Environmental Permit Variation Application

(UP3138LT)

Document Ref: PHNX2VAR

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Document PHNX2VAR: Standard Variation to Environmental Permit UP3138LT

Non-technical summary:

Syngenta Limited proposes to change the chemical operation in the south part of plant cc0843. This would replace the existing process in the South side of the asset but keep the existing process in the North side of the asset (as approved by Variation notice number EPR/UP3138LT). The proposed process is part of the development of a new crop protection active ingredient (AI) which is already manufactured on a smaller scale elsewhere on the site (as approved by variation 17).

Plant cc0843 has existing equipment available that, along with newly purchased equipment, will be developed to create a dedicated manufacturing unit.

Key improvements associated with the new proposal are as follows:

- Bulk storage tanks containing organic solvents on the new process will be vented through the main plant scrubber to reduce volatile organic compound emissions (VOCs)
- The reaction stage for the new process will be undertaken at sub-zero temperatures, thereby reducing VOCs
- Introduction of a chilled two stage scrubbing system to reduce VOCs from the new process
- Routing of aqueous effluent associated with the South building and associated areas (that should not contain the active ingredient) towards an effluent containment, the contents of which will be tested prior to release, either to sewer or for offsite treatment if contaminated with the AI to prevent accidental discharge in the event of a loss of containment of AI
- Use of pumps for liquid transfer, rather than pressure transfers, to reduce VOC emissions
- Reuse of aqueous process wastes wherever practical in the new process

There are no changes resulting from this variation to the management systems and techniques of Syngenta Limited as defined by the Environmental Permit UP3138LT as part operator of the regulated facility at Huddersfield.

This development in cc0843 has been subject to the formal project management processes operated within Syngenta; this includes procedures for Management of Change, Process Risk Assessment and the Project Management Process.

Details of the variation:

The detailed information relevant to the variation is included below.

1. About the installation

The following table indicates the changes to the activity in the stationary technical unit. The introduction of a new process to produce an insecticide active ingredient within an existing plant represents an introduction of a new process, however it does not introduce a new scheduled activity under the Environmental Permitting (England and Wales) Regulations 2016; therefore, Table S1.1 of our permit is not affected. The table below shows how the variation relates to the currently permitted activities.

Description of the activity	*Schedule 1 reference*	*Operator*	*Changes*
Plant health product or biocide manufacture in plant cc0843	Section 4.1 Part A (1) (a)	Syngenta Limited	Scale up the manufacture of an insecticide active ingredient already made in smaller quantities elsewhere on site by modifying an existing plant.

1.1 Summary description of the plant

This section provides a summary of the proposed process at Plant cc0843.

The proposed process in Plant cc0843 will be a manufacturing process to produce an insecticide active ingredient (AI), SYN547407. This AI is already made at another plant (cc0868) on site in smaller quantities and this change will allow the scale up of production of this AI by modifying an existing plant.

The operating units within Plant cc0843 for manufacturing an insecticide AI operate solely on a batchwise basis. The control of key process parameters, e.g. temperature and addition rates, is required to ensure safe and robust operation, and optimum quality by minimising impurity formation. The proposed process will comprise a single reactor, evaporation and crystalliser line, supplemented by two filter and dryer sets located in the South building on cc0843.

Operations are Process Control System (PCS) computer controlled following processing steps as defined by the sequences. Written Operating Instructions are used to cover non-routine operations, e.g. start-up, shutdown and cleanouts for maintenance. Safety trips and interlocks are provided within the PCS and supplemented by independent Safety Integrity Level (SIL) rated functions in accordance with the Syngenta Ltd.'s Safety Instrumented System (SIS) Management System.

1.2 Material Flow

Plant cc0843 occupies four floors. The main process items for the manufacturing process e.g. reactor, evaporator, crystalliser and dryers will be located on the ground floor and the bulk storages are external to the plant building. Some plant will be located at higher levels in the building to allow discharge using gravity.

Raw materials are either handled in packages, eg Flexible Intermediate Bulk Containers (FIBCs) for powders or in bulk tankers/tanks for liquids. Some small volume materials are handled in smaller packaging such as drums. Discharge of small packages will be carried out using Local Exhaust Ventilation that vents to atmosphere. Powders will be handled via specific powder handling equipment, using lean and dense phase pneumatic systems, rotary valves and screw conveyors, with dedicated intermediate vessels for transfer to receiving vessels. Liquids in bulk storages will be transferred to the receiving vessels using pumps.

Transfers between reactors are generally carried out by pump transfer to reduce VOC emissions where possible. Transfers to bulk storages, and between ancillary vessels, are also achieved by either pumping (where possible) or by nitrogen pressure transfer.

The plant condensers and vessel cooling use a chilled glycol cooling medium that is fed from a centrally operated chiller unit on the plant.

Gas streams for the process and associated storages will be treated via a designated abatement system to remove VOCs. Liquors arising from this process will be reused where possible.

1.3 Principal Process and Plant Items

The proposed Agrochemical Active Ingredient Manufacturing Process:

A solid agrochemical intermediate is discharged from FIBC's into a batch reactor containing organic solvent, ion exchange resin, additional reagents, and catalyst. The reaction is carried out at low temperature over a period of hours. The reaction mixture is then warmed, filtered to remove the resin and an evaporation stage carried out to remove solvent. Water is then charged to the mixture and crystallisation occurs. The resultant

slurry is then filtered and washed in a pressure filter. The damp cake is charged via gravity to be dried under vacuum in a dedicated dryer. The final product is discharged into FIBC's.

Liquid process waste streams arising are distillates, filtrates and scrubber liquors, all containing organic solvent and water. These are either recycled in process where possible, or sent off-site for third party recycling, or disposal. Used ion-exchange resin, and solids packaging will be sent off-site for third party disposal.

Aqueous waste from floor washing and rainwater from bunds will be contained and tested for active ingredient, prior to being sent to the site Effluent Treatment Plant, or off-site for further treatment if required.

The following key equipment will be associated with the new process. It should be noted that the majority of the equipment exists from previous processes.

Additional Equipment	***Plant cc0868***	***Comments***
Process Vessels	• 1 No. Reactor • 2 No. Pressure filter • 1 No. Evaporator • 1 No. Crystalliser • 2 No. Dryer	Volumes up to 58 m^3
Storage	• 8 No. Bulk Storage Tanks for raw materials and wastes	Vessels up to 77m^3
Other Tanks	• 4 No. Tanks for various purpose • 4 Powder Hoppers	Charge vessels, measure vessels and pump tanks
Other Equipment	• Waste gas stream scrubbing abatement equipment • Dust filters • Pumps	
Pipework	• Additional pipework associated with equipment	Additional pipework associated with equipment

1.4 The Abatement Systems

The abatement system operates to minimise the potential emissions to atmosphere from the process.

The main process vessels are vented via a central condenser cooled with a chilled cooling medium operating as cold as is practical to avoid freezing of condensates.

The main release point to atmosphere on the manufacturing unit is via two packed tower scrubbers with a chilled water scrubbing medium; the vents from the reaction vessel condensers, vacuum pumps, pressure filters, storage vessels containing solvent, measure vessels, and head tanks are all vented via these scrubbers.

Release to atmosphere from the solids charging systems is carried out via filters designed to recover solids captured, backed up with HEPA filters. The blower on the pneumatic powder transfer system (PTS) is protected from dust contamination by a process filter/membrane in the conveying vessel and then by a guard filter; this design effectively prevents any emissions via this route. In the event that the membrane should fail the PTS will not be able to operate and the guard filter will ensure that any potential fugitive emissions are also kept to a minimum.

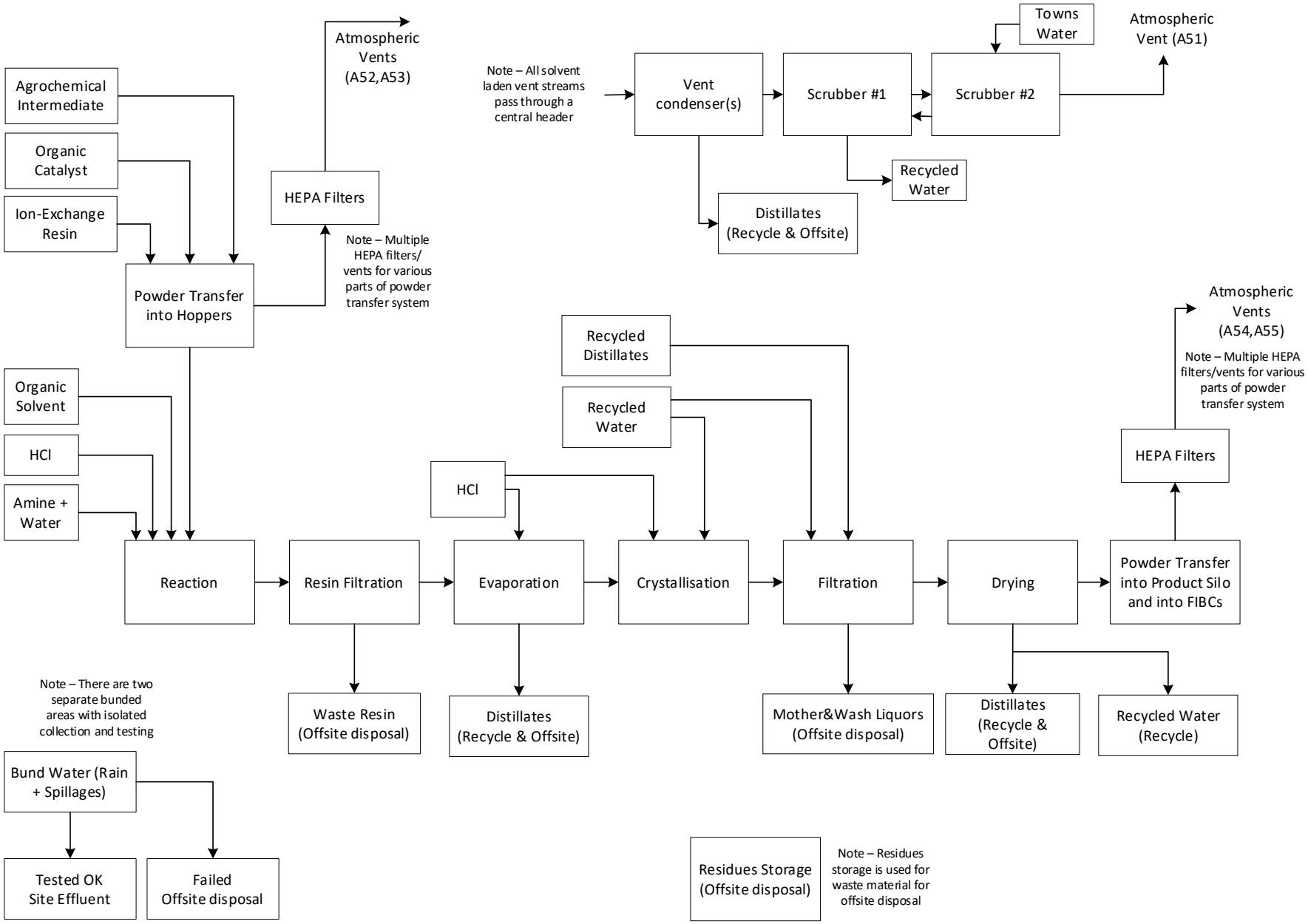
A schematic of the proposed process is provided on the next page.

1.5 Environmental Risk Assessment

A Source-Pathway-Receptor model Environmental Risk Assessment has been completed by experienced consultants to assess the activities in this permit variation. It has been completed in line with the CDOIF guidance for compliance with COMAH requirements and will be used for the COMAH Reg 10 submission.

The Risk Assessment concluded that the Calder Corridor and Humber Estuary are at risk from uncontrolled releases of the Active Ingredient. The potential worst case MATTE C events from the new process are predicted to potentially occur at the Humber Estuary and its sensitive marine habitats. The main pathway for this would be via the effluent treatment plant. The assessment of the project has highlighted the importance and criticality of the preventative and mitigation measures for operations that could result in an unplanned release of AI to the effluent drainage system and at the effluent treatment plant to ensure there is not an uncontrolled release off-site of effluent containing AI in exceedance of the emission limit. The assessment concludes all risks to the environment are either Broadly Acceptable or ALARP with the preventative and mitigation measures in place at the site.
A separate qualitative Risk Assessment has been completed and is included with this application.

Cc0843 SCHEMATIC - Agrochemical Active Ingredient Manufacturing Unit



2. Emission Control & Abatement

2.1 Diagrams

The emissions release points are indicated on the site plan document H/A3/618015.

2.2 Emissions Points

The variation will introduce the following emissions points to the facility

Release point reference	*Activity*	*Location of emission point*	*Techniques used to minimise emissions*
A51	Agrochemical Active Ingredient Manufacturing process	Plant cc0843	Low temperature condensation for VOCs, and subsequent gas absorption
A52	Powder Transfer – Raw materials	Plant cc0843	Particulate HEPA filter
A53	Powder Hopper – Raw materials	Plant cc0843	Particulate HEPA filter
A54	Powder Transfer – Final product	Plant cc0843	Particulate HEPA filter
A55	Powder Hopper – Final product	Plant cc0843	Particulate HEPA filter

The release points listed above have been considered by our in-house MCerts Level 2 Team Leader with reference to M1 and the necessary requirements for vent emissions monitoring have been advised to the Project Manager of the design team who will ensure these requirements are included in the final re-commissioned plant.

All other minor emission points, i.e. atmospheric storage breather vents and Pressure relief routes, are listed in separate tables in section: “Potential fugitive emissions to air”

2.3 Emission Point Abatement equipment

The following table summarises the abatement equipment associated with the introduced emissions points

Release point reference	*Emission type and pollutant*	*Abatement equipment identifier*	*Proposed or existing*
A51	*Vapour – Acetonitrile*	*Condenser – 38/510 Scrubbers - 38/100 and 38/200*	*Proposed*
A52, A53, A54, A55	*Particulates*	HEPA filters *36/302, 36/122, 36/502, 36/422*	*Proposed*

2.4 Details of abatement for specific emission points

The following table details the abatement equipment specific to each emission point

	Detail / Vent ID	*A51*	*A52, A53, A54, A55*
1	**Abatement equipment** Type of equipment used/principle of operation	Low temperature condenser and 2 packed tower scrubbers	4 HEPA filter units with blower
2	**Process stage or release point** Where is this equipment?	North side of plant building via scrubber fan vent directed above roof height	Internal to plant out via roof
3	**Identifier** Unique identifier of this equipment	Sources of VOCs from processing vessels via condensers: 38/510 All vents via 38/100 & 38/200 Packed tower scrubbers	36/302, 36/122, 36/502, 36/422, HEPA filters on powder transfer equipment and powder hoppers
4	**Pollutant removal** What pollutant(s) is the abatement equipment intended to remove?	Acetonitrile	Agrochemical intermediate, organic catalyst, ion-exchange resin dust
5	**Age and design life** How old is the equipment and when will it reach the end of its design life?	The scrubbers are approx. 25 years old. Mechanical inspections indicate that they are in suitable condition to be repurposed for this new duty, however initial design suggests one of the columns will need to be redesigned for the duty	Equipment is new
6	**Key functional details** What is the specification / design duty of the equipment? e.g. operating temperature, flow rate, residence time, combustion control, inlet / outlet pollutant concentrations, removal efficiencies, etc.	Condensers to cool and condense process vapours to <20°C. Service temperature is close to 0°C The Packed Tower design duty is for general plant venting and absorption of Acetonitrile vapours released by the process: water is re-circulated through the packed towers and cooled to approximately 2-4C in each scrubber. The gas flow through the column is mainly nitrogen but not controlled.	The HEPA filter units are designed to vent excess gas drawn into the powder transfer system from either the powder itself or nitrogen injected into the system
7	**What is the typical loading of this equipment from the process?**	Variable during the batch processing as a result of pressure transfers, tanker offloading, evaporation, and solids drying. The scrubber system will handle on worst case 500 kg/h of vent gasses. Estimates indicate that these will contain up to 5kg/h of Acetonitrile.	Loading: <1kg per batch The solid being handled is powder but several guard filters in place to recover material prior to the final filtration stage.

	Detail / Vent ID	*A51*	*A52, A53, A54, A55*
8	***What is the abatement performance of this equipment?***	Expected to achieve >97% VOC abatement. This will be validated on start-up Consideration with H1 has shown the final emission will be low compared to the long and short-term significance thresholds for ACN.	Consideration with H1 has shown the final emission will be very low compared to the short term significance threshold
9	**Operational controls** Describe the process controls in place and how these are monitored (including any alarms) to ensure optimum performance, e.g. prevent pollutant breakthrough.	High vent temperature readings on the outlets of condensers to show performance. Operation of the Packed Scrubbers is controlled by sequence. Normal performance is assured by scrubber tank level, flow alarms and system temperature. The acetonitrile content in the scrubber liquors will be measured and the liquors replaced accordingly.	Pressure drop is used to identify that filters are in place and are not dirty. The process control sequence monitors these values and communicates out of specification conditions to the plant operators.
10	**Describe any management controls in place to ensure optimum performance,** e.g. cleaning and preventative maintenance.	Routine maintenance on condensers Packing is inspected and cleaned or replaced as appropriate	The filter units are to be inspected periodically, based on a preventive maintenance strategy and will be replaced as necessary The filter unit has a differential pressure indicator across it which gives operators indication of fouling, and high readings will initiate replacement.
11	**Describe any procedures in place in the event of catastrophic equipment failure**, e.g. fire or dust explosion, filter media rupture, cooling water failure or scrubber liquor flow failure.	Software and manual procedures to safely stop plant in event of abatement failure Solvent detectors will be fitted in the plant to give early warning of loss of containment	Low pressure drop reading indicated HEPA filter failure. Upstream HEPA filter failure would lead to mechanical failure of the blower which would stop the process.

	Detail / Vent ID	*A51*	*A52, A53, A54, A55*
12	**How is protection provided during start-up, shut down and momentary stoppages?**	Main process sequences check that the condensers and scrubber system are operational. Operational procedures used by team to check plant is fit to start up after maintenance include check scrubber system is working	Unit is only operated during the relevant charging. Or packing operations and is thus operated for short periods on a start/stop basis.
13	**Is there a bypass** under what circumstances can it operate?	Catch tank vent which is used in emergency relief scenarios. Liquid overfill of vessels leads to liquid in the vent header which then drains to the catch tank. Failure of catch tank seal would result in gas being drawn in from catch tank as fan keeps scrubber inlet -ve pressure compared to atmosphere.	No
14	**Detail any significant differences between the design and current duty of the unit and the reason for these differences.** Comment on whether these differences have an adverse affect on the environmental performance	Existing scrubbers were used for toluene abatement. New design is to use water as the scrubbing agent and conditions have been chosen to ensure efficient ACN abatement	None
15	**Describe any operational problems with the unit**	None.	None
16	**Wastes** What is the fate of the pollutant removed from the air stream? e.g. spent scrubber liquor or adsorbent.	The aqueous effluent from the scrubbers containing the ACN is reused within the process as water charges. Eventually this aqueous stream is processed to recover the acetonitrile as part of the solvent recovery process.	The filter units are replaced as necessary; these will have captured process dusts and will be disposed off appropriately. The units will be cleaned out subject to a periodic formal procedure and these materials will be combined with the filter units for disposal
17	Are there any other waste products, e.g. spent catalysts?	Cleaned column packing is replaced as necessary. This is perceived to be an infrequent requirement.	Spent HEPA filters
18	**How are these recycled, covered or disposed of?**	Column packing is removed from site and disposed of appropriately	Disposed of with non-routine waste for offsite treatment.

3. Emissions to air and water

This section deals with emissions to air and water from the proposed process.

3.1 Annual mass limits for emissions to air

The following table proposes annual mass limits for substances emitted to air by the process via the identified release points

Substance	*Annual mass emissions*	*Proposed Limit*
Acetonitrile	<800kg (estimated)	<100g/h
Particulates (intermediate, catalyst, active ingredient, and ion exchange resin)	<1kg	No limit set

Acetonitrile annual mass emission has been calculated in the following way:

Worst case emission rate = be 100g/h,

Maximum annual emissions, based on approximately 8000 working hours a year = 8000 x 100g = 800kg

3.2 Annual mass limits for emissions to water and sewer

There are no direct emissions to water from the process. Releases to drain and subsequent effluent plant are from rainwater in bunds and yard areas and minimal cleaning water.

The following table proposes annual mass limits for substances emitted to sewer by the process.

Substance	*Annual mass emissions*	*Yorkshire Water Effluent Consent Limit for ACN*
Acetonitrile	Nominally zero. Only emissions would be trace amounts from unplanned contamination	300mg/l

3.3 Emission to sewer discussion

In the event of unplanned contamination it is recognised that Acetonitrile has a high removal rate from wastewater treatment plants of nearly 90%. Any accidental releases will be treated in the wastewater treatment plants on and off site.

It should be noted that emissions to sewer are also subject to regulatory control under a Water Industry Act 1991, consent managed by our Sewerage Undertaker, Yorkshire Water Services. Emissions to sewer will therefore be undertaken with the full agreement of Yorkshire Water Services. Yorkshire Water have already given consent for ACN emissions at 300mg/l due to another process emission on site.

3.4 Potential fugitive emissions to air

3.4.1 Fugitive emissions from operations

Potential sources of fugitive emissions are considered in the table below.

	Normal Operation		***Maintenance***		***Displacement***				***Drumming off & Loading***		***Sampling the Process***		***Pressure Relief***		***Clean outs***				
Potential Fugitive Emission	*Flanges , pumps , Pipes*	*Actual emissions (y / n)*	*Break ins*	*Actual emissions (y / n)*	*Processing & Material transfer*	*Actual emissions (y / n)*	*Tanker on / off loading*	*Actual emissions (y / n)*	*Charging to / from drums / bags*	*Actual emissions (y / n)*	*Sampling*	*Actual emissions (y / n)*	*PRV or BD relief event*	*Actual emissions (y / n)*	*Emptying Assets*	*Actual emissions (y / n)*	*Total Fugitive Loss (kg)*	*Inventory used per year (tonnes)*	*% loss as total of inventory*
Dusts																			
Agrochemical Intermediate	Neg.	*N*	Neg.	*Y*	Neg.	*N*	*N/A*	*N*	Neg.	N	Neg.	*N*	Neg.	*N*	Neg.	*Y*	<5	2200	<<1
Organic Catalyst	Neg.	*N*	Neg.	*Y*	Neg.	*N*	*N/A*	*N*	Neg.	N	Neg.	*N*	Neg.	*N*	Neg.	*Y*	<5	135	<1
Ion Exchange Resin	Neg.	*N*	Neg.	*Y*	Neg.	*N*	*N/A*	*N*	Neg.	N	Neg.	*N*	Neg.	*N*	Neg.	*Y*	<5	190	<<1
Agrochemical Active Ingredient	Neg.	*N*	Neg.	*Y*	Neg.	*N*	*N/A*	*N*	Neg.	N	Neg.	*N*	Neg.	*N*	Neg.	*Y*	<5	1900	<1
VOCs																			
Acetonitrile	Neg.	Y	Neg.	Y	Minor	Y	Minor	Y	Minor	N	Neg.	Y	Neg.	Y	Neg.	Y	<100	13500	<1
Others																			
Amine Reagent	Neg.	Y	Neg.	Y	*Insig.*	Y	Insig.	Y	Neg.	N	Neg.	Y	Neg.	Y	Neg.	Y	*<20*	325	<<1
Sodium hydroxide	Neg.	Y	Neg.	Y	*Insig.*	Y	*N/a*	N	Neg.	Y	Neg.	Y	Neg.	Y	Neg.	Y	*<50*	54	0.1
Hydrochloric Acid	Neg.	Y	Neg.	Y	Neg.	Y	*N/a*	N	Neg.	Y	Neg.	Y	Neg.	Y	Neg.	Y	<5	135	<1

Notes associated with the table:
Due to the variable nature of fugitive emissions, emissions bands have been created to more easily represent emission potential. These bands are as follows:
• Negligible (Neg.): 0-5kg; • Insignificant (Insig.): 6-50kg; • Minor: 51- 100kg: • Small: 101-500kg; • limited: > 501kg

3.4.2 List of breather vents on the plant

The breather vents for all storages and vessels containing ACN in any significant concentration are combined, routed to the scrubber and out via A51, so are not listed.

Unique Vent identifier	*Type of operation*	*Substance*
Vent from 37/922	Drum emptying	Amine
Vent from 37/625	Drum/IBC emptying and filling	Acetonitrile, agrochemical intermediate, sodium hydroxide
Vent from 55/556	Storage with conservation vent PDPV2478/2 outlet via a scrubber, used during tanker offloading	HCl

As part of the project these storages will all be tied to the plant main abatement system thereby reducing VOC emissions.

3.4.3 List of vents associated with pressure relief devices

Note – It is planned to capture the main process vents inside the building into a single relief header. However, the design has not completed for this arrangement and so individual vents are listed below.

Syngenta Equipment No.	*Description*	*Pressure Relief Stream(s)*	
		Stream No.	*Device Type(S)*
40/966	Acetonitrile Storage	PDPV 4684/2	RV
40/596	Distillates Storage	PDPV 8063/2	RV
41/896	Recycled Water Storage	PDPV 4552/2	RV
41/790	Mother Liquor Storage	PDPV 2122/2	RV
55/556	HCl Storage (existing, also used for current process in KIPN)	PDPV 2478/3	RV

Syngenta Equipment No.	*Description*	*Pressure Relief Stream(s)*	
		Stream No.	*Device Type(S)*
45/716	Residues storage	PDPV 2103/2	RV
27/900	Reactor	PDPV TBC	RV
27/940	Resin Filter	PDPV TBC	RV
28/830	Evaporator Hold Vessel	PDPV TBC	RV
28/800	Crystalliser	PDPV TBC	RV
29/970	Filter	PDPV TBC	RV
29/980	Dryer	PDPV TBC	RV
38/900	Relief System Catch Tank	PVBD TBC	BD

RV - Relief valve, BD – Bursting disc,

3.5 Potential fugitive emissions to water

It is considered that there is no potential for fugitive emissions to water resulting from the operation of the Agrochemical Active Ingredient process within plant cc0843 by the provision of adequate surfacing to the areas of operation where this could occur, subsequent collection and testing prior to release to drain.

3.6 Subsurface structures

Sump number and design yet TBC. All vessels and the warehouse have secondary containment and overflow to drainage system to the sites effluent treatment plant (ETP). All liquid in secondary containment will be tested for AI before being released through the drainage system to ETP (exception is amine unloading area where there is no risk of AI contamination).

The details of the sumps are included in the following table

			One of these must be present for any Sump			
Sumps	***Location***	***Construction***	***Leak Detection***	***Secondary Containment***	***Inspection Frequency***	***Date of Previous Inspection***
TBC	See drainage plan (warehouse yard x2, HAFB storage area)	Concrete	Scheduled inspections	N/A	Annually	n/a New

3.7 Potential pollution areas

The following table contains a list of the potential pollution areas on the plant and an assessment of the surfacing of these areas versus the BAT criteria in sector guidance EPR 4.02; this excludes bulk storage vessels that are all bunded in accordance with the requirements of sector guidance EPR 4.02 and CIRIA C736.

Area	***EPR 4.02 BAT criteria for surfacing***				
	an impervious surface	***spill containment kerbs***	***sealed construction joints***	***bunding***	***connection to a sealed drainage system***
Main processing building	Yes	Yes – kerbs all around	Yes	n/a	Yes, drains to tank farm bund
West tanker station	Yes	Sloped and kerbed	Yes	n/a	Yes, drains to tank farm bund
Warehouse yard	Yes	kerbed	Yes	n/a	Yes, drains to designated sump and pumped to test tank
Tank farm	Yes	n/a	Yes	Yes	Pumped to test tank (tested to ensure acceptable to send to ETP)
Amine storage and discharge area	Yes	kerbed	Yes	n/a	Yes, drain to ETP

3.8 Odour sources

Experience of running the operation in another facility has demonstrated there are no odours generated. Odorous substances are fully contained.

Activity or process	*Describe intentional release points Locations*	*Describe fugitive or other potential release opportunities Fugitive emission points*	*What odorous materials are used, or type of odour generated? For example, are these raw materials, intermediates, by-products, finished products or wastes?*	*Is any routine or occasional monitoring undertaken?*	*What form, how often, and what are typical results?*	*Are there any existing emission limits or other conditions relating to these emissions?*	*Details*	*Describe the actions taken to prevent or minimise emissions. Demonstrate that there will not be a problem under normal conditions. Training and management techniques should be included, as well as*	*Describe the actions to be taken to meet BAT and timescales Actions*
General overview: There two potential sources of odour. These come from the storage, handling and processing of the acetonitrile and resin.	There intentional release points on plant cc0843 include A51 for the acetonitrile vapours and A51 for the resin handling	Fugitive emission points vary depending on each substance. Flanges, valves, pump and agitator seals are recognised as potential sources of small releases.	No "notable" odorous substances are used in this process.	Yes	The site Environmental Manager undertakes an informal regular walkover audit, which extends to the site boundary. In addition, the site Duty Managers (DMs), who work on a continuous shift pattern, would address both potential and actual (i.e. public complaints) issues were they to occur. Their various routine duties mean they will attend a large part of the site within a 24 hour period All staff are encouraged to report any observed abnormalities via an established electronic HSE incident reporting system.	Yes – for the acetonitrile	None specifically relating to odour, but the acetonitrile will have emission limits applied via the EPR Pernit. These limits will bring the odour potential to below the odour threshold	Control devices associated with vent abatement systems relating to those emissions with odour potential are included under 'Section 4.2' In addition the following measures are taken: - waste inventories are kept to a practicable minimum - reporting of all losses of containment, however trivial, is encouraged & formalised	No actions considered necessary.

4. Soil and Groundwater Pollution Prevention

4.1 Potentially Polluting Substances

The Potentially Polluting Substances that will be present on Plant cc0843 resulting from the operation of the Agrochemical Active Ingredient process are listed in the following table

Substance	*CAS Number*	*Index Number Table 3.2*	*Hazard Statements*	*Maximum stored (tes)*
Acetonitrile	75-05-8	-	H225, H332, H312, H302, H319	77
Agrochemical intermediate	2475232-73-4	-	H400, H410	30
Resin	69011-18-3	-	H318	20
Catalyst	1879067-61-4	-	H360D, H400 , H410	20
Caustic soda solution	1310-73-2	-	H290, H314	10
Hydrochloric acid solution	7647-01-0	017-002-01-X	H290, H314, H335	60
Amine	7803-49-8	612-122-01-4	H290, H318, H315, H317, H373, H335, H351, H302 + H312, H400	25
Waste filtrates	Not Assigned		H225, H302, H332, H312, H319, H317, H361f, H410	77
Waste distillates	Not Assigned	-	H225, H302, H332,H312, H319, H317, H411	77
Active molecule (in FIBCs)	2061933-85-3	-	H317, H361f, H400,H410	30

The substances that are held within bulk storages have been subject to an Assessment of Land Pollution Potential according to the following assessment table:

Substance	Relevant Activity	Potential for Pollution from the Relevant Activity	1	2	Primary Containment		Secondary Containment		Tertiary Containment		3	4	5	Little Likelihood of Pollution	Reasonable Possibility of Pollution
			Records of Pollution	Existence of Pollution Prevention Measures	Method of Primary Containment	Testing & Inspection of Primary Containment	Nature of Secondary Containment	Testing & Inspection of Secondary Containment	Nature of Tertiary Containment	Testing & Inspection of Tertiary Containment	Adequacy of Pollution Prevention Measures?	Proposed Integrity Testing of Pollution Prevention Measures Adequate?	Adequate documented Mgt System to Demonstrate Operator Management and Competence with the Relevant Activity?		
Acetonitrile Distillates storage Recycled water storage Mother liquor storage	on / off loading, storage and processing of chemicals	Spill and failure of all levels of containment	No	Yes	Process equipment/ tanks	Daily manual and visual checks , Rolling inspection program	Bund (to CIRIA C736)	Daily visual checks, Rolling inspection program	Concrete hard-standing - inclined to drain	Daily visual checks, Rolling inspection program	Yes	Yes	Yes	**YES**	

As a result of assessing the area associated with the operation of this process this will be categorised as a Zone II of Land Pollution Potential.

4.2 Site Protection and Monitoring Programme

A review of the Potentially Polluting Substances that will be handled and stored has been completed.

The site already has an extensive groundwater contamination monitoring programme. The programme will be updated as a result of this project. Key substances in this process will be tested for in the vicinity of the plant in order to detect any losses.

The Infrastructure Inspection and Maintenance Schedule is still being developed but an example from a similar process elsewhere on site is included in the table below.

PLANT XXXX: Inspection and Maintenance Schedule							
AREA	TYPE	Material	ID	Leaks Spills & faults	FREQ	Integrity Checks	FREQ
Subsurface Structures	Sumps	Interceptor sump	Plant drains			Visual - repairs if necessary	12m
		Interceptor sump	Storage compound			Visual - repairs if necessary	12m
	Drains	Effluent drainage from Plant including connection into main spine sewers	Accessed through DAMS system			CCTV inspection	≤5yrs
Primary Containment	BULK STORAGE TANKS	Acetonitrile	25/300	*See Note 1 below*		Visual by engineer	12m
		Waste water storage	45/200				
		Distillates storage	45/100				
		Mother liquor storage	45/300				
	Drums	Sodium hydroxide (aq.)	As labelled	Visual inspection	As and when used Daily checks on Amine		
		Resin					
		Organic Catalyst					
		Waste ex-filtration					
		Amine Raw Material					
	IBCS	HCL	As Labelled	Visual Inspection	As and When Use		
	Sacks / FIBCs	Agrochemical intermediate	As labelled	Visual inspection	As and when used		
		Active ingredient					
	Above ground Pipework	Various within plant	via plant diagrams	*See Note 1 below*		Visual by engineer (formal SAP task for registered pipe)	12m
		To/from plant bulk storages (as above)					
		Bulk storage bund (west)	04/201	Visual inspection	Weekly		12m

PLANT XXXX: Inspection and Maintenance Schedule							
AREA	TYPE	Material	ID	Leaks Spills & faults	FREQ	Integrity Checks	FREQ
Secondary Containment	Bunded Areas	Bulk storage bund (south)	04/202			Interior / exterior inspection	
Tertiary Containment	Roadways	Plant traffic	Various	*See Note 1 below*		Visual - repairs if necessary	12m
	Waste Storage areas	Waste from manufacturing operations and IQ batches	As labelled	Visual inspection	Weekly	Visual - repairs if necessary	
	Raw material storage areas (liquids)	All liquid process ingredients in drums and IBCs	As labelled	Visual inspection	Weekly	Visual - repairs if necessary	
	Raw material storage areas (dry solids)	All agrochemical intermediates Low volume solid ingredients	Various	Visual inspection	Weekly	Visual - repairs if necessary	12m
	Tanker areas	On/off loading operations of raw materials & final product	Various	Visual inspection	Weekly	Visual - repairs if necessary	12m

Note 1
Syngenta has a culture of visual inspection and formal reporting (via the site wide Enablon) system and as such all staff and contractors, as part of their normal duties, are vigilant for potential problems on any plant, equipment or infrastructure. These are reported and recorded and appropriate repair and maintenance actions are implemented and the corrective actions recorded. As such there is an audit trail for any issues identified through the visual inspection process.

5. Other Environmental Considerations

5.1 Raw material fate table

The following table summarises the raw material consumptions and their environmental fate.

This recently developed process was subject to structured decision analysis to determine the route for chemical synthesis, and processing agents, using relevant criteria, i.e. health safety and environment criteria (e.g. hygiene, process safety and ecological criteria), technical risk, as well as a commercial analysis.

Raw material / function	*Chemical nature /composition where appropriate*	*Amount used per year (te)*	*Fate % to product % to water % to sewer % to waste/land % to air*	*Environmental hazard where known (e.g. degradability, bioaccumulation potential, toxicity to relevant species); plus Hazard Statements from current classification*	*Is there a suitable alternative for those with significant impact potential. Will it be used (if not explain).*
Agrochemical Intermediate 1	Base material	2160	88% to product 12% to waste	Low solubility in water H400: Very toxic to aquatic life. H410: Very toxic to aquatic life with long lasting effects.	Selected chemical route, best for the process
Organic Catalyst	Reagent	120	100% to waste	Solid, low solubility in water H400: Very toxic to aquatic life H410: Very toxic to aquatic life with long lasting effects	No significant impact potential
Ion exchange Resin	Reagent	230	100% to waste	Insoluble in water. Surface photodegradation is expected with exposure to sunlight. The polymeric component is not expected to biodegrade. No potential for bioaccumulation.	No significant impact potential
Amine	Reagent	302	76% to product 24% to waste as salt	Soluble in water. LC50 (96 h) H400 Very toxic to aquatic life. 7.2 mg/l, Pimephales promelas (fathead minnow). LC50 (80 h) 4 mg/l, Salvelinus fontinalis EC50 (48 h) 0.64 mg/l, Daphnia magna EC50 (72 h) 0.29 mg/l, Scenedesmus subspicatus EC10 (3 h) 0.28 mg/l, activated sludge, domestic Accumulation in organisms is not to be expected.	No significant impact potential; none released to sewer

Raw material / function	*Chemical nature /composition where appropriate*	*Amount used per year (te)*	*Fate % to product % to water % to sewer % to waste/land % to air*	*Environmental hazard where known (e.g. degradability, bioaccumulation potential, toxicity to relevant species); plus Hazard Statements from current classification*	*Is there a suitable alternative for those with significant impact potential. Will it be used (if not explain).*
Acetonitrile	Solvent	10000	80% recovery and 20% to waste	Soluble in water. LC50 (Pimephales promelas Fathead minnow).: 1,640 mg/l. Exposure time: 96h. 48-hour LC50 >1000 mg/L Oryzias latipes (Medaka, high-eyes) EC50 (green algae): 7,943 mg/l. Exposure time: 48 h. 48 hr LC50 521 mg/L Artemia salina larvae Not considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher	Organic solvent required; insignificant amounts released to sewer
Deionised water	Solvent	121	100% to waste	No Hazard.	No impact potential
Hydrochloric acid solution	Inorganic acid	60	100% to waste	LC_{50}, 96 hours: 20.5 mg/l, Lepomis macrochirus (Bluegill) Acute toxicity - aquatic invertebrates EC_{50}, 48 hours: 0.45 mg/l, Daphnia magna EC_{50}, 72 hours: 0.73 mg/l, Freshwater algae Expected to be biodegradable. and not expected to be bioaccumulating	No impact potential
Caustic soda solution	Alkali	10	100% to waste as salt	Concentrations greater than 10ppm, especially in fresh water, or a pH value equal to or greater than 10.5 may be fatal to fish and other aquatic organisms. Can cause damage to aquatic plants. Can cause damage to vegetation. Low potential for bioaccumulation. Degrades readily by reaction with the natural carbon dioxide in the air. Harmful to aquatic organisms due to high pH.	No significant impact potential

NB: Figures above are given for a theoretical full year's production

5.2 Water Usage

The Agrochemical final product process consumes 9000 tes/yr of water. Water is used as a reagent, for line flushing, product washing and scrubber liquors.

5.3 Waste storage areas

The following waste storage areas will be in use

Name of the area	*Wastes Stored*	*Are the areas clearly identified including maximum storage capacity and maximum storage times?*	*How close is the area to sensitive boundaries? Including:* *• watercourses* *• areas of public use/vulnerable to vandalism* *• other sensitive boundaries.*	*Are any further improvements needed to minimise risks?*
Plant cc0843 storage compound	Solids from filtration post-Reaction stage And Non-routine waste material	Yes	Lees Beck runs under the main avenue next to the plant. Compound has a sump which is discharged to a storage for testing, prior to the site effluent treatment plant. No security or sensitive boundary issues	No

5.4 Significant waste streams

There are 2 significant liquid waste streams generated by the process, and one incidental solid waste stream; initial discussions have taken place with selected waste management companies regarding these streams. In general, these streams will be fully assessed during the commissioning phase of the plant with the initial arising probably being sent for disposal, typically by high temperature incineration. The recycled water is put back in to the process. These waste streams are shown on the Process Flow Diagram.

Possibilities for recovery operations are being pursued as a later project. This aims to enable onsite solvent recovery and minimise waste.

Source of the residue	*Residue Description*	*How do you, or propose to, deal with it?*	*Give details*
Reaction stage	Waste resin solids	Disposal / potential for recovery	The initial approach will be to dispose of the waste, e.g. incineration In the early years of production, trials will be considered for regeneration and recycle of the ion-exchange resin

Source of the residue	Residue Description	How do you, or propose to, deal with it?	Give details
Distillation Stage	Waste organic solvent - liquid	Disposal / potential for recovery	The waste is highly flammable. The initial approach may be to dispose of the waste, e.g. incineration, whilst commissioning takes place. Once manufacturing is established post-commissioning, the solvent will be recovered by a contractor and reused in the process
Isolation stage - mother liquors & washes from product filtration	Waste organic solvent - liquid	Disposal / potential for recovery	The waste is highly flammable. The initial approach will be to dispose of the waste, e.g. incineration, whilst commissioning takes place. Once manufacturing is established post-commissioning, the solvent will be recovered by a contractor and reused in the process

5.5 Energy consumption

The process and plant has no energy intensive operations or equipment. Detailed process instructions will include turning off equipment when it is not in use. The equipment within plant cc0843 will be linked into the site Process Control System (PCS) so that the operating parameters can be investigated or monitored from any networked personal computer on site.

Syngenta's Health, Safety and Environment (HSE) management system includes the management of sustainability matters and energy is one the key aspects included. Energy consumption is reviewed regularly with the aim of identifying areas for reduction.

5.6 Noise and Vibration

Routine operations on the whole site have been considered for the potential nuisance resulting from noise or vibration from; Chemical manufacturing operations (24 hours, 7 days a week); Materials handling and waste storage; Vehicle engine noise and reversing alarms; Contractor plant and machinery.

The conclusion from this is that the operations do not represent a high risk of causing annoyance as the noisier activities would be predominantly restricted to daytime working hours (08:00 to 18:00 and the chemical manufacturing activities do not generate significant noise levels.

Plant cc0843 is located relatively close to the site boundary and neighbouring residential property and management of the plant will consider the potential for annoyance to be caused; the main processing operations are inside the plant building, which will mitigate the potential for nuisance to result from noise and vibration.

6. Monitoring of process variables

We propose the following monitoring of the process for the routine operation, plus measures taken during the commissioning of the process.

The following table determines the routine air monitoring for the process, and the extra monitoring required during commissioning

Release Point	*Analyte*	*Routine Monitoring Frequency*	*During Commissioning*	*Monitoring Methods*
A51	Acetonitrile	6 monthly	Monitoring required during start-up	BS EN 12619 (or other method agreed in writing with the EA)
A52, A53, A54, A55	Particulates	None [expected emission is insignificant]	Check that equipment is installed and operating correctly	n/a

The following table determines the routine effluent monitoring of plant discharges for the process, and also the extra monitoring required during commissioning

Sample Name	*When*	*Analyte*	*Technique*	*Analyst*	*Discharge Limits*
Waste water samples	Every discharge to ETP	Verify composition	Analytical	QCESG	40 m^3/day
Final Site Effluent	For 6 months after commissioning	Acetonitrile	Analytical	QCESG	300mg/l

Prior to its discharge from the site at point S1, the effluent is subject to a Fill/Test/Empty regime at the Effluent Treatment Plant whereby up to 2000m^3 of effluent is held pending the completion of a set of agreed analytical tests, including Acetonitrile, to verify it is acceptable for discharging to the sewer. This is in addition to other indications from continuous in-line monitoring of the nature of the site effluent e.g. pH and total carbon.