Substantial Variation Application – Plant 5.1

Permit Number: EPR/BT9844IK

Chemoxy International Limited

Billingham Site

Project Number: 60609533
TERP 60609533-001

29th April 2020

Quality information

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1. Non-technical Summary

Chemoxy International Limited ("Chemoxy") is a wholly owned subsidiary of Seqens and they operate chemical facilities at sites in Middlesbrough and Billingham, both in the industrial area of Teesside.

The Billingham facility is located on the CF Fertilisers Billingham complex, and operates under an Environmental Permit (ref: EPR/BT9844IK) for the toll manufacture of organic chemicals and also the recovery of solvents.

The proposed changes to be made by this permit variation application are to introduce a new production plant (Plant 5.1), a new tank farm to support Plant 5.1, and a new portable small container storage area. The new Plant 5.1 will increase production at the site by nominally 30%.

Plant 5.1 will consist of a reactor, a distillation column (for liquid separations) and a vent scrubber. Plant 5.1 will be very similar in design to the other plants operated at the site (i.e. Plants 2.1 and 4.1).

A new cooling tower will also be installed to service Plant 5.1.

Whilst not being initially constructed and operated when Plant 5.1 comes into production, this variation will also request permission to install two new effluent storage tanks for the future storage and quarantine of effluent arising from the site (replacing existing effluent storage tankage).

The location of Plant 5.1, the tank farm and associated equipment is to the south of the current Chemoxy site on brownfield land, which is already incorporated within the installation boundary.

The portable container storage area is located at the east of the site.

Chemoxy are currently procuring land to the north of the site. This land will be included within the installation boundary but it is not planned to be used for manufacturing operations.

All plants on the site operate under a Multi-Product Protocol – allowing different chemical "families" to be produced by defined chemistries. All the current plant is multipurpose, and Plant 5.1 will also be a multipurpose plant.

Plant 5.1 will be capable of manufacturing all of the products currently manufactured on Plants 1.1 to 4.1. The objective of Plant 5.1 is to initially manufacture ChemoxyCare products (6 and 8), i.e. two different long chain aliphatic diols, and also a chemical intermediate, i.e. a long chain epoxy alkane. The ChemoxyCare products are used in cosmetics.

The intention is for two new effluent storage tanks to be installed at the site. The new tanks (TK004 and TK005) will have a capacity of 250m^3 each and will be installed to the east of the existing effluent storage tanks (TK001 and TK002) in the area of the old methanol storage tank plinths (to the north of the new portable container storage areas).

The new tanks will replace the existing effluent storage tanks TK001 and TK002. However, there may be a period when Plant 5.1 becomes operational, during which the existing effluent tanks will continue to be used, with Plant 5.1 effluent being pumped to the existing effluent tanks.

Best Available Techniques (BAT)

A BAT assessment has been undertaken on the proposed new plant to show compliance with technical guidance. A BAT comparison report is included within this variation application.

Management Techniques

Existing site procedures for environmental protection will be upgraded to incorporate the new plant and equipment, e.g. emergency response plans.

In addition, specific procedures will be written for the new plant, e.g. scrubber system operating control procedure.

The sites maintenance system and procedures will be expanded to cover the new plant and equipment.

Raw Materials

The raw materials to be used in the new processes fit within the existing site process chemistries, site permitted activities and within the Multi Product Protocol (MPP). There is therefore no change to the environmental hazard and environmental risk profile of the chemicals used onsite resulting from this variation, apart from the onsite storage of a greater volume of chemicals through the installation of a new Tank Farm.

Emissions to Air

Plant 5.1 will generate emissions to atmosphere via one new emission point to air, which is from the Plant 5.1 wet scrubber. This is defined as release point A5.

A H1 impact assessment has been carried out, to assess the impact of emissions from A5. The conclusions of this assessment are that the long- and short-term impacts of the emissions are “insignificant”.

The H1 impact assessment is an integral part of the Multi-Product Protocol.

No chemicals are emitted from release point A5 that are of concern with regards to requiring a Habitats Assessment.

Emissions to Controlled Waters

The emissions to controlled waters from the site are through a third-party sewer drainage system, i.e. the CF Fertiliser sewer drainage system to the River Tees (discharge RTO1). RTO1 is consented by the Environment Agency for CF Fertiliser UK Limited.

The site currently has a single discharge of effluent to the CF Fertiliser sewer drainage system – emission point S1.

Plant 5.1 will pump its effluent over to the existing site effluent tanks for discharge as part of S1.

There will be no change to the consent conditions currently applied to emission point S1 by the Environmental Permit.

The effluent from Plant 5.1 will be rainwater falling on the plant, roadways and hardstanding; and occasionally the last steam cleaning/washes of process vessels.

The character / composition of the effluent will not change as a result of Plant 5.1. ChemoxyCare and other existing products and processes are currently manufactured on other plants at the site and effluent from these manufacturing activities currently reports in emission S1.

A H1 impact assessment has been carried out, to assess the impact of the consent limit emissions from S1. The conclusions of this assessment were that the impacts of the pollutants with water quality standards are “insignificant”.

The H1 impact assessment to controlled waters is an integral part of the Multi-Product Protocol.

A Habitats Assessment was undertaken, owing to the proposed extension of the Teesmouth and Cleveland Coast SPA up to the Tees Barrage. The assessment concluded a negligible impact from the consented species in emission S1.

Two additional release points to controlled waters are requested to be added to the Environmental Permit as a result of this application. These are release points S2 and S3.

Release point S2 is an existing release of rainwater, which is not currently captured within the current Environmental Permit. This release is rainwater to the site storm drains from a remote bund serving a tank of methyl chloride. The rainwater is visually tested before opening an isolation valve to allow the rainwater discharge.

Release point S3 is a release of rainwater from a newly built portable container storage area. This consists of three storage areas for drums and intermediate bulk containers (IBC’s). One area is for

hazardous / non-hazardous material small containers. The second area is for empty used containers. The third area is for empty new containers. All areas have bunds or closed containment drainage. Rainwater will be released to the site storm drains by opening isolation valves once the rainwater has been visually tested.

Both S2 and S3 will report in the RTO1 discharge to the River Tees.

Emissions to Sewer

There are no emissions to municipal sewer as trade effluent, where the effluent is processed at a municipal sewage treatment works, as a result of this permit application.

Emissions to Soil and Groundwater

There are no emissions to soil or groundwater as a result of this permit application, e.g. soakaways.

Dust

There are no new sources of dust as a result of introducing Plant 5.1 and this application to vary the permit.

Odour

There are no new sources of odour as a result of introducing Plant 5.1 and this application to vary the permit.

Waste Generation

There are no changes to the procedures governing waste disposal as a result of this permit variation.

Wastes will be assessed and disposed of, in line with current procedures and practices at the site.

The site has a resource Efficiency Team, that meets quarterly to set and monitor key performance indicators and targets. Waste generation is tracked and monitored as a specific metric (as tonnes waste/tonne product) and waste minimisation projects may be initiated if deemed appropriate.

The processes that will be operated on Plant 5.1 fall within the existing plant activities and products, i.e. they are all manufactured under the MPP envelope on other plants on site. The wastes generated will therefore be the same as currently produced on site.

The increase in waste quantity is expected to be an additional 1,750 tonnes/year of wastes exported from site as a result of Plant 5.1 operations.

Energy Efficiency

The addition of the new Plant 5.1 will increase the overall energy use on the site due to the additional processing capacity.

Wherever possible, the site aims to use the most energy efficient equipment available. The site complies with the European Minimum Energy Performance Standard (EU MEPS) scheme. The scheme sets mandatory minimum efficiency levels for electric motors introduced into the European market.

The site operates under an existing Climate Change Agreement.

Noise and Vibration

The new processing equipment to be installed includes pumps and agitators, which have electrical drives and are sources of noise. A noise assessment has therefore been carried out to assess the impact associated with this new equipment at nearly receptors.

This assessment included monitoring background levels of similar equipment, followed by analysis of the impact of additional sources using specialist software. Worst-case conditions were used as the basis of this assessment, with the new equipment operating continuously.

The results of this analysis concluded that sound levels at the nearest residents were not significant and the impact of the new plant was considered to be low.

Site Condition Report

An update to the Site Condition Report, covering the installation of new Plant 5.1 and the identification of monitoring needs to provide a site baseline, is contained within this variation application.

Climate Change Risk

The site has a draft climate change risk assessment within its Environmental Management System.

Environmental Risk Management

The site's management system incorporates several policies and procedures for emergency and incident response.

The policies and procedures will be expanded to cover the new plant and equipment introduced by this variation.

The new plant and equipment will be subject to HAZOP throughout the various stages of the installation project and an integral part of the HAZOP will be risks to the environment.

A qualitative assessment of the potential risks to the environment has been undertaken and are included in this variation application.

Firewater

Firewater generation and flow has been modelled for the new plant.

Firewater would be collected in the 18-inch main storm drain for the site. The firewater would be held back by the emergency "flapstopper" drain isolation valve, which would be activated in a fire event.

The retained fire water would be pumped from the "flapstopper" valve chamber by a high capacity pump into a new bund to the north east of the control room building. The bund will hold the contaminated firewater – awaiting off-site disposal.

2. Introduction

Chemoxy International Limited ("Chemoxy") is a wholly owned subsidiary of Seqens and they operate chemical facilities at sites in Middlesbrough and Billingham, both in the industrial area of Teesside. The Billingham facility is located on the CF Fertilisers Billingham complex, and operates under an Environmental Permit (ref: EPR/BT9844IK) for the toll manufacture of organic chemicals and also the recovery of solvents.

The site currently has a number of production facilities under the current Environmental Permit, namely:

- Plants 1.1 and 1.2; which are serviced by a shared scrubber for abating emissions to air (Release Point A1);
- Plant 1.3; which has a vent to air (Release Point A2);
- Plant 2.1; which is serviced by a scrubber for abating emissions to air (Release Point A3);
- Plant 3.1; which has no designated emission points to air; and
- Plant 4.1; which is serviced by a scrubber for abating emissions to air (Release Point A4).

In addition to the above, the site currently discharges effluent from their onsite effluent holding tanks, into the CF Fertilisers sewer drainage system, which ultimately reports in the RT01 discharge into the River Tees. The RT01 discharge is subject to an effluent discharge consent, held by CF Fertilisers with the Environment Agency.

The Chemoxy site discharge into the CF Fertilisers drainage sewer drainage system is emission point S1 within their Environmental Permit (EPR/BT9844IK/V007) and the discharge requirements mirror those contained within a discharge agreement held between Chemoxy and CF Fertilisers, so as to protect the RT01 discharge conditions.

The proposed changes to be made by this permit variation application are to introduce a new production plant (Plant 5.1), a new tank farm to support plant 5.1, and ancillary supporting operations.

Plant 5.1 will consist of a reactor, a distillation column (for liquid separations), a liquid/liquid extraction column (to be installed at a later date) and a vent scrubber. The plant will operate independently from the other existing plants mentioned above. Plant 5.1 will be very similar in design to the existing Plant 2.1, however newer equipment (similar to that used on Plant 4.1) will be employed.

As part of the introduction of Plant 5.1, a new multi-purpose tank farm associated with the plant will be constructed, consisting of fourteen new storage tanks. Installation of the tanks will be phased; ten tanks will be installed initially and a further four at a later date. In addition, a drum and IBC storage area is to be developed to the east of the site in an area already within the installation boundary.

A new cooling tower will also be installed to service Plant 5.1.

Whilst not being initially constructed and operated when Plant 5.1 comes into production, this variation request will also request permission to install two new effluent storage tanks for future storage and quarantine of effluent arising from the site (replacing existing effluent storage tankage).

The location of Plant 5.1, the tank farm and associated equipment is to the south of the current Chemoxy site on brownfield land, which is already incorporated within the installation boundary.

Chemoxy have procured land to the north of the site, which in recent years has been used as office space and an engineering workshop (latterly occupied by Mammoet – engineering and heavy lifting equipment). This land will be included within the installation boundary but is not planned to be used for manufacturing operations.

The new Plant 5.1 will increase production at the site by nominally 30%.

2.1 Applicant Details

Table 2-1 Applicant Details

Item	Detail
Company Name	Chemoxy International Limited
Installation Name	Billingham Custom Processing Site
Installation Address	Road 11 Process Park, Billingham, Cleveland. TS23 1LB
Installation Contact	Rachel Mitford
Registered Office	All Saints Refinery, Cargo Fleet Road, Middlesbrough, Cleveland. TS3 6AF
Company Registration Number	350164

2.2 Reason for the Application

Chemoxy would like to vary the permit in order to extend the existing plant operations and increase production capacity, through the construction of a new processing plant (5.1).

The permit variation is to include the addition of a new multi-purpose process unit and to update the permit with current rainwater discharges. The changes consist of the following new equipment and clarifications:

- A single reactor;
- An integral distillation column;
- A liquid/liquid extraction column (to be installed later, along with the additional four bulk storage tanks in the tank farm - below)
- A vent gas scrubber column (an additional release point to atmosphere (Release Point A5));
- A cooling tower to service the new plant;
- A multi-purpose tank farm – consisting of fourteen new tanks. Installation of the tanks will be phased; ten tanks will be installed initially and a further four at a later date;
- A drum and IBC storage area;
- The addition of two new effluent storage tanks (to be installed at a later date);
- The addition of effluent from Plant 5.1 area / new tank farm / cooling tower into the existing effluent tanks (Tanks TK001 and 002). This is the existing release point to the CF Fertiliser sewer drainage system (emission point S1);
- Classification of the existing rainwater discharge from the Methyl Chloride bund as emission point S2. This is a periodic rainwater discharge to the site storm drains and then to the CF

Fertiliser drainage system after visual testing, and is to be added to the current permit for completeness;

- The site has created a storage area to the east of the site for the storage of drums and IBC's. This area has a closed drain systems, which occasionally discharges clean rainwater, and it is proposed that this becomes emission point S3. This is a rainwater discharge to the CF Fertiliser sewer drainage system after visual testing and is to be added to the current permit for completeness; and
- An extension of the site boundary to incorporate a newly purchased area of land (the northern area formally occupied by Mammoet – offices and engineering workshops).

It should be noted that emission point S1 will, in future, be transferred to the new bulk effluent storage tanks, when they are constructed at a later date. In addition, a liquid-liquid extraction column will be added at later date in the project following initial commissioning of the main plant

3. Installation Details

3.1 Scheduled Activities

The installation is currently permitted to operate the following activities:

Table 3-1 Scheduled Activities

Activity Listed in Schedule 1 of the Environmental Permitting Regulations	Description of Specified Activity	Limits of Specified Activity
Section 4.1 A(1)(a)(i)	Producing organic chemicals such as hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic), subject to the Multi Product Protocol.	Receipt of raw materials to the reaction and the storage of finished product.
Section 4.1 A(1)(a)(ii)	Producing organic chemicals such as esters, organic salts, aldols, and ethers subject to the requirements of the Multi Product Protocol.	Receipt of raw materials to the reaction and the storage of finished product.
Section 4.1 A(1)(a)(iv)	Producing organic chemicals such as quaternary salts, amine oxides and amides subject to the requirements of the Multi Product Protocol.	Receipt of raw materials to the reaction and the storage of finished product.
Section 4.1 A(1)(a)(viii)	Producing organic chemicals such as plastic materials (for example polymers, synthetic fibres and cellulose-based fibres).	Receipt of raw materials to the reaction and the storage of finished product.
Section 5.3 A(1)(a)(ii)	Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment.	Receipt of raw materials from storage to the treatment by distillation only and the storage of finished products. Limited to waste types and quantities as specified in table S2.2 of the Environmental Permit.

Activity Listed in Schedule 1 of the Environmental Permitting Regulations	Description of Specified Activity	Limits of Specified Activity
Section 5.3 A(1)(a)(iii)	Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving blending or mixing waste prior to submission to the activity described in Section 5.3 A(1)(a)(ii).	Receipt of raw materials to blending and mixing if required to storage pending treatment by distillation. Limited to waste types and quantities as specified in table S2.2 of the Environmental Permit.
Section 5.6 A(1)(a)	Temporary storage of hazardous waste with a total capacity exceeding 50 tonnes pending any of the activities listed in Section 5.3.	From receipt of raw materials to storage pending use in the section 5.3 activity. Limited to waste types and quantities as specified in table S2.2 of the Environmental Permit.

The new plant will undertake activities already defined within Table S1.1 of the site's Environmental Permit (as reproduced above in Table 3-1).

No changes to scheduled activities are required as part of this application to vary the permit.

3.2 Proposed Changes

3.2.1 Process Description

The new plant will be used initially and primarily for the manufacture of products already manufactured at the site. The main use will be for personal care products known by the trade name ChemoxyCare. The new plant will allow for increased production. Other existing products will also be manufactured on the new plant.

The ChemoxyCare processes fit within the existing permitted process chemistry and will be operated under the existing Multi-Product Protocol (MPP). Plant 5.1 is very similar in design and operation as Plant 2.1; however, newer and more modern equipment will be specified and installed.

The new plant will undertake activities already defined within the site's Environmental Permit. It is also anticipated that the unit will be used to manufacture diol's and epoxides. These reactions utilise hydrogen peroxide as a raw material, which will be stored in its own dedicated storage tank.

Due to the multi-purpose nature of the site; Plant 5.1 may also be used to carry out other existing activities covered under the MPP chemistry envelope.

3.2.2 Unit Operations

Plant 5.1 consists of a reactor (RE501), a distillation column (COL501) and associated ancillary equipment. The reactor and distillation column can be operated at atmospheric pressure, under vacuum or up to a pressure of 8 barg.

The plant can be operated with the reactor and column in series or as a discrete reactor and separate distillation column, which can work independently. This allows flexibility of plant operations and maximises the multi-product nature of the plant.

Some of the reaction products require washing prior to distillation. Initially this operation will be done in a storage tank and later a liquid/liquid extraction column will be installed to perform this operation.

A new mechanical induced draught counter current flow cooling tower is to be installed to serve Plant 5.1. Water from a discrete cooling water basin will be recirculated through process heat exchangers.

The cooling tower will have running and standby recirculation pumps. The total flow to the plant and the flows to the critical items of process equipment (i.e. condensers) will be monitored. Low flow detection and alarms will be installed.

3.2.3 Process Chemistry

Plant 5.1 will be a multipurpose production unit.

The initial intention is to carry out the production of two key products that will be used in the cosmetic industry (ChemoxyCare products 6 and 8). These two products are long chain aliphatic diols. The processes are similar, and this application illustrates the generic chemistry, as contained within the sites multi product protocol (MPP), as an exemplar process.

An epoxy alkane will also be initially manufactured on Plant 5.1. This is also currently manufactured at the site. This is toll-manufactured for a customer who uses it to produce other chemicals. This manufacturing process is also covered by generic chemistry, as contained within the sites MPP.

It should be recognised that the actual chemicals manufactured are commercially sensitive.

ChemoxyCare 6 and 8 Manufacture (Long Chain Aliphatic Diols)

This process involves the catalytic oxidation of a long chain aliphatic alkene with hydrogen peroxide. The reaction mixture is then neutralised before the organic layer (crude product) is separated and washed. Finally, the product is purified by distillation under vacuum.

ChemoxyCare 6 uses Alkene 3 and ChemoxyCare 8 uses Alkene 1 as the raw materials in their manufacture.

The process is described under the existing site MPP as reaction O13, namely:

O13) Alcohol Manufacture from an alkene

alkene + hydrogen peroxide ----> alcohol

e.g. nonene + hydrogen peroxide ----> 1,2 nonane diol

The stages of the process include:

- Alkene and a catalyst are charged to the reactor and heated. Cooling is then established before the addition of 50% hydrogen peroxide commences. The addition rate is adjusted to maintain the process temperature.
- Once all of the hydrogen peroxide solution has been fed to the reactor (as defined by the process batch instructions), cooling or heating is maintained, as required, until the reaction is complete.
- The reaction mixture is then cooled and then neutralised. Cooling is applied to maintain a steady reaction temperature during the neutralisation. Once complete, the mixture is settled before the lower aqueous layer is run off for disposal.
- The upper layer is then washed with water and left to settle. The organic product is then isolated by distillation.

Epoxy Alkane Manufacture

The process involves the oxidation of a long chain aliphatic alkene with hydrogen peroxide and a catalyst. The product is first isolated through phase separation then distilled under vacuum. The epoxy alkane manufacture uses Alkene 2 as the raw material.

The process is described under the existing site MPP as reaction O15, namely:

O15) Manufacture of epoxides

alkene + hydrogen peroxide ----> epoxide + water

This can be generically described as:

$$R_1R_2C{=}CR_3R_4 + H_2O_2 \text{ ----> } R_1R_2COCR_3R_4 + H_2O$$

Where: R1, R2, R3, and / or R4 can be hydrogen, alkyl, aryl, alkene or ether groups.

e.g. decene + hydrogen peroxide = epoxy decane + water

The stages of the process include:

- The alkene and the catalyst are charged to the reactor, and heated.
- The reaction rate is limited by the rate at which heat can be removed. Hydrogen peroxide solution is fed over a number of hours. The major safety requirement is the control of the hydrogen peroxide addition rate. A flow of 50% peroxide solution is established to the reactor and the addition rate is adjusted to maintain the process temperature.
- Cooling is maintained throughout this reaction phase. Once the reaction is complete, the mixture is cooled and allowed to settle. The lower layer is run off as aqueous waste to a tank, and the upper layer is transferred to another tank (crude product).
- The crude product is then washed and then fed to a vacuum distillation unit to purify the product.

3.2.4 Abatement of Emissions

A new scrubber will be installed to abate emissions to atmosphere resulting from Plant 5.1 operation. The wet scrubber is designed to be flexible in its configuration and the scrubbing liquor can be tailored to optimise the abatement of the particular VOC's released from any given process.

3.2.5 Tank Farm

A new tank farm located adjacent to Plant 5.1 will contain fourteen (14) new storage tanks. This will include a dedicated hydrogen peroxide tank and numerous multipurpose tanks for the storage of organic raw materials and products. The bulk storage tanks are typically 100 to 200m^3 in capacity (see later for details). Installation of the tanks will be phased; ten tanks will be installed initially and a further four and the liquid/liquid extraction column at a later date;

3.2.6 Permit Boundary

Plant 5.1 and the new tank farm will be located to the south of the current Chemoxy site on brownfield land that is already incorporated within the installation boundary.

A new area of land to the north of the site has been purchased. In recent years, this land has been used as office space and an engineering workshop (previously occupied by Mammoet). This area of land is to be included within the installation boundary, but it is not planned to be used for manufacturing operations.

A site plan showing the new permit boundary (in green) has been included in Appendix A – Figure 1.

This site plan also shows the location of Plant 5.1, to the south of the site, the Release Points to Air (A1, A2, A3, A4 and new Point A5) and the Emission Points to Sewer (S1 and newly defined points S2 and S3).

A general arrangement drawing of the plant and equipment for Plant 5.1 is shown pictorially in Appendix A – Figure 2. This is a preliminary 3D design drawing showing the relative location of plant and equipment, to illustrate the general plant arrangements.

3.3 BAT Assessment of Proposed Changes Relative to Primary Guidance

A Best Available Techniques (BAT) assessment has been undertaken to support the permit variation.

The guidance documents used to undertake the BAT assessment were:

- Speciality Organic Chemicals EPR 4.02 (SOC) – March 2009;
- Selected BAT Conclusions from the Waste Treatment BREF (WT August 2018) relating to waste solvent storage, blending, and recovery by distillation; and

- CIRIA C736 - Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises (2014).

The Common Waste Water and Waste Gas Treatment / Management in the Chemical Sector BREF (CWW June 2016) is likely to be applied alongside the Waste Gas BREF, which is currently in preparation (at first draft stage – November 2019), when they apply to the Fine Organic Chemicals Sector. The CWW BAT Conclusions have been included for completeness within the BAT assessment.

The BAT assessment is a standalone document within Appendix B.

3.4 Substantial Change

Pre-application discussions with the Environment Agency highlighted that the variation was considered to be a Substantial Variation by the Environment Agency.

Consequently, this application to vary the permit is made as a Substantial Variation.

4. Management Techniques

4.1 General

The proposed changes will not lead to any significant changes to the existing Chemoxy site management systems.

The new plant and equipment will be managed in accordance with the operating systems already employed on site. The site already manufactures the products to be made on the new plant at the site.

The addition of the new plant and equipment (Plant 5.1) is to replicate production plant at the site (Plants 2.1 and 4.1) so as to increase manufacturing capability.

Procedures will be modified or updated to reflect the new plant and storage areas as required.

Specific procedures will be developed or updated to include the new plant as follows:

- Scrubber system operating controls and procedures;
- Materials storage and segregation;
- Bund and sump emptying procedures; and
- Discharges to CF Fertiliser drainage system.

Prior to new process plant being introduced, a full HAZOP study is undertaken. The HAZOP studies consider the manufacturing process at the conceptual design stage, through the detailed design stage and they are fully reviewed on commissioning and operation.

The findings of the conceptual HAZOP study have been included in the “Seqens Billingham, Plant 5.1 COMAH Regulation 10 Addendum Report”, June 2019, HFL Consulting Ltd. This is available to the Environment Agency as joint Competent Authority under the COMAH legislation.

4.2 Environmental Management Systems

The site is accredited to the ISO14001:2015 standard and has therefore demonstrated that there are extensive procedures relating to environmental management in operation at the site.

4.3 Management of Change

The introduction of new processes, equipment, raw materials, emissions etc. is managed under the site’s management of change procedures.

Technical personnel are responsible for identifying and managing change.

Since the changes to the site activities are considered to be a Substantial Change by the regulator, the implementation of the new equipment and processes will be carefully monitored by a multi-disciplinary management team.

A critical part of the sites management of change process is the sites MPP.

4.4 Maintenance

The site has an extensive Planned Preventative Maintenance (PPM) system. Maintenance is planned and tracked using an electronic system. Both routine and planned maintenance are managed through the Computerised Maintenance Management System (CMMS) known as Workmate.

The new process plant and equipment that will be installed to facilitate the new process will initially be operated and maintained in line with manufacturer's recommendations.

The maintenance system incorporates the inspection and maintenance of environmentally critical equipment.

The main plant equipment (reactor and distillation unit) incorporates a number of critical to the environment controls.

In summary, the critical to environment controls are:

- Instrumented safety system trip and alarm as follows:
  - High level on the reactor that trips the steam to the reactor and reboiler and closing the feed and small additions system block valves.
  - High level on the distillation column which trips the steam to the reboiler and closes the column feed emergency block valve.
  - High temperature on the reactor which trips the steam to the reactor and the reboiler by closing the steam control and emergency block valves.
  - High temperature in the vent to the vacuum package and scrubber.
  - Low flow in the cooling water return from the distillation column condenser.
  - Low speed on the reactor agitator that will trip the Hydrogen Peroxide feed line.
  - High temperature in the reactor vent condenser to the vent scrubber.
  - High temperature in the reactor base which trips the steam to the reactor by closing the steam control and emergency block valves and trips the Hydrogen Peroxide feed line emergency block valve.
  - Low temperature in the reactor base which trips the Hydrogen Peroxide feed line emergency block valve.
  - High level and high pressure in the liquid/liquid extraction column that closes the feed valves. There is also flow control on the reflux line to the distillation column.
- There is a "flapstopper" emergency isolation valve installed in the storm water drainage system. When activated, the "flapstopper" closes and isolates the storm water drainage system so that material remains within the site drains and cannot be discharged to the CF Fertilisers drainage system and thence the River Tees through RT01. The "flapstopper" valve is also considered to be a 'critical to the environment' item and is tested and maintained in accordance with site procedures.

Routine inspections of the drainage system are undertaken using CCTV. The new drainage system will be added to the schedule of inspection.

Regular inspections of the site bund and containment systems are also undertaken.

5. Raw Materials and Storage

5.1 Raw Materials

The raw materials to be used in the new process fit within the existing site process chemistries, site permitted activities and within the Multi Product Protocol (MPP). There is therefore no change to the environmental hazard and environmental risk profile of the chemicals used onsite resulting from this variation, apart from the onsite storage of a greater volume of chemicals through the installation of a new Tank Farm.

Whilst the new plant within Plant 5.1 is considered to be multipurpose, and capable of undertaking the MPP site envelope reactions which are currently undertaken on other plants, the main products that will be manufactured on Plant 5.1 will be the two ChemoxyCare cosmetic products, 6 and 8, which are long chain aliphatic diols.

As an indication of raw material usage and raw material hazards on Plant 5.1, the raw materials used per batch for the manufacture of ChemoxyCare 8 are presented in Table 5-1. These would be stored within the new tank farm.

However, as mentioned earlier Pant 5.1 is a multi-purpose plant and other products may also be manufactured in this plant, as per the MPP envelope.

Table 5-1 Raw Materials (and Products) for ChemoxyCare 8 Manufacture

Substance	Quantity Used per Batch (tonnes)	Max Quantity Stored (tonnes)	Main Hazards
Alkene 1	8.2	100m^3 (new tank)	H225: Highly flammable liquid and vapour H304: May be fatal if swallowed and enters airways H400: Very toxic to aquatic life H410: Very toxic to aquatic life with long lasting effects
Organic acid (concentration used in range 80-99%)	7.2	100m^3 (new tank)	H226: Flammable liquid and vapour H302: Harmful if swallowed H314: Causes severe skin burns H318: Causes serious eye damage H331: Toxic if inhaled
50% hydrogen peroxide	5.8	61m^3 (new tank)	H272: May intensify fire; oxidiser H314: Causes severe skin burns H318: Causes serious eye damage H335: May cause respiratory irritation H412: Harmful to aquatic life with long lasting effects
50% sodium hydroxide	11.2	100m^3 (new tank)	H290: May be corrosive to metals H314: Causes severe skin burns and eye damage H318: Causes serious eye damage
ChemoxyCare 8	10.7 (max)	200m^3 (new tank)	Not considered hazardous

The raw materials for ChemoxyCare 6 manufacture would also be stored in the general purpose tanks within the new tank farm, i.e. Alkene 3 (raw material – 100m^3 tank) and ChemoxyCare 6 (product – 100 or 200m^3 tank).

The raw materials for the epoxy alkane manufacture would also be stored in the general purpose tanks within the new tank farm, i.e. Alkene 2 (raw material – 100m^3 tank) and epoxy alkane (product – 100 or 200m^3 tank).

The site stock of ancillary materials such as cooling water treatment chemicals will remain unchanged.

5.2 Storage

5.2.1 Bulk Storage

New Bulk Storage Tanks

A new multi-purpose tank farm is to be constructed for Plant 5.1 for the storage of raw materials and bulk product.

The new tank farm will consist of fourteen (14) bulk storage tanks, located within three dedicated separate bunds. The bund compounds are known as compound 11a, 11b and 11c and follow on from the site bund / compound numbering system. Installation of the tanks will be phased; ten tanks will be installed initially and a further four at a later date. The proposed liquid/liquid extraction column will also be located within the tank farm.

A layout plan of the bulk storage tanks is provided in Appendix A – Figure 3: Tank Farm and Bund Layout. They are also shown as a 3D representation within Appendix A - Figure 2: General Arrangement Drawing (3D) of Plant 5.1.

All of the tanks located in the new tank farm are constructed of stainless steel. They all have level indication, high level alarms, high level trips and emergency block valves with signals back to the control room DCS. The majority of the tanks are also fitted with emergency vent manhole covers (EVMC).

The containment system has been designed recognising CIRIA 736 guidance, e.g. 110% containment of the largest tank, 25% containment of the total bund tankage etc. (see BAT Assessment Appendix B).

The bunded compounds 11a and 11b are separated by a bund wall. Compound 11c is a dedicated bund for the storage of hydrogen peroxide only. Tank 514 (hydrogen peroxide) and its bund is physically separated from the other bunds, with a tank loading bay being located in between the bunded areas (see Appendix A – Figure 3).

A description of the tanks and their capacities is presented in Table 5-2.

Table 5-2 Bulk Storage Tanks

Bund	Tank	Capacity (m^3)	Other Details
11a	501/1	9	Horizonal compartmented tank with steam heating to one of the compartments.
	501/2	5	Tank has a nitrogen blanket installed. Level indication with high level alarm and trip.
	501/3	9	501/3 is heated and has temperature indication, control and trip.
	502	100	Tank has a nitrogen blanket installed. Level indication with high level alarm and trip. This tank is configured so that it can be heated in the future.
	503	100	Tanks have nitrogen blankets installed. Level indication with high level alarms and trips.
	504	100	The tanks are heated and have temperature indication, control and trips.

Bund	Tank	Capacity (m^3)	Other Details
	505	100	
	506	100	
	507	100	Tank has a nitrogen blanket installed. Level indication with high level alarm and trip. This tank is configured so that it can be heated in the future.
	508	200	Tanks have nitrogen blankets installed. Level indication with high level alarms and trips.
	509	200	The tanks are heated and have temperature indication, control and trips.
11b	510	100	
	511	100	Tanks have nitrogen blankets installed. Level indication with high level alarms and trips.
	512	100	The tanks are heated and have temperature indication, control and trips.
	512	100	
11c	514	61	Hydrogen peroxide storage tank. Tank has a nitrogen blanket installed. Level indication with high level alarm and trip. The tank is heated and has temperature indication, control and trips. It also has a high temperature alarm. The tank has an open vent and vacuum relief valve.

With the exception of the hydrogen peroxide tank, all of the tanks are multipurpose tanks and can be used to store a variety of materials. However, when selecting a storage tank for use, the following criteria are considered:

- Compatibility of other materials stored in the locality (i.e. within the same bund);
- Suitability of the materials of construction;
- Nitrogen blanketing facility for flammable materials;
- Heating capability; and
- Venting to a scrubber if required.

The classification of materials to be stored in the new tank farm are:

- Toxic materials;
- Flammable materials, e.g. isobutanol, acetic acid, acetic anhydride, isoamyl alcohol;
- Highly flammable materials, e.g. methanol, ethanol, isopropanol;
- Materials hazardous to the aquatic environment, e.g. Solvesso 100; and
- Other typically used materials such as glycolic acid solution, lactic acid solution, myristic acid and monoethylene glycol.

All the above chemicals are covered by existing operations under the MPP for the existing manufacturing plant (Plants 1.1 through to 4.1).

Liquid/Liquid Extraction column

When installed, this unit will be used to wash and separate crude product. The column will be constructed of stainless steel and will be operated at atmospheric pressure. Liquid product will be fed to the column from a storage tank via a flow control system. Water will also be fed to the column via a

flow control system. All operations are observed and controlled from the plant control system in the control room. The column is effectively an agitated multi stage washing vessel, there is no chemical reaction carried out and the different liquid phases are separated prior to leaving the column and transferred to the appropriate storage tank. The column is lagged but not heated. There are no additional air or liquid emissions from this unit. Washed product overflows from the top of the column and is pumped away. Overfill is prevented by a high level trip system, which isolates the feed lines into the column. The column pressure is also monitored and high pressure will also trip closes the feeds to the column.

Existing Methyl Chloride Bulk Storage Tank

The site has a dedicated bulk tank for the storage of methyl chloride. The tank is 45m³ (TK 2408) and sits within its own dedicated secondary containment bund, which is sized for 107% of the total tankage. The bund is a closed unit, from which uncontaminated rainwater is released (after visually testing) into the storm water drains. This emission is currently not defined within the extant Environmental Permit and it is proposed to add this as a new emission point (emission point S2) for completeness. The emission is released uncontaminated rainwater from the methyl chloride bulk storage area into the site storm water drainage system. This then enters the CF Fertiliser sewer drainage system, which then reports as the CF Fertiliser RT01 discharge to the River Tees.

Given that methyl chloride is highly volatile in nature (flash point of -45°C), it is unlikely that any spillage of material will enter the drainage system and be discharged via the site storm water drains. The bund sump is isolated and can only be drained manually via a locked drain valve assembly.

A fixed methyl chloride gas detection system, with automatic shutdown on activation, is installed in the storage area to minimise / prevent any spillages. The gas detection system is included in the planned preventative maintenance regime as critical equipment.

5.2.2 Drum and IBC Storage

The site has created an area to the east of the site for the storage of drums and intermediate bulk containers (IBC's). The area consists of three storage areas, which are:

- One area (approx. 460m²), with a full containment bund with drain isolation and ramped access for fork-lift trucks, will be used to store hazardous and non-hazardous materials in drums and IBC's.
- The second area (approx. 274m²), with closed drainage containment, will be used for the storage of empty used containers awaiting off-site laundering / recycle.
- The third area (approx. 600m²), with closed drainage containment, will be used for the storage of new (unused) containers.

Appropriate segregation of incompatible materials will be provided. Materials will be stored in compliance with the following codes of practice:

- HSG 71: Chemical warehousing: the storage of packaged dangerous substances; and
- HSG 51: The storage of flammable liquids in containers.

Hazardous and Non-hazardous Material Storage Area

The available storage capacity of the bunded containment area will depend on the materials to be stored and the distances to provide sufficient segregation, whilst maintaining adequate containment capacity for spills. The area has a full bund wall and drains to an isolated sump.

The closed drains and sump will gather rainfall and can be emptied into the CF Fertilisers sewer drainage system, after visual testing, and via an oil interceptor. This is proposed to be emission point S3.

Typical substances contained within the hazardous and non-hazardous area include:

- Toxic materials, e.g. methanol.
- Flammable materials, e.g. iso-butanol, acetic acid, Solvesso 100.

- Highly flammable materials, e.g. iso-propanol, Industrial Methylated Spirit, methanol, toluene.
- Harmful to the environment materials, e.g. Solvesso 100, cyclohexane.

The storage of drums and IBCs of Dangerous Substances at Billingham is outlined in a documented procedure ('Use of Storage Areas on Billingham Site') and each area has an associated risk assessment covering its use. The purpose of the procedure is to ensure that contact between incompatible materials does not initiate events leading to a Major Accident.

Used Empty Container Storage and New Empty Container Storage Areas

These two storage areas are used only for used empty containers and for new unused containers. These areas also have bunded and drain isolation containment.

The surfaces of the two areas drains into two sumps. These local sumps drain via underground pipework to a common sump with an isolation valve. The sump can then be discharged, after visual testing, into the same drain line as the emission from the hazardous and non-hazardous storage area, i.e. into emission point discharge S3.

Rainwater in the sumps / bunds of all three areas will be analysed prior to being discharged. In the event that material is lost to the storage area bunds / sumps; then the contents of the bunds / sumps would be collected and removed for offsite disposal.

The new storage area and drainage arrangements are shown in Appendix A – Figure 1: Site Plan, Installation Boundary and Release Points and Figure 4: Site Drainage Plan.

5.2.3 Warehousing

Chemoxy has purchased two (2) acres of land adjacent to the north boundary of the current site boundary. The land houses an office block, two warehouse style buildings and an open area of hardstanding.

The new area of land needs to be included in the installation and permit boundary. The new installation boundary, accommodating the procured land to the north, is shown in Appendix A – Figure 1.

At this juncture, there will be no permitted activities undertaken in this new area of land.

In the future, the site may consider using the larger of the warehouse style buildings for undercover storage of packed goods. Should this be the case, the site will discuss this future use with the Environment Agency.

5.2.4 Effluent Tanks

The intention is for two new effluent storage tanks to be installed at the site. The new tanks (TK004 and TK005) will have a capacity of 250m³ each and will be installed to the east of the existing effluent storage tanks (TK001 and TK002) in the area of the old methanol storage tank plinths (to the north of the new portable container storage areas) - see Appendix 1 Figure 1: Site Plan, Installation Boundary and Release Points.

The new tanks will replace the existing effluent storage tanks TK001 and TK002. However, there may be a period when Plant 5.1 becomes operational, during which the existing effluent tanks will continue to be used, with Plant 5.1 effluent being pumped to the existing effluent tanks.

Currently, should the effluent generated on site not meet the discharge conditions defined in the Environmental Permit for emission point S1; then the effluent tanks can be used to isolate the contaminated material prior to treatment or offsite disposal. The installation of the new tanks (TK004 and TK005) and the commissioning of a new bund will allow for a significant increase in the onsite effluent containment capacity, above that provided by the current tankage (TK001 and TK002).

Current practice is for one of the effluent tanks to be filled, isolated and then analysed. Provided that the effluent is in specification then it is discharged to the CF Fertilisers drainage system and thence RTO1 into the River Tees. RTO1 is consented by the Environment Agency for CF Fertilisers. Whilst

the first tank is isolated and analysed, the second tank is then put into service and effluent is pumped to this tank. Only one tank is filled at any one time.

Further details of the effluent system are provided in Section 9, Emissions to Controlled Waters.

5.2.5 Drainage Arrangements

Existing Drainage Arrangements

The construction of Plant 5.1 does not affect the existing drainage arrangements / procedures on the current footprint of the processing facility, namely:

- The existing drainage will remain in its current mode with the site process effluent drains (not stormwater drains) going to the effluent pit and being pumped into the effluent tanks (TK001/002) where the effluent is analysed before release.
- The existing firewater arrangements will stay in place for the current footprint with potentially contaminated firewater being pumped into the firewater tank (TK003).
- Uncontaminated stormwater goes directly to the CF Fertiliser sewer drainage system, and thence the RT01 discharge, via an emergency "flapstopper" isolation valve arrangement to the east of the control room. The "flapstopper" provides protection to the RT01 discharge in the event of an unexpected release into the stormwater drains, i.e. spillage or fire event.

Additional Plant 5.1 Drainage Arrangements

The addition of Plant 5.1 to the Billingham site includes the construction of some new drains to deal with effluent captured within the footprint of the new plant. In reviewing the operation of the new drains, consideration has been given to normal operation, normal operation in heavy rain conditions and the worst-case firewater scenario and how the new Plant 5.1 drains interface with the existing drainage arrangements under these circumstances.

Normal Operation of Plant 5.1

Steam is imported to the site and will be used by Plant 5.1 for heating purposes. It is not economically viable to return steam condensate to the supply network. Consequently, steam condensate will be routed into the 18" drain to the east of the control room, which contains the "flapstopper" emergency isolation valve. This discharges into the CF Fertilizer sewer drainage system and is discharged as combined discharge RTO1.

Plant 5.1 process, tank farm, and road tanker offloading / loading area drains will be collected within the new Plant 5.1 drains and ultimately flow through a "firetrap" chamber to a small effluent pit. From here the effluent will be pumped via a transfer line to the existing process drainage system to the north of the warehouse. From here it will run into the current effluent pits and then be pumped into effluent tanks TK001 and TK002, to be treated in the same manner as the existing effluent.

It should be recognised that the effluent is only rainwater that comes into contact with process plant (where it can pick up small fugitive liquid emissions, e.g. from flex hoses) and road surfaces.

Normal Operation of Plant 5.1 During Heavy Rainfall Periods

Drainage modelling has shown that in the event of heavy rain the normal operation mode (described above) will cope with heavy rain for prolonged periods. As an added measure, excessive effluent (which is essentially rainfall) could be routed from the new small effluent pit directly into the 18" drain upstream of the "flapstopper" emergency isolation valve, provided that the material is shown to be clean.

Firewater Management in the Event of a Fire on Plant 5.1

Drainage modelling has shown that in the event of the worst-case fire water scenario, the new pump between the new small sump and the existing site process effluent drainage system will not cope with the firewater flow. Consequently, there is a risk that the new pump could be compromised in the event of a fire in the proximity of the pump.

As part of the drainage upgrade plans, a new drainage channel will be routed from the new effluent sump on Plant 5.1 to the 18" storm water drain to the east of the site, upstream of the "flapstopper"

emergency isolation valve. This will allow the overflow from the effluent pit of firewater into the 18" storm water drainage network and therefore avoid any firewater being released onto unmade ground. The firewater will collect in the 18" storm drain to the east of the control room building and be prevented from going into the CF Fertiliser drainage system (and then RTO1) via emergency activation of the "flapstopper" isolation valve.

Fire water will then be pumped from the "flapstopper" valve chamber by a high capacity pump into a bund to the north east of the control room building. This new bund will consist of the refurbishment of the old Methanol storage bund. This new bund will house the new effluent tanks (TK004 and TK005) when they are constructed.

6. Emissions to Air

The new Plant 5.1 will undertake the manufacturing processes and chemistries that are already defined within the site's Environmental Permit and undertaken on Plants 1.1 to 4.1, in accordance with the sites Multi Product Protocol (MPP).

Plant 5.1 will initially be used to manufacture ChemoxyCare 6 and 8 products and epoxy alkane, which are long chain diol's and epoxides. These reactions utilise hydrogen peroxide.

A new scrubber has been installed to serve Plant 5.1 and the emission point from the scrubber has been defined as release point A5.

Due to the plant operations mirroring those of existing plant (Plants 1.1 to 4.1 or release points A1 to A4); it is proposed that the emission limits, monitoring frequency and monitoring methods applied are the same as A1 to A4. The proposed limits are given in Table 6-1.

It should be recognised that none of the plants (including the new Plant 5.1) have forced air movements, for example induced draught fans that extract gases / vapours from the plant for treatment in scrubbers. The vapours / gases processed by the scrubbers are those that are released from the plant passively, i.e. through the filling of a reactor vessel or through volume changes within vessels. Consequently, the volumetric flow from the plant emission points are very low. This is shown in Table 6-2, which gives the emission rates for the current plant (between 2.07 to 11.5m^3/hr).

Consequently, where concentration limits have been specified at the release points within the permit, these have been based upon the performance of the scrubbers on high concentration / low flow duties and acceptable impact criteria, using the H1 impact assessment tool (i.e. "insignificant" impact).

Scrubbers are BAT for multiproduct plant as they can be configured for multiple duties, i.e. treating acid gases, alkaline gases, different organic vapours by changing the scrubbing media.

The proposed emission rate for new Plant 5.1 is 2.07m^3/hr, which is very low.

Table 6-1 Proposed Emission Limits and Monitoring Frequency for Plant 5.1 (Release Point A5)

Parameter	Limit	Reference Period	Monitoring Frequency	Monitoring Standard or Method
Class A Volatile Organic Compounds (expressed as species)	100 g/h		Quarterly	BS EN 13649
Class B Volatile Organic Compounds (expressed as DME)	2 kg/h	Average over batch	Quarterly	BS EN 13649
Dimethyl ether (DME)	4 kg/h	Average over batch	Quarterly	BS EN 13649

Formaldehyde	10 g/m³	Quarterly

VOC's will potentially be emitted from release point A5 during the manufacturing processes, and hence the generic VOC mass release limits currently in force for other plants on the site are proposed.

It should be recognised that, prior to operating a manufacturing process on a plant, the process is subject to a H1 impact assessment, that is embedded within the MPP (see 6.1). Should the MPP show an impact that was "significant" under the generic VOC mass emission limits, due to the species of organic emitted, then actions would be taken to achieve an acceptable impact, i.e. impose tighter plant operational limits than the generic limits.

Dimethyl ether (DME) is unusual as it is emitted as a result of an esterification process (under the MPP) when methanol is dehydrated as a side reaction at one stage of the process. Consequently, a mass emission rate is requested as a limit in Table 6-1. DME is difficult to recover / abate at such low production rates and is only produced for a short time in part of a production cycle.

Again, to retain flexibility of production on Plant 5.1, a formaldehyde concentration limit is included in Table 6-1. "Paraform" (paraformaldehyde) or formaldehyde solution is used in some manufacturing processes on site.

Both the DME and formaldehyde limits are currently on existing plant (release points A1 to A4).

6.1 Multi Product Protocol (MPP)

Manufacturing operations at the site are governed by a Multi Product Protocol (MPP), which is essential owing to the diversity of manufacture and the need for rapid response to the marketplace for toll manufacture.

The fundamentals of the MPP have been reviewed as part of the plant expansion.

The basis of the MPP is to control the level of emissions from the processes such that the impacts at ground level are below the levels of significance, as determined by the H1 calculation tool / methodology.

The original version of the MPP was established when the site had three process vents (Plant 1.1/1.2, Plant 1.3 and Plant 2.1 for release points A1, A2 and A3).

Hence when considering impacts the following was assumed:

- For short term impacts it was assumed that two of the three vents would combine and contribute to ground level impacts (i.e. aggregation). Hence, when assessing a new process on one of the plants, the allowable emission from the vent for a pollutant could not exceed a Process Contribution (PC) value of 5% of the short term EAL or AQS at ground level, i.e. half of the "insignificance" trigger value contained within the H1 methodology.
- For long term impacts it was assumed that no cumulative effects occurred, primarily due to the level of operating hours of the plants. Hence, when assessing a new process on one of the plants, the allowable emission from the vent for a pollutant could not exceed a Process Contribution (PC) value of 1% of the long term EAL or AQS at ground level, i.e. the full "insignificance" trigger value contained within the H1 methodology.

Since the MPP was written, there have been two new release points added to the site (Plants 4.1 and 5.1 or release points A4 and A5).

Release point A4 was added during a previous permit variation (a standard variation) with the introduction of Plant 4.1 (Permit Variation EPR/BT9844IK/007 – 23/07/2015).

Release point A5 will be added with the introduction of Plant 5.1 as part of this application to vary the permit.

Table 6-2 presents operating data for the current and proposed release points on site.

Flow data has been estimated based on 2018 data and it has been assumed that Plant 5.1 will have similar operating conditions as Plant 4.1.

Table 6-2 Billingham Site Release Point Details (2018 data)

Plant	Release Point	Stack Height (m)	Average Flow Rate (m^3/hr)	Maximum Flow Rate (m^3/hr)	Hours of Operation (hours)
Plant 1.1/1.2	A1	21.2	8.01	17.43	7084
Plant 1.3	A2	6.6	2.15	5.6	1009
Plant 2.1	A3	18	11.5	24.2	7153
Plant 4.1	A4	21	2.07	4.39	6880
Plant 5.1	A5	35	2.07	4.39	6880

Due to the increase in the number of vents since the initial MPP was developed, the site undertook a thorough review of processes operated at the Billingham site between 1st January 2017 and 30th November 2019.

The data showed that there were no occasions where more than two vents were releasing the same materials. Over this approximately three year period, the data also showed that two vents were releasing the same material around 20% of the time.

The addition of Plant 5.1 will be used primarily to manufacture the products defined in Section 3.2.3, hence freeing capacity on the other plants for other manufacturing processes.

The review has concluded that the addition of Plant 5.1 should not influence the current MPP "aggregation rules" and they will remain unchanged.

6.2 Effective Release Point Heights

The actual heights of the release points associated with each of the plants is presented in Table 6-3. The table also presents the effective release heights for use in the H1 assessment / MPP.

Effective release heights were calculated using Environment Agency Guidance; "Air emissions risk assessment for your environmental permit".

Table 6-3 Release Point Heights

Release Point	Process Plant	Actual Stack Height (m)	Effective Height of Release (m)
A1	Plant 1.1/1.2	21.2	11.5
A2	Crystalliser F2406	6.6	0
A3	Plant 2.1	18	6.1
A4	Plant 4.1	21	11.1
A5	Plant 5.1	35	34.4

6.3 Impact Assessment

As an illustration of the MPP in practice, an assessment has been made using the Environment Agency Horizontal Guidance Note H1 screening tool for the manufacture of ChemoxyCare materials and also the processes liberating di-methyl ether and formaldehyde.

Using the H1 methodology, it is possible to screen out 'insignificant' emissions and those emissions where further assessment is not required based on the appropriate Air Quality Standard (AQS) or Environmental Assessment Level (EAL) for each pollutant.

Screening of the emissions is achieved using simplified dispersion factors contained within the Technical Guidance. These factors are applied based on the effective release height or the emission source and are used to estimate the ground level concentration per unit release of pollutant.

Using the H1 guidance, together with the normal operating release conditions, it is possible to estimate the worst-case ground level concentrations arising from each source over short-term and long-term emission scenarios. The predicted Process Contribution (PC) can then be compared with the appropriate EAL contained in the H1 guidance document, so as to determine the 'significance' of the pollutant emission with regards to the impact on the environment.

Under the H1 guidance, a pollutant is defined as 'insignificant' where:

- PC ≤ 1% of the EAL or EQS for long term releases; and
- PC ≤10% of the EAL or EQS for short term releases.

In addition, an estimate of the Predicted Environmental Concentration (PEC) can be made by adding the PC to an appropriate estimate of the background Ambient Concentration (AC) currently in the environment. The PEC can be compared with the appropriate EAL so as to identify whether detailed dispersion modelling or further study of the emissions is necessary.

A pollutant emission is considered to require further dispersion modelling or assessment where:

- Predicted Environmental Concentration (PEC) > 70% of EAL for long term releases; or
- Process Contribution (PC) > 20% of the headroom (short term EAL minus twice the long term AC); or
- There are any local receptors that are sensitive to any of the emissions that have not been screened out as insignificant.

However, as discussed in Section 6.1 - MPP, owing to the MPP "aggregation rules" for stacks discharging at the same time, the significance criteria for short term emissions is reduced in line with the MPP to:

- PC ≤5% of the EAL or EQS for short term releases.

This accommodates for two vents aggregating in the short term.

The long-term significance criteria remain as the H1 methodology, with no aggregation as all processes are batch and not continuous manufacture (i.e. continuous emissions):

- PC ≤ 1% of the EAL or EQS for long term releases; and

6.3.1 Emissions Inventory

The releases from the processes for the manufacture of ChemoxyCare materials and also the processes liberating di-methyl ether and formaldehyde have been calculated using process mass balance calulations.

Abatement plant performance (condensers and scrubbers), based on operating experience, is also factored into the emission inventory.

Table 6-4 presents the emission data for Plant 5-1 which was input into the H1 calculation tool spreadsheet.

The peak release rate was input as the annual average rate and the plant was assumed to be operating 100% of the time. These will overestimate the impacts as all processes are batch and not continuous manufacture (i.e. continuous emissions).

It should be noted that the predicted mass emissions are compliant with the proposed generic consent conditions within Table 6-1.

Table 6-4 Emissions Inventory for Plant 5.1

Substance	Release Rate Annual Average (g/s)	Release Rate Peak (g/s)
Alkene 3	0.356	0.356
Benzene	0.006	0.006
Toluene	0.208	0.208
Methanol	0.269	0.269
Organic Acid	0.127	0.127
Alkene 1	0.289	0.289
Dimethyl Ether	1.111	1.111
Formaldehyde	0.00003	0.00003

*For the purposes of the assessment the process has been assumed to be operating 100% of the time.

Alkene 2 (for epoxy alkane manufacture) will have a lower emission rate than Alkenes 1 and 3, due to it being a longer chain alkene of lower volatility. In addition, there is no EAL value available from workplace exposure information. Assuming the material is released at a lower level than Alkenes 1 and 3, and that the EAL values are higher, then the impacts will be less than Alkenes 1 and 3 and therefore insignificant.

The results of the H1 impact assessment (using the calculator tool) are presented in Table 6-5, against the MPP “insignificance” criteria.

Table 6-5 Results of H1 Assessment of Plant 5.1 Emissions

Substance	EAL (LT) (µg/m³)	EAL (ST) (µg/m³)	PC (µg/m³)	%PC of EAL	>1% EAL	PC (µg/m³)	%PC of EAL	>5% EAL
Alkene 3	1,450	14,500	0.513	0.035	**No**	23.8	0.164	**No**
Benzene	5.00	195	0.009	0.173	**No**	0.458	0.235	**No**
Toluene	1,910	8,000	0.301	0.016	**No**	14.0	0.175	**No**
Methanol	2,660	33,300	0.389	0.015	**No**	18.0	0.054	**No**
Organic Acid	96.0	2,900	0.183	0.191	**No**	8.48	0.293	**No**
Alkene 1	3,400	34,400	0.417	0.012	**No**	19.4	0.056	**No**
Dimethyl Ether	7,660	95,800	1.61	0.021	**No**	74.4	0.078	**No**
Formaldehyde	5.00	100.0	0.00004	0.0008	**No**	0.00186	0.002	**No**

From the results of the H1 assessment it can be seen that at the anticipated emissions rates from the process, the emissions all screen out as “insignificant” using the significance criteria identified in the Multi Product Protocol (MPP). Further impact assessment / dispersion modelling is therefore not required.

The electronic H1 tool accompanies this document as Appendix C.

6.4 Habitats Assessment – Air Impacts

The H1 guidance states that the impact of the site on protected conservation areas must be considered.

The Institute of Air Quality Management (IAQM) recently issued “A guide to the assessment of air quality impacts on designated nature conservation sites”, June 2019 which, together with the H1 guidance identifies the following chemicals of concern:

- Ammonia (NH_3);
- Sulphur dioxide (SO_2);
- Oxides of Nitrogen (NO_x);
- Hydrogen fluoride (HF);
- Hydrogen chloride (HCl);
- Ozone (O3);
- Persistent Organic Pollutants (POPs – bio accumulative organic materials, harmful to the environment);
- Nutrient nitrogen deposition; and
- Acid deposition.

POPs are considered within the process evaluation stage of the MPP.

The emissions from Plant 5.1 are not anticipated to release any of the chemicals of concern identified above, based upon the chemistries to be undertaken (initially ChemoxyCare 6 and 8, and epoxy alkane). Consequently, a Habitats impact assessment has not been undertaken for emissions to air.

Should the MPP identify any of the above chemicals, as part of its evaluation to conduct a manufacturing process on Plant 5.1, discussions will be held with the Environment Agency over supplying an appropriate Habitats Assessment from aerial emissions will be undertaken.

6.5 Monitoring

Monitoring will be undertaken in accordance with the current monitoring protocols and standards of the existing Environmental Permit (EPR/BT9844IK/V007).

Table 6-6 presents the proposed monitoring frequency and methods for Plant 5.1 (release point A5).

The monitoring requirements are the same as Plant 1.1 (release point A1), which has the same consent limits as those proposed for Plant 5.1 (release point A5).

Table 6-6 Proposed Monitoring Frequency and Methods for Release Point A5 (Plant 5.1)

Parameter	Limit	Reference Period	Monitoring Frequency	Monitoring Standard or Method
Class A Volatile Organic Compounds (expressed as species)	100 g/h	Spot Sample	Quarterly	Note 1

Class B Volatile Organic Compounds (expressed as DME)	2 kg/h	Spot Sample	Quarterly	Note 1
Dimethyl ether (DME)	4 kg/h	Spot Sample	Note 2	In house method using gas bag.
Formaldehyde	10 g/m³	Spot Sample	Note 2	BS CEN/TS 13649

Note 1: Sample absorption onto carbon tube (Method CEN/TS 13649) or in-house method using gas bags (method based on EPA0040) for GC/FID analysis.

Note 2: Monthly, only when a process has the potential to emit these species.

The sample port for Release Point A5 will be designed so as to be compliant with the Environment Agency requirements (as specified within the M series guidance, i.e. M1).

As the plant is under construction, a pre-operational audit will be undertaken as part of commissioning and reported back to the Environment Agency (see Table 6-7).

Table 6-7 Release Point A5 Sample Port Improvement Condition

Improvement Condition
Undertake a pre-operational audit and confirm with the Environment Agency that the sampling arrangements for Release Point A5 are compliant with Environment Agency guidance (M series).

7. Waste Minimisation and Management Techniques

7.1 Waste Procedures

There are no changes to the procedures governing waste disposal as a result of this permit variation.

Wastes will be assessed and disposed of, in line with current procedures and practices at the site.

The site is continually trying to find ways to minimise waste. Wastes are disposed of only to licenced and approved waste management contractors in line with Duty of Care guidance.

The site has a resource Efficiency Team, that meets quarterly to set and monitor key performance indicators and targets. Waste generation is tracked and monitored as a specific metric (as tonnes waste/tonne product) and waste minimisation projects may be initiated if deemed appropriate.

The site, being a toll chemical manufacturer, needs to make sure that wastes are minimised wherever possible as this can adversely affect production costs. Consequently, waste minimisation, energy efficiency and raw materials utilisation are at the heart of all manufacturing processes.

7.2 Waste Types

The processes that will be operated on Plant 5.1 fall within the existing plant activities and products, i.e. they are all manufactured under the MPP envelope on other plants on site. The wastes generated will therefore be the same as currently produced on site.

The quantity of wastes will increase due to the additional manufacturing capacity on site, however there should be no change in the quantities generated per tonne of product. Indeed, the site has objectives to minimise waste generation per tonne of product.

The actual quantities of waste produced are process dependent and the waste will vary in content depending on which combinations of processes are operated.

The increase in waste quantity is expected to be an additional 1,750 tonnes/year of wastes exported from site as a result of Plant 5.1 operations.

The quantity of waste generated in 2018 was 6,313 tonnes and 4,345 tonnes in 2019, which is an average of 5,329 tonnes a year.

The additional waste generation equates to an approximate waste increase of 33% compared to an approximate increase in production capacity of 30%.

8. Site Condition Report

An update to the Site Condition Report is contained within Appendix D – ERM Report "Full Site Condition Report". Project No: 0488402, covering the installation of new Plant 5.1 and the site baseline.

The report reviews the historic soil and groundwater assessments at the installation and presents a series of borehole locations and analytes for investigation, to define a site baseline.

The proposed monitoring boreholes are provided in the Table 8-1.

Table 8-1 Proposed Boreholes to Establish a Baseline (new Plant 5.1)

Area	Location	Proposed Boreholes
Zone 1a	Manufacturing – existing operational areas	URS 2003 boreholes including BH101, BH102, BH105, BH107, BH109, BH111 and BH112. ERM 2013 borehole including BH201, BH202. Ramboll 2017: RE-WS104 (replaces URS BH113), RE-WS113 (replaces URS BH113),
Zone 1b	Manufacturing – new Plant 5.1 area	Baseline boreholes (BH1, BH2/2A, BH3, BH4, BH5 and BH6) are no longer present as the area is undergoing construction. It is recommended to install three (3) new groundwater monitoring boreholes.
Zone 2	Ancillary operations area	No baseline investigation has been undertaken. There are no immediate plans for chemical storage to be undertaken in this part of the site. A site investigation is recommended to establish baseline conditions, but this is to be completed once this area of the site is proposed to be used for chemical storage.
Zone 3	Storage	Monitoring boreholes include RE-WS101, RE-WS111, RE-WS114

It is proposed that a monitoring regime for these boreholes comprises of the following contaminants of concern:

- Heavy metals;
- Volatile Organic Compounds (VOCs) plus TICs;
- Semi Volatile Organic Compounds (SVOCs) plus TICs;
- Total Petroleum Hydrocarbons (TPH) (carbon banding and aliphatic-aromatic split); and
- Acetates and Alcohols.

9. Emissions to Controlled Waters

The emissions to controlled waters from the site are through a third-party sewer drainage infrastructure.

The following emission points discharge into the CF Fertilisers sewer drainage system, which then discharges into the River Tees through the RTO1 discharge. CF Fertilisers have a discharge consent for the RTO1 discharge with the Environment Agency.

The three emission points are:

- S1 – Discharge from the main site effluent storage tanks (Tanks TK001/TK002);
- S2 – Rainwater discharge (periodic) from the methyl chloride tank bund area (existing discharge but not currently logged as a discharge in the Environmental Permit);
- S3 – Rainwater discharge from the new portable container storage areas (x3) for drum and IBC storage.

9.1 Emission Point S1 - Existing Effluent Discharge

The site has a consent within its Environmental Permit to discharge effluent into the CF Fertiliser sewer drainage system, as emission point S1.

The emission limit values and monitoring requirements for emission point S1 in the Environmental Permit are reproduced in Table 9-1.

Table 9-1 Emission Point S1 – Current Emission Limits and Monitoring Requirements

Emission Point Ref	Parameter	Limit	Monitoring Frequency	Monitoring Method
S1 Effluent Holding Tanks TK001 and TK002 (final discharge to the Tees outfall RTO1)	Chemical Oxygen Demand	450 kg/day[1]	Daily analysis of representative tank sample.	C&FC 100201
	pH	5.0 – 9.0	Daily analysis of representative tank sample.	pH probe calibrated against standard buffer solution [C&FC 100134]
	Copper	0.2 mg/l	Quarterly	Inductively coupled Plasma Spectroscopy
	Copper quarterly mass load	No Limit Set	Quarterly Calculation	
	Vanadium	0.5 mg/l	Quarterly	Inductively coupled Plasma Spectroscopy

1 Excess of 450 kg/day COD release to sewer permitted on occasions of high rainfall. Prior to agreement for increase to be confirmed with third party discharge consent holder.

The site currently discharges effluent from their onsite effluent holding tanks, into the CF Fertilisers sewer drainage system which ultimately reports in to the RTO1 discharge into the River Tees.

The discharge from RTO1 is subject to an effluent discharge consent that is held by CF Fertilisers with the Environment Agency.

Where applicable, the site S1 discharge requirements mirror those contained within the agreement held between Chemoxy and CF Fertilisers, so as to protect the RTO1 discharge conditions.

The CF Fertilisers discharge consent is based on the discharge of BOD. However, effluent is analysed for COD and the BOD is then calculated based on a BOD:COD ratio of 1:3.

In addition to the above parameters, the S1 discharge agreement with CF Fertilisers also have the following conditions:

- Temperature < 37°C.
- Total flow of < 250 m^3/day.
- No visible oil or grease.

The addition of new Plant 5.1 has the potential to generate additional effluent for emission point S1, but the site is committed to an effluent minimisation initiative.

As a result, the site believe that they can introduce Plant 5.1 and not require an increase in the effluent discharge from S1. There will be no change in the current effluent discharge.

9.1.1 Effluent from New Plant 5.1

The majority of process effluent that will be generated from Plant 5.1 will be removed from site by an approved waste disposal contractor for disposal. However, as is current practice for other plants, the final steamings from tank/vessel cleaning are discharged under consent as part of the S1 discharge.

The addition of Plant 5.1 to the Billingham site includes the construction of some new drains to deal with effluent captured within the footprint of the new plant. In reviewing the operation of the new drains, consideration has been given to normal operation, normal operation in heavy rain conditions and the worst-case firewater scenario and how the new Plant 5.1 drains interface with the existing drainage arrangements under these circumstances.

Normal Operation of Plant 5.1

Steam is imported to the site and will be used by Plant 5.1 for heating purposes. It is not economically viable to return steam condensate to the supply network. Consequently, steam condensate will be routed into the 18” drain to the east of the control room, which contains the “flapstopper” emergency isolation valve. This discharges into the CF Fertiliser sewer drainage system and is discharged as combined discharge RTO1.

Plant 5.1 process, tank farm, and road tanker offloading / loading area drains will be collected within the new Plant 5.1 drains and ultimately flow through a “firetrap” chamber to a small effluent pit. From here the effluent will be pumped via a transfer line to the existing process drainage system to the north of the warehouse. From here it will run into the current effluent pits and then be pumped into effluent tanks TK001 and TK002, to be treated in the same manner as the existing effluent.

It should be recognised that the effluent is only rainwater that comes into contact with process plant (where it can pick up small fugitive liquid emissions, e.g. from flex hoses) and road surfaces

Normal Operation of Plant 5.1 During Heavy Rainfall Periods

Drainage modelling has shown that in the event of heavy rain the normal operation mode (described above) will cope with heavy rain for prolonged periods. As an added measure, excessive effluent (which is essentially rainfall) could be routed from the new small effluent pit directly into the 18” drain upstream of the “flapstopper” emergency isolation valve, provided that the material is shown to be clean.

9.2 Emission Point S2 – Rainwater from Methyl Chloride Bund

This is an existing release of rainwater which is not currently captured within the current Environmental Permit.

The methyl chloride tank has a capacity of 45m³ and is located within its own dedicated bund, which provides containment for 107% of the total tankage.

The bund is a closed unit, from which uncontaminated rainwater is released (after visual testing) into the storm water drains. This emission is currently not defined within the extant Environmental Permit and it is proposed to add this as a new emission point (emission point S2) for completeness. The emission is a release of uncontaminated rainwater from the methyl chloride bulk storage area into the site storm water drainage system. This then enters the CF Fertiliser sewer drainage system, which then reports as the CF Fertiliser RT01 discharge to the River Tees.

Given that methyl chloride is highly volatile in nature (flash point of -45°C), it is unlikely that any spillage of material will enter the drainage system and be discharged via the site storm water drains. The bund sump is isolated and can only be drained manually via a locked drain valve assembly.

A fixed methyl chloride gas detection system, with automatic shutdown on activation, is installed in the storage area to minimise / prevent any spillages. The gas detection system is included in the planned preventative maintenance regime as critical equipment.

As emission point A2 discharges rainwater (subject to contamination checks) it is proposed that there be no consent limits placed upon the discharge.

9.3 New Emission Point S3 – Rainwater from the Portable Container Storage Areas

Three new portable container storage areas have been created to the east side of the site. Further details of the new storage areas is presented in Section 5.2.2

One of the areas will be used for the storage of hazardous and non-hazardous materials (raw materials and products) in drums and IBC's. This area has a full containment bund with ramped access for fork-lift trucks. The available storage capacity of the bunded containment area will depend on the materials to be stored and the distances to provide sufficient segregation, whilst maintaining adequate containment capacity for spills. The area has a full bund wall and drains to an isolated sump. The closed drains and sump will gather rainfall and can be emptied into the CF Fertilisers sewer drainage system, after visual testing, and via an oil interceptor. This is proposed to be emission point S3.

Two other areas have also been created with drainage containment; one for empty used containers awaiting off-site laundering / recycling and the other for the storage of new (unused) containers.

The surfaces of the two areas drains into two sumps. These local sumps drain via underground pipework to a common sump with an isolation valve. The sump can then be discharged, after visual testing, into the same drain line as the emission from the hazardous and non-hazardous storage area, i.e. into emission point discharge S3.

Rainwater in the sumps / bunds of all three areas will be analysed prior to being discharged. In the event that material is lost to the storage area bunds / sumps; then the contents of the bunds / sumps would be collected and removed for offsite disposal.

The new storage area and drainage arrangements are shown in Appendix A – Figure 1: Site Plan, Installation Boundary and Release Points and Figure 4: Site Drainage Plan.

As emission point A3 discharges rainwater (subject to contamination checks) it is proposed that there be no consent limits placed upon the discharge.

9.4 Surface / Storm Water

9.4.1 Existing Site Infrastructure (excluding Plant 5.1)

The non-contaminated rainwater / surface water drains are separated from the process water (effluent) drains on the existing site.

Rainwater falling on non-process areas, i.e. the roadways, offices, non-process hardstanding etc. is routed to the main 18" storm water drains at the east of the site, which then flows into the CF Fertilisers sewer drain system. This is then discharged to the River Tees via the RTO1 discharge point (see Appendix A – Figure 4: Site Drainage Plan).

The 18" storm water drain contains the emergency "flapstopper" isolation valve prior to discharge to the CF Fertilisers sewer drainage system.

The "flapstopper" device allows the site storm water drains to be isolated and quarantined in the event of a spill onsite or a fire event.

In the case of storm water contamination, the "held back" storm water can either be pumped back into the effluent tanks (TK001/TK002) for processing or sent for off-site disposal.

9.4.2 New Plant 5.1

All surface waters on the new Plant 5.1 will be processed through the existing sites effluent system (see Section 9.1.1). This decision was made owing to the fact that most of the new Plant 5.1 area is process and very little non-process areas are present, i.e. new roadways etc. Consequently, drains separation (i.e. separate process and surface water drains) has not been undertaken.

New Plant 5.1 and the tank farm are located within dedicated bunded areas. Rainwater collected in these bunds is visually tested prior to being discharged into the Plant 5.1 drains.

Drainage waters from the Plant 5.1 area is discharged via a flame trap to the existing site effluent treatment system, into the effluent tanks (TK001/TK002), and will become part of emission S1.

The drainage arrangements are shown in Appendix A – Figure 4: Site Drainage Plan.

9.5 Fire Water

A fire water model for the whole site was developed in 2017 and this model has since been updated to include new Plant 5.1.

Drainage modelling of the Plant 5.1 area has shown that in the event of the worst-case fire water scenario, the new pump between the new small sump and the existing site process effluent drainage system will not cope with the firewater flow. Consequently, there is a risk that the new pump could be compromised in the event of a fire in the proximity of the pump.

As part of the drainage upgrade plans, a new drainage channel will be routed from the new effluent sump on Plant 5.1 to the 18" storm water drain to the east of the site, upstream of the "flapstopper" emergency isolation valve. This will allow the overflow from the effluent pit of firewater into the 18" storm water drainage network and therefore avoid any firewater being released onto unmade ground. The firewater will collect in the 18" storm drain to the east of the control room building and be prevented from going into the CF Fertiliser drainage system (and then RTO1) via emergency activation of the "flapstopper" isolation valve.

Fire water will then be pumped from the "flapstopper" valve chamber by a high capacity pump into a bund to the north east of the control room building. This new bund will consist of the refurbishment of the old Methanol storage bund. This new bund will house the new effluent tanks (TK004 and TK005) when they are constructed.

9.6 Risk Assessment to Controlled Waters

Emission discharges S2 and S3 are rainwater discharges to the CF Fertliser sewer drainage system (and hence RTO1) after checking for contamination. They are from bunded storage and no contamination is expected. Consequently, it is not proposed to place limits upon these discharges nor assess their impacts.

There will be no change to emission point S1 from the main site, in terms of its discharge. The current consent limits within the Environmental Permit will be met, even though effluent from new Plant 5.1 will be sent to the existing main site effluent tanks, for discharge as emission S1.

It should be noted that the effluent from Plant 5.1 will be predominantly rainwater falling on the plant areas. As is current practice for other plants on site, the final steaming's from tank/vessel cleaning will also be sent to the effluent tanks from Plant 5.1.

The character / composition of the effluent will not change as a result of Plant 5.1. ChemoxyCare and other existing products are currently manufactured on other plants at the site and effluent from ChemoxyCare manufacturing currently reports in emission S1.

In other words, no new chemicals or products are being introduced to the site that would report in emission S1 through adding Plant 5.1 to the site.

The MPP considers new manufacturing operations and part of the methodology is to assess impacts to controlled waters (using the H1 assessment), priority hazardous substances of concern, persistent organic pollutants etc. The MPP would require consultation with the Environment Agency on impacts that were deemed "significant" or if named substances or substances of concern were required to be consented.

As mentioned earlier, the addition of Plant 5.1 is not changing the discharge to controlled water (emission S1) and so normally would not require an impact assessment.

However, given that the Teesmouth and Cleveland Coast SPA, Ramsar Site and SSSI are proposed to be extended up the River Tees to the Tees barrage, an impact assessment on the River Tees is included within this variation application.

The impact assessment consists of two parts, a H1 impact assessment and a follow-on Habitats Assessment. The H1 impact assessment is based upon the current consent limits for emission point S1.

9.6.1 H1 Assessment – Specific Chemicals Analysis (Metals)

The current permitted species in emission S1 are highlighted in Table 9-1 (earlier).

The Environment Agency's H1 assessment methodology has been used to undertake an environmental impact assessment into the River Tees (via the S1 discharge into the CF Fertiliser drains and then via the RTO1 discharge).

The effluent combines with other effluents in the drains within the CF Fertiliser site, prior to finally being discharged to the River Tees (RTO1). This dilution has been ignored.

Three years of S1 emission data, from Q1 2016 to Q3 2019, have been used in the assessment.

The data available for the metals included in the discharge consent is presented in Table 9-2. BOD has been assessed separately (see Section 9.6.3).

Table 9-2 Billingham Site Effluent Emissions Data (Discharge S1)

	Copper (mg/l)	Vanadium (mg/l)
Average	0.065	0.001
Maximum	0.190	0.003
Consent Limit	0.200	0.500

Effluent is ultimately discharged to the River Tees at RTO1, which at the point of discharge is influenced by the tide, and therefore the tests for discharges to estuaries and coastal waters has been applied.

The H1 methodology requires the input of both annual average (AA) and maximum allowable concentrations (MAC) of each substance of concern; for assessment of both long term and short-term impacts.

For the AA, the average data from 2016 to 2019 has been used. However, for the MAC the consent limits have been used as this is the maximum concentration that could be discharged. It can be seen however that the actual maximum concentration observed in the discharge for vanadium is significantly below the consent limit.

Effluent is discharged intermittently, with a maximum allowable discharge is 250m³/day (this is the agreement with CF Fertilisers but is not replicated within the Environmental Permit). This equates to 0.002894 m³/s and this flow rate has been used in the assessment.

A description of the tests and the corresponding results of the H1 impact assessment are presented below.

Test 1 – Estuaries and Coastal Waters

This initial test determines whether the level of a pollutant in the discharge is more than its EQS value. Both the annual average (AA) and the maximum allowable concentration (MAC) EQS values need to be tested. If the concentration of the pollutant is less than the EQS then it can be screened out and considered not to be a risk to the environment. Any substances that cannot be screened out will fail Test 1 and will need to be carried forward for further assessment.

Table 9-3 presents the findings of Test 1. The release of vanadium is screened out at Test 1 as the release concentration is less than the EQS. Consequently, the impact of the vanadium emission is considered "insignificant".

The releases of copper however cannot be screened out at this stage.

Table 9-3 Test 1 – Release Concentrations Compared to EQS (Metals)

Substance	Release Conc. (AA) (µg/l)	EQS (AA) (µg/l)	RC < 100% EQS	Release Conc. (MAC) (µg/l)	EQS (MAC) (µg/l)	RC < 100% EQS
Copper	65.4	3.76	No – Fail	200	No EQS	N/A
Vanadium	0.897	100	Yes - Pass	500	No EQS	N/A

Test 2 - Freshwater Assessment

Test 2 requires a check on whether the effluent is discharged to the low water channel (which is mainly saline) or in the upper parts of the estuary where the water is mainly fresh.

The water at the RTO1 discharge point is in the upper water channel of the tidal river. Consequently, the H1 methodology advises that the assessment for freshwaters be used starting at Test 2.

The H1 states that for the freshwater tests; that freshwater flow rates and upstream quality be used but that the EQS for estuaries and coastal waters be used.

The H1 tool estimates the process contribution (PC) of the discharge with respect to the EQS (estuary and coastal waters). If the PC is estimated to be <4% of the EQS, then the discharge is considered to have passed this test and be screened out; and no further tests are required to be undertaken. The pollutant emission is deemed to have an "insignificant" impact.

In order to calculate the PC, multiply the effluent flow rate (EFR) by the release concentration (RC) – step 1.

Then add the value for the EFR to the river flow rate (RFR) – step 2.

The PC is then determined by dividing the result of step 1 by step 2.

The input data for this test is presented in Table 9-4.

Table 9-4 Test 2 – Input Data

Parameter	Input
Effluent Flow Rate (EFR)	0.002894 m^3/s
Mean River Flow Rate	20.403m^3/s (at Low Moor)
95th Percentile Flow Rate (RFR)	3.059 m^3/s (at Low Moor)

The effluent discharge rate is based on the maximum discharge consent of 250m^3/day.

The mean flow rate and 95th percentile flow rate for the receiving water has been sourced from the NRFA database (http://nrfa.ceh.ac.uk/data/search), specifically for the monitoring station Tees at Low Moor (25005) (https://nrfa.ceh.ac.uk/data/station/meanflow/25009). The monitoring station is significantly upstream of the discharge point and is also upstream of the Tees Barrage.

The use of the river data will significantly underestimate the dilution of the discharge, as the tidal flushing effect in combination with the river flow dilution will not have been taken into account.

Calculating the impact of the emission based solely on river flow, within the H1 calculator, will therefore overestimate the predicted impacts (underestimating the dilution) and this is a very conservative approach.

The results of Test 2 are presented in Table 9-5.

Table 9-5 Results of Test 2

	RC-AA (µg/l)	EQS - AA (µg/l)	4% of EQS (µg/l)	PC-AA (µg/l)	PC <4% EQS (µg/l)
Copper	65.4	3.76	0.150	0.0618	Yes – Pass

The release of copper can be screened out at Test 2.

There is no MAC-EQS available for copper.

Due to the conservative estimates that have been used in the assessment it can be concluded that the discharges of metals to the River Tees have an “insignificant” impact.

9.6.2 Screening of Priority Hazardous Substances

The H1 methodology requires that a screening assessment is undertaken for specific priority hazardous substances, to determine whether the annual level of pollutants discharged is more than the significant load.

As mentioned earlier there will be no change to the emission S1 discharge consent conditions by virtue of adding Plant 5.1 to the site. Currently emission S1 does not discharge any priority substances to the River Tees via RTO1 (CF Fertilisers consented discharge).

As mentioned earlier, the MPP considers new manufacturing operations and part of the methodology is to assess impacts to controlled waters (using the H1 assessment), priority hazardous substances of concern, persistent organic pollutants etc. The MPP would require consultation with the Environment Agency on impacts that were deemed “significant” or if named substances or substances of concern were required to be consented.

9.6.3 Impacts of COD

The impact of BOD/COD can be estimated using the Environment Agency’s Monte Carlo method (H1 Annex D2: Assessment of Sanitary and Other Pollutants within Surface Water Discharges).

The Monte Carlo method is used to assess potential impacts of discharges containing sanitary pollutants which includes BOD, ammonia and suspended solids. The site's Permit has emission limits set for COD with no limits defined for BOD. For the purposes of the agreement with CF Fertilisers, a ratio of BOD:COD of 1:3 is assumed.

Using the Monte Carlo assessment, two tests are used to determine if discharges to surface waters are acceptable. A discharge is acceptable if:

- It does not cause deterioration in quality of the water body receiving the discharge; and
- The receiving water meets its target quality standards.

The guidance however states that sanitary pollutants to estuaries and coastal waters is not covered by the Monte Carlo assessment. The discharge from RTO1 is into the tidal River Tees, downstream from the Tees Barrage, where the receiving waters are a mixture of fresh water and saline waters, depending on the tidal cycle.

Consequently, the Monte Carlo assessment cannot be used.

When considering the discharge into the River Tees, emission point S1 is consented for 450kg/day COD. This is within a tank discharge of 250m^3/day (CF Fertiliser agreement).

The emission at consent conditions is therefore 1,800mg/l COD.

In accordance with the dilution criteria applied to the metals in the discharge (see Section 9.6.1, Test 2), then the dilution factors applied by the river dilution alone would reduce the COD concentration down to 1.7mg/l COD in the initial mixing zone.

A general COD level in the initial mixing zone of 1.7mg/l is not expected to have an impact upon the river / marine environment. This is likely to be a BOD level of nominally 5.1mg/l (a 1:3 ratio).

At these levels it is highly unlikely that the COD/BOD will impact significantly upon the dissolved oxygen content of the receiving waters.

In addition, the COD does not contain priority hazardous substances or persistent organic pollutants or substances of concern. Consequently, at a level of 1.7mg/l COD, no significant impacts are expected from a water impact perspective.

As mentioned in Section 9.6.1, the use of only river flow data is a gross underestimate of dilution, as the river flow data employed is high up the River Tees (at Low Moor) and does not account for the full river flow. In addition, the dilution does not consider tidal dilution within the tidal River Tees.

The estimated COD/BOD levels would therefore be significantly lower than estimated in the initial mixing zone.

Nevertheless, to confirm that the discharge has negligible impact on the water environment, a speciation study will be undertaken on the major components of the COD in emission S1, so that a focused impact assessment on discrete organic species can be undertaken - see Table 9-6.

It is recognised that this will be a "snapshot" of the effluent owing to variable nature of production at the site and indicative.

Table 9-6 Impact Assessment Improvement Condition

Improvement Condition
Undertake a study to speciate the main components of COD within emission S1 and undertake a H1 impact assessment on the major species within the discharge. This is to confirm that the discharge has an "insignificant" impact.

9.7 Habitats Assessment – Water Impact

The H1 guidance states that the impact of the site on protected conservation areas must be considered.

The Teesmouth and Cleveland Coast SSSI, pSPA and RAMSAR is of interest for the following nationally important features that occur within and are supported by the wider mosaic of coastal and freshwater habitats:

- Jurassic geology;
- Quaternary geology;
- sand dunes;
- saltmarshes;
- breeding harbour seals Phoca vitulina;
- breeding birds, e.g. avocet Recurvirostra avosetta, little tern Sternula albifrons and common tern Sterna hirundo;
- a diverse assemblage of breeding birds of sand dunes, e.g. saltmarsh and lowland open waters and their margins;
- non-breeding birds, e.g. shelduck Tadorna tadorna, shoveler Spatula clypeata, gadwall Mareca strepera, ringed plover Charadrius hiaticula, knot Calidris canutus, ruff Calidris pugnax, sanderling Calidris alba, purple sandpiper Calidris maritima, redshank Tringa totanus and Sandwich tern Thalasseus sandvicensis;
- an assemblage of more than 20,000 waterbirds during the non-breeding season; and
- a diverse assemblage of invertebrates associated with sand dunes.

The Teesmouth and Cleveland Coast SSSI, pSPA and RAMSAR is an extensive mosaic of coastal and freshwater habitats centred on the Tees Estuary. These include sand dunes, saltmarshes, mudflats, rocky and sandy shores, saline lagoons, grazing marshes, reedbeds and freshwater wetlands.

The site stretches from Crimdon Dene Mouth in the north, to Marske in the south, inland to Billingham and upstream to the Tees Barrage.

The Tees is one of the most heavily modified estuaries in the country and has lost the majority of its former intertidal habitat to land claim.

The semi-natural habitats that remain are nestled amongst significant industrial development, including one of the United Kingom's busiest container ports and a large proportion of its chemical processing industry, and are surrounded by urban settlements.

The SSSI, pSPA and RAMSAR includes the whole of the Tees Estuary, from its mouth between North Gare and South Gare, upstream to the tidal limits of the Tees and Greatham Creek. This contains a large area of intertidal mud and saltmarsh. The coastal strip is predominantly sandy but includes rocky foreshores as well as areas of muddier substrate and an area with peat deposits, including the remains of a submerged forest. There are large dune systems on either side of the estuary mouth: Seaton Dunes to the north of the Tees and Coatham Dunes to the south. Flanking the estuary are extensive areas of wet grassland and freshwater pools, together with smaller patches of a wide range of different habitats including reedbed, saline lagoons and brownfield grassland.

The emission point S1 discharge from the site, through the RTO1 discharge, has been assessed by the H1 impact assessment tool (see Section 9.6).

The consented emissions of copper and vanadium have been assessed as having an "insignificant" impact concentration relative to EQS values for the metals. Similarly, the level of COD/BOD in the initial mixing zone is estimated as 1.7mg/l and 5.1mg/l respectively. These are very low levels of metals and organic material in the upper section of the tidal River Tees some 9km from the estuary mouth, where many of the sensitive species are located.

The SSSI, pSPA and RAMSAR citations relate to geology, sand dunes, breeding and migratory birds, and invertebrates within the sand dunes.

The very low levels of metals and COD/BOD in the initial mixing zone would be significantly further diluted before reaching the sensitive species (the estuary mouth being 9km downstream). In addition,

the soluble pollutants, being located within the tidal salt water column, would seldom be in contact with the sensitive receptors noted in the citations. There would be minimal source - pathway – receptor linkages between the emission and the sensitive receptors

It is concluded that the very low levels of metals and COD/BOD would have a negligible impact upon the designated sensitive species.

Again, it should be noted that emission point S1 has not changed as a consequence of this variation request and the addition of new Plant 5.1. Therefore, there is no new risk to sensitive species or Habitats.

10. Emissions to Municipal Sewer

There are no emissions to municipal sewer as trade effluent, where the effluent is processed at a municipal sewage treatment works, as a result of this permit application.

11. Emissions to Soil and Groundwater

There are no emissions to soil or groundwater as a result of this permit application, e.g. soakaways.

12. Land Take

Chemoxy has purchased two (2) acres of land adjacent to the north boundary of the existing Environmental Permit site boundary. The land houses an office block, two warehouse style buildings and an open area of hardstanding.

The new area of land is to be included in the installation and permit boundary (see Appendix A – Figure 1).

There will be no permitted activities undertaken in this new area of land.

13. Energy Management

The addition of the new Plant 5.1 will increase the overall energy use on the site due to the additional processing capacity.

Wherever possible, the site aims to use the most energy efficient equipment available.

The site complies with the European Minimum Energy Performance Standard (EU MEPS) scheme. The scheme sets mandatory minimum efficiency levels for electric motors introduced into the European market. However, this standard does not apply to hazardous area motors (where DSEAR and ATEX compliance is required) hence the following Billingham Plant 5.1 drive motors are excluded from EU MEPS:

- Agitator;
- Reactor Circulation/Transfer Pump;
- Reflux Pump;
- Side-stream Pump;
- Tails Pump;
- Reboiler Circulation Pump;

- Vacuum Pump; and
- Storage Import/Export/Feed Pumps.

The other drive motors (the Cooling Tower Fans and the Cooling Water Circulation Pumps), located in safe areas, are IE3 (Premium Efficiency) rated.

EU MEPS requires that all motors purchased after 1 January 2017, with a rated output of 0.75 – 375 kW, must meet either the IE3 efficiency level or the IE2 level if fitted with a variable speed drive.

In addition to the safe area IE3 motors, four drives will be connected to variable speed drives. The driven speed of the Cooling Water Circulation Pumps will be reduced to match the Phase 1 requirements of the new plant and thereby reduce the energy consumption.

To save additional energy, the driven speed of the Cooling Tower Fans, within limits, will be adjusted based on the cooling water temperature leaving the tower.

With regards to lighting for the site; LED linear and spotlights will be installed on all of the new Plant 5.1 structures and the new substation to reduce energy consumption.

The site operates under an existing Climate Change Agreement.

An estimate of the absolute and relative increase in energy consumption for the site, due to the new multi-purpose plant, is presented in Table 13-1.

Table 13-1 Absolute and Relative Energy Consumption

	Absolute Energy Increase per Year		Relative Increase (vs 2016 to 2018 average)	
	Electricity	Steam	Electricity	Steam
Estimated Plant 5.1 Impact	1,600 MWh	12,000 Te	-18%	-36%

14. Climate Change Risk Assessment

A climate change risk assessment is required within a new permit application if a screening assessment is failed. As this variation request is a substantial variation the screening assessment (contained within Application Form Part B2 – General – New Bespoke Permit) and is reproduced below.

CATEGORY	SCREENING QUESTIONS	SCORE	YOUR SCORE
1 TIMESCALES	How long will a permit be required for this site/activity?		
	5 years or less of operation. No need to fill in the rest of the screening. You do not need to fill in a risk assessment. Please go straight to question 7.	0	
	Less than 20 years of operation	1	
	Until between 2040 and 2060 (between 20 and 40 years from now)	3	
	Until 2060 or beyond (more than 40 years from now)	5	
1 FLOODING	What is your site's risk of flooding from rivers or the sea?		
	Not in a flood-risk zone	0	
	Very low or Low	1	
	Medium	2	
	High	5	
3 WATER USE	If you use water for your site operations or fire prevention, what is the source of your water?		
	Water not required	0	
	Mains water	1	
	Surface water or groundwater abstraction	5	
		TOTAL SCREENING SCORE	

If a total screening score of five (5) or greater is achieved, then a climate change risk assessment must accompany the variation application.

The site criteria are:

- Timescales = 20 to 40 years = 3
- Flooding = Not in a flood risk zone [1] = 0
- Water Use = Mains water = 1

The Environment Agency guidance specifies that:

"If you get a screening score of 5 or more, you will need to complete your climate change risk assessment and submit it with your application form.

If you have a screening score of less than 5 you do not need to submit your risk assessment with your application form, but you must still complete the risk assessment. You need to keep it as part of your environmental management system."

The site has a draft climate change risk assessment within its Environmental Management System. It is a draft document titled – "Climate Change Risk Assessment and Mitigation Measures Definition".

15. Noise and Vibration

A baseline sound survey was undertaken at the site in July 2019.

The baseline sound monitoring was carried out in accordance with measurement guidance in British Standard BS 7445: 2003 'Description and Measurement of Environmental Noise'[2].

Acoustic monitoring was undertaken at two noise sensitive locations. The locations were chosen as they were deemed representative of the properties located to the west and southwest of the site. The sound monitoring locations were:

- M1 – Roscoe Road (on the green space located to the front of no. 49).
- M2 – Mill Lane (to the front of no. 53).

[1] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map
[2] BS 7445: 2003 'Description and Measurement of Environmental Noise'. British Standards Institution.

In addition to the baseline sound survey, measurements were also undertaken of equivalent items of fixed plant and equipment located at the existing multi-purpose processing facility at the site. These data have been used to derive sound power levels to incorporate in a noise model.

The full noise assessment report is presented in Appendix E.

15.1 Methodology

A model of the proposed plant and surrounding area was developed using SoundPLAN (v8) sound modelling software. The model included the ground topography, existing buildings and residential properties around the site. The software implements the standard sound prediction methodology detailed in ISO 9613:1996[3].

The Ordnance Survey base mapping and the layout of the existing buildings on the site were obtained from commercially available mapping[4].

The design details for the Plant 5.1 and associated plant were taken from engineer's drawings.

The following heights have been used in the model:

- All pumps (other than P526) are located 0.5m above the platform level for each pump.
- Pump P526 is located 16m above ground level.
- Agitator AG501 is located 8m above ground level.
- The column/stack outlet (emission point A5) is 35m above ground level.

Octave band sound power levels for the proposed items of plant were derived from measurements of equivalent plant located at the existing facility.

To ensure a worst-case assessment, the highest measured sound pressure level for each item of proposed plant was used to derive the sound power level.

The model was used to calculate sound levels at representative sensitive receptors and an assessment was carried out in accordance with BS 4142; to determine if the calculated rating levels will result in a significant noise impact.

Specific sound levels have been predicted due to the operation of the plant during the daytime and night-time at each of the identified sensitive receptors. The predicted sounds levels are presented in Table 15-1.

Table 15-1 Predicted Free Field Specific Sound Levels at Receptors

Receptor	Distance from Site Boundary (m)	Floor/Period	*Specific Sound Level* ($L_{Aeq,Tr}$ dB)
R1 – 49 Roscoe Road	685	Ground Floor / Day	25
		First Floor / Night	28
R2 – 89 Roscoe Road	735	Ground Floor / Day	23
		First Floor / Night	28
R3 – 61 Mill Lane	750	Ground Floor / Day	20
		First Floor / Night	22

[3] International Organization for Standardization (1996) ISO 9613: 1996 Part 2 Attenuation of sound during propagation outdoors, ISO.
[4] Ordnance.survey.co.uk/opendatadownload

15.2 Results

In line with a conservative approach, a +2 dB penalty was applied for tonality that may be just perceptible at the closest noise sensitive receptors.

Considering the plant and equipment, it is not expected that there will be any impulsive features associated with the proposed plant. Therefore, no penalty for impulsivity has been applied.

The proposed plant will generally operate continuously, and hence no penalty for intermittency is applicable.

Following the procedures outlined in BS 4142: 2014, the *Rating Level* has been compared to the *Background Sound Level*, as shown in Table 15-2.

Table 15-2 Sound Assessment

Receptor	Period	*Specific Sound Level* ($L_{Aeq,Tr}$ dB)	*Rating Level* ($L_{Ar,Tr}$ dB)	*Background Level* (L_{A90} dB)	*Rating Level* minus *Background* (dB)	Conclusion from BS 4142
R1	Day	25	27	45	-18	Low impact, depending on context
	Night	28	30	42	-12	Low impact, depending on context
R2	Day	23	25	45	-20	Low impact, depending on context
	Night	28	29	42	-12	Low impact, depending on context
R3	Day	20	22	43	-21	Low impact, depending on context
	Night	22	24	43*	-19	Low impact, depending on context

* The minimum LA90 at night was higher than that during the day. For a worst-case assessment, the daytime LA90 has been used to represent the night-time LA90.

Table 15-2 shows that the rating levels at the receptors are well below the lowest measured background sound levels during both the daytime and night-time periods. This therefore indicates that the sound levels at the closest receptors will not be significant and the sound from the new multi-purpose processing unit (Plant 5.1) is considered to be of low impact.

The context is that various items of fixed plant will be installed within an existing industrial/commercial area and the installation of the new plant is highly unlikely to alter the current soundscape.

It is noted that the modelling undertaken assumes that the proposed plant will be operational 100% of the time, thus providing a worst-case assessment.

15.3 Conclusions

The assessment is a worst-case assessment as it assumes that the external plant will have an operational on-time of 100%, during both daytime and night-time periods, and the predicted noise levels have been assessed against the lowest measured background sound levels at the closest noise sensitive receptors.

Sound levels at the closest receptors due to the operation of the new plant have been predicted. The *Rating Levels* at the receptors are greater than 10 dB below the *Background Sound Levels* at all

receptors, during both the daytime and night-time periods. This therefore indicates that the sound levels at the closest receptors will not be significant and the sound from the new plant is considered to be of low impact.

16. Dust

There are no new sources of dust as a result of introducing Plant 5.1 and this application to vary the permit.

Dust generation is considered as part of the sites MPP when introducing new product manufacture under the MPP envelope chemistries and prescribed activities. No new sources of dusts are introduced as part of this variation request.

17. Odour

There are no new sources of odour as a result of introducing Plant 5.1 and this application to vary the permit.

Odour generation is considered as part of the sites MPP when introducing new product manufacture under the MPP envelope chemistries and prescribed activities. No new sources of odour are introduced as part of this variation request.

18. Environmental Risk Management

18.1 Emergency and Incident Response

The site's management system incorporates several policies and procedures for emergency and incident response that are relevant to this application. These are:

- Incident Reporting and Investigation;
- Policy for Emergency Response Plans;
- Spill and Firewater Run-Off procedures; and

Incidents and near misses are recorded in an electronic database and investigated and actioned appropriately.

The site EHS Manager is in regular contact with the local council's Emergency Planning Department and emergency services to review emergency procedures.

A new fire detection system, which automatically sounds the site fire alarm and alerts the Billingham Complex Fire Service (Falck Fire Services), will be installed to monitor the new bunded containment areas.

Access for the Emergency Services will be via the east or west boundary roads.

All of the new assets will be subject to DSEAR / ATEX assessments and Hazardous Area Classifications (HACs) will be defined. Appropriate instrument and electrical equipment will be used within the zones, for example the new bunded storage area will be classified as a Zone 2 area and only Zone 2 rated equipment will be installed.

The site has modelled all credible fire scenarios, to ensure suitable containment of potentially contaminated firewater. This modelling was extended to new Plant 5 and the new tank farm / storage areas and a firewater containment strategy is in place (see Section 9.5).

18.2 Environmental Risk Assessment

The new plant and equipment will be subject to HAZOP throughout the various stages of the installation project. These will include the Front-End Engineering Design (FEED), Detailed Design and As Built plant.

An integral part of the HAZOP will be risks to the environment.

A qualitative assessment of the potential risks to the environment has been undertaken.

The assessment includes risks to the environment from:

- Fugitive emissions;
- Visible plumes; and
- Emergency and incident events.

The assessment includes:

- A review of the prevention, control and mitigation techniques;
- A review of the pathways and receptors of any releases; and
- An assessment of the overall risk.

The assessment is contained in Table 18-1.

It should be recognised that no new chemicals are being introduced to the site although storage levels have increased with the introduction of the new tank farm. In addition, the total tankage on site has increased.

Table 18-1 Environmental Risk Assessment

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Assessment of Fugitive Emission Risks						
Loss of primary containment from the reaction vessel or the distillation column through mechanical failure.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	The plant is subject to planned preventative maintenance (PPM) and regular inspections, which could trigger maintenance events. The plant is located within a dedicated bund that is designed to be in compliance with CIRIA 736 guidance on containment. Any material losses would be retained in the bund. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site – limited by small reactor / distillation column volumes. Loss of materials into the River Tees – limited by small reactor / distillation column volumes.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Loss of primary containment from the reaction vessel or distillation column due to overfilling.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	The reactor vessel is fitted with a high-level instrumented safety system trip and alarm that closes the reactor feed. It also trips the steam to the reactor and the reboiler. The high-level alarm will prevent the reactor overtopping. The column is fitted with a high-level instrumented safety system trip and alarm that closes the feed to the column. It also trips the steam to the reactor and the reboiler. There are procedures in place to ensure that there is sufficient capacity in a receiving vessel prior to charging / receipt of materials. Any material losses would be retained in the bund. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site – limited by small reactor / distillation column volumes. Loss of materials into the River Tees – limited by small reactor / distillation column volumes.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Loss of primary containment during material transfers to the reactor.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	Materials are transferred from dedicated bulk storage tanks using hard piped systems. Where flexible pipes or small packed materials are transferred to the reactor, this is undertaken with the bund. The site has systems and procedures in place for inspecting and testing flexible hoses and pipework on a regular basis. Any material losses would be retained in the bund. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site – limited by small reactor volume. Loss of materials into the River Tees – limited by small reactor volume.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Loss of primary containment from the reaction vessel or distillation column due to over temperature or over pressure.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	The reactor vessel and distillation column are fitted with a high temperature instrumented safety system trip and alarm that trips the steam to the reactor and the reboiler by closing the steam control and emergency block valve. The temperature will thereby be reduced. In the event of the high temperature trip failing to prevent overtopping of the reactor or loss of containment from the distillation column, the plant is located within a dedicated bund that is designed to be in compliance with CIRIA 736 guidance on containment. The reactor vessel and distillation column are fitted with a high pressure instrumented safety system trip and alarm that trips the steam to the reactor and the reboiler by closing the steam control and emergency block valve. The temperature and therefore pressure will be reduced. In the event of an over pressure event, the reactor and distillation column will vent to atmosphere through pressure relief valves, at a safe locations. Any material losses would be retained in the bund. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site – limited by small reactor / distillation column volumes. Loss of materials into the River Tees – limited by small reactor / distillation column volumes.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Emissions of VOCs to atmosphere due to failure of the condenser.	Human receptors near the site (i.e. on the Billingham Complex).	Release from the scrubber vent (at 35m) into the air. Dispersion in the air and migration to ground level human receptors.	There is a high temperature instrumented safety system trip and alarm in the exit line from the vent condenser to the vent scrubber. This trips the steam to the reactor / reboiler and will stop material being vaporised and transferred to the vent condenser. There is also a low flow instrumented safety system trip and alarm in the cooling water return from the vent condenser, which trips the steam to the reactor / reboiler and will stop material being vaporised and transferred to the vent condenser. A wet scrubber is in place after the vent condenser to minimise emissions of VOC’s to atmosphere. The scrubber is designed to be multipurpose and different scrubbing media can be used to optimise the scrubbing potential. In the event that the condenser fails then the scrubber would continue to abate emissions for a short period of time and until the VOC load subsides due to the steam being isolated from the reactor / reboiler.	The probability is very low due to the high efficiency of the scrubber and that the VOC load would quickly subside – due to the steam heating to the reactor / reboiler being shut off.	Short term elevated levels of VOC to air - curtailed by scrubber performance. Discharge at height of 35m allows good dispersion. Near field effect. Impacts human receptors on the Billingham Complex.	Very Low. **Mitigation measures are considered BAT**
Emissions of VOCs to atmosphere due to scrubber failure. Failure could be mechanical, electrical or through elevated temperature.	Human receptors near the site (i.e. on the Billingham Complex).	Release from the scrubber vent (at 35m) into the air. Dispersion in the air and migration to ground level human receptors.	There are a number of control measures in place in case of scrubber failure. There is high level software alarm on the scrubber fluid tank, flow indication and low flow alarm on the scrubber fluid circulation system and an installed spare recirculation pump. Should the scrubber circulation fail then process operators will be alerted and can act quickly to minimise the impact of unabated emissions, through shutting the plant down and recommissioning the scrubber. The scrubber system and ancillary equipment will also be subject to routine maintenance, inspection and testing to ensure that its operation is unlikely to be interrupted. The scrubber receives potential hot process emissions that could lead to a temperature increase in the scrubber and then failure. There are a number of protection measures in place to prevent the temperature in the scrubber escalating. There is a high temperature instrumented safety trip and alarm in the vent to the vacuum package and scrubber. This trips the steam to the reactor and reboiler which would safely reduce the temperature and gradually stop the reaction.	The probability is very low due to the control measures in place.	Short term elevated levels of VOC to air. Discharge at height of 35m allows good dispersion. Near field effect. Impacts human receptors on the Billingham Complex.	Very Low. **Mitigation measures are considered BAT**

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Loss of primary containment from the scrubber.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	The scrubber is located within a dedicated bund servicing the manufacturing equipment of Plant 5.1. The bund provides secondary containment in the event of spillage. The scrubber has low flow alarm that would be triggered should the level of scrubber liquor drop. Any material losses would be retained in the bund. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site – limited by small scrubber inventory. Loss of materials into the River Tees – limited by small scrubber inventory	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Loss of containment from a bulk storage tank (in the tank farm) due to overfilling.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	Each of the bulk storage tanks has multiple layers of protection. All tanks have level indication, high level alarm, high level trips and emergency block valves with signals back to the control room. Operators are in attendance when offloading / loading of road tankers is undertaken. There are procedures in place to ensure that there is sufficient capacity in a tank prior to offloading materials from road tankers. It would be very difficult for loss of containment to occur due to overfilling of a tank. However, should the tank be overfilled, the tanks are all located within a dedicated bunded tank farm. The tank farm is complaint with CIRIA 736 guidance with regards to containment. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site. Loss of materials into the River Tees.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Loss of containment from a bulk tank (in the tank farm) due to bulk storage tank / tank infrastructure failure.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	Each of the bulk storage tanks has multiple layers of protection. All tanks have level indication and emergency block valves with signals back to the control room. It is unlikely that the tanks could be ruptured due to vehicular impact as the tank farm is protected by a raised bund wall. Road tanker offloading/loading procedures are in place to prevent road tanker drive away whilst still connected to the process. The bulk storage tanks and infrastructure will be added to the sites maintenance schedule and tank inspections list. The tanks are all located within a dedicated bunded tank farm. The tank farm is complaint with CIRIA 736 guidance with regards to containment. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site. Loss of materials into the River Tees.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Loss of containment from a bulk tank (in the tank farm) due to over temperature.	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	Most of the storage tanks have the ability to be heated. However, the heated tanks have additional layers of protection and they have temperature indication, temperature control and high temperature trip installed. The tanks are all located within a dedicated bunded tank farm. The tank farm is complaint with CIRIA 736 guidance with regards to containment. Outside of the bunds there is no open / unmade ground in the Plant 5.1 area. The roadways and process areas do not have segregated drains. All rainwater is sent to the existing site effluent tanks (TK001/TK002). Any minors leaks / spills, outside of bunds, would either be cleaned up at source (spill kits) or be sent to the effluent tanks. Civil infrastructure (bunds and drains) will be subject to integrity inspection and be within the site maintenance plan. There is no drainage route for spilt materials to enter the site storm drains, however in the highly unlikely event that material was to escape into the site storm drains; the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability is very low for both source – pathway – receptor linkages due to the control measures in place.	Contamination of soil and groundwater beneath the site. Loss of materials into the River Tees.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Loss of containment from the new portable container storage areas (bunded hard standing)	Soil and groundwater beneath the site. River Tees.	Migration of spills onto unmade ground and penetration into soil and groundwater. Enters site storm drains and flows to RTO1 discharge to River Tees.	There are three new storage areas for portable containers at the east of the site. One of these areas is used for the storage of hazardous / non-hazardous materials. The other two are for used empty containers and unused empty containers. The hazardous / non-hazardous materials area is purpose built and has a full containment bund with ramped access for fork lift trucks. The other areas are on hard standing with closed containment drainage. The largest individual portable container storage volume is $1m^3$. Hence loss of containment events would be limited to relatively small volumes. All containment areas drain to closed drainage sumps. Rainwater is only released to the site storm drains after checking water quality. The hard standing and drainage system is subject to inspection and repair. Spill kits are in the area for cleaning up small spillages. In the highly unlikely event that material was to escape into the site storm drains, the material can be isolated by activating the emergency “flapstopper” isolation device in the main storm drain from the site, to protect RTO1. Contaminated material could then be removed for recovery/offsite disposal.	The probability of spilt materials entering the soil, groundwater or the River Tees is considered to be very low due to the control measures in place.	Contamination of soil and groundwater beneath the site – limited by size of portable containers ($1m^3$ max). Loss of materials into the River Tees – limited by size of portable containers ($1m^3$ max).	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
Loss of containment from the combined storm water / process drainage system on plant 5.1 – which is pumped to the existing effluent tanks.	Soil and groundwater beneath the site.	Migration of spills from drains due to defects into soil and groundwater.	The drainage system is subject to periodic inspection and maintenance. The drains and sumps are routinely inspected using CCTV to ensure integrity of the structures. Defects are rectified.	The drainage system serves as tertiary containment in the event of an emergency. The probability of contamination being lost to ground through broken drainage infrastructure is very unlikely due to the mitigation measures.	Potential for small quantities of hazardous materials or contaminated rainwater to reach the ground and groundwater.	Very Low **Mitigation measures are considered BAT**
Assessment of Visible Plume Risks						
Visible plume from cooling tower. Plume will disperse and could ground under very exceptional circumstances.	Human receptors on the Chemoxy site. Loss of Visual amenity / nuisance.	Recombinant steam plume formed in air.	The cooling towers can generate recombinant steam plumes under extreme weather conditions, i.e. very wet / humid days or very cold days. The magnitude of the steam plumes will be limited through cooling tower design. The cooling tower plume length will be short, dissipating within 4 to 5m from the cooling tower. Grounding impacts, if they occurred, would be in close proximity to the cooling towers onsite. There would be no off-site impact.	The probability is very low due to the inherent design of the cooling tower.	Potential for a visible plume to be generated on site. Under very exceptional circumstances plume could ground on the site. No offsite impacts.	Very Low **Mitigation measures are considered BAT**
Assessment of Accident Risks						

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Fire on the new plant and equipment.	Human receptors on the Chemoxy site / greater Billingham complex.	Emissions of smoke to the air.	The site is remote from residential receptors, within the Billingham Industrial Complex. Consequently, smoke effects from a fire are likely to primarily affect site personnel. Firewater generation and flow has been modelled for the new plant. Firewater would be collected in the 18-inch main storm drain for the site. The firewater would be held back by the emergency "flapstopper" drain isolation valve, which would be activated in a fire event. The retained fire water would be pumped from the "flapstopper" valve chamber by a high capacity pump into a bund to the north east of the control room building. This new bund will consist of the refurbishment of the old Methanol storage bund. The bund will hold the contaminated firewater – awaiting off-site disposal. The drainage system is subject to periodic inspection and maintenance. The drains and sumps are routinely inspected using CCTV to ensure integrity of the structures. Defects are rectified. The emergency "flapstopper" isolation valve is an environmentally critical piece of equipment and is routinely inspected, tested and maintained.	The probability is very low. Early intervention through the alarm systems should minimise the extent of a fire and the level of fire water generation. Containment infrastructure is in place for firewater containment and management.	Complaints of smoke / smells from local residential receptors.	Very low for human receptors.
	Soil and groundwater beneath the site.	Contaminated fire water finds unmade ground and migrates into soil and groundwater.			Loss of firewater into soil and groundwater.	Very low for soil and groundwater.
	River Tees.	Enters site storm drains and flows to RTO1 discharge to River Tees.			Loss of firewater into River Tees (via RTO1).	Very low for River Tees. **Mitigation measures are considered BAT**
Flooding of the site and associated contamination of flood waters with chemicals stored on site.	River Tees.	Flood waters would fill the site, become contaminated and then recede back into the River Tees.	The site is not in a flood risk zone (https://flood-warning-information.service.gov.uk/long-term-flood-risk/map). Secondary containment measures, e.g. bunding, would offer protection against floodwater infiltration.	The probability is negligible as the site is not in a flood risk zone.	Loss of site chemicals to the River Tees.	Negligible. **Mitigation measures are considered BAT**
Vandalism to plant, equipment and infrastructure and associated loss of containment of chemicals, products and wastes from the site.	Soil and groundwater beneath the site.	Migration of spills onto unmade ground and penetration into soil and groundwater.	The site is located on the Billingham Industrial Complex, which is owned by CF Fertilisers. The complex has 24-hour security and access to the complex is tightly controlled through the main complex access gate – which is permanently manned. Visitors require pre-approval by site occupants. The complex is surrounded by high security fencing, with CCTV surveillance. Appropriate security signage is on the perimeter fencing and at access points. The security measures are consistent with those required for Upper Tier COMAH facilities, and there are numerous COMAH facilities on the Billingham Complex.	The probability of vandalism / trespass is very low due to the access mitigation measures that are applied.	Contamination of soil and groundwater beneath the site. Loss of materials into the River Tees.	Very low for soil and groundwater. Very low for River Tees. **Mitigation measures are considered BAT**
	River Tees.	Enters site storm drains and flows to RTO1 discharge to River Tees.				

Appendix A - Figures

Appendix B – BAT Assessment

- Permit Variation. BAT Assessment – Plant 5.1. Permit Number: EPR/BT9844IK. Chemoxy International Limited, Billingham Site. Project Number: 60609533. Report number: TERP 60609533-002

Appendix C - Emissions to Air Screening Assessment

- H1 Calculation Tool (Electronic Copy). File name: Appendix C - Plant 5.1 Air Impacts.mdb

Appendix D - Site Condition Report

- ERM Report. Full Site Condition Report. Chemoxy International Ltd. 1 April 2020. Project No: 0488402

Appendix E - Noise Monitoring

- 'Billingham 5.1, Proposed Mulit-Purpose Process Unit Acoustic Assessment' - AECOM Report 60609533_Acoustic_1, 4th October 2019.