Proposed Changes to the current permitted activities

The following changes are proposed to the current activities, as defined in all previous permit applications and variations up to this date.

The permitted activities will be taken separately in turn on the following pages.

Note that the term 'closure' in the lists below means full de-inventory & decontamination and physical severance from any remaining live assets. Previously bunded or kerbed areas will be breached to ensure stormwater runs-off these areas.

Please refer to the Overview Process Flow Diagram (document reference: VRL_HPEOverviewPFD), which represents the HPE plant following implementation of these changes.

However, it should be noted that this is still a work in progress and therefore some connection lines are inaccurate but main plant items are indicated and the overall process is demonstrated by this diagram.

Generally, red coloured items denote new/changed equipment and black coloured items denote existing equipment.

Accurate 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).

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

- Closure of the EDC1 & EDC2 boiling reactors including physical severance to chlorine and ethene supplies.

- Closure of the EDC1 & EDC2 reactor 4-stage condensation trains and caustic scrubbers, including the common fridge unit (associated air emission point PT-09).

- Closure of Cooling Tower No.5 and chemical dosing systems, which served the above condensation trains, therefore cessation of water purge to drain (associated water emission point W56).

- Closure of the EDC1 & EDC2 HCl strippers and Hydecat reactors (associated air emission points PT-37 and PT-38).

- Closure of the EDC1/2 stock tanks, namely T301 and T302 (associated air emission point PT-01).

- One of the above tanks, T302, will be re-purposed as a firewater stock tank and re-named T105. A new firewater pump house will be constructed adjacent to this tank, providing diesel powered pumps to supply approx. 800 m^3/hr to the new deluge systems on T201, T703, Reactor structure or Wash area. The tank and top-up water supply has been designed to allow sufficient firewater capacity to supply this deluge requirement for 2 hours duration.

- Closure of the VDC4 EDC stock tanks and road loading facility for EDC export from site (associated air emission point VDC-09).

- The existing DC3 pure EDC stock tank, D102, has been demolished, due to surplus pure stock requirements. Instead a new pumping drum, D305, 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).

  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 on HPE plant and onto the vents incinerator during normal operation. If this route 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.

Note that an old DC3 crude EDC stock tank, D101 remains out of service (as it has been for some time and reported as such) and has now been physically disconnected from the rest of process plant/instrumentation (associated air emission point DC-16).

- 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.

- Replacement of the Boiler Feed Water Pumps, which were previously oversized and a significant contribution to reliability issues of the Vents Incinerator, with newly designed versions to match the current plant duty.

- Installation of an additional cooling tower cell (X133) adjacent to the existing X102A/B cells, new chemical dosing system, new cooling water pumps and cooling water distribution pipework to feed the new Reactors as well as existing exchangers. Most of the underground cooling water piping network has been replaced with new above-ground pipework for ease of inspection/maintenance. The cooling towers will continue to purge/drain into the Outfall 56 drainage system (associated water emission point W56).

- 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).

- 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.

- Closure of the DCA/B low temperature direct chlorination reactors and acid/caustic wash system, along with associated heat exchangers, pumps, coolers, chlorine & ethene feeds.

  These units were normally vented to the dry and wet vent headers on DC3 plant and onto the vents incinerator during normal operation. If this route was unavailable then the vents would be diverted to their associated caustic scrubber C201A/B, which will also be closed as there are not correctly designed/located to serve the new HPE plant (associated air emission points DC-14a and DC-14b).

- Installation of 2 x new Low Temperature Direct Chlorination (LTDC) EDC reactors (R2101 and R2501) based on licensed OxyVinyls design/technology. Each LTDC reactor produces

50% of the total crude EDC required by the plant (same as existing 440 ktpa capacity of Vynova assets).

Ethene and chlorine streams are fed to the reactor under flow control, where they react in the vertical liquid-phase pipe section of the reactor in a stream of circulating EDC. The motive force for the EDC circulation is provided by the lift effect of the feed gas bubbles and the thermosiphon effect resulting from the differences in liquid density in the two sections. The circulating EDC, heated by the exothermic reaction, is cooled as it circulates downward through the reactor's integral shell and tube heat exchanger, connected to the plant cooling water circuit. An on-stream free chlorine analyser is provided to continuously control the amount of excess chlorine in the EDC product for optimum reaction efficiency. 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.

Oxygen is present in the LTDC Reactor chlorine feed. Sufficient Nitrogen is added to the reactor vapour space to keep the vent stream mixtures safely out of the flammable envelope (oxygen lean). Vapour from each reactor is sent to a new Vent Gas Chiller (E2102/E2502) to recover EDC after which the liquid EDC flows by gravity back to the respective reactor. The vent streams from the condensers are then directed to the plant dry vent header and onto the vents incinerator under normal operating conditions.

- Installation of new ethene pipework from the existing DC3 letdown system to feed the new LTDC EDC reactors with associated feed control and shutdown systems.

- Installation of a new common chlorine 14" NB main that runs from a tie-in downstream of the Runcorn MCP (Membrane Chlorine Plant) intermediate letdown, to the new LTDC reactor structure. New feed control and shutdown systems will be installed.

  A new 4" NB maintenance vent pipeline will also be installed to run alongside the 14" NB chlorine main, which will allow the chlorine main to be purged back to the Runcorn MCP plant. The maintenance vent will be purged with nitrogen and normally left isolated.

- Installation of a new refrigeration package to provide the necessary cooling for the Reactor Vent Gas Chillers, 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).

- Modifications 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.

- 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.

- 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. 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.

- 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).

- 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.

- 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.

- 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.

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

- Closure of the EDC1 & EDC2 hydrochloric acid stock tanks, namely T608A and T608B, including pumping systems & tanker off-loading facility (associated air emission point PT-24).

- Installation of new hydrochloric acid tanker off-loading facility to allow periodic direct filling of the DC3 hydrochloric acid stock tanks D757 and D758 as required.

- Minor operational change is the physical removal of redundant equipment on the desorption system on the Incineration Unit, which has been off-line for many years (previously was used to strengthen HCl concentration to produce HCl gas for production of EDC on the VC3 oxychlorination Unit, part of the VCM plant at the time).

- Minor operational change is the replacement of the HCl absorption column C751 (part of the combustion gas treatment train on the Incineration Unit) – end-of-life trayed column being replaced with new packed column (designed to match current plant configuration i.e. no desorption system).

- Closure of the export of hydrochloric acid to the Industrial Chemicals Ferrous/Ferric Chloride Plant on Runcorn Site, which has now been demolished.

- Closure of the vent connection from the INEOS Technologies (Vinyls) Limited PVC Pilot Plant on Runcorn Site, hence there will now be no VCM of any significance present on the Vynova asset (associated air emission point DC-14a).

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

- Closure of the EDC1/2 Residues storage and handling vessels, namely T532 and T729 (associated air emission point PT-04).

- Closure of the CTC (Carbon TetraChloride) import facility used to dilute mixed residues and render it non-flammable.

- The DC3 Residues Drums, D814A/B, will no longer be used to store liquid residues and will be emptied of bulk liquid. They will be physically disconnected from liquid pipelines in/out of the vessels. However, residual solids in these drums are yet to be cleaned out and hence will remain connected to the dry vent header on HPE plant.

- The existing DC3 crude EDC stock tank, D103, will be converted to a liquid residues stock tank and renamed T703. This tank will accept liquid residues from the C351 heavies column and new pumps will be installed to pump this material to the liquid residues incinerator.

  The 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. If this route 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.

- Incorporation of the protocol for particulate monitoring from the common flue gas stack S751 as previously 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 to be applied (associated air emission point DC-1, to be renamed HPE-1).

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

- Closure of the EDC1/2 effluent neutraliser vessels along with caustic/acid reagent systems (associated air emission point PT-23 and associated E4 discharge to INEOS Inovyn Central Effluent Plant [EIP]).

- This means there will no longer be any acceptance of INEOS Inovyn Cereclor Plant waste acid.

- Full-cleaning and filling of drainage pits, overflows & channels across EDC1/2, leaving only stormwater drains (associated water emission point W56).

  Only exception to this is the West Effluent Pit which is being re-purposed as a HPE 700 Unit effluent buffer pit. 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.

- Closure of the contaminated drainage system on DC3 including the BASF Separator and associated tank/pumps/connecting pipework which previously pumped potentially contaminated water (& stormwater) to INEOS Inovyn Central Effluent Plant (EIP) (associated E2 discharge point).

  There is no requirement for a contaminated drainage system on HPE as only the live equipment areas (which will be bunded or kerbed) will be directed to the new Effluent Treatment Plant and any other areas will simply be stormwater run-off.

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

  Please refer to the Overview HPE Civils Diagram (document reference: VRL_HPECivils), which represents the HPE plant's new structures, pipebridges, kerbed areas and bunds. Also, please refer to the north and south drain systems diagrams (document references: VRL_OF49Drains and VRL_OF56Drains).

- Re-purposing of the Interceptor Pit, which was previously part of the DC3 contaminated drainage system, as a cess pit for foul sewer. This will replace an existing foul sewer cess pit which is situated further south and down the embankment towards the BASF area.

- The Land drainage system (which collects water from INEOS Inovyn owned land and flows into the Embankment Pit) will transfer ownership to INEOS Inovyn.

- 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, coolers and local vent system (associated air emission point DC-13 and associated E1 discharge to INEOS Inovyn Central Effluent Plant [EIP]).

- Installation of 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 (to satisfy the BAT-AEL for EDC in Table 10.5 of the LVOC BATc document and the BAT-AEPLs for EDC and VCM in Table 10.3). 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). 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 process.

  Briefly, the new ETP will firstly neutralise the various waste water streams within a Redox correction vessel (D611) where bisulphite or sodium hypochlorite is added as a reagent, followed by a two-stage pH correction process in vessels D612 & D613. Then the waste water is passed through a stripping column (C615) before final pH adjustment in D618 and pumping to INEOS Inovyn's EIP (associated E1 discharge point).

  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).