H1 Assessment

EPR/XP3037SE

Empire Treatment Works

Veolia ES (UK) Limited

Previous version - December 2021 v1

Current version (this document) - February 2023 v2

H1 risk assessment of point source emissions to air from three scrubber emission points at Empire Treatment Works

1. Background

The air pollution control residue 'APCr' treatment plant at Veolia's Empire Treatment Works in Aldridge is a physico-chemical process which uses acidic liquid waste to neutralise the residual alkalinity of the APCr in a reaction which produces a non hazardous solid filter cake.

The current plant comprises:

- 6 APCr powder silos (SC1 - 6) and 4 bulk waste blending 'T' tanks (T1-4), and one new tank 'T5' which was installed in Q1 2022.
- 3 identical existing mixers (Existing Mixer 1 - 3) and one newer trial mixer (Trial Mixer 4) which was installed in Q1 2022.
- A central open conveying belt which accepts processed cake discharges from Existing Mixer 1 - 3 (Trial Mixer 4 discharges directly into the Process Cake Bay)
- A Process Cake Receiving Bay (50m^3 capacity)
- A single stage (acid liquor) scrubber system (A6)

The current process operated broadly as follows:

- APCr is received by transfer from road vehicles into one of six powder silos (SC1 - 6) which are arranged into pairs with each pair connecting to one process mixer.
- APCr is neutralised with acidic waste stored in the 'T@ tanks.
- The neutralisation reaction takes place in the mixers with reaction residues discharging onto a single open conveyor belt servicing all three mixers which transfers material to an open 'Process Cake Receiving Bay'.
- Capacity is maintained in the Receiving Bay by removing material by loading shovels and delivering to one of four covered storage locations located across the site.
- Once cake residue has completed reaction, it is loaded into tipper trucks by loading shovels for onward disposal.

The design of the current mixing and conveying system is largely of an open nature including the mixers and a single open conveyor system which deposits reacted cake

into an open bay. The current mixer and conveyor system require a high level of manual input and maintenance and the design makes cleaning challenging resulting in inefficiency due to both planned and unplanned downtime. The current mixers are each fed from only two each of the six lime silos which limits process flexibility and reduces options in the event of breakdown. The current component parts of the plant are generic rather than bespoke and are not optimised to handle the flow characteristics of the waste inputs, particularly the powder resulting in labour intensive, sub-optimal plant performance. The scrubber associated with the current system is an old single stage unit which limits the waste types which can be used as APCr neutralisers. An undersized Processed Cake Recieving Bay creates a bottleneck requiring multiple vehicle movements across the site resulting in the potential for cake tracking and unnecessary agitation representing a fugitive emission.

As a result, the current system could be improved to provide better controls to; increase operational flexibility, reduce the staff resource required to maintain the operation, reduce blockages causing outages, and also to further minimise fugitive odour potential through enclosed design and a multistage scrubber as well as reducing intrasite processed cake movement.

Veolia is therefore proposing an overhaul of the plant comprising a bespoke design taking into account the extensive experience within the business in processing the subject waste streams, lessons learned from operation of the current process and recent trials of new mixing equipment (see below).

Key improvements to the plant will effectively make it more enclosed providing better control of the source input material during processing principally by removing the need for an open conveying system and configuration the APCr infeed so that each input powder silo can feed any (new) mixer.

2. Trial Mixer 4

In 2022, under local Environment Agency area agreement, a new trial enclosed twin continuous paddle mixer ‘Trial Mixer 4’ was installed. Unlike Existing Mixers 1 - 3 which discharge to an open conveyor, the trial mixer is mounted to discharge via enclosed screw conveyor directly into the Process Cake Receiving Bay, removing the need for transport of reacted cake from the mixer by conveyor entirely. The installation and operation of Trial Mixer 4 was undertaken in parallel with one of the existing mixers being taken offline and did not represent an increase in throughput. The trial mixer incorporates an automatic cleaning system comprising a series of sparge pipes designed to reduce the need for manual cleaning. Additionally the trial mixer includes

hinged counterbalance covers which creates far easier access for routine cleaning and maintenance. The throughput of the mixer is approximately 24 m^3/hr and it was designed as a medium term prototype specified to trial the more enclosed approach to process control. Since installation the system has confirmed the anticipated improvement over the current configuration. The success of Mixer 4 has provided justification for the role out of the new technology across the rest of the APCr plant.

3. Review of project scope and timing

The APCr plant will now be upgrade as follows:

- Installation of two new 50 m^3/hr enclosed mixers (New Mixer 1 - 2) as part of a phased replacement / decommissioning programme (removal of existing Mixer 1 - 3 and Trial Mixer 4). Due to the available space in the APCr building being limited Mixer 1 will be installed in a temporary location initially then moved to its final location once space is made available from the removal of Mixers 1 - 3 and associated conveyor and the Process Cake Receiving Bay has been extended.
- Replacement screw feeders from powder silos into new mixers allowing any infeed combination. These will use variable speed drives to control volumetric control of powder flow and retractable screw and drive for ease of cleaning.
- Use screw feeders / screw conveyors which will removal of the need for open belt conveying
- Extension of the current 50m^3 processed cake bay to approximately double storage capacity at this location reducing a bottleneck in emptying the bay and also reducing vehicle intra site movements to other cake storage locations and reducing the potential for cake tracking and unnecessary agitation.
- Enclosure and extraction of the cake bay in addition to the mixers.
- Installation of a three stage scrubber to replace the existing single stage scrubber. The new scrubber will include three stages; a water / alkaline scrubber, acidic scrubber and a carbon scrubber. The three stage design is considered to increase assurance that acid and alkaline component gases from the neutralisation process are removed. The addition of a carbon filtration stage will ensure any residual volatiles that could be odorous are captured. The change to a substantially enclosed system will give the site the opportunity to extend the range of bulk acid neutralisers used within the process to include those with an organic fraction.

- An additional bulk waste blending tank ‘T5’ installed to allow for an increase in volume of bulk consolidated liquids and to provide a more robust process to allow for downtime and inspections on the other four ‘T’ tanks.

Table 1 - Comparison of current plant and the proposed end point

Current plant	New plant
6 APCr powder silos	6 existing APCr powder silos retained, improved silo to mixer feeding mechanism installed for new mixers.
4 bulk waste blending tanks (T1-4)	5 bulk waste blending tanks (4 existing retained and 1 new - ‘T5’). N.B. T5 is already installed under EA area agreement.
3 identical existing Mixers (Mixer 1-3) and one new trial Mixer (Trial Mixer 4)	2 entirely new enclosed mixers installed in a phased programme in parallel with decommissioning of Mixer 1 - 3 and Trial Mixer 4.
Central open conveying belt	Decommissioning of central conveyor belt system and replacement with enclosed screw conveyors for new Mixers 1 and 2. Removal of the central conveyor opens up space to relocate New Mixer 1, expand the Process Cake Receiving Bay and creates space for New Mixer 2.
Process Cake Receiving Bay	Expansion of the cake bay (roughly a doubling in capacity)
One stage (acid reagent) scrubber system (A6)	Three stage (acid reagent - alkali reagent - activated carbon) scrubber system with new emission point (A18). Decommissioning of the current one stage scrubber (A6) once the phased decommissioning of Mixer 1 - 3 and trial Mixer 4 is complete.

Table 2 - Phasing of the improvement project

Project action	Phasing
Installation of ‘Trial Mixer 4’ (under EA Area agreement)	February 2022
Installation of new acid tank ‘T5’ (under EA Area agreement)	February 2022
Installation of new scrubber ‘A18’	September 2023
Installation of new ‘New Mixer 1’ / removal of ‘Trial Mixer 4’	September 2023
Remove old conveyor and ‘Existing Mixer 1 - 3’ / decommissioning of single stage scrubber ‘A6’	October 2024
Extension of ash bay and relocation of ‘New Mixer 1’ to utilise space	Jan to may 2025

created by removal of existing ‘Mixer 1 - 3’ and ‘Trial Mixer 4’	
Installation of ‘New Mixer 2’	June 2025

4. Plant capacity

The overhaul of the plant will mean that there will be sufficient capacity available to meet future demand. As the mixers tend not to operate in parallel the increase to annual throughput will be gained principally from design optimisation leading to more efficient operation. The table below show that once the overhaul is complete maximum throughput will improve by approximately 25%.

Table 3 - Plant capacity and throughput

Input	Current	Future
APCr (tonne/yr)	60,000	75,000
Consolidated Liquid (tonne/yr)	29,552	36,940
Total (tonne/yr)	89,552	111,940
Throughput (tonne/day)	350	437

The ratio of APCr:Consolidated Liquid is based on roughly 67%:33% as this ensures there is enough liquid to neutralise the alkalinity of the APCr. The throughput of the plant is based on working day availability of 256 per year and operating for 6 hours a day.

5. Emissions to air

Any gas from the bulk blending tank (T5) will discharge through an existing scrubber listed as emission point A16 along with existing bulk blending tanks 'T1 - 4'. Gases generated from 'New Mixer 1 - 2' will discharge through a new three stage scrubber 'A18' which will be sited in the southeastern corner of the APC building at approximately SK 04406 02307. 'Existing Mixers 1-3' and 'Trial Mixer 4' will continue to discharge through existing single stage scrubber reference emission point 'A6' in the site plan. Decommissioning of 'Existing Mixers 1-3', 'Trial Mixer 4' and scrubber 'A6' will take place in a phased programme currently expected to run up to Q2 2025.

The emissions points which this assessment relates are:

- A16 - 'Main scrubber' - Acid plant storage and process and APC plant storage serving existing tanks 'Jumbo' storage tank, Acid storage tanks AR3 to AR8, Treatment tanks SP1 - 5, APC sludge tanks / PFT19, bulk waste blending tanks T1 - 4 and new T5. The scrubber uses an alkaline reagent and is designed to scrub acidic component gases e.g. hydrogen halides, sulphur dioxide, hydrogen sulphide (H_2S).
- A6 - 'One stage mixer scrubber' - serving 'Existing Mixers 1 - 3' and 'Trial Mixer 4'. The scrubber uses an acid reagent and is designed to scrub alkaline component gases such as ammonia and also remove any residual particulates.
- A18 - 'Three stage mixer scrubber' - serving proposed New Mixers 1 - 2. The scrubber use both acid and alkaline reagents in two separate stages to scrub both acid and alkaline component gases. There is a carbon polishing stage specified principally to ensure conditioning of the working area ensuring any VOC carried over from organic acid inputs are captured.

A screening impact assessment of emissions has therefore been undertaken using the Environment Agency Guidance 'Air emissions risk assessment for your environmental permit' and the EA's H1 tool.

6. Site location and receptors

The Facility is located off Stubbers Green Road off Longridge Road in Aldridge. The primary purpose is for storage and repacking of hazardous waste prior to disposal and recovery.

6.1. Human receptors

The land use surrounding the Facility is predominantly industrial in nature, the closest area of relevant exposure for both long and short term Environmental Assessment Levels 'EAL' are occupied houseboats in the canal basin to the east of the facility. Other human receptors are further afield and include residential houses to the north of the facility a minimum of 350 metres from the subject emission points. The Facility is located within Walsall AQMA which was declared on 01/04/2006, an area encompassing the whole borough (relating to both annual and hourly NO_2 objectives). The source of the NO_2 is indicated to be a 'mixture of road types'. Where relevant, background pollutant concentrations will be considered.

6.2. Ecological receptors

There are several ecological receptors within screening distance of the Facility, including a SAC and three SSSI. There are no Ramsar Sites or Special Protection Areas within screening distance.

Ecological receptors are described in table 1 and 2 below:

6.2.1. Ecological screening (10km)

Table 4 - Relevant ecological receptors (10km screening distance)

Special Areas of Conservation (England)			
Name	**Reference**	**Hectares**	**Distance from Facility (m)**
Cannock Extension Canal	UK0012672	5.15	3200

6.2.2. Ecological Screening (2km)

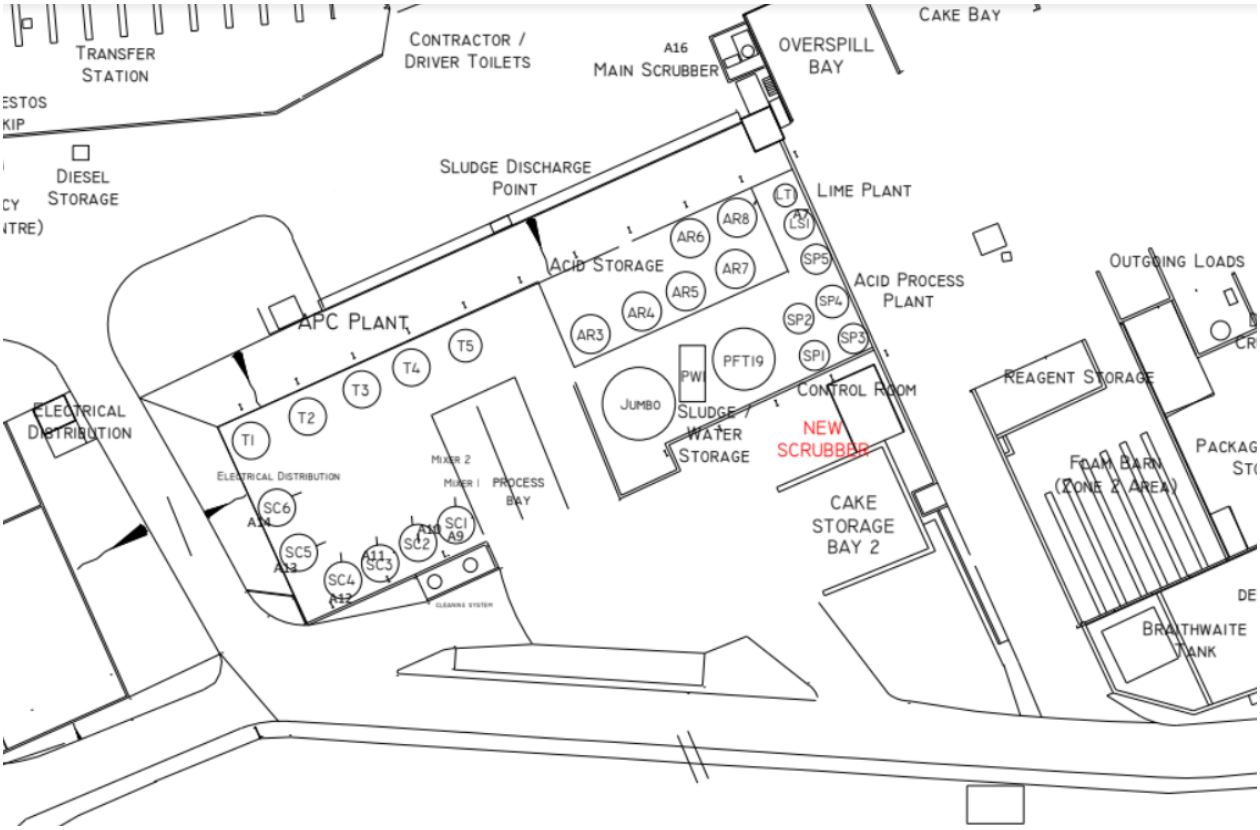
Table 5 - Relevant ecological receptors (2km screening distance)

Sites of Special Scientific Interest			
Name (citation type / driver)	**Reference**	**Hectares**	**Distance from Facility (m)**
Daw End Railway Cutting SSSI (Geological)	1002650	8.06	1833
Jockey Fields SSSI (Biological)	1002039	17.92	388

Swan Pool & The Swag SSSI (Biological)	1002427	6.12	417
Stubbers Green Bog SSSI (Biological)	1002154	2.78	600

7. New Mixer 1 - 2, New Scrubber A18 and expanded Process (receiving) bay

Fig 1 - Location of proposed new scrubber A18



8. Emission monitoring

Point source scrubber emissions from A6 and A16 are monitored monthly for all determinants using an extractive sampling method. A sample is obtained using an extractive sample pump from each scrubber vent stack through one or more impingers containing appropriate liquid to absorb the relevant gases / vapours. The sample pump is operated for a period of 30 - 45 minutes during a period when the associated treatment plant is being operated continuously to ensure the sample is representative. Impinger fluids are then analysed using a combination of ion chromatography and 'wet' analytical methods.

Particulate sampling was undertaken using an extractive sampling pump and an IOM sampler. The IOM sampler during the sampling period contained a 0.8µm membrane filter. The weight of the filter is recorded before and after sampling and the difference is used to calculate the particulate quantity.

Monthly monitoring for acid gas / alkaline gas / dust and VOC will be carried out in an equivalent manner for three stage scrubber unit A18 once operational.

This report considers sampling undertaken over the period January 2019 to December 2022. For screening purposes the maximum measurement result in the 4 year monitoring period has been used to account for time varying emissions as a worst case scenario. In the case of relevant long term standards this is highly conservative.

9. Main Scrubber 'A16'

9.1. System purpose and design

The A16 scrubber unit is designed to remove mineral acid gas from bulk storage and blending tanks.

Wet 'scrubber' systems involve the scrubbing of the flue gas with an aqueous based alkaline reagent to remove / neutralise the acid gas content of the emissions. The system is a packed bed scrubber with a highly efficient gas / liquid contactor designed for the purpose of removing pollutants from contaminated air and discharging abated air to atmosphere. The system is designed so the scrubbing liquor falls down the tower while the contaminated air passes up the tower allowing maximum mass transfer between a soluble gas and a solvent. The filtered air is exhausted through a 3m integrated stack at grid reference SK 04449 02311 situated next to the south east corner of the APCr treatment building.

The extended base section of the scrubber is utilised as a collection tank for the scrubbing solution and also as a location for the recirculation pump, level controls and pH sensor. The scrubbing solution is pumped from the scrubber base to the top of the packed bed section via the recirculation pipework system and is evenly distributed over the bed via a ladder distributor located at the top of the packed bed section. The scrubbing solution passes through the bed by gravity over the packing and down to the base collection tank.

The scrubber operates under a regime in which the pH of the scrubbing liquor is continuously monitored. The control panel is fitted with an alarm and if the pH of the liquor deviates from a set value then the alarm will sound.

9.2. Stack height and dispersion

The integrated standing stack serving the scrubber is approximately 3m emitting just above the eaves of the treatment plant building. As the stack is less than 2.5 times the height of the directly adjacent building there is potential for dispersion of emissions to be subject to the effects of airflow over the building envelope. In accordance with Environment Agency guidance for screening purposes the effective stack height is treated as zero.

9.3. Operational profile

Data relating to the number of hours the equipment is operational has been obtained from 2019 - 2022 for alkaline reagent scrubber A16 with average usage across both years at approximately 51%. The operational profile is not expected to change significantly as a result of the proposed additional bulk blending tank 'T5'. Currently the site operates for 16 hour days, however, for screening purposes continuous operation all year will be assumed as a starting point as VES is not seeking to request restricted hours of operation as part of the requested permit variation. Based on the operational profile it is considered both short term and long term exposure is relevant.

9.4. Emission characteristics

There are five bulk waste blending tanks (T1 to T5) installed that are used to blend a variety of bulked wastes prior to further treatment within the site. T5 was installed in Q1 2022 under EA area agreement. The tanks receive waste via a series of ways:

- Sludge inputs via off load point SV3,
- Acidic inputs from Acid Storage tanks AR3 and AR4
- Highly viscous and acidic packaged waste blends from tank SP4

These tanks are mixed to achieve a certain consistency and acidity before moving onto further treatment, into the APCr Mixers. The addition of the new T5 tank and associated extraction increases the volumetric flow to the scrubber with a resulting total flow at the point of emission of 6850m^3 / hr. The modifications to the system have been subject to detailed design to ensure sufficient capacity is available for the increased flow and for example there will be no carry over through the stack. The established monitoring regime for emission point A16 includes HCl, Cl, NH_3, SO_2, NO_2 and H_2S and is deemed to be suitable for use in screening the impact of the proposed changes.

9.5. H1 Source data

Table 6 - H1 source input data (A16)

Item	Unit	Value
Stack data		
Stack height	m	3
Effective stack height	m	0
Stack location	OS Grid Reference	SK 04449 02311
Flue gas conditions		
Operating temperature	^{o}C	Ambient
Volume at actual conditions	Am^3/s	6850
Pollutant concentrations and mass emissions (maximum from 4 years monthly monitoring data)		
HCl release concentration	$\mu g/m^3$	11.62
HCl release rate	g/s	0.00022
Cl release concentration	$\mu g/m^3$	35.20
Cl release rate	g/s	0.000067
NH_3 release concentration	$\mu g/m^3$	2.31
NH_3 release rate	g/s	0.000004
SO_2 release concentration	$\mu g/m^3$	11.73
SO_2 release rate	g/s	0.000022
NO_2 release concentration	$\mu g/m^3$	7.52
NO_2 release rate	g/s	0.000014
H_2S release concentration	$\mu g/m^3$	9.10
H_2S release rate	g/s	0.000017
H_2SO_4 release concentration	$\mu g/m^3$	2.63
H_2SO_4 release rate	g/s	0.000005
Operational profile	%	51% (4472 hours) based on actual operation. 67% (5840 hours based on 16 hours

		per day.

* Based on 2019 - 2022 operational data

10. Existing single stage APC mixer scrubber 'A6'

10.1. System purpose and design

The A6 scrubber unit is designed to remove alkaline gas including ammonia generated during the APCr mixing process. The system scrubs the flue gas with an aqueous based acid reagent to remove / neutralise the alkaline gas content of the emissions.

The system is a packed bed wet scrubber of similar design to the scrubber serving emission point A16. The scrubbing liquor is pumped to a high point and falls down the tower while the contaminated air stream passes up the tower allowing maximum mass transfer between soluble gas and a solvent. The filtered air is exhausted through a 3m free standing stack at grid reference SK 04393 02341 situated immediately to the west of the APCr mixers.

The base section of the scrubber is utilised as a collection tank for the scrubbing solution and also as a location for the recirculation pump, level controls and pH sensor. The scrubbing solution is pumped from the scrubber base to the top of the packed bed section via the recirculation pipework system and is evenly distributed over the bed. The scrubbing solution passes through the bed by gravity over the packing and down to the base collection tank.

The pH of the scrubber liquor is continuously monitored and the system is fitted with an alarm which sounds if there is deviation beyond a specified operational range.

10.2. Stack height and dispersion

The integrated standing stack serving the scrubber is approximately 3m emitting just above the eaves of the treatment plant building. As the stack is less than 2.5 times the height of the directly adjacent building there is potential for dispersion of emissions to be subject to the effects of airflow over the building envelope. In accordance with Environment Agency guidance for screening purposes the effective stack height is treated as zero.

10.3. Operational profile

Data relating to the number of hours the equipment is operational has been obtained from 2019 and 2020 for scrubber A6 with average usage across both years at

approximately 24%. The operational profile is not expected to change significantly as a result of the proposed changes. Currently the site operates for 16 hour days, however, for screening purposes continuous operation will be assumed all year as a starting point as VES is not seeking to request restricted hours of operation as part of the requested permit variation. Based on the operational profile it is considered both short term and long term exposure is relevant.

10.4. Emission characteristics

Trial Mixer 4 is supplied with APCr from a Silo via a single tubular screw conveyor and consolidated liquid from a 'T' tank via a centrifugal pump. Once the materials are mixed, the product (or cake) discharges from the mixer outlet into the 'cake' bay located below. The addition of Trial Mixer 4 and associated extraction will increase the volumetric flow to the scrubber with a resulting total flow at the point of emission of 4000m^3 / hr. The modifications to the system have been subject to detailed design to ensure sufficient capacity is available for the increased flow and for example there will be no carry over through the stack. In the case of the A6 scrubber it was historically moved from a different plant and the design capacity is higher than the currently proposed flow. The established monitoring regime for emission point A6 includes NH_3 and particulates and is deemed to be suitable for use in screening the impact of the proposed changes.

10.5. H1 Source data

Table 7 - H1 source input data (A6)

Item	Unit	Value
Stack data		
Stack height	m	3 (approx)
Effective stack height	m	0
Stack location	OS Grid Reference	SK 04393 02341
Flue gas conditions		
Operating temperature	^oC	Ambient
Volume at actual conditions	Am^3/hr	4000
Pollutant concentrations and mass emissions (maximum from 4 years monthly monitoring data)		
NH_3 release concentration	$\mu g/m^3$	1.36
NH_3 release rate	g/s	0.000002

Dust release concentration	µg/m^3	32
Dust release rate	g/s	0.000036
Operational profile	%	24% (2080 hours) based on actual operation* 67% (5840 hours based on 16 hours per day.

* Based on 2019 - 2022 operational data

11. New three stage APC mixer scrubber 'A18'

11.1. System purpose and design

The new A18 scrubber unit is designed to treat 4000m^3/hr of gas at 20°C through a three stage treatment process comprising a water / alkaline reagent (e.g. NaOH), an acid reagent (e.g. H_2SO_4) and an activated carbon filter. Each of the acid and alkaline scrubbers will have a 1.59m^3 integral sump of HDPE build. Both alkaline and acid scrubbing stages will be of packed bed design. In each case the scrubbing reagent is pumped to a high point and falls down the tower while the contaminated air stream passes up through the tower allowing maximum mass transfer between soluble gas and a solvent. The base section of the scrubber is utilised as a collection tank for the scrubbing solution and also as a location for the recirculation pump. The A18 scrubber unit is designed to remove both alkaline gas including ammonia and acid gases which could be generated in the APCr neutralisation process. The final stage of the scrubber is an activated carbon filter which has been included to remove any residual and / or potentially odorous volatile organics in the waste gas stream. The carbon filter is essentially a polishing stage specified principally to condition the working area immediately around the APCr building. The addition of the carbon scrubbing stage may also allow for an expansion of the input waste neutralisers to include a higher organic fraction however this would be done in a controlled manner including laboratory bench testing and the sites established waste acceptance protocols. Carbon breakthrough will be monitored and exchange carried out as required. The design of the system will extract air from both the newly enclosed Process Cake Storage bay and the connected New Mixer 1 and 2.

The filtered air is exhausted through an approximately 3m stack at grid reference SK 04406 02307 sited in the southeastern corner of the APCr treatment building.

The new scrubber incorporates the following features:

- Differential pressure transmitter to monitor pressure drop which may indicate blockage / loss in efficiency, or if the package media need cleaning or replacing.
- Liquid reagent flow control and monitoring which can indicate blockages / pipework restrictions or spray nozzle blinding,
- An inline pH probe which provides a real time indication of when scrubber liquor is spent and requires replacement including the option to set a trigger alarm.
- Fabrication of HDPE design material (PE100 grade) producing a highly corrosion resistant ta.

11.2. Schematic of new three stage scrubber system A18

Fig 2 - Design overview of the proposed new scrubber

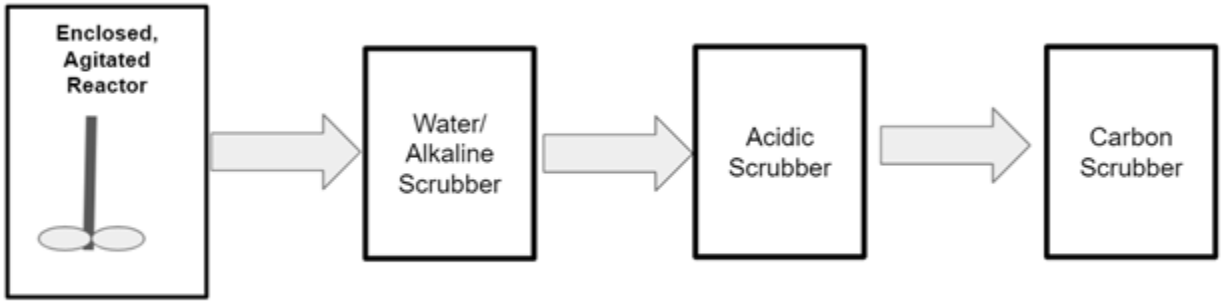
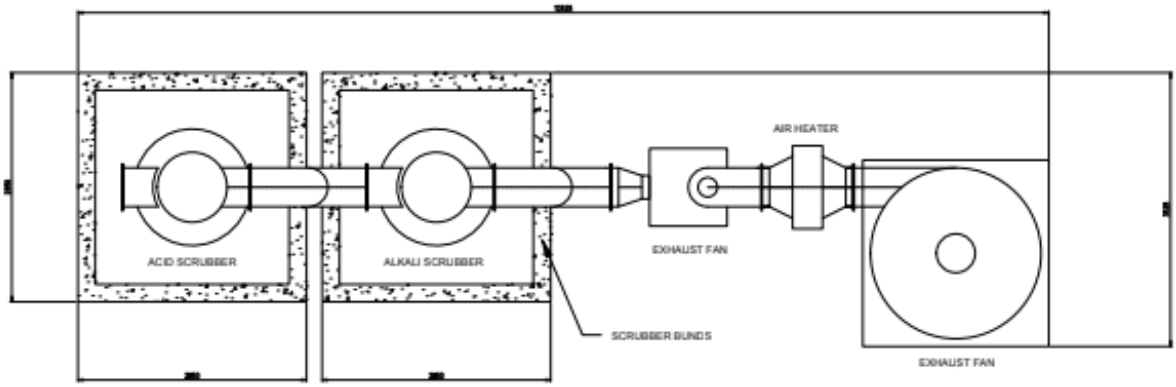


Fig 3 - Indicative site layout for the new scrubber system



11.3. Stack height and dispersion

The integrated standing stack serving the scrubber will be approximately 3m tall emitting just above the eaves of the treatment plant building. As the stack is less than 2.5 times the height of the directly adjacent building there is potential for dispersion of emissions to be subject to the effects of airflow over the building envelope. In accordance with Environment Agency guidance for screening purposes the effective stack height is treated as zero for the purpose of the H1 assessment.

11.4. Operational profile

Data relating to the number of hours the equipment is operational has been obtained from 2019 to 2022 for scrubber A6 with average usage across all years at approximately 24%. For the purpose of this assessment it is assumed that the new A18 three stage scrubber will operate with the same profile as the existing A6 single stage scrubber.

Currently the site operates for 16 hour days, however, for screening purposes continuous operation will be assumed all year as a starting point as VES is not seeking to request restricted hours of operation as part of the requested permit variation. Based on the operational profile it is considered both short term and long term exposure is relevant.

11.5. Emission characteristics

New Mixers 1 and 2 will be supplied with APCr from silos SC1 - 6 via tubular screw conveyor and consolidated liquid from one of 'T' tanks 1 - 5 via a centrifugal pump. Once the materials are mixed, the product (or cake) will discharge from one of the mixer outlets into the Process Cake Receiving Bay located below.

It is proposed that the cake bay will be enclosed and the new three stage scrubber A18 will pull air from the bay creating a negative pressure through the enclosed mixers and associated conveyors.

The volumetric flow to the scrubber will result in total flow at the point of emission of 4000m^3 / hr. The system has been subject to detailed design to ensure sufficient capacity is available. The system has not been installed so these have been estimated using monitored data from existing emission points A6 and A16 and the design volumetric flow rate.

11.6. H1 Source data

Table 8 - H1 source input data (A18)

Item	Unit	Value
Stack data		
Stack height	m	3 (approx)
Effective stack height	m	0
Stack location	OS Grid Reference	SK 04406 02307
Flue gas conditions		
Operating temperature	^{o}C	Ambient
Volume at actual conditions	Am^3/hr	4000
Pollutant concentrations and mass emissions (estimated using maximum from 4 years monthly monitoring data for emission points A6 and A16)		
NH_3 release concentration	$\mu g/m^3$	1.36
NH_3 release rate	g/s	0.000002
Dust release concentration	$\mu g/m^3$	32
Dust release rate	g/s	0.000036
HCl release concentration	$\mu g/m^3$	11.62
HCl release rate	g/s	0.00022
Cl release concentration	$\mu g/m^3$	35.20
Cl release rate	g/s	0.000067
SO_2 release concentration	$\mu g/m^3$	11.73
SO_2 release rate	g/s	0.000013
NO_2 release concentration	$\mu g/m^3$	7.52
NO_2 release rate	g/s	0.000014
H_2S release concentration	$\mu g/m^3$	9.10
H_2S release rate	g/s	0.000010
H_2SO_4 release concentration	$\mu g/m^3$	2.63
H_2SO_4 release rate	g/s	0.000003
Operational profile	% estimated	24% (2080 hours) based on actual

		operation of A6* 67% (5840 hours) based on 16 hours per day.

* Based on 2019 - 2022 operational from existing scrubber A6 and A16

12. H1 Output

12.1. Process contributions for screened substances

Air Impacts

Calculate Process Contributions of Emissions to Air

This table estimates the Process Contribution (PC), calculated as the maximum ground level concentration for each emission listed in the inventory, according to the release point parameters input earlier. If you have more accurate data obtained through dispersion modelling, this may be entered as indicated and will be used instead of the estimated PC.

Number	Substance	Long Term EAL µg/m3	Long Term PC µg/m3	Long Term * Modelled PC µg/m3	Short Term EAL µg/m3	Short Term PC µg/m3	Short Term * Modelled PC µg/m3
1	Ammonia (human health receptor)	180	0.00110		2500	0.0289	
2	Particulates (PM10) (24 hr Mean)		-		50	0.278	
2	Hydrogen chloride		-		750	0.137	
3	Particulates (PM10) (Annual Mean)	40	0.0106			0.278	
3	Hydrogen sulphide	140	0.00406		150	0.107	
4	Sulphur Dioxide (15 Min Mean)		-		266	0.138	
5	Nitrogen Dioxide	40	0.00335		200	0.0882	
6	Chlorine		-		290	0.414	
7	Ammonia (ecological receptor - Sensitive Lichens)	1	0.00110			0.0289	
8	Nitrogen Dioxide (Ecological - Daily Mean)	30	0.00335		75	0.0882	
9	Sulphur Dioxide (1 Hour Mean)		-		350	0.138	
10	Sulphur Dioxide (24 Hour Mean)		-		125	0.138	
11	Sulphur Dioxide (Ecological - Sensitive Lichens)	10	0.00522			0.138	
14	Sulphuric acid	10	0.00116		300	0.0306	

12.2. Stage 1 impact screening

Air Impact Screening Stage One

Screen out Insignificant Emissions to Air

This page displays the Process Contribution as a proportion of the EAL or EQS. Emissions with PCs that are less than the criteria indicated may be screened from further assessment as they are likely to have an insignificant impact.

Number	Substance	Long Term EAL	Short Term EAL	Long Term			Short Term		
				PC	% PC of EAL	> 1% of EAL?	PC	% PC of EAL	> 10% of EAL?
		µg/m3	µg/m3	µg/m3	%		µg/m3	%	
1	Ammonia (human he	180	2,500	0.00110	0.000609	No	0.0289	0.00116	No
2	Particulates (PM10) (	-	50.0	-	-		0.278	0.555	No
2	Hydrogen chloride	-	750	-	-		0.137	0.0182	No
3	Particulates (PM10) (	40.0	-	0.0106	0.0264	No	0.278	-	
3	Hydrogen sulphide	140	150	0.00406	0.00290	No	0.107	0.0714	No
4	Sulphur Dioxide (15	-	266	-	-		0.138	0.0518	No
5	Nitrogen Dioxide	40.0	200	0.00335	0.00837	No	0.0882	0.0441	No
6	Chlorine	-	290	-	-		0.414	0.143	No
7	Ammonia (ecological	1.000	-	0.00110	0.110	No	0.0289	-	
8	Nitrogen Dioxide (Ec	30.0	75.0	0.00335	0.0112	No	0.0882	0.118	No
9	Sulphur Dioxide (1 H	-	350	-	-		0.138	0.0393	No
10	Sulphur Dioxide (24 H	-	125	-	-		0.138	0.111	No
11	Sulphur Dioxide (Ecc	10.00	-	0.00522	0.0522	No	0.138	-	
14	Sulphuric acid	10.00	300	0.00116	0.0116	No	0.0306	0.0102	No

13. Discussion

The combined emissions from existing scrubber units A16 and A6 and proposed scrubber A18 are screened out at stage 1 of the H1 assessment meaning that long term emissions are less than 1% of the respective long term Environmental Assessment Level 'EAL' and short term emissions are less than 10% of relevant short term EAL. In air quality terms the emissions can be considered insignificant for both human health and ecological receptors.

There are also several reasons why the assessment can be considered conservative. The H1 assessment assumes continuous operation, the actual operational profile is much lower for all three scrubbers. The H1 assessment assumes continuous operation of all three scrubbers as a conservative starting point. Given the results show insignificance during simultaneous operation there was no need to model the phasing including decommissioning of A6 once Existing Mixers 1 - 3 and Trial Mixer 4 are removed. Pollutant emissions H1 inputs are based on monthly monitoring carried out between January 2019 and December 2022 so a wide range of operational conditions have been covered including a substantial period where Trial Mixer 4 has been operating. The availability of monitored data, which in this case establishes very low mass emission of relevant pollutants, provides reassurance that the chemistry of

the tanks and mixers is well controlled. Maximum recorded emission during the selected 4 year monitoring period has been used for each parameter screened as part of the assessment which is highly conservative.

Even based on the conservative assessment the combined process contribution of the scrubber units is several orders of magnitude lower than the stage 1 screening threshold.

14. Conclusions

The results of the risk assessment and screening exercise show that operation of all emission points can be treated as insignificant in air quality terms. Existing and proposed scrubbers systems will be subject to operation, servicing and maintenance in accordance with manufacturer's recommendations. Procedures are in place to ensure filter media and reagents are replaced when required and any malfunctions or breakdowns are detected quickly and resolved.