqueous layers are separated by decantation and the aqueous liquid is again recycled to the EDC feed and surplus sent to ETP, whilst the EDC is pumped to the final stage of washing.

The third stage is a water wash (D2325) to reduce the salt content before the crude EDC is pumped to the crude stock tank T201, via a new product cooler to ensure safer storage temperature. The EDC/aqueous layers are separated by decantation. The aqueous liquid is recycled to the EDC feed and the surplus is used as the water feed to the caustic wash vessel.

All three washing vessels are connected to the plant wet vent header and onto the vents incinerator under normal operating conditions.

A new maintenance drum (D2360) will be installed within the HPE reactor/wash area to facilitate an enclosed system for purging/emptying of equipment in this area, which will itself be connected to the wet vent header.

1.1.7 Wet Vents Scrubber

In the event that the normal wet vent header route is not available to the vents incinerator, then new diversion valves/pipework and a new caustic scrubber (C2351) will be installed local to the new Reactor/Wash area to ensure the vent gases are stripped of residual chlorine and HCl before discharge to the atmosphere via a new 60m high vent pipe which runs up the Stack 49 structure (new air emission point HPE-21, functionally replacing DC-14a).

1.1.8 Crude EDC Storage

Within the bund/location of the demolished D102, a new crude EDC stock tank has been built, T201, with a capacity of 3500 m^3. Due to the increased size of tank in this bund the interconnecting wall of the T703 bund has been breached so that the combined bund capacity is now 6283 m^3, in which T201 is the largest tank.

This new tank will not vent directly to atmosphere as it will be connected to a new vents blower system to push it into the wet vent header and onto the vents incinerator during normal operation. The tank will operate at 5-15 mbarg pressure and ambient temperature. The pressure is controlled by allowing surplus gas to leave the tank via the vent connection to the blower system , or in case of falling pressure to admit nitrogen gas into the tank.

If the normal venting route to the incinerator is unavailable then the vent will be diverted to the existing Stack 49 as there are no acidic gases present that require scrubbing (associated air emission point DC-15, which is being renamed HPE-15). Only in exceptional circumstances e.g. TAR event, the tank may be required to vent locally and standard calculation for emissions used.

A new maintenance drum (D954) will be installed within the HPE stock tank area to facilitate an enclosed system for purging/emptying of equipment in this area, which will itself be connected to the wet vent header.

1.1.9 Distillation

The Distillation unit area has generally remained unchanged, except to say that the choice of reactor technology is likely to lead to less residues produced due to the higher quality of crude EDC anticipated.

Due to the location of the new Reactor & Wash area, a new Recovered EDC Collection vessel (D360) will be installed in 300 Unit area to allow EDC to be collected from the existing

distillation units and the new Effluent Treatment Plant (ETP). The EDC can then be recycled (pumped) back to the new Wash section. The new vessel will be vented to the existing wet vent collection header system.

1.1.10 EDC Product Storage

The existing DC3 pure EDC stock tank, D102, which had a capacity of 1600m^3 has been demolished, due to surplus pure stock requirements. Instead a new pumping drum, D305, with a capacity of 16.5m^3 has been installed to accept the pure EDC product from the C351 Heavies column and pump it to the Storage Spheres. Therefore there will no longer be a direct vent to atmosphere from pure EDC storage (associated air emission point DC-17).

The Storage Spheres remain unchanged.

1.1.11 Road Tanker Loading

Closure of Bay 1 at the 6th Ave EDC loading facility and associated import line to the crude stock tank on DC3. This is due to the poor condition of the pipeline (which was the cause of a loss of containment environmental incident in recent years) and very little requirement for use. Any future requirement to import EDC from tankers will be considered as a separate project local to T201 on HPE Plant.

Upgrading of the 6th Ave EDC loading facility to allow dual bay tanker loading by improving interlock systems and by installation of a new drainage and containment system. This means that a full tanker loss of containment would be directed into a large collection pit and not towards the adjacent tanker bay – therefore removing the resultant risk of a BLEVE on the adjacent tanker due to potential pool fire.

The tanker de-pressurisation vapours from the 6th Ave loading facility will no longer be directed to atmosphere via Stack-49 (associated air emission point DC-15, which is being renamed HPE-15) but will be directed to the vapour space of the crude EDC stock tank T201. Hence, under normal operation the tankers will de-pressurise into the wet vent header on HPE plant and onto the vents incinerator.

1.2 BAT Demonstration

1.2.1 Large Volume Organic Chemicals (LVOC) BREF

The following General BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Monitoring of emissions to air

BAT 2 – Monitor channelled emissions to air

Following the implementation of Project Summer, the only remaining continuous point source of air emission (and hence applicable to the LVOC BREF) will be the existing Incineration Flue Gas Vent Stack, HPE-1.

The project will not be making any changes to HPE-1 itself or the requirements for monitoring the emissions from it.

Therefore the outcome of the previous agreements with the Environment Agency during the LVOC review of the existing permit still apply and the monitoring requirements as defined in the permit will be complied with - only exception to this being the subject of an Improvement Condition (IC11) in the latest EPR permit to specifically measure EDC and VCM emissions from this vent point (which can only continue) following plant start-up.

Emissions to air

BAT 8 – Reduce the load of pollutants sent to the final waste gas treatment

There are some inherent design features of Project Summer which have contributed to this BAT without the use of any of the prescribed reduction techniques:-

With the closure of the EDC1/2 reactors, air addition is no longer required to the chlorine feed gas at the Runcorn Membrane Chlorine Plant (MCP) hence the chlorine feed is of higher purity, minimising the amount of nitrogen required to be added to the reactor vent to render it safe by reducing oxygen concentration below the minimum concentration for flammability. This in turn will limit the amount of EDC that is entrained with the nitrogen vent gas flow, which would otherwise be larger.

The choice of Low Temperature Direct Chlorination reactors and the Oxy-Vinyls technology means that the bulk EDC liquid inside the new reactors is maintained below its boiling point and as low as possible for reaction efficiency, at the desired set point of 55°C. This minimises the amount of vaporisation of EDC into the reactor vent gas. High temperature protective trips shutdown the reactor if a temperature excursion occurs.

The Oxy-Vinyls technology of the new reactors results in a different control system to existing EDC1/2 and DCA/B reactors where an excess of ethene was the main reaction parameter. For the new reactors, the control of the feed gases is such that a small excess of chlorine will be maintained in the bulk EDC liquid, thereby minimising the quantity of unreacted ethene in the vent gas.

The project has also employed the relevant techniques from the narrative BAT throughout the design, the appropriate measures are shown below:

BAT 8b

- New refrigeration package installed to provide the necessary cooling to new refrigerated reactor vent gas chillers on each reactor to cool the reactor off-gas down to -18°C. This will condense approx. 98% of EDC from the reactor vent gas stream to recover the EDC and the liquid collected in the integral Knock-Out pot flows by gravity back to the respective reactor.

BAT 8f

- New (additional) Knock-Out pots/drums have been installed on the dry & wet vent headers to the Vents Incinerator (thermal oxidiser) from the new Reactor/Wash areas to reduce carryover of droplets/liquid entrainment.

BAT 10 – Reduce channelled emissions of organic compounds to air

The principle of this narrative BAT is one of the main aims of Project Summer. The project has employed the most significant technique (BAT 10e) from the narrative BAT, by designing the new HPE plant to ensure that all channelled air emission points are now directed to the existing Vents Incinerator (thermal oxidiser). Namely:

- Closure of the EDC1/2 plant with associated EDC stock tanks therefore removing the air emission points PT-01 and PT-09

- Closure of the VDC4 EDC stock tanks and road loading facility therefore removing the air emission point VDC-09.

- Demolition of the DC3 EDC pure stock tank therefore removing the air emission point DC-17.

- Disconnection of the already out-of-service DC3 old crude stock tank therefore removing the air emission point DC-16.

- Installation of a new stock tank vents blower system so that these emissions will be directed to the Vents Incinerator under normal operation, therefore removing the air emission point DC-20.

- The tanker de-pressurisation vent from the 6th Ave EDC loading facility will be re-directed away from Stack 49 (air emission point DC-15) and will be connected to the new crude EDC stock tank T201 via new vent pipework.

- The new Reactor vents, new Wash system vents, new ETP vents, new maintenance drums and new buffer vessels will all be connected via new pipeline/systems to the appropriate dry or wet vent headers to be directed to the Vents incinerator under normal operation.

Hence, following the implementation of Project Summer, the number of continuous air emission points will be reduced from 13 to 1, the remaining one being the existing Incineration Flue Gas Vent Stack, HPE-1, part of the permitted activity AR4.

The techniques already described in BAT 8b are applicable to BAT 10a, such that the combination of BAT 10a and BAT 10e techniques are used to minimise channelled emissions of organics to air

Emissions to water

BAT 14 – Use an integrated waste water management and treatment strategy

In order to reduce waste water volumes, the project has rationalised various systems across the DC3 and EDC1/2 plants to provide a waste-water management and treatment strategy for the new HPE plant. Namely:

- Closure of the Cooling Tower No.5 and associated chemical dosing systems, therefore removing the purge/drain of this system to water emission point W56.

- Full cleaning and filling of drainage pits, overflow and channels across the closed EDC1/2 plant, leaving only clean surface water drains.

- Closure of the 'contaminated drainage' system on DC3 which previously pumped potentially contaminated and clean surface water to a BASF separator and then pumped this waste water to the INEOS Inovyn Central Effluent Plant (EIP). Only two drainage systems will be retained on the HPE plant: clean surface water drains and process waste water drains within live unit areas. These live unit areas will be kerbed appropriately to minimise catchment area as much as possible and hence only send as little as possible volume to the process drains to the new ETP.

Residues

BAT 17 – Reduce the amount of waste bring sent for disposal

Although residues generated by the Vynova Runcorn EDC purification process are already used as a fuel in the Liquid Residues Incinerator to generate Hydrochloric acid, as previously described to the Environment Agency as part of the LVOC permit review, the project will likely reduce the amount of residues that are actually produced by the installation choice of the new LTDC reactors. This is because the low temperature reactors are designed to increase the purity of the crude EDC product and therefore reduce the volume of residues produced during further purification to HPE specification.

Other than normal operating conditions

BAT 18 – prevent or reduce emissions from equipment malfunctions

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review, but a review of some of the techniques was required as part of the detailed design phase of the project e.g. SIL classifications, HAZOPS and LOPA to identify significant environmental hazards and determine critical equipment. For example, the main equipment in the new refrigeration system includes two 50% duty refrigerant compressors and a duty/standby pair of Syltherm pumps which are designed to auto-start upon trip of the duty pump (to avoid loss of cooling of the reactor vent and subsequent higher organics loading).

This is a continuing process and is likely to be reviewed again following early life operating experience of the new HPE plant, using all the techniques as described.

Similar abatement systems as previously described for technique BAT 18c are being installed by the project, for the times when the dry and wet vent gases cannot be sent to the Vents incinerator. The existing DC3 caustic scrubbers C201A (emission point DC-14a) and C201B (emission point DC-14b) will be replaced with new purposely designed caustic scrubbers for the latest HPE plant configuration:

- C2351 (emission point HPE-21) – new wet vent scrubber that will discharge at a higher level of 60m from the Stack 49 structure
- C2350 (emission point HPE-22) – new reactor dry vent scrubber that will discharge at a higher level of 60m from the Stack 49 structure

These wet scrubbing systems will reduce emissions to air of acidic gases (as defined in BAT 12). However, given the alternative vent abatement systems are less effective for VOC's than the Vents incinerator, Vynova is committed to minimising incinerator downtime as the main focus to reduce emissions (i.e. technique BAT 18b).

A specific significant improvement being made by the project is the replacement of the Boiler Feed Water pumps that supply the Waste Heat Boiler on the existing Vents Incinerator and which is integral to its operation. In recent years, poor performance was almost solely caused by the failure of the Boiler Feed Water Pumps. These pumps were oversized and ultimately not fit for purpose for the existing plant duty. Hence, these pumps have been re-designed accordingly and installed as a major improvement to vents incinerator reliability going forward.

BAT 19 – prevent or reduce emissions to air and water occurring during other than normal operating conditions

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review, but a review of the management and monitoring of pollutant releases during such periods is required as a result of the project changes.

See separate discussion document on this topic (document reference: VRL_PartC3_3b)

The following specific EDC/VCM production BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Emissions to air

BAT 75 – Reduce the organic load sent to the final waste gas treatment and to reduce raw material consumption

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review.

Specifically for technique BAT 75a, compliance will remain the same for the new HPE plant. As described in BAT 17 the project may improve this further with the design choice of low temperature reactors that will increase the purity of the crude EDC product and thereby reduce the volume of residues.

The project has also complied with the technique BAT 75c, as previously described in BAT 8.

BAT 76 – Treat the combined waste gas streams from EDC production by using a thermal oxidiser followed by two-stage wet scrubbing

The principle of this BAT is one of the main aims of Project Summer - to treat all waste gas streams from the HPE plant using a thermal oxidiser followed by two-stage wet scrubbing, which is the existing Vents incinerator and flue gas treatment train (designed and operated to the description provided in the BAT) to reduce emissions to air of organic compounds, HCl and Chlorine.

The project is making the modifications already described in BAT 10 to allow this to happen. Using the heat & mass balance for the new plant, a study was completed in detailed design to assess the impact on the existing Vents incinerator, working with a Thermal Oxidiser designer/manufacturer (Thyssen Krupp) for their technical/expert advice. The conclusion was that the existing incineration plant is suitable for the new HPE plant without requiring modifications itself.

Hence it is expected that the BAT-AELs listed in Table 10.2 and the latest LVOC permit will continue to be met, as previously described to the Environment Agency during the LVOC permit review. The only exception to this being the subject of an Improvement Condition (IC11) on the latest EPR permit to specifically measure EDC and VCM emissions, which has already been described in BAT 2.

Emissions to water

BAT 79 – Monitor emissions to water

As all process waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, then this BAT is mostly applicable to that activity, hence see information in the equivalent section for permitted activity AR4.

As described in BAT 14 above, the only flows to Outfall from AR1 in future will be clean surface water run-off and the cooling towers on DC3 (new HPE plant) will continue to purge/drain into the Outfall 56 drainage system. Therefore the only monitoring that is relevant to this permitted activity is for EDC.

Despite having no direct connection to EDC processing plant, both Outfalls will be monitored for EDC as described in the current EPR permit, which requires at least 3 spot samples to be taken every 24 hours. These samples will be analysed by the INEOS Inovyn shift lab team with the capability of measuring down to 35 ppb (0.035 mg/l). Given the fact that the average concentration of these 1095 samples will be multiplied by the variable flowrate to Outfall within a calendar year to obtain a mass emission, which is then rated to the purified EDC production total for the year, this is considered an adequate limit of measurement.

New weir arrangements are being installed by the project on each Outfall chamber route so that monitoring equipment (e.g. pH and temperature probes) will remain flooded at all times and new flowmeters are being installed on each Outfall chamber to provide indication of the various flows that will be obtained during different weather conditions. This will enable the current fixed (legacy) estimate of 1400 m^3/day to be challenged for Outfall 56 and new information provided for Outfall 49 (currently dry/zero flow Outfall).

BAT 80 – Use hydrolysis and stripping as close as possible to the source to reduce the load of chlorinated compounds requiring treatment.

Hydrolysis is not relevant to Vynova Runcorn as already communicated to the Environment Agency as part of the LVOC permit review.

To minimise emissions to air from waste water collection, all organic containing waste water streams from this permitted activity (AR1) under normal operation have been designed by the project to be fully contained within closed pipework/tanks/pumping systems before sending to the new Effluent Treatment Plant (AR4).

The BAT-associated emission level for EDC of 0.05g/t of EDC purified are relevant to this permitted activity (AR1) for Outfalls 49 and 56. However, there will be no direct connection of these Outfall drain routes to EDC processing plant (see BAT 14).

Some inventory/characterisation monitoring of Outfall 56 has been recently been undertaken, working with INEOS Inovyn and external laboratory analysis throughout 2023, which gave the following results…

Analyte	Unit	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56
Weather													
		01/11/2022	NO	17/01/2023	22/02/2023	21/03/2023	25/04/2023	23/05/2023	21/06/2023	25/07/2023	15/08/2023	05/09/2023	10/10/2023
			FLOW										
1,2-Dichloroethane	ug/l	<20		93.162	<20	<20	<20	<20	<20	22.927	<20	37.8	<20

This work was undertaken with the plant off-line and therefore no cooling tower purge flow, hence the concentrations recorded may be higher than expected during normal conditions with the plant back on-line. However, taking the results which were <LOD as LOD, then the average EDC concentration observed is approx. 28 µg/l.

Even using the fixed legacy estimate of 1400m^3/day for this Outfall, this equates to approx. 0.04 g/t EDC purified (335,000 t/yr), hence it is expected that the BAT-AEL can be achieved and will be monitored frequently as per BAT 79. As there will be no input from process streams, any deviations will only be due to emergency spills or drain breaches which will be identified and rectified as soon as possible.

1.2.2 Common Waste Water and Waste Gas treatment/management (CWW) BREF

The following BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Environmental Management Systems

BAT 1 – Implement and adhere to an environmental management system (EMS)

The project has revised the existing EMS processes and procedures, which are monitored under ISO14001 (see separate document VRL_PartC2_3d). For completeness, following plant start-up, an audit will be completed to ensure that all the features described in this narrative BAT have been incorporated and are working in practice, which is already the subject of an Improvement Condition (IC10) on the latest EPR permit.

BAT 2 – Establish and maintain an inventory of waste water and waste gas streams

The project has produced an inventory of waste water and waste gas streams, including chemical production processes, as part of the detailed design stage and development of the heat & mass balances for the various parts of the new plant. These documents are available for inspection if required.

The new plant design has included online measurements for the monitoring of certain parameters such as flow, temperature, pH etc. to appropriately record, trend and report as necessary. Also, sample points have been strategically located to allow streams to be characterized in practice when the plant starts-up.

This is already the subject of an Improvement Condition (IC10) on the latest EPR permit. The sampling and analysis regime for the plant has been revised for this purpose and is available for inspection on request.

Monitoring

BAT 3 – Monitor key process parameters at key locations

As all process waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, then this narrative BAT is mostly applicable to that activity, hence see information in the equivalent section for permitted activity AR4.

The only flows to Outfall (water) from AR1 in future will be clean surface water run-off to Outfall 49 and Outfall 56. Also, the cooling towers on DC3 (new HPE plant) will continue to purge/drain into the Outfall 56 drainage system.

Despite having no direct connection to EDC processing plant, new weir arrangements are being installed by the project on each Outfall chamber route so that the new continuous monitoring equipment (online 2 x pH and temperature probes) that is being installed will remain flooded at all times. Also, new flowmeters are being installed on each Outfall chamber to provide indication of the various flows that will be obtained during different weather conditions. This will enable the current fixed (legacy) estimate of 1400 m^3/day to be challenged for Outfall 56 and new information provided for Outfall 49 (currently dry/zero flow Outfall).

BAT 4 – Monitor emissions to water in accordance with EN standards with at least the minimum frequency required

The emissions to water from AR1 are to Outfall 49 and Outfall 56. Both these Outfalls will be monitored as described in the current EPR permit, including the relevant methods/standards.

However, following review with the INEOS Inovyn lab team, to achieve the required standards and limits of detection for several components (namely AOX, Chromium and Copper) would require significant changes and investment in analysis equipment. Hence for early life operation of the HPE plant it is planned to outsource these analyses to an external analysis provider until sufficient data can be obtained to assess whether the testing/frequency of these components is appropriate going forward. This assessment is already the subject of an Improvement Condition (IC12) on the latest EPR permit for AOX and IC13 for metals.

BAT 5 – Periodically monitor diffuse VOC emissions to air from relevant sources

The project has employed the various techniques described in BAT 19 to reduce the potential for diffuse VOC emissions to air as far as practicable, hence it is considered that the techniques already described & communicated to the Environment Agency in the LVOC permit review are applicable.

The Hygiene Monitoring mass spectrometer system is being replaced and upgraded to serve the new HPE plant, with new sample locations installed to ensure coverage of all ongoing production areas. The system will be used to provide local surrounding air analysis for the purpose of fugitive emissions recording (as part of the LDAR programme). See attached DCS screenshot/map (document reference: VRL_HPELowLevelDetectors).

Emissions to water

BAT 7 – Reduce the usage of water and the generation of waste water

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review and the principles described have been included within the new HPE plant design e.g. steam condensate will be used as the primary feed to the new EDC wash system, rather than fresh water.

In order to reduce waste water volumes, the project has rationalised various systems across the existing DC3 and EDC1/2 plants for the new HPE plant. Namely:

- Closure of the Cooling Tower No.5 and associated chemical dosing systems, therefore removing the purge/drain of this system to water emission point W56.

- Full cleaning and filling of drainage pits, overflow and channels across the closed EDC1/2 plant, leaving only clean surface water drains.

BAT 8 – Segregate uncontaminated waste water streams from those that require treatment

The project is modifying existing drainage & containment systems to allow separation of contaminated and non-contaminated waste water streams to the extent feasible on the existing site.

Specifically, the 'contaminated drainage' system on DC3 will be closed which previously pumped potentially contaminated and clean surface water to a BASF separator and then pumped this waste water to the INEOS Inovyn Central Effluent Plant (EIP). Going forward, only two drainage systems will be retained on the HPE plant: clean surface water drains and process waste water drains within live unit areas. These live unit areas will be kerbed appropriately to minimise catchment area as much as possible and hence only send as little as possible volume to the process drains to the new ETP. The clean surface water drains will either run into Outfall 56 (north area of HPE plant) or Outfall 49 (south area of HPE plant).

BAT 9 – Provide an appropriate buffer storage capacity for waste water incurred during other than normal operating conditions

As described in BAT 8 above, live plant areas will be kerbed to contain any spillages of contaminated material. These areas have been designed with sumps/pits and pumps to transfer this material to a central plant effluent buffer storage which is part of the permitted activity AR4, hence see information in the equivalent section for this activity.

BAT 10 – Use an integrated waste water management and treatment strategy

The principle of this narrative BAT is one of the main aims of Project Summer.

The new HPE plant has been designed to current industry best practice to meet the required techniques of this BAT i.e. prevent/reduce water contaminants at source, recover into the process where possible.

The remaining process waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, see BAT 11.

BAT 11 – Pre-treat waste water that contains pollutants that cannot be dealt with adequately during final waste water treatment

See BAT 11 for the permitted activity AR4, as all waste water streams from this activity (AR1) are directed to AR4.

BAT 12 – Use an appropriate combination of final waste water treatment techniques

There are no contaminated waste water streams directed to a receiving water body from this permitted activity (AR1). Any such streams are sent to the new Effluent Treatment Plant, see permitted activity AR4.

The direct emissions to water from AR1 are to Outfall 49 and Outfall 56. These will contain clean surface water run-off only and for Outfall 56 only the purge/drain from the cooling towers on DC3 (new HPE plant).

As described in BAT 4, both these Outfalls will be monitored as described in the current EPR permit, including the relevant methods/standards.

As already communicated to the Environment Agency as part of the LVOC permit review, the following BAT-associated emission levels (as yearly averages) will apply from Tables 1, 2 and 3 of this BAT:-

Total Organic Carbon (TOC) of 33 mg/l, if the emission exceeds 3.3 t/yr
Total Suspended Solids (TSS) of 35 mg/l, if the emission exceeds 3.5 t/yr
Adsorbable Organically bound halogens (AOX) of 1 mg/l, if the emission exceeds 100 kg/yr
Chromium (Cr) of 25 µg/l, if the emission exceeds 2.5 kg/yr
Copper (Cu) of 50 µg/l, if the emission exceeds 5.0 kg/yr

From historical records, as communicated during the LVOC permit review, Outfall 56 has (where previously measured) achieved compliance to these BAT-AELs

Some inventory/characterisation monitoring of Outfall 56 has been recently been undertaken, working with INEOS Inovyn and external laboratory analysis throughout 2023, which gave the following results…

Analyte	Unit	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56	CK56
Weather													
		01/11/2022	NO	17/01/2023	22/02/2023	21/03/2023	25/04/2023	23/05/2023	21/06/2023	25/07/2023	15/08/2023	05/09/2023	10/10/2023
			FLOW										
Suspended Solids	mg/l	4		37	80	48	16	14	19	17	5	9	1
Chromium	mg/l	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	mg/l	0.0123		0.1144	0.0205	0.1119	<0.01	0.0144	0.0123	0.0351	0.0144	<0.01	<0.01
TOC as C	mg/l	6.45		6.08	8.99	9.32	10.91	11.14	9.22	12.14	12.82	11.49	10.91
ALS (External) Analysis													
AOX*	mg/l	0.246			0.151	0.228	0.09	0.162	0.224			0.218	0.118
Volatile Organic Compounds (VOCs)													
Benzene	µg/l	<1		<1	<1	<1	<1	<1	<1			<1	<1
Ethylbenzene	µg/l	<1		<1	<1	<1	<1	<1	<1			<1	<1
m,p-Xylene	µg/l	<1		<1	<1	<1	<1	<1	<1			<1	<1
o-Xylene	µg/l	<1		<1	<1	<1	<1	<1	<1			<1	<1
Sum of detected Xylenes	µg/l	<2		<2	<2	<2	<2	<2	<2			<2	<2
Toluene	µg/l	<1		<1	<1	<1	<1	<1	<1			<1	<1

This work was undertaken with the plant off-line and therefore no cooling tower purge flow, hence the concentrations recorded may be higher than expected during normal conditions with the plant back on-line. Suspended solids were affected by Project Summer construction work in early 2023 as previously discussed with the Environment Agency. Clearly the INEOS Inovyn Laboratory limits of detection for Chromium and Copper are not appropriate for the BAT-AEL's, as already described in BAT 4 above. However, despite this, if <LOD results are taken to be LOD, then it is expected that all the BAT-AELs can be achieved. These will be monitored as per BAT 4 and subject to an Improvement Condition (IC12) on the latest EPR permit for AOX and IC13 for metals.

Waste

BAT 13 – Prevent or reduce the quantity of waste being sent for disposal

The project is improving compliance with this narrative BAT, as described in LVOC BAT 17.

Emissions to air

BAT 15 – Enclose the emission sources and to treat the emissions, where possible.

The principle of this narrative BAT is one of the main aims of Project Summer, ensuring that vent emissions from all plant items are contained and routed to the dry and wet vent header

systems for treatment prior to discharge as already described in LVOC BAT 10, 75, 76 and part of 80.

This includes the installation of new enclosed maintenance drainage systems to existing or new maintenance drums. These are strategically located around the plant to collect and then transfer any drainings in a contained manner to the new Wash system for recovery or to the new ETP for treatment.

Only the off-spec effluent buffer storage is open to atmosphere, however VOC emissions are not expected as all VOC contacting effluent would have been subject to steam stripping and only diverted to the off-spec effluent sump during a effluent treatment plant upset. Therefore, the risk of VOC emissions is low. In addition, a top layer of water is provided within the buffer storage to reduce emissions.

BAT 16 – Use an integrated waste gas management and treatment strategy that includes process-integrated and waste gas treatment techniques

The principle of this narrative BAT is one of the main aims of Project Summer, as already described in LVOC BAT 8, 10, 75 and 76.

BAT 19 – Prevent or reduce diffuse VOC emissions to air

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review and the principles described have been included in the design principles for Project Summer, as well as for the construction and commissioning phases.

For instance, the project has designed and selected high-integrity equipment as described in Section 6.2 of the CWW BAT conclusions (e.g. use of canned or mag-drive pumps, corrosion resistant materials, high-integrity gaskets, etc.). Future maintenance of equipment has been considered in the design (e.g. pipework racks at low levels, cooling water pipework above ground) as well as a computerised 3D model of the new plant being used to carry out layout reviews throughout the detailed design stage.

For construction and commissioning phases, numerous procedures and systems have been implemented to ensure the plant is handed over in-line with the design requirements (e.g. flange/gasket management process, leak tests & handover procedures, pre-start up safety reviews, etc.)

For ongoing operation and maintenance of the plant, numerous procedures and systems are being updated for the new HPE plant e.g. SAP maintenance and routine planning system hierarchy updated to match ongoing and new plant equipment, spares reviews, maps and checklists for monitoring of leaks, sniffer checks with portable hand-held VOC analyser, to name but a few.

Significantly, the main aim of the Project was to collect/contain VOC emissions and treat them in the incinerator (thermal oxidiser) as described in Section 6.2 of the CWW BAT conclusions.

BAT 22 – Set up and implement a noise management plant

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review. The noise survey for the plant will be repeated following the start up of the new HPE plant and the noise management plan updated accordingly.

BAT 23 – Prevent or reduce noise emissions

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review. The project has designed and selected new equipment to satisfy the required standards.

AR2 – Section 4.2A(1)(b) – Manufacturing hydrogen chloride and hydrochloric acid

2.1 Technical Description

2.1.1 HCl off-loading and storage

The project has installed a new hydrochloric acid tanker off-loading facility to allow periodic direct filling of the hydrochloric acid stock tanks D757 and D758. These stock tanks are unchanged by the project.

The new off-loading installation has been designed to modern standards with automatic trip systems to avoid loss of containment. This has removed the vulnerability of the old EDC1/2 system due to the asset condition and potential for HCl leaks, which could lead to emissions to water (Outfall). Also the EDC1/2 tanks which were directly vented to atmosphere have now been closed.

2.1.2 HCl generation & absorption in Incineration plant

The HCl absorption system on the Incineration Unit remains largely unchanged, but the project has re-designed the HCl absorption column C751 due to the existing column displaying poor performance in operation before the plant was shutdown. This end-of-life trayed column is being replaced with new packed column (designed to match current plant configuration i.e. no desorption system). The TAR (overhaul) work completed on the Incineration Unit post plant shutdown revealed a full re-lining of the final scrubbing column C752 was required, the damage is suspected to have been caused by the high loading of HCl placed upon it due to the under-performance of the C751 column. Together, these two pieces of work will now improve the HCl absorption process and minimise HCl emission to air via the incinerator flue gas stack (air emission point HPE-1).

Closure of the Industrial Chemicals Ferrous/Ferric Chloride Plant on Runcorn Site, which has since been demolished, means that there will be no ongoing requirement to import HCl tankers for the purpose of export to this plant when the incineration plant is off-line and hence minimise emissions of HCl from local vents.

2.2 BAT Demonstration

2.2.1 Large Volume Organic Chemicals (LVOC) BREF

The following General BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Emissions to air

BAT 8 – Reduce the load of pollutants sent to the final waste gas treatment

The project is replacing the main HCl absorption column C751 in order to significantly improve current compliance with this narrative BAT, specifically technique BAT8d:-

BAT 8d

- The end-of-life trayed column (C751) was operating very inefficiently prior to the plant shutdown and the loading on downstream waste gas treatment i.e. caustic scrubber C752 was increasing. The project is replacing the column with a newly designed packed column for the current plant duty which will improve HCl absorption capability into water, allowing the HCl to be recovered as much as possible to be used as acid reagent.

BAT 10 – Reduce channelled emissions of organic compounds to air

The principle of this narrative BAT is one of the main aims of Project Summer. The project has employed the most significant technique (BAT 10e) from the narrative BAT, by designing the new HPE plant to ensure that all channelled air emission points are now directed to the existing Vents Incinerator (thermal oxidiser). Namely:

- Closure of the EDC1/2 hydrochloric acid stock tanks & existing tanker off-loading facility therefore removing the air emission point PT-24.

- The new tanker off-loading facility will pump directly to the existing hydrochloric acid stock tanks D757 and D758 which are normally vented to the incinerator scrubber systems.

Emissions to water

BAT 14 – Use an integrated waste water management and treatment strategy

The project has rationalised various systems across the DC3 and EDC1/2 plants to provide a waste-water management and treatment strategy for the new HPE plant. Namely:

- Closure of the EDC1/2 hydrochloric acid stock tanks & existing tanker off-loading facility therefore removing the need for containment/drainage systems, and leaving only clean surface water drains.

- The new tanker off-loading facility has been designed for spillage containment and new gulley/drainage channels installed to direct any spillages/washdown to a newly-purposed 700 Unit (incineration plant) buffer pit, which was previously used as the west (2nd) effluent pit on EDC1/2. From there, any collected waste water is pumped to the HPE effluent treatment plant.

Other than normal operating conditions

BAT 19 – Prevent or reduce emissions to air and water occurring during other than normal operating conditions

Compliance with this narrative BAT will be improved by the closure of the export of hydrochloric acid to the Industrial Chemicals Ferrous/Ferric Chloride Plant on Runcorn Site, which has now been demolished. This is because if the Incineration plant was off-line then import of acid was still required to feed the Iron Salts plant, thereby leading to a venting requirement of the HCl stock tanks via local water scrubber pot T751, instead of the caustic scrubbing system on the Incineration unit. This requirement has now ceased.

The following specific EDC/VCM production BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Emissions to air

BAT 76 – Treat the combined waste gas streams from EDC production by using a thermal oxidiser followed by two-stage wet scrubbing

As described in BAT 8d above, the project is improving the absorption of HCl with the replacement of C751 in the Incineration plant, hence it is expected that the BAT-AELs for HCl and chlorine will continue to be met as previously described to the Environment Agency during the LVOC permit review.

Residues

BAT 85 – Reduce the amount of hazardous waste being sent for disposal and to increase resource efficiency

As described in BAT 8d above, the project is improving the absorption of HCl with the replacement of C751 in the Incineration plant, hence it is expected that compliance with the relevant technique BAT 85b will also improve.

2.2.2 Common Waste Water and Waste Gas treatment/management (CWW) BREF

The following BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Monitoring

BAT 3 – Monitor key process parameters at key locations

There are no emissions to water from AR2, all waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, hence see information in the equivalent section for permitted activity AR4.

Emissions to water

BAT 8 – Segregate uncontaminated waste water streams from those that require treatment

The principle of this narrative BAT is one of the aims of Project Summer, as already described in LVOC BAT 14.

BAT 9 – Provide an appropriate buffer storage capacity for waste water incurred during other than normal operating conditions

As described in LVOC BAT 14 above, the EDC1/2 west (2nd) effluent pit has been re-purposed as a 700 Unit buffer pit to provide storage capacity for spillages/abnormal conditions.

BAT 10 – Use an integrated waste water management and treatment strategy

There are no emissions to water from AR2, all waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, see BAT 11.

BAT 11 – Pre-treat waste water that contains pollutants that cannot be dealt with adequately during final waste water treatment

See BAT 11 for the permitted activity AR4, as all waste water streams from this activity (AR2) are directed to AR4.

BAT 12 – Use an appropriate combination of final waste water treatment techniques

There are no emissions to water from AR2, all waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, see permitted activity AR4.

Emissions to air

BAT 15 – Enclose the emission sources and to treat the emissions, where possible.

The principle of this narrative BAT is one of the main aims of Project Summer, ensuring that vent emissions from all plant items are contained and routed to treatment systems prior to discharge as already described in LVOC BAT 10 and 76.

BAT 16 – Use an integrated waste gas management and treatment strategy that includes process-integrated and waste gas treatment techniques

The principle of this narrative BAT is one of the main aims of Project Summer, as already described in LVOC BAT 8, 10 and 76.

AR3 – Section 5.1A(1)(a) – Incineration of liquid residues from hazardous waste

3.1 Technical Description

3.1.1 Residues storage

Due to the physical remoteness of the EDC1/2 Residues storage and handling vessels (namely T532 and T729) and their lack of vent connections to the Vents Incinerator, the project is closing these facilities. Instead, all Residues storage will now be located on the HPE plant.

The previously used residues drums, D814A/B, will also be taken out of service as, although they are connected to the vents incinerator, they do not have sufficient bunding, fire protection or buffer volume to provide sensible time periods between campaign burning of residues. Prior to plant shutdown, to address the fire protection issue, the residues were mixed with imported CTC (Carbon TetraChloride) to render the contents of these vessels non-flammable.

To provide the necessary residues buffer storage capacity for the HPE plant, the project is converting the existing DC3 crude EDC stock tank, D103, to a liquid residues stock tank and renaming it T703. This tank will accept liquid residues directly from the C351 heavies column and new pumps will be installed to pump this material to the liquid residues incinerator. The tank is sufficiently bunded (as per previous duty) and will have an active fire protection system installed which will be connected to the new HPE plant firewater deluge network.

This means that they will no longer be any requirement to import CTC into the plant and therefore extra organic loading on the vents incinerator has been removed.

T703 will no longer vent directly to atmosphere as it will be connected to a new vents blower system to push it into the wet vent header and onto the vents incinerator during normal operation. The tank will operate at 5-15 mbarg pressure and ambient temperature. The pressure is controlled by allowing surplus gas to leave the tank via the vent connection to the blower system , or in case of falling pressure to admit nitrogen gas into the tank.

If the normal venting route to the incinerator is unavailable then the vent will be diverted to the existing Stack 49 as there are no acidic gases present that require scrubbing (associated air emission point DC-15, which is being renamed HPE-15). Only in exceptional circumstances e.g. TAR event, the tank may be required to vent locally and standard calculation for emissions used.

A new maintenance drum (D954) will be installed within the HPE stock tank area to facilitate an enclosed system for purging/emptying of equipment in this area, which will itself be connected to the wet vent header.

3.1.2 Residues Incineration

The Residues Incineration plant remains largely unchanged. The downstream flue gas treatment & HCl absorption system has been improved by the project, as already described in AR2.

3.2 BAT Demonstration

3.2.1 Large Volume Organic Chemicals (LVOC) BREF

The following General BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Monitoring of emissions to air

BAT 2 – Monitor channelled emissions to air

Following the implementation of Project Summer, the only remaining continuous point source of air emission will be the combined incinerator flue gas vent stack, HPE-1 (was previously DC-1). A number of the requirements for monitoring this vent, as stated in the latest EPR permit, have been derived from the Waste Incineration Directive (WID). There is an existing agreement/protocol used for particulate monitoring, which was agreed in writing with the Environment Agency on 24/7/2017 due to the technical inability of the continuous emission monitor (CEM) on the stack to distinguish between particulates generated from combustion activity or not, and hence the use of a 50% inference rule is applied.

It is requested that, as part of this permit review, the monitoring requirements for particulate matter on this vent are updated in the EPR permit to match this agreement.

Emissions to air

BAT 8 – Reduce the load of pollutants sent to the final waste gas treatment

The project is converting the existing DC3 crude EDC stock tank, D103, into a liquid residues stock tank and renamed T703. This tank is designed to accept the liquid residues direct from the C351 heavies column and new fire protective systems will be installed on this tank. This means that there is no requirement anymore to import Carbon TetraChloride (CTC) into the plant to dilute the liquid residues to render them non-flammable, therefore reducing this loading on residues tank vents to the incinerator.

BAT 10 – Reduce channelled emissions of organic compounds to air

The principle of this narrative BAT is one of the main aims of Project Summer. The project has employed the most significant technique (BAT 10e) from the narrative BAT, by designing

the new HPE plant to ensure that all channelled air emission points are now directed to the existing Vents Incinerator (thermal oxidiser). Namely:

- Closure of the EDC1/2 residues storage and handling tanks therefore removing the air emission point PT-04.

- The 'new' residues stock tank T703 tank will no longer vent directly to atmosphere (associated air emission point DC-20) as it will be connected to a new vents blower system to push it into the wet vent header on HPE plant and onto the vents incinerator during normal operation.

Emissions to water

BAT 14 – Use an integrated waste water management and treatment strategy

The project has rationalised various systems across the DC3 and EDC1/2 plants to provide a waste-water management and treatment strategy for the new HPE plant. Namely:

- Closure of the CTC (Carbon TetraChloride) tanker import facility on EDC1/2 adjacent to the Residues storage and handling vessels, therefore removing the need for containment/drainage systems, and leaving only clean surface water drains in this area.

Residues

BAT 17 – Reduce the amount of waste bring sent for disposal

As already discussed in BAT 8, there is no longer any need to import Carbon TetraChloride (CTC) into the plant to dilute the liquid residues to render them non-flammable and therefore the project will reduce the total amount of mixed residues generated and required to be sent to the Liquid Incinerator.

The following specific EDC/VCM production BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Emissions to air

BAT 75 – Reduce the organic load sent to the final waste gas treatment and to reduce raw material consumption

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review.

Specifically for this permitted activity, the project is improving compliance as already described in BAT 8.

BAT 76 – Treat the combined waste gas streams from EDC production by using a thermal oxidiser followed by two-stage wet scrubbing

The principle of this BAT is one of the main aims of Project Summer - to treat all waste gas streams from the HPE plant using a thermal oxidiser followed by two-stage wet scrubbing, which is the existing Vents incinerator and flue gas treatment train (designed and operated to the description provided in the BAT).

The project is making the modifications already described in BAT 10 to allow this to happen. A study was completed in detailed design to assess the impact on the existing Vents incinerator, working with a Thermal Oxidiser designer/manufacturer (Thyssen Krupp) for their technical/expert advice. The conclusion was that the existing incineration plant is suitable for the new HPE plant without requiring modifications itself.

Hence it is expected that the BAT-AELs listed in Table 10.2 and the latest LVOC permit will continue to be met, as previously described to the Environment Agency during the LVOC permit review.

3.2.2 Common Waste Water and Waste Gas treatment/management (CWW) BREF

The following BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Monitoring

BAT 3 – Monitor key process parameters at key locations

There are no emissions to water from AR3, all waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, hence see information in the equivalent section for permitted activity AR4.

Emissions to water

BAT 8 – Segregate uncontaminated waste water streams from those that require treatment

The principle of this narrative BAT is one of the aims of Project Summer, as already described in LVOC BAT 14.

BAT 10 – Use an integrated waste water management and treatment strategy

There are no emissions to water from AR3, all waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, see BAT 11.

BAT 11 – Pre-treat waste water that contains pollutants that cannot be dealt with adequately during final waste water treatment

See BAT 11 for the permitted activity AR4, as all waste water streams from this activity (AR3) are directed to AR4.

BAT 12 – Use an appropriate combination of final waste water treatment techniques

There are no emissions to water from AR3, all waste water streams from this permitted activity will be sent to the new Effluent Treatment Plant, see permitted activity AR4.

Waste

BAT 13 – Prevent or reduce the quantity of waste being sent for disposal

The project is improving compliance with this narrative BAT, as described in LVOC BAT 17.

Emissions to air

BAT 15 – Enclose the emission sources and to treat the emissions, where possible.

The principle of this narrative BAT is one of the main aims of Project Summer, ensuring that vent emissions from all plant items are contained and routed to treatment systems prior to discharge as already described in LVOC BAT 10 and 76.

BAT 16 – Use an integrated waste gas management and treatment strategy that includes process-integrated and waste gas treatment techniques

The principle of this narrative BAT is one of the main aims of Project Summer, as already described in LVOC BAT 8, 10, 75 and 76.

BAT 19 – Prevent or reduce diffuse VOC emissions to air

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review and the principles described have been included in the design principles for Project Summer, as well as for the construction and commissioning phases.

For instance, the project has designed and selected high-integrity equipment as described in Section 6.2 of the CWW BAT conclusions (e.g. use of canned or mag-drive pumps, corrosion resistant materials, high-integrity gaskets, etc.).

For construction and commissioning phases, numerous procedures and systems have been implemented to ensure the plant is handed over in-line with the design requirements (e.g. flange/gasket management process, leak tests & handover procedures, pre-start up safety reviews, etc.)

For ongoing operation and maintenance of the plant, numerous procedures and systems are being updated for the new HPE plant e.g. SAP maintenance and routine planning system

hierarchy updated to match ongoing and new plant equipment, spares reviews, maps and checklists for monitoring of leaks, sniffer checks with portable hand-held VOC analyser, to name but a few.

Significantly, the main aim of the Project was to collect/contain VOC emissions and treat them in the incinerator (thermal oxidiser) as described in Section 6.2 of the CWW BAT conclusions.

AR4 – Section 5.4A(1)(a)(ii) – Disposal of non-hazardous waste in a facility with a capacity of more than 50 tonnes per day by physico-chemical treatment

4.1 Technical Description

4.1.1 Effluent Treatment Plant

The project is installing a new Effluent Treatment Plant (ETP) on HPE, purposely designed to neutralise the various waste water streams from the plant and strip them of organics down to a level which is acceptable for release to Outfall. The detailed design of the equipment was based on OxyVinyls mass balance information for the new Reactor and Wash systems, supported by analysis of existing plant effluent samples taken prior to the plant shutdown in 2022. Predictive OLI modelling and vendor laboratory tests have also been used to validate the unit operations' theoretical capabilities.

The main streams going to effluent treatment will be:

- Contained effluent stream from EDC Wash
- Spent caustic from Incineration Unit
- Acid purge from Incineration Unit
- Contained effluent from Incineration Unit
- Crude EDC storage tank water layer
- Caustic effluent purge from Dry Vent Scrubber
- Caustic effluent purge from Wet Vent Scrubber
- Caustic effluent purge from ETP Vent Scrubber
- IBC reprocessing
- Surface water drains from live plant areas (potentially contaminated)

The resultant waste water will still be pumped to the INEOS Inovyn Central Effluent Plant (EIP) due to solids content (associated E1 discharge point). EIP is designed to remove these solids before discharge to an INEOS Inovyn owned Outfall but can no longer treat organic material to an acceptable standard and hence the design of the HPE plant's new ETP to include this full removal process.

The treatment scheme provided by the new ETP is described below:

- A pre-treatment stage will be required for some of the feed streams, in which bisulphite or hypochlorite in feed streams is removed by the controlled addition of sodium hypochlorite or sodium bisulphite respectively. As these reactions will need to be undertaken at neutral or alkaline pH to prevent excessive degassing of SO2 or Cl2,

sodium hydroxide addition is also carried out in this stage to ensure the pH is 8.5 or above. The effluent stream will also be cooled in this stage.

- Two stages of pH adjustment are then carried out in D612 & D613. The first stage adjusts the pH of effluent from 8.5 or above to ca. pH 5 with the final target being 3. This is achieved by addition of HCl as required.

- The acidified effluent at pH 3.0 from D613 is pumped to the steam stripper C615 in which organics are removed from effluent by direct steam stripping.

- Stripped effluent from the stripper package is routed to the final pH correction stage, in which the pH is adjusted from 3.0 to neutral (target range 6.0 to 9.0). The pH adjustment is performed in 2 stages, the first being in-line addition of NaOH to stripped effluent line, with pH target of 5.0. The second stage of pH adjustment is performed in the vessel itself, D618, using addition of NaOH (or HCl if required) to the recycle line.

- The flows from ETP to EIP will be monitored online for pH, temperature, ORP and total organic carbon. If the effluent to EIP is out of specification, then this stream will be returned to the HPE plant primary effluent collection pit (Bund-007) for re-treatment by an arrangement of actuated valves.

The process vents from the new ETP normally flow to the main plant wet vent header and onto the vents incinerator, but when this route is unavailable the vent gases will be diverted to a new dedicated vents scrubber (C629) and then to atmosphere (new air emission point HPE-23).

4.1.2 Plant bunds, drains and water collection

The project is fully decontaminating and filling drainage pits, overflows & channels across EDC1/2, leaving only stormwater drains (associated water emission point W56). The only exception to this is the West Effluent Pit which is being re-purposed as the HPE 700 Unit effluent buffer pit (Bund-039). All previous drain connections from the EDC1/2 area are being severed and this pit will only now accept washings/drainage from the new hydrochloric acid tanker off-loading facility as well as the HPE 700 Unit drainage pit. New air driven diaphragm pumps will be installed to convey this potentially acidic effluent to the new Effluent Treatment Plant (ETP) on HPE. The pit will no longer overflow directly to Outfall 56 but into the HPE 700 Unit area drains.

The network of drains from original DC3 process areas will be modified such that only uncontaminated runoff from inactive areas feeds into the stormwater drain systems, either to

Outfall 56 (for north plant areas) or Outfall 49 (for south plant areas). There will therefore be no requirement for a separate contaminated drainage system (that previously existed on DC3) on the new HPE plant as the new/live equipment areas, which will be bunded or kerbed appropriately, will be collected in new/existing containment pits and directed to the new Effluent Treatment Plant. Any other areas will simply be stormwater run-off, as just described.

The stormwater drains located in the south area of DC3 will no longer be pumped into the BASF separator and sent to INEOS Inovyn Central Effluent Plant (EIP), they will flow directly to Outfall (associated water emission point W49).

The Land drainage system (which collects potentially historically-contaminated water from INEOS Inovyn owned land and flows into the Embankment Pit) will transfer ownership to INEOS Inovyn. This system will continue to pump to their EIP.

4.2 BAT Demonstration

4.2.1 Large Volume Organic Chemicals (LVOC) BREF

The following General BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Emissions to air

BAT 8 – Reduce the load of pollutants sent to the final waste gas treatment

The project is installing a new Effluent Treatment Plant which is connected to the vents incinerator (i.e. final waste gas treatment). The design has incorporated the relevant techniques from this narrative BAT, including technique BAT8f as the original vent route to the wet vent system has been re-used, but specifically the technique BAT 8b has been employed for the new equipment:-

BAT 8b

- Cooling water condensation is used on the overheads stream from the new Effluent Treatment Plant (ETP) steam stripping column to condense approx. 80% of EDC from this stream. The liquid EDC is collected in a downstream Knock-Out pot which is then pumped back to the new Wash area to recover/re-use the EDC.

BAT 10 – Reduce channelled emissions of organic compounds to air

The principle of this narrative BAT is one of the main aims of Project Summer. The project has employed the most significant technique (BAT 10e) from the narrative BAT, by designing the new HPE plant to ensure that all channelled air emission points are now directed to the existing Vents Incinerator (thermal oxidiser). Namely:

- Closure of the EDC1/2 effluent neutralisation plant therefore removing the air emission points PT-23, PT-37 and PT-38.

- All the new ETP equipment vents will be connected via pipeline/systems to the HPE plant's wet vent header to be directed to the Vents incinerator under normal operation.

The techniques already described in BAT 8b are applicable to BAT 10a, such that the combination of BAT 10a and BAT 10e techniques are used to minimise channelled emissions of organics to air.

Emissions to water

BAT 14 – Use an integrated waste water management and treatment strategy

In order to reduce waste water volumes, the project has rationalised various systems across the DC3 and EDC1/2 plants to provide a waste-water management and treatment strategy for the new HPE plant. Namely:

- Closure of the EDC1/2 effluent treatment plant along with caustic/acid reagent systems (associated E4 discharge to INEOS Inovyn Central Effluent Plant [EIP]). No longer any acceptance of INEOS Inovyn Cereclor Plant waste acid.

- Closure of the existing DC3 Plant Effluent Treatment facility, comprising of two pH correction / mixing vessels (D8004 and D8005) and a crude steam stripper / flash column (C805) along with associated heat exchangers, pumps and coolers.

- Installation of a new Effluent Treatment Plant (ETP) for the HPE plant, purposely designed to neutralise the various process waste water streams and strip them of organics, as it is understood that the INEOS Inovyn EIP can no longer treat organic material to an acceptable standard.

  For the design of the new ETP, the inventory of the effluent streams has been established by a sampling and analysis regime before the DC3 plant was shutdown and using the heat & mass balances for expected waste water streams for new plant. The detailed flow and characteristics of the effluent streams were then defined for the new effluent mass balance. The approach to the effluent treatment is to use an integrated waste management and treatment strategy that strives to maximise separation of effluent streams from rain water drains. The main contaminant in many of the effluent streams is ethylene dichloride (EDC) and the treatment process was developed to recover EDC where feasible, in order to meet the discharge consents as if it were being discharged directly to Outfall (receiving water body). However, the resultant waste water will still be pumped to the INEOS Inovyn Central Effluent Plant (EIP) due to solids content (associated E1 discharge point).

Other than normal operating conditions

BAT 18 – prevent or reduce emissions from equipment malfunctions

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review, but a review of some of the techniques was required as part of the detailed design phase of the project e.g. SIL classifications, HAZOPS and LOPA to identify significant environmental hazards and determine critical equipment.

This has led to the installation of a new dedicated abatement system (as previously described for technique BAT 18c) for the new ETP, for the times when the vent gases cannot be sent to the Vents incinerator. Previously the DC3 effluent plant vent was discharged to atmosphere (associated air emission point DC-13) without any abatement if the effluent system could not vent to the plant wet vent header. Now these will pass through a new vent scrubber, C629, local to ETP (emission point HPE-23).

This wet scrubbing system will reduce emissions to air of acidic gases (as defined in BAT 12). However, given this system is less effective for VOC's than the Vents incinerator, Vynova is committed to minimising incinerator downtime as the main focus to reduce emissions (i.e. technique BAT 18b), as discussed in the permitted activity AR1.

BAT 19 – prevent or reduce emissions to air and water occurring during other than normal operating conditions

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review, but a review of the management and monitoring of pollutant releases during such periods is required as a result of the project changes.

See separate discussion document on this topic (document reference: VRL_PartC3_3b) which describes minimising loading on effluent e.g. no T201 water draining, etc.

The following specific EDC/VCM production BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Emissions to air

BAT 75 – Reduce the organic load sent to the final waste gas treatment and to reduce raw material consumption

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review.

Specifically for this permitted activity, the project is improving compliance as already described in BAT 8.

BAT 76 – Treat the combined waste gas streams from EDC production by using a thermal oxidiser followed by two-stage wet scrubbing

The principle of this BAT is one of the main aims of Project Summer - to treat all waste gas streams using a thermal oxidiser followed by two-stage wet scrubbing, which is the existing Vents incinerator and flue gas treatment train (designed and operated to the description provided in the BAT). The project is making the modifications to this permitted activity already described in BAT 10 to allow this to happen.

See the equivalent section for permitted activity AR1 for more information.

Emissions to water

BAT 79 – Monitor emissions to water

As described in BAT 14 above, all process waste water streams from the HPE plant will be sent to this permitted activity and then onto the INEOS Inovyn Central Effluent Plant (EIP). Hence, there are no direct emissions to a receiving water body from this permitted activity and therefore the only monitoring that is relevant is for the outlet of the waste water stripper.

The new ETP is being designed with the facility to sample the process stream at this point and will be monitored for EDC and VCM as described in the current EPR permit, which requires at least 3 spot samples to be taken every 24 hours. These samples will be analysed by the INEOS Inovyn shift lab team with the capability of measuring down to 35 ppb (0.035 mg/l) for EDC. This limits of measurement is <10% of the BAT-AEPLs of 0.4 mg/l for EDC, as listed in Table 10.3 of the LVOC BATc document.

As already communicated to the EA as part of the LVOC permit review, the BAT-associated environmental performance level for VCM is not relevant to Vynova Runcorn as the asset has

specifically only produced purified EDC from 2015. However, sampling and analysis of VCM is the subject of an improvement condition (IC14) in the latest EPR permit with the aim to prove this is the case in early life operation of the HPE plant.

BAT 80 – Use hydrolysis and stripping as close as possible to the source to reduce the load of chlorinated compounds requiring treatment.

Hydrolysis is not relevant to Vynova Runcorn as already communicated to the Environment Agency as part of the LVOC permit review.

To minimise emissions to air from waste water collection, all organic containing waste water streams from the HPE plant under normal operation have been designed by the project to be fully contained within closed pipework/tanks/pumping systems before sending to this permitted activity (i.e. the new Effluent Treatment Plant).

The new ETP has been designed to strip the plant waste water of organics before pumping to the INEOS Inovyn EIP. The new dedicated stripping column, C615, has been specified to meet the discharge consents for EDC as if it were being discharged directly to Outfall (receiving water body) as it understood that the INEOS Inovyn Central Effluent Plant (EIP) can no longer treat organics. Hence, in order to meet the LVOC BATc requirements the following extract from the Basis of Design document for the new ETP shows the steam stripper design parameters as:-

Steam Stripper Package

- The table below outlines the requirements to be met by the liquid stream at the boundary limit of the steam stripper package.

Parameter	Unit	Value
Total Chlorinated Hydrocarbons	mg/l	1
Ethylene Dichloride (EDC)	mg/l	0.011
Vinyl Chloride	mg/l	0.05
Temperature	°C	30

Hence the new plant is designed to meet the BAT-associated environmental performance levels for EDC of 0.4 mg/l and for VCM of 0.05 mg/l, given in Table 10.3 of the LVOC BATc document. Furthermore, the BAT-associated emission level for EDC of 0.05g/t of EDC purified given in Table 10.5 of the LVOC BATc document is designed to be met, as under worst case conditions (high effluent flow, low purified EDC production) this BAT-AEL is equivalent to approx. 0.056 mg/l.

4.2.2 Common Waste Water and Waste Gas treatment/management (CWW) BREF

The following BAT conclusions are relevant to the proposed changes (Project Summer) for the HPE plant at Vynova Runcorn:-

Environmental Management Systems

BAT 1 – Implement and adhere to an environmental management system (EMS)

See the equivalent section for permitted activity AR1.

BAT 2 – Establish and maintain an inventory of waste water and waste gas streams

The project has produced an inventory of waste water and waste gas streams, including chemical production processes, as part of the detailed design stage and development of the heat & mass balances for the various parts of the new plant. These documents are available for inspection if required.

Please note that phosphorus and nitrogen species are not present in effluent in any significant concentrations that require treatment/removal. Also, the treatment scheme for the plant waste water does not include biological treatment and hence data on bio-eliminability (e.g. BOD, BOD/COD ratio, Zahn Wellens test, biological inhibition potential) is not necessary.

The new ETP plant design has included online measurements for the monitoring of certain parameters such as flow, temperature, pH, ORP, TOC, etc. to appropriately record, trend and report as necessary. Also, sample points have been strategically located to allow streams to be characterized in practice when the plant starts-up.

This is already the subject of an Improvement Condition (IC10) on the latest EPR permit. The sampling and analysis regime for the plant has been revised for this purpose and is available for inspection on request.

Monitoring

BAT 3 – Monitor key process parameters at key locations

As process waste water streams from the HPE plant will be directed to this permitted activity (AR4). However, there will be no direct emissions to a receiving water body from this permitted activity as the processed final effluent stream is pumped to the INEOS Inovyn Central Effluent Plant (EIP).

The treatment process within the new ETP includes different stages of pH adjustment by addition of acid/alkali and de-chlorination with addition of sodium bisulphite/sodium hypochlorite solutions, all with on-line pH/ORP monitoring and control. Continuous temperature and flow monitoring is also designed at appropriate locations throughout the process. The outlet stream will be continuously monitored for flow, temperature, pH/ORP and Total Organic Carbon (TOC).

Manual sample points have also been designed at strategic locations, including the outlet stream, to verify on-line measurements and to provide the monitoring requirements to the standard and frequency as defined in BAT 4.

BAT 4 – Monitor emissions to water in accordance with EN standards with at least the minimum frequency required

There will be no direct emissions to a receiving water body from this permitted activity as the processed final effluent stream is pumped to the INEOS Inovyn Central Effluent Plant (EIP). However, the waste water stream will be monitored as described in the current EPR permit, including the relevant methods/standards.

BAT 5 – Periodically monitor diffuse VOC emissions to air from relevant sources

See the equivalent section for permitted activity AR1.

Emissions to water

BAT 7 – Reduce the usage of water and the generation of waste water

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review and the principles described have been included within the new ETP plant design e.g. the effluent stripper package is designed to remove & then condense the EDC from the waste water stream and therefore recover/re-use raw materials.

In order to reduce waste water volumes, the project has rationalised various systems across the existing DC3 and EDC1/2 plants for the new HPE plant. Namely:

- Closure of the EDC1/2 effluent treatment plant with associated caustic/acid reagent systems.

- No longer any acceptance of INEOS Inovyn Cereclor Plant waste acid.

BAT 8 – Segregate uncontaminated waste water streams from those that require treatment

This narrative BAT has been the design principle for the new HPE plant containment and effluent treatment scope of work.

Essentially the new ETP is designed for only the process waste water flows and drains within live unit areas of the HPE plant. The only other remaining plant drainage system is clean surface water drainage which will be directed to Outfall 56 or Outfall 49, see the equivalent section for permitted activity AR1 for more information.

The live unit areas will be kerbed appropriately to minimise catchment area as much as possible and hence only send as little as possible volume to combine with the process waste water streams that are sent to the new ETP.

The BASF separator & pumping system will be closed and the embankment pit which accepts land drains (that are owned by INEOS Inovyn) will transfer ownership to INEOS Inovyn and pump down their effluent main to their EIP plant. The treated process effluent from the new ETP will be pumped down our separately owned effluent main to the INEOS Inovyn EIP, hence systems have been segregated as far as possible.

BAT 9 – Provide an appropriate buffer storage capacity for waste water incurred during other than normal operating conditions

The effluent plant design has included interim storage of potentially contaminated rainwater in most individual live plant areas, as described in BAT 8 above, along with a significant buffer storage (in pits Bund-007 & Bund-039). In some cases, new kerbed areas have been constructed with new pits/pumping systems.

Most of the contaminated rainwaters are routed into Bund-007 which is the primary effluent collection pit, before being pumped from there to the new ETP. The buffer storage provided

in Bund-007 & Bund-039 also caters for storage of out of specification effluent returned for re-treatment in the effluent treatment plant. Even more buffer storage is provided by the overflow of Bund-007 to Bund-029 and onto Bund-008 if necessary.

The layout of the bunds is shown in document VRL_HPECivils.

In summary, the primary effluent collection pit, Bund-007, has sufficient capacity for the maximum rainfall case and the biggest single loss of containment event combined. However the volume generated by 2 hours of firewater deluge on reactor and wash areas is way in excess of the capacity of Bund-007. This event will be mitigated by the overflow to Bund-029, and on to Bund-008, which have adequate capacity for this event.

BAT 10 – Use an integrated waste water management and treatment strategy

The principle of this narrative BAT is one of the main aims of Project Summer, specifically techniques BAT 10a and BAT 10b have been incorporated into the design of the new HPE plant, see the equivalent section for permitted activity AR1.

The new ETP plant has been designed specifically for technique BAT10c.

The final effluent stream from the new ETP does not require any biological treatment, nitrogen removal or phosphorus removal as described in technique BAT 10d, but will be sent to the INEOS Inovyn EIP for final solids removal techniques before discharge to the receiving water body.

BAT 11 – Pre-treat waste water that contains pollutants that cannot be dealt with adequately during final waste water treatment

As described in LVOC BAT 80, the ETP plant has been designed with a sufficiently large steam stripping column with an outlet waste water stream able to meet the discharge consents for EDC as if it were being discharged directly to Outfall (receiving water body) as it understood that the INEOS Inovyn Central Effluent Plant (EIP) being used for final waste water treatment can no longer treat organics using appropriate techniques i.e. would otherwise be simply stripped to air as part of the treatment process.

BAT 12 – Use an appropriate combination of final waste water treatment techniques

There are no contaminated waste water streams sent to a receiving water body directly from this permitted activity (AR4), hence the BAT-associated emission levels in Tables 1, 2 and 3 do not apply and some components are not even relevant as previously communicated to the Environment Agency as part of the LVOC permit review.

The outlet process water from the new ETP is pumped to the INEOS Inovyn EIP for final treatment i.e. only requiring solids removal post project, and there has been no change to the INEOS Inovyn process for solids handling or requirement for any changes to these techniques.

Emissions to air

BAT 15 – Enclose the emission sources and to treat the emissions, where possible.

The principle of this narrative BAT is one of the main aims of Project Summer, ensuring that vent emissions from all effluent plant items are contained and routed to the wet vent header system for treatment prior to discharge as already described in LVOC BAT 10, 76 and part of 80.

Only the off-spec effluent buffer storage is open to atmosphere, however VOC emissions are not expected as all VOC contacting effluent would have been subject to steam stripping and only diverted to the off-spec effluent sump during a effluent treatment plant upset. Therefore, the risk of VOC emissions is low. In addition, a top layer of water is provided within the buffer storage to reduce emissions.

BAT 16 – Use an integrated waste gas management and treatment strategy that includes process-integrated and waste gas treatment techniques

The principle of this narrative BAT is one of the main aims of Project Summer, as already described in LVOC BAT 8, 10, 75 and 76.

BAT 19 – Prevent or reduce diffuse VOC emissions to air

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review and the principles described have been included in the

design for Project Summer, including the new ETP, as well as for the construction and commissioning phases.

See the equivalent section for permitted activity AR1 for more information.

BAT 22 – Set up and implement a noise management plant

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review. The noise survey for the plant will be repeated following the start up of the new HPE plant and the noise management plan updated accordingly.

BAT 23 – Prevent or reduce noise emissions

Compliance with this narrative BAT was already communicated to the Environment Agency as part of the LVOC permit review. The project has designed and selected new equipment to satisfy the required standards.