Appendix E Organic Fine Chemicals BATc / Production of Speciality Organic Chemicals Sector (EPR 4.02) BAT Assessment

Agilent Environmental Permit Application: Redacted for the Public Register

Best Available Techniques & Operating Techniques

Agilent Technologies LDA UK Limited

SLR Project No.: 410.064951.00001

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Assessment of Indicative BAT for Production of Speciality Organic Chemicals

The following table provides an assessment of the operational techniques carried out by Agilent against the BAT requirements contained within the Production of Speciality Organic Chemicals Sector (EPR 4.02) Sector Guidance Note.

Table E1 Best Available Techniques – Production of Speciality Organic Chemicals Sector Guidance Note

Guidance Section No.	Requirement	Operating to BAT	Demonstration of BAT Compliance
Scope	The Production of Speciality Organic Chemicals Sector (EPR 4.02) transposes the requirements of the Manufacture of Organic Fine Chemicals BRef into UK Guidance. This note applies to activities regulated under the following section of schedule 1 of the Regulations: Section 4.1 - Organic Chemicals, Part A(1).	Yes	The BRef document applies as the site activities are defined under Section 4.1 of Schedule 1 to the Environmental Permitting Regulations 2016
1	**Managing your activities**		
1.1	**Environmental performance indicators** Monitor and benchmark your environmental performance and review this at least once a year. Your plans for minimising environmental impacts should be incorporated into on-going improvement programmes. Indicators can be derived using the Horizontal Guidance Note H1 Environmental Risk Assessment (see GTBR Annex 1). It is suggested that indicators are based on tonnes of organics produced (tOP) as they provide a good basis for measuring performance within an installation or a single company year on year.	Yes	The company wide EHS Management System is certified to ISO 14001. The site operates an Integrated Management System that is in accordance with ISO 14001. Agilent will set key performance indicators which will include review of product yield, energy use and other relevant KPI's. These will be reviewed periodically and used to set future efficiency targets.
1.2	**Accident management** In addition to the guidance in Getting the Basics Right, guidance prepared in support of the COMAH Regulations may help you in considering ways to reduce the risks and consequences of accidents, whether or not they are covered by the COMAH regime.	Yes	The site does not qualify for regulation under the Control of Major Accident Hazards (COMAH) Regulations (2015). An Emergency Plan is implemented and maintained at the site to ensure the site's staff are fully prepared for such incidents. The plan will be reviewed every three years as a minimum, and after any reportable incident on site. The document will be continually improved in these reviews to include best practice and minimise the risk of accidents occurring. The site also operates under a Spill Management Plan; Fire Management Plan and Flood Management Plan.
1.3	**Energy efficiency:** Some large processes are major users of heat and power, and others produce energy from their exothermic reactions. For these there may be greater	Yes	Energy efficiency will be managed in conjunction with the EMS and reviewed periodically. The scale of production at the site is

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	opportunities for optimising energy efficiency in comparison to the smaller installation in the sector and to many industrial sectors. Assess the environmental impact of each process and choose the one with the lowest environmental impact. (We recognise that your choice may be constrained, for example, by the integration of processes on a complex site).		relatively small. However, energy efficiency is still a key performance indicator which is measured and tracked. Targets for energy reduction are set on an annual basis, The following energy saving measures have been undertaken recently at the site: • Replacement of old steam boilers with more efficient low temperature hot water boilers. • Installation of a power correction system in Units 2 and 3. • Installation of solar panels to contribute to the site's energy supply (155KW Solar Panel system installed on the roof of Unit 3). • Replacement of air-cooled condensers with more efficient water-cooled condensers. • Upgrading the HVAC controls to reduce run-times of the chiller and air handling units. This is an existing site, so there are some constraints to applying designed in energy efficiency measures.
1.4	**Efficient use of raw materials and water** As a general principle, you need to demonstrate the measures you take to: ▪ Reduce your use of all raw materials and intermediates. ▪ Substitute less harmful materials, or those which can be more readily abated and when abated lead to substances that are more readily dealt with. ▪ Understand the fate of by-products and contaminants and their environmental impact. You should where appropriate: 1. Maximise heat transfer between process streams where water is needed for cooling. Use a recirculating system with indirect heat exchangers and a cooling tower in preference to a once-through cooling system. 2. Where water is used in direct contact with process materials, recirculate the water after stripping out the absorbed substances.	Yes	The polymerisation process has been suitably designed to optimise the use of raw materials and product yield. Agilent review the contents and volumes of raw materials used in the production of polymers to identify where practical reduction or changes to less harmful raw materials can be made. 1.The polymerisation reactors and filter /dryers are heated using low temperature hot water on-site boilers. These are not high temperature processes and the opportunities for heat recovery are therefore limited. 2.Due to the specification of the products manufactured, to keep the standard of the product high, it is not possible to re-use water used in the process.

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1.5	**Avoidance, recovery and disposal of wastes** Waste should be recovered unless it is technically or economically impractical to do so. You should list in detail the nature and source of the waste from each activity as the response to the emissions inventory requirement of the Application. Where there are a very large number of relatively small streams it may be appropriate to aggregate similar and comparatively insignificant waste streams. You should where appropriate: 1. Demonstrate that the chosen routes for recovery or disposal represent the best environmental option. Consider avenues for recycling back into the process or reworking for another process wherever possible. 2. Provide a detailed assessment identifying the best environmental options for waste disposal where you cannot avoid disposing of waste.	Yes	All waste generated at the site is sent either for recycling, re-use as cement kiln fuel, for energy generation or treatment. No waste is disposed of to landfill. Waste generation at the site will be reviewed periodically and where necessary an appropriate improvement programme will be implemented. Waste production will be avoided wherever possible. Any waste produced on site will be recovered, unless there are instances whereby it is not technically or economically practicable to do so.
2	**Operations**		
2.1	**Design of a new process** During new project development environmental issues should be an integral part of discussion at every stage of the design, beginning with the initial concepts. At the initial stage of the development of the process there should be a formal and comprehensive study – the first stage in a formal HAZOP study – of the likely environmental consequences from: ▪ The use of raw materials, and production of all intermediates and products. ▪ All routine emissions, discharges and solid/liquid waste streams. ▪ Non-routine or unplanned releases and disposals. You should where appropriate: 1. Consider all potential environmental impacts from the outset in any new project for manufacturing chemicals. 2. Undertake the appropriate stages of a formal HAZOP study as the project progresses through the process design and plant design phases. The HAZOP studies should consider amongst other things the points noted above.	Yes	The potential environmental impacts will be considered when designing any new project for manufacturing chemicals including raw materials, emissions and residues. The design of any new process will be subject to full assessment of both safety and environmental risks through the use of Hazard Identification (HAZID), Hazard and Operability Study (HAZOP) and Pressure System Safety Regulations (PSSR). The site has a management of change process that outlines the appropriate assessments that must be undertaken in event of a new process being introduced on site.
2.2	**Storage and handling of raw materials, products and wastes** You should where appropriate: 1. Store reactive chemicals in such a way that they remain stable, such as under a steady gas stream, for example. If chemical additions are necessary, then tests	Yes	1. Chemicals are held in dedicated storage locations in sealed containers. Materials will be stored in accordance with manufacturer’s guidance and grouped dependant in their

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	should be carried out to ensure the required chemical composition is maintained. Inhibitors may also be added to prevent reactions. 2. Vent storage tanks to a safe location. 3. Use measures to reduce the risk of contamination from large storage tanks. In addition to sealed bunds, use double-walled tanks and leak detection channels. 4. Use HAZOP studies to identify risks to the environment for all operations involving the storage and handling of chemicals and wastes. Where the risks are identified as significant, plans and timetables for improvements should be in place.		compatibility, with a suitable separation being provided between non-compatible materials. 2. Chemicals are stored in drums not tanks. Transfer is carried out by air pumps into sealed containers. 3. There are no large tanks. Chemicals are stored in drums (maximum volume 205 litres). Pumping stations within storage areas are bunded and storage areas are bunded. 4. A Control of Substances Hazardous to Health (COSHH) assessment is undertaken prior to the use of chemicals, and if the chemical is found to present a hazard to health, it is added to the COSHH inventory. Material Safety Data Sheets (MSDS) for any potentially hazardous materials or chemicals is kept on site together with the COSHH register. The MSDS provides information on how chemicals should be handled, stored and disposed of, and what to do in the event of an accident. Raw material, intermediate, waste and product storage are reviewed as part of the HAZOP process.
2.3	**Plant systems and equipment.** A wide range of ancillary equipment is required throughout the process, which may include ventilation, pressure relief, vacuum raising, pumps, compressors, agitators, valves, purging and heating/cooling. Some of these systems give rise to a waste stream, for example wet vacuum systems or dust extraction equipment, and all of them have the potential to give rise to fugitive emissions. You should formally consider potential emissions from plant systems and equipment. You should where appropriate: 1. Formally consider potential emissions from plant systems and equipment and have plans and timetables for improvements, where the potential for substance or noise pollution from plant systems and equipment has been identified. 2. Carry out systematic HAZOP studies on all plant systems and equipment to identify and quantify risks to the environment. 3. Choose vacuum systems that are designed for the load and keep them well maintained. Install sufficient instrumentation to detect reduced performance and to warn that remedial action should be taken.	Yes	1. All potential emissions from the process systems, including noise, have been identified in this BAT-OT and measures to control emissions are in place (refer 410.064951.00001_NIA). Monitoring and recording of conditions within the plant is carried out on a continuous basis to enable continuous mapping of the process in order to ensure efficiency of the process. The site has a pre-planned preventative maintenance (PPM) system in place including daily checks, visual inspections, analysis of water quality, plant gauges, etc. There is a daily checklist detailing the checks that are required and records of the results of these checks. For larger plant there is PPM planner in place. 2. The design of any new process will be subject to full assessment of both safety and environmental risks through the use of HAZID, HAZOP and PSSR. 3. Vacuum systems (polymer beads are dried under vacuum) have been designed to meet the operational requirements and will be inspected and maintained to ensure correct operation. Appropriate equipment monitoring systems have been integrated into the design.

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2.3	**Plant systems and equipment – over-pressure protection systems.** You should where appropriate: 1. Carry out a systematic HAZOP study for all relief systems, to identify and quantify significant risks to the environment from the technique chosen. 2. Identify procedures to protect against overpressure of equipment. This requires the identification of all conceivable over-pressure situations, calculation of relief rates, selection of relief method, design of the vent system, discharge and disposal considerations, and dispersion calculations. In some cases, careful design can provide intrinsic protection against all conceivable over-pressure scenarios, so relief systems and their consequential emissions can be avoided. 3. Maintain in a state of readiness all equipment installed in the venting system even though the system is rarely used.	Yes	1. The design of all process activities has been subject to full assessment of both safety and environmental risks through the use of HAZID, HAZOP and PSSR. 2. The plant has been designed to minimise the need for pressure relief systems. Overpressure safety systems (where required) have been appropriately sized and designed. Over pressure protection systems comprise vent systems fitted with bursting discs. 3.Over pressure protection systems are maintained by the PPM.
2.3	**Plant systems and equipment – heat exchangers and cooling systems.** You should where appropriate: 1. Consider leak detection, corrosion monitoring and materials of construction, preferably in a formal HAZOP study. Plans and timetables for improved procedures or replacement by higher integrity designs should be in place where the risks are identified as significant. 2. If corrosion is likely, ensure methods for rapid detection of leaks are in place and a regime of corrosion monitoring in operation at critical points. Alternatively, use materials of construction that are inert to the process and heating/cooling fluids under the conditions of operation. 3. For cooling water systems, use techniques that compare favourably with relevant techniques described in the Industrial Cooling Systems BRef.	Yes	1.Leak detection, corrosion monitoring and materials of construction for heating and cooling equipment are assessed as part of a formal HAZOP study and measure taken for any significant risks. 2.The design of heating and cooling systems had considered methods for rapid detection of leaks, corrosion monitoring and materials of construction 3.Heating and cooling are achieved by closed loop heater/chillers using recirculating heat transfer fluid.
2.3	**Plant systems and equipment – purging facilities.** Assess the potential for the release to air of VOCs and other pollutants along with discharged purge gas and use abatement where necessary.	Yes	Reactors and filter/dryers are operated under a continuous nitrogen flow. Exhaust gas, including vents from associated vacuum pumps are either directed to a scrubber system prior to discharge to atmosphere, or for emission sources with insignificant emission levels, these are vented directly to atmosphere. VOC condensers are installed on the majority of process plant with the potential for elevated levels of VOC emission.
2.4	**Reaction stage** It is important to consider how the chemistry and engineering options may contribute to releases to the environment from the reaction stage, both directly and as a consequence later in the process. It is also important that these	Yes	1. The design of the reactors has taken into account the chemistry of the polymerisation and coating reactions.

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	considerations are made at the process design stage – before plant design and equipment selection is commenced. You should where appropriate: 1. With a clear understanding of the physical chemistry, evaluate options for suitable reactor types using chemical engineering principles. 2. Select the reactor system from a number of potentially suitable reactor designs - conventional STR, process-intensive or novel-technology - by formal comparison of costs and business risks against the assessment of raw material efficiencies and environmental impacts for each of the options. 3. Undertake studies to review reactor design options based on process-optimisation where the activity is an existing activity and achieved raw material efficiencies and waste generation suggest there is significant potential for improvement. The studies should formally compare the costs and business risks, and raw material efficiencies and environmental impacts of the alternative systems with those of the existing system. The scope and depth of the studies should be in proportion to the potential for environmental improvement over the existing reaction system. 4. Maximise process yields from the selected reactor design, and minimise losses and emissions, by the formalised use of optimised process control and management procedures (both manual and computerised where appropriate). 5. Minimise the potential for the release of vapours to air from pressure relief systems and the potential for emissions of organic solvents into air or water, by formal consideration at the design stage - or formal review of the existing arrangements if that stage has passed.		2. The site only produces relatively small batches of product. The reactor systems are designed for optimum production efficiency associated with small to medium batch processes. 3. HAZOP studies are undertaken to review reactor design processes. The site also employs a 'continuous improvement' approach . All employees are trained and empowered to raise the opportunity for efficiency gains in the process if these are identified. 4. Process controls are predominantly manual with a scheduled introduction of automated controls in place. There is a dedicated process engineering team who ensure that yield is optimised. 5.During normal operation, the process has been designed to ensure that there is only a short time period where the reaction is active. During abnormal operation, i.e., accidental runaway reaction, the free radical polymerisation would terminate itself, reducing the potential for emissions to air.
2.4	**Minimisation of liquid losses from reaction systems** You should where appropriate: 1. Use the following features that contribute to a reduction in waste arisings from clean-outs ▪ Low-inventory continuous throughput reactors with minimum surface area for cleaning. ▪ Minimum internals such as baffles and coils in the reactor. ▪ Smooth reactor walls, no crevices. ▪ Flush bottom outlet on reaction vessels. ▪ All associated piping to slope back to the reactor or to a drain point. ▪ Sufficient headroom under the reactor for collection of all concentrated drainings in drums or other suitable vessel, if necessary.	Yes	1.Production is in small batches. Campaigns will be organised to minimise cleaning between batches where possible. Reactors and pipework systems have been designed to minimise the need for cleaning and the potential for wastes to accumulate within the systems. Agilent currently use the following techniques to reduce waste arisings from clean-outs: • Internal equipment has been minimised with only some baffles used within the reactors and no coils; • Reactors have smooth walls and no crevices; • Some reaction vessels have flush bottom outlets;

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	▪ Minimal pipework, designed to eliminate hold-up and to assist drainage. ▪ Pipework designed to allow air or nitrogen blowing. ▪ System kept warm during emptying to facilitate draining. ▪ HAZOP studies used to assess the potential for the choking of lines by high-melting-point material. ▪ Campaigns sequenced so that cleaning between batches is minimised. ▪ Campaigns made as long as possible to reduce the number of product changeovers. ▪ Where a complete clean is necessary, use cleaning methods that minimise the use of cleaning agents, (e.g., steam-cleaning, rotating spray jets or high-pressure cleaning) or use a solvent which can be re-used. ▪ Carry out HAZOP studies to minimise the generation of wastes and to examine their treatment/disposal. ▪ Consider use of disposable plastic pipe-liners. ▪ Eliminate or minimise locations for solids to settle-out. ▪ Consider duplicate or dedicated equipment where it can reduce the need for cleaning that is difficult.		• Minimal pipework; • Pipework designed to push through contents; • System kept warm during emptying to facilitate draining; • HAZOP studies used to assess the potential for the choking of lines; and • Where a complete clean is necessary, spray jets using aqueous based detergents are employed. Consider duplicate or dedicated equipment where it can reduce the need for cleaning that is difficult.
2.4	**Reaction stage – minimisation of vapour losses** There are many techniques for minimising the potential for vapour losses and for collection and abatement of vapour displaced into vent lines. You should where appropriate: 1. Review your operating practices and review vent flows to see if improvements need to be made. 2. Consider opportunities to enhance the performance of abatement systems.	Yes	1. Agilent will review operating practices, vent flows and management of exhaust emissions required for new products. 2. The site is currently in the process of introducing automated controls. Use of a computerised system will maximise yield and minimise vapour losses. The computerised system will also allow monitoring of the performance of the reaction stage, so any adjustments required to allow the most efficient operation can be made quickly.
2.5	**Separation stages – liquid-vapour separations** On completion of the reaction, it is usually necessary to separate the desired product from the other components in the reaction system. You should where appropriate: 1. Choose your separation technique following a detailed process design and HAZOP study. Follow formal operating instructions to ensure effective separation and minimisation of losses. Adhere to design conditions such as heat input, reflux flows and ratios, etc.	Yes – once scrubber and reactors are installed with fault monitoring.	1. Reactors and filter/dryers are operated under a continuous nitrogen flow. Exhaust gas, including vents from associated vacuum pumps are either directed to a scrubber system prior to discharge to atmosphere, or for emission sources with insignificant emission levels, these are vented directly to atmosphere. VOC condensers are installed on the majority of process plant with the potential for elevated levels of VOC emission.

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	2. Install instrumentation to warn of faults in the system, such as a temperature, pressure or low coolant-flow alarms.		2. Agilent have projects in place to replace the scrubber and reactors with fault monitoring.
2.5	**Separation stages– liquid-liquid separations** You should where appropriate: 1. Use techniques which maximise physical separation of the phases (and also aim to minimise mutual solubility) where practicable. 2. When the phases are separated, use techniques which prevent (or minimise the probability and size of) breakthrough of the organics phase into a waste-water stream. This is particularly important where the environmental consequences of subsequent releases of organics to air or into controlled waters may be significant (e.g., where the effluent is treated in a DAF unit or some of the organic components are resistant to biological treatment). 3. When a separation is done by hand, use a "dead man's handle", backed-up by good management, to improve the chance of the flow being properly controlled as the phase-boundary approaches. 4. Consider if automatic detection of the interface is practicable. 5. Where you are discharging to drain, consider whether there should be an intermediate holding or "guard" tank to protect against accidental losses from the organics phase.	N/A	Not applicable - there are no liquid-liquid separations.
2.5	**Separation stage – liquid-solid separations** Different separation techniques will be BAT for different applications, with factors like solubility, crystallisation rate and granular size being important. The main solid-liquid techniques are centrifuging, filtration, sedimentation, clarification, drying and ion exchange. You should where appropriate: 1. Use techniques to minimise, re-use and/or recycle rinse water, and to prevent breakthrough of solids. 2. Install instrumentation or other means of detecting malfunction as all of the techniques are vulnerable to solids breakthrough. 3. Consider installing "guard" filters of smaller capacity downstream which, in the event of breakthrough, rapidly 'clog' and prevent further losses. 4. Have good management procedures to minimise loss of solids, escape of volatiles to air and excessive production of wastewater.	Yes	Solid product is separated from the liquid phase using a wet sieving process and also filter drying. These processes are carried out at small scale. 1. Due to the nature of the product, to ensure high quality it is not possible to re-use rinse water. The process has been designed not to use excess wash water. 2. Processes are predominantly under manual control (with automated systems being introduced) operated by a dedicated process engineering team. 3. The process has undergone HAZOP and HAZID assessments to ensure that it runs at optimal efficiency. 4. Refer to Appendix F and G for management procedures for emissions to air and sewer.

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2.6	**Purification stage** Waste associated with the purification stage may arise from: ▪ Impurities in the raw materials – so a change in the raw material specifications may reduce waste arisings. ▪ By-products generated by the process – so a change in reaction conditions, catalyst, solvent etc. may improve the selectivity of the reaction or eliminate by-product formation. Liquid products are usually refined by distillation, with filtration used to remove. solid contaminants. Sources of loss are: ▪ Gas entrainment. Gas or vapour flow will carry away volatile material either as vapour or as entrained droplets. Additional condenser heat-exchange area or colder heat-exchange fluid can improve the recovery rate, and coalescing demisters are relatively cheap and easy to install. ▪ Ineffective separation. A better separation in the distillation column can be achieved by using more stages (theoretical plates) or more reflux. Modern types of packing or high-efficiency trays can often produce a marked improvement for a modest capital investment. ▪ Filtration. Enclosed filtration is usually used, and this is not normally a source of great vapour loss to air. Liquid discharged during cleaning or changing of filters should be returned to the process. Purification of solid products by washing and crystallisation. Washing and crystallising activities have the potential to produce large volumes of dilute liquors so counter-current systems of operation should be used wherever possible. During drying, the aim should be to produce the maximum concentration of solvent in the gas to allow recovery of the solvent. The use of vacuum during drying can improve both solvent recovery and energy efficiency.	Yes	The polymer solids are subject to a series of washing stages in filter/dryers. Nitrogen gas used to pressurise the vessels, together with the exhaust from the associated vacuum pumps, is vented to atmosphere via a wet gas scrubber to remove volatile organic components.
2.7	**Chemical process controls** Reaction conditions such as temperatures, pressures, rocking or stirring rates, catalyst age, input and output flow rates, addition of materials (and so on) are imperative to the efficient conversion of raw materials to product. You should where appropriate: 1. Monitor the relevant process controls and set with alarms to ensure they do not go out of the required range.	Yes	Processes are predominantly under manual control (with automated systems being introduced) operated by a dedicated process engineering team.

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2.8	**Analysis** You should where appropriate: 1. Analyse the components and concentrations of by products and waste streams to ensure correct decisions are made regarding onward treatment or disposal. Keep detailed records of decisions based on this analysis in accordance with management systems.	Yes	Waste streams and by products that are sent for cement kiln fuel are analysed by the contractor on receipt to ensure that the waste is fit for purpose.
3	**Emissions and monitoring**		
3.1	**Point source emissions - air.** You should where appropriate: 1. Formally consider the information and recommendations in the BREF on Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector (see Reference 1) as part of the assessment of BAT for point-source releases to air, in addition to the information in this note. 2. Identify the main chemical constituents of the emissions, including VOC speciation where practicable. 3. Assess vent and chimney heights for dispersion capability and assess the fate of the substances emitted to the environment. 4. Use the following measures to minimise emissions to air: • recover emissions rich in organics by fractionation and then recycle. • recover and reuse solvents. • continuously monitor off-gas concentration from reaction vessels, dryers, condensers, evaporators and scrubbers where off-gases are shown to be environmentally significant.	Yes	1.Refer to Appendix F for the consideration of BAT against the ‘Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector’ BRef. 2. The site operates an air emissions inventory. 3. Agilent has an inventory of vent and chimney heights. 4. A recent review of the inventory has resulted in further assessment, including a BAT options appraisal and technology selection for waste gas abatement (refer Section 11.1.2 of the main BATOT report). The site is committed to installing the BAT option to ensure compliance with the BAT-AEL’s and BAT operating techniques. A temporary scrubber will be used to reduce concentrations of compounds further whilst the new abatement system is being designed, commissioned and installed. Agilent intends that the upgraded waste gas abatement system should be operational by approximately Q3 2025.
3.1	**Point source emissions - water.** You should where appropriate: 1. Control all emissions to avoid a breach of water quality standards as a minimum. Where another technique can deliver better results at reasonable cost it will be considered BAT and should be used. 2. Use the following measures to minimise water use and emissions to water: • Where water is needed for cooling, minimize its use by maximising heat transfer between process streams.	Yes	1.The majority of effluent generated onsite is chlorinated and unchlorinated waste solvent (containing water) , which is not discharged to sewer, but collected and transferred offsite to be used as cement kiln fuel. Emissions to sewer of other site effluent and wastewater will be monitored in line with the environment permit to ensure that applicable BAT AEL’s are not exceeded.

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	• Use water in recirculating systems with indirect heat exchangers and a cooling tower rather than a once through system. (A water make-up treatment plant and a concentrated purge stream from the system to avoid the build-up of contaminants are likely to be necessary.) • Leaks of process fluids into cooling water in heat exchangers are a frequent source of contamination. Monitoring of the cooling water at relevant points should be appropriate to the nature of the process fluids. In a recirculatory cooling system, leaks can be identified before significant emission to the environment has occurred. The potential for environmental impact is likely to be greater from a once through system. Planned maintenance can help to avoid such occurrences. • Water used for cleaning can be reduced by a number of techniques, e.g., by spray leaning rather than whole vessel filling. • Strip process liquor and treat, if necessary, then recycle/reuse • Use wet air oxidation for low volumes of aqueous effluent with high levels of organic content, such as waste streams from condensers and scrubbers. • Neutralise waste streams containing acids or alkalis to achieve the required pH for the receiving water. • Strip chlorinated hydrocarbons in waste streams with air or steam and recycle by returning to process where possible. • Recover co-products for re-use or sale. • Periodically regenerate ion exchange columns. • Pass waste water containing solids through settling tanks, prior to disposal. • Treat waste waters containing chlorinated hydrocarbons separately where possible to ensure proper control and treatment of the chlorinated compounds. Contain released volatile chlorinated hydrocarbons and vent to suitably designed incineration equipment. • Non-biodegradable organic material can be treated by thermal incineration. However, the thermal destruction of mixed liquids can be highly inefficient, and the waste should be dewatered prior to incineration.		Uncontaminated rainwater from the southern car park and roof of Unit 1 flows into a soakaway within the car park at location W1 shown in Drawing 002. Chemicals are not stored, handled, offloaded or processed in this area. Environmental awareness training at the site also informs employees of the potential risk posed by the presence of the soakaway.. 2.Water use minimisation techniques: • The chiller units are run on recirculated systems. Chiller units are regularly maintained by a suitably licensed subcontractor. • Reverse osmosis water used in the ion exchange is monitored and a subcontractor engaged to replace the cartridge system when this has become exhausted. • Cleaning is undertaken by spray jets with aqueous based detergents. • Replacement of water-cooled condensers with more water efficient air-cooled condensers.

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3.1	**Point source emissions to land.** Landfill of wastes should only be contemplated after all other alternatives have been thoroughly examined and rejected. Use the following measures to minimise emissions to land: ▪ Use settling ponds to separate out sludge (Note: Sludge can be disposed of to incinerator, encapsulation, land or lagoon depending upon its make up.) ▪ Chlorinated residues should be incinerated and not released to land. (Chlorinated hydrocarbons are not to be released to the environment due to their high global warming and ozone depletion potentials.) ▪ Either recycle off spec product into the process or blend to make lower grade products where possible. ▪ Many catalysts are based on precious metals, and these should be recovered, usually by return to the supplier.	N/A	Not Applicable – There is a soakaway but this is for uncontaminated runoff.
3.2	**Fugitive emissions to air** You should where appropriate: 1. Identify all potential sources and develop and maintain procedures for monitoring and eliminating or minimising leaks and releases of VOCs from all non-process stream sources. 2. Choose vent systems to minimise breathing emissions (for example pressure/ vacuum valves) and, where relevant, should be fitted with knock-out pots and appropriate abatement equipment. 3. Use the following techniques (together or in any combination) to reduce losses from storage tanks at atmospheric pressure: • Maintenance of bulk storage temperatures as low as practicable, taking into account changes due to solar heating etc. • Tank paint with low solar absorbency. • Temperature control. • Tank insulation. • Inventory management. • Floating roof tanks. • Bladder roof tanks.	Yes	The potential for fugitive emissions to be generated is low. No significant fugitive VOC emission sources are anticipated as: • The amount of raw materials input into the process is low at 185.09 tonnes per year. • Pipework is located indoors and is minimal. Pipework is maintained under a planned preventative maintenance system. • Controls are in place where chemicals are transferred. • Chemical 2, chemical 3 and chemical 4 are all transferred to process via diaphragm pumps from a DENIOS unit. These chemicals are delivered in sealed containers, transferred via minimal sealed indoor pipework into a sealed process that vents to a channelled emission point to air. • Chemicals stored in 205 L drums are transferred into smaller containers within the drum store utilising air pumps. • The proposed process will operate under a preventative maintenance programme to manage

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	• Pressure/vacuum valves, where tanks are designed to withstand pressure fluctuations. • Specific release treatment (such as adsorption condensation).		equipment that could potentially result in diffuse emissions to air. • The processes use high integrity equipment. • The process is sealed with the exception of the vent system which directs VOCs to channelled emission points.
3.2	**Fugitive emissions to surface water, sewer and groundwater** You should where appropriate: 1. Provide hard surfacing in areas where accidental spillage or leakage may occur, e.g., beneath prime movers, pumps, in storage areas, and in handling, loading and unloading areas. The surfacing should be impermeable to process liquors. 2. Drain hard surfacing of areas subject to potential contamination so that potentially contaminated surface run-off does not discharge to ground. 3. Hold stocks of suitable absorbents at appropriate locations for use in mopping up minor leaks and spills and dispose of to leak-proof containers. 4. Take particular care in areas of inherent sensitivity to groundwater pollution. Poorly maintained drainage systems are known to be the main cause of groundwater contamination and surface/above-ground drains are preferred to facilitate leak detection (and to reduce explosion risks). 5. Additional measures could be justified in locations of particular environmental sensitivity. Decisions on the measures to be taken should take account of the risk to groundwater, taking into consideration the factors outlined in the Agency document, Policy and Practice for the Protection of Groundwater, including groundwater vulnerability and the presence of groundwater protection zones. 6. Surveys of plant that may continue to contribute to leakage should also be considered, as part of an overall environmental management system. In particular, you should consider undertaking leakage tests and/or integrity surveys to confirm the containment of underground drains and tanks	Yes	The site benefits from impermeable surfacing and sealed drainage in the areas where chemicals are stored, handled and processed. Chemical storage areas are bunded. Unloading takes place in a dedicated area with emergency drain bunding provisions and forklift operators are trained in procedures in the case of spillages. The site has a number of chemical storage locations (internal, external, refrigerated, and frozen) to ensure chemicals are stored, segregated and bunded in line with manufacturer's guidance. Periodic inspection of the drainage system will be undertaken during the lifetime of the permit to inspect its integrity. All tanks, chemical storage areas, drainage and containment systems will be subject to a pre-planned maintenance and inspection programme, including periodic integrity testing where applicable. Spill kits will be located at key areas (unloading, chemical storage etc) to assist with the clean-up of small spills and employees in this area will receive environmental management and chemical handling training.
3.3	**Odour** The requirements for odour control will be installation-specific and depend on the sources and nature of the potential odour. You should where appropriate: 1. Manage the operations to prevent release of odour at all times.	Yes	Potential sources of odour from the chemical manufacturing activities include point-source emissions of volatile organic compounds associated with the feedstocks, reagents and solvents as well as liquid wastes produced. Fugitive emissions at the site are considered to be minimal. The site only handles 185 tonnes of raw materials per year.

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	2. Where odour releases are expected to be acknowledged in the permit, (i.e., contained and treated prior to discharge or discharged for atmospheric dispersion): • For existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance. • For new installations, or for significant changes, the releases should be modelled, and it is expected that you will achieve the highest level of protection that is achievable with BAT from the outset. • Where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made. • Where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in our view, to increase the odour impact at receptors, you should take appropriate and timely action, as agreed with us, to prevent further annoyance (these agreed actions will be defined either in the permit or in an odour management statement). 3.Where odour generating activities take place in the open, or potentially odorous materials are stored outside, a high level of management control and use of best practice will be expected. 4. Where an installation releases odours but has a low environmental impact by virtue of its remoteness from sensitive receptors, it is expected that you will work towards achieving the standards described in this guidance note, but the timescales allowed to achieve this might be adjusted according to the perceived risk. 5. Where further guidance is needed to meet local needs, refer to Horizontal Guidance Note H4 Odour (see GTBR).		1.For the small number of chemicals utilised onsite that have the potential to generate odour; the following measures are employed on site to minimise the risk of impact from odour: • A scrubber is used to removed VOCs from the exhaust gases from the main processing area; • Vents from vacuum pumps are routed via the gas scrubber; • Potentially odourous chemicals are stored in sealed containers; • Potentially odourous chemicals are handled in low volumes, no more than 100 L at a time; • Potentially odourous chemicals are handled indoors; and • Potentially odourous chemicals are used within closed systems. 2. There is no history of odour problems or odour complaints at the site, so modelling is not considered to be required. A qualitative assessment of odour risk has been made in the environmental risk assessment (410.064951.00001_ERA). 3. Potentially odour generating activities do not take place in the open. 4. The site is not situated in a remote area. 5. The site’s current management techniques are considered to be appropriate.
3.4	**Noise and vibration** You should where appropriate: 1. Install particularly noisy machines such as compactors and pelletisers in a noise control booth or encapsulate the noise source. 2. Where possible without compromising safety, fit suitable silencers on safety valves. 3. Minimise the blow-off from boilers and air compressors, for example during start up, and provide silencers.	Yes	The following processes and checks will be carried out to minimise the potential for noise emissions: • Blow off from compressors will be minimised. • Regular inspections by the relevant department managers or designated personnel will be made to ensure that the equipment is well maintained. • Maintenance records will be kept up to date and be available upon request.

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			• Regular maintenance will be carried out periodically. • Periodic maintenance checks will be undertaken in accordance with the manufacturer's instructions, to ensure efficient running of engine machinery. e.g., lubrication of moving parts to reduce noise. • Plant will be commissioned to operate at suitable duty levels, to minimise noise emissions as far as practicable. • Periodic checks of plant operation will be undertaken, to ensure that plant is running at the appropriate (lowest) operating duty. • Equipment will be operated by trained, competent staff. • Potentially noisy activities will not be undertaken at night. The site does not operate particularly noisy equipment such as compactors or pelletisers.
3.5	**Monitoring and reporting of emissions to air and water** You should where appropriate: 1. Carry out an analysis covering a broad spectrum of substances to establish that all relevant substances have been taken into account when setting the release limits. The need to repeat such a test will depend upon the potential variability in the process and, for example, the potential for contamination of raw materials. Where there is such potential, tests may be appropriate. 2. Monitor more regularly any substances found to be of concern, or any other individual substances to which the local environment may be susceptible and upon which the operations may impact. This would particularly apply to the common pesticides and heavy metals. Using composite samples is the technique most likely to be appropriate where the concentration does not vary excessively. 3. If there are releases of substances that are more difficult to measure and whose capacity for harm is uncertain, particularly when combined with other substances, then "whole effluent toxicity" monitoring techniques can be appropriate to provide direct measurements of harm, for example, direct toxicity assessment.	Yes.	Monitoring of emissions to air has been undertaken in accordance with BAT 3.5. Periodic monitoring of air emissions will be undertaken in line with the stipulations of the Common Waste Gas Management and Treatment Systems in the Chemical Sector BRef.

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3.5	**Monitoring and reporting of waste emissions** You should where appropriate: 1. Monitor and record: ▪ The physical and chemical composition of the waste. ▪ Its hazard characteristics. ▪ Handling precautions and substances with which it cannot be mixed.	Yes	All wastes generated by the new process are managed in accordance with existing site procedures including characterisation. All waste generated at the site is sent either for recycling, re-use as cement kiln fuel, for energy generation or treatment. No waste is disposed of to landfill.
3.5	**Environmental monitoring (beyond installation)** You should where environmental monitoring is needed: 1. Consider the following in drawing up proposals: ▪ Determinands to be monitored, standard reference methods, sampling protocols. ▪ Monitoring strategy, selection of monitoring points, optimisation of monitoring approach ▪ Determination of background levels contributed by other sources. ▪ Uncertainty for the employed methodologies and the resultant overall uncertainty of measurement. ▪ Quality assurance (QA) and quality control (QC) protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail. ▪ Reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information.	Yes	The air emissions risk assessment (AERA) is provided as a standalone report for this environmental permit application (410.064951.00001_AERA). The AERA quantified and assessed the potential air quality impacts associated with potential emissions from the process operations at the Agilent's organic polymer manufacturing site. The AERA concluded that the emissions process contribution can be considered 'insignificant' against relevant long-term and short-term standards for the protection of human health. As such, environmental monitoring for emissions to air beyond the installation is not considered to be required. The Noise Impact Assessment (410.064951.00001_NIA) included monitoring data from two offsite receptors, residential back gardens located along Essex Road and Churchill Road. This assessment was undertaken in line with BAT 3.5.

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