Caulmert Limited

Engineering, Environmental & Planning
Consultancy Services

Knottingley Waste to Resource Facility

FCC Recycling (UK) Limited

Environmental Permit Variation Application

Process Description and BAT Review for the Physical and Physico-chemical Treatment of Aqueous & Inorganic Wastes, Solids and Sludges

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DISCLAIMER

Process Description and BAT Review for the Physical and Physico-chemical Treatment of Aqueous & Inorganic Wastes, Solids and Sludges

TABLE OF CONTENTS

DRAWINGS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

1.1 Overview

1.1.1 FCC Recycling (UK) Limited ('the Operator') (a subsidiary of FCC Environment (UK) Limited) have appointed Caulmert Limited to prepare an environmental permit variation application to vary its existing permit ref. EPR/JP3547JL to include additional activities at the Knottingley Waste to Resource Facility on Weeland Road, Knottingley, West Yorkshire, at postcode WF11 8DZ (hereafter referred to as 'the Site').

1.1.2 FCC Recycling (UK) Limited currently operates the Knottingley Waste to Resource Facility which is dedicated to the storage, transfer, treatment, and recovery of industrial wastes. The site is located in Knottingley occupying a site historical associated with chemical processing, notably coal tar and related products dating back to the mid-Victorian era. The site falls within a larger area previously occupied by coal tar processing activities (to the East and West) now a mix of industrial and low-grade agricultural land. The Bank Dole Cut and Lock (part of Aire and Calder Navigation canal) and the River Aire lies to the North, and the A645 road to the South. Approximately 300m to the West, over the canal, lies an industrial area including a glassworks beyond which are residential areas.

1.2 Proposed Operation

1.2.1 The Operator proposes to carry out a series of physical and physico-chemical treatment activities to facilitate recovery and disposal activities under the following headings:

- The physical aspect will include the inspection, storage, and processing (e.g., dismantling and sorting, separation, bulking or shredding) of hazardous and non-hazardous materials for recovery or off-site disposal;
- Physico-chemical treatment of Aqueous and Inorganic Wastes which will include physico-chemical treatment of solid and liquid wastes to facilitate recovery or disposal;
- Physico-chemical treatment of Solids and Sludges involving drying of solid and sludge wastes to facilitate recovery or disposal;
- Metals and Inorganic Salts Recovery; and
- Drying.

1.2.2 The physical and physico-chemical treatment processes will incorporate mixing, blending, separating, washing, filtering, chemical treatment (including pH adjustment, redox reactions, precipitation reactions, absorption, adsorption), solids separation (filtering, decanting), drying and storage for recovery or disposal.

1.2.3 The metals and inorganic salts recovery will comprise pH adjustment, precipitation reactions, extraction/separation of precipitated solids, washing and storage for recovery of the precipitated solids, with the remaining liquid effluent either being treated on site or taken off-site for further treatment.

1.2.4 In addition, drying of non-flammable and inorganic wastes to drive off water as steam and produce a granular, low dust, 10 % moisture solid for recovery or disposal.

1.3 Report Context

1.3.1 This report provides a process description and a Best Available Techniques (BAT) review for all existing and proposed waste treatment activities listed below, as well as the remaining activities under the existing permit ref. EPR/JP3547JL.

- Inspection, storage, and processing (e.g., **dismantling and sorting, separation, bulking or shredding**) of hazardous and non-hazardous materials for recovery or offsite disposal;

- **Physico-chemical treatment of Aqueous and Inorganic Wastes, Solids and Sludge** of up to 300 tonnes per day treatment that will include pH adjustment, chemical precipitation, reduction, oxidation, blending and filtering, in an enclosed, self-bunded building with a wet scrubber and carbon filter extraction outside. This will also include shredding and repackaging of waste materials, storage of palletised packaged wastes, reagents and solids and use of a filter press. Fully bunded tank areas will be provided for storage in separate tanks, including bunded vehicle reception area. Suitable wastes may be used to replace reagents in the proposed leachate and aqueous waste treatment operation (see document ref. 5827-CAU-XX-XX-RP-V-0307 for more details), or in other treatment processes. The physico-chemical treatment of solids and sludge will include preparing/conditioning air pollution control residues, etc. and storage of solids and sludge in enclosed, self-bunded buildings; this will involve mixing, washing, filtering, precipitating out, conditioning and filter pressing with outputs not used on site, being transferred for recovery, treatment or disposal.

- **Metals and Inorganic Salts Recovery** of up to 200 tonnes daily treatment that will include sequential pH adjustment of wastes, precipitation reactions (through addition of reagents or suitable wastes), separation of precipitated solids by extraction or filtration and storage for recovery of the solids (e.g. ferrous sulphate, various heavy metal salts etc.) with the remaining liquid effluent taken off-site for suitable treatment or disposal. There will be storage and mixing tanks sited within bunded areas with vented air passed through wet gas scrubbers. All process equipment within the building with venting via the wet scrubbers.

- **Drying** using GPD 14W 190 Single Condenser paddle dryer or similar drier will be used to dry up to 200 tonnes of wet solids per day. The operation involves drying

the wet solids in vessels equipped with heated paddles to drive off water as steam and produce a granular, low dust, 10% moisture solid for recovery or disposal at a suitable site. Steam will be discharged via a low stack or condensed for release to sewer per the Discharge Consent in place at the site. The solids will be stored within RORO skips to await recovery or disposal. Wastes to be dried are non-flammable and inorganic.

1.3.2 These activities involve the following listed activities:

- *Section 5.6 A(1)(a) 'Temporary Storage of hazardous waste with a total capacity >50 tonnes'.*
- *Section 5.3 A(1)(a)(ii) 'Crushing of empty metal drums/containers + Packaged waste processing including sorting, washing, shredding, crushing and repackaging of hazardous waste materials'.*
- *Section 5.3 A(1)(a)(iv) 'Recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving repackaging'.*
- *Section 5.3 A(1)(a)(ii) 'Recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physicochemical treatment.'*
- *Section 5.3 A(1)(a)(iii) 'Recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving blending or mixing.'*

1.4 BAT Assessment

1.4.1 The above operations are assessed in line with the following BAT conclusions and guidance:

- '*Best Available Techniques (BAT) Conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council*', from the Official Journal of the European Union [1];
- Environment Agency (EA) guidance '*Chemical waste: appropriate measures for permitted facilities*' published 18 November 2020. [2]

1.5 Additional Report within the Permit Variation Application

1.5.1 The other activities to be added to the permit as part of this permit variation application have been assessed against the relevant BAT and appropriate measures in the following reports:

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.208.01.0038.01.ENG&toc=OJ%3AL%3A2018%3A208%3ATOC
[2] https://www.gov.uk/guidance/chemical-waste-appropriate-measures-for-permitted-facilities

- 5827-CAU-XX-XX-RP-V-0306 - Process Description and BAT Review for RDF Preparation.
- 5827-CAU-XX-XX-RP-V-0307 - Process Description and BAT Review for the Physico-chemical and Biological Treatment of Leachate and Aqueous Wastes.

2.0 WASTE PRE-ACCEPTANCE AND ACCEPTANCE

2.1 Waste Pre-acceptance

Pre-acceptance assessment

2.1.1 Before any waste is accepted onto site, a pre-acceptance assessment must be carried out. Here information on wastes requiring recovery or disposal shall be received as an enquiry. The initial enquiry should provide sufficient information to start the pre-acceptance assessment of the waste. Where it does not, further information shall be requested.

2.1.2 The information provided must include the following:

- A general description including the characteristics and composition of the waste, to enable the hazards associated with the waste to be determined;
- Process of origin and EWC;
- Compositional information;
- Age of the waste;
- Size of container, quantity, and frequency of production;
- SDS (Safety Data Sheet) or analysis where it is available;
- Consideration will be given as to whether POPs may be present, and more information sought if required.

2.1.3 Where there is not enough information to assess the waste or a process route, more information will be requested from the client. Where sufficient information cannot be provided by the client to initially assess the waste, or the EWC for the waste is not listed as acceptable in the Environmental Permit for the receiving site, the enquiry shall be declined.

2.1.4 The enquiry will be given a unique reference number which shall allow recording of information, including analyses, associated hazard, and process route, which can be accessed throughout the pre-acceptance and acceptance process and ensuring traceability throughout.

2.1.5 Samples may be requested to assist with the characterisation of the waste material or to help identify the most suitable process route (this is covered in the document ref. **'IMS-4-01.02.06-BM Processing Pre-acceptance Samples' procedure**). Where the material is deemed unsuitable for processing on site, consideration will be given to transfer the material to an alternative site to enable a more suitable recovery of disposal route to be undertaken.

2.1.6 An indicative quotation, if requested by the client, may be issued subject to a further assessment of a sample or the provision of more information.

2.1.7 Where a sample is not possible as the waste will not yet exist until it is required to be removed (e.g., from a cleaning operation or from a new production process) or derives from an emergency or spillage, then an indicative quotation, using the expected composition

information, shall be issued stating the conditions required for the waste to be acceptable. Sampling to meet pre-acceptance will be undertaken on the first load of such material to provide sufficient information to confirm acceptability and process route. If necessary, a waste may be rejected at this stage.

2.1.8 Pre-acceptance samples will undergo analysis by the site's laboratory chemist and may also be analysed at a third party laboratory.

2.1.9 Once sufficient information on the waste stream has been supplied and a suitable route identified, an appropriate quotation will be provided to the client. The quotation shall refer to any samples provided (and its reference number), its characteristics or composition determined, any restrictions on the waste or quantity and the proposed disposal site(s). The quotation shall refer to the unique reference number that was allocated to the enquiry.

2.1.10 Where a suitable recovery or disposal route cannot be identified, the waste shall be declined.

2.1.11 All quotations and associated information shall be retained for six years.

Pre-acceptance assessment of samples

2.1.12 When a sample is received, it shall be subject to an assessment on whether the container and labelling are suitable to allow safe storage and handling. If necessary, the sample shall be repackaged and/or relabelled.

2.1.13 Assessment will be made to ascertain whether there is a need for special preservation or storage requirements of samples. Unless storage at ambient temperatures in glass, polyethylene or metal containers will result in a significant change to the characteristics or hazards associated with a waste, then no special techniques are required.

2.1.14 Based on the information provided with the initial enquiry, the likely process route shall be confirmed. A treatability assessment shall be undertaken to confirm that the route is correct, and the required level of treatment can be achieved. The treatability assessment as a minimum will confirm the characteristics and composition of the waste relevant to the process route. Where chemical treatment is required, assessment may include a lab scale mock-up of the treatment process so that suitability for treatment and the composition of treatment outputs and their fate can be confirmed.

2.1.15 Where the treatability assessment does not produce the desired outcome then consideration and assessment of alternative process routes will be made that can generate the desired outcome or the waste enquiry will be rejected.

2.1.16 Where appropriate, based on the details provided at the enquiry stage, the results of the treatability assessment and knowledge of similar wastes or treatment considerations prevalent at the time of receipt, additional treatability and analyses shall be undertaken. Analyses may be required at a third-party laboratory.

2.1.17 Treatability studies and associated analytical work undertaken by FCC Environment will be carried out in-line with good laboratory standards with the provision for tracking samples and results against the relevant enquiry, selection of appropriate test methods and appropriate calibration of equipment used.

2.1.18 Where third party analyses are required, this shall be to recognised standard (where an appropriate one exists) and where practicable, undertaken by a UKAS or MCERTS accredited laboratory. Analytical details shall be maintained for six years.

2.1.19 Samples received shall be retained for one month and treatability and analytical details shall be maintained for six years.

2.1.20 The waste characteristics, process route, and any special instructions shall be recorded on the Enquiry system referenced to the unique reference number of the enquiry.

2.2 Waste Acceptance

Bookings and Vehicle reception

2.2.1 Unless exceptional circumstances dictate, all wastes shall be booked into the site at least the working day prior to delivery. The booking shall identify the quotation reference and the European Waste Classification (EWC) code (this is covered in the document ref. **'IMS-4-01.08.01-BM Acceptance, Booking & Inspection Form Generation' procedure**). Where the code is not considered appropriate or not acceptable under the permit, the client will be contacted and the booking refused. If there is insufficient capacity so that the waste cannot be offloaded, then the booking request shall be declined. Under such circumstances, where an alternative site exists that can accept the waste, the client shall be informed of this. See permit boundary plan (ref. 5827-CAU-XX-XX-DR-V-1804) showing the proposed tanker holding area on the site.

2.2.2 Waste which arrive without pre-booking but have been pre-accepted and quoted may be accepted if capacity exists, otherwise the waste consignment shall be rejected.

2.2.3 The acceptance of hazardous waste requires a minimum HNC qualified Chemist or other suitable qualification. Wastes will not be received on site unless there is sufficient capacity to store or treat the waste and that sufficient staff are present to supervise this activity.

2.2.4 On arrival at the site, the vehicle will be weighed using the on-site weighbridge and then directed to the vehicle reception area. Documents relating to the waste consignment (transfer note and/or hazardous waste consignment note) shall be checked and where errors are evident these shall be corrected, if practicable, before the vehicle is accepted otherwise the load will be rejected.

2.2.5 Weighbridge records for loads received shall be generated using site weighbridges unless the vehicle has an acceptable printed weighbridge ticket the details of which will be recorded.

Where circumstances dictate weighing cannot be undertaken, an estimated weight based upon the vehicle size and the material being carried shall be. Weighbridge records form part of the Enquiry system which tracks wastes.

2.2.6 Bulk wastes will be sampled and/or inspected prior to unloading depending upon their type. Packaged wastes will be inspected prior to unloading for soundness of containment and subsequently inspected and sampled following unloading.

2.2.7 Following completion of unloading, the vehicle delivering the consignment shall be re-weighed and the consignment documentation completed. The weight details shall be recorded on the Enquiry system so that there is a record of the information of the waste enquiry, of pre-acceptance (where applicable) and acceptance of individual loads.

2.2.8 Following inspection and analysis of the loads, where significant variations from the pre-acceptance information are detected, the customer will be contacted to ascertain why the material differs from the enquiry as these variations in characteristics or composition which may indicate the waste is not as described. If the material is deemed to be acceptable on site, the sample will undergo the full pre-acceptance process, for tankers this will be prior to off-loading, so that the most suitable route can be determined. Should the material be unsuitable for process on site or a transfer route cannot be identified the load will be rejected.

2.2.9 In addition to that information on the Enquiry system, details of consignment notes, and associated weight records shall be maintained for six years.

Bulk Deliveries (tankers and skips)

2.2.10 Prior to off-loading bulk waste in tankers, the driver will be requested to obtain an appropriate sample or samples. They may be representative of the load as a whole or targeted (e.g. for settled solids or immiscible layers). The sample(s) will be analysed to confirm the characteristics and composition of the load against the initial enquiry and suitability for the intended process route will be confirmed (this is covered in the document ref. **'IMS-04-01.08.19-KETP Sampling of tankers' procedure**).

2.2.11 Where possible, tankered waste shall be received into an empty tank. If it is desirable that a waste be added to a storage tank which already contains a waste, the laboratory staff will then be responsible for assessing the compatibility of the wastes following the Procedure for Assessing Compatibility of Wastes to be Mixed during Storage. This is covered in the document ref. **IMS-4-01.07.37-KLAB**, and further supported by the **'KNY SWP 007 - Transfer and Bulking of Liquids' Safe Working Procedure (SWP).**

2.2.12 Skip deliveries will be directed into the appropriate off-loading area where the load will be visually checked against the expected description on the inspection form, with the Site Operator paying attention to any contamination, excessive dust, or odour.

2.2.13 Should the load contain a small amount of unexpected material, these will be segregated and sorted and disposed of accordingly. Any such incidental materials destined for offsite will be drummed or packaged and labelled appropriately. If the material is not acceptable onto site, it will be segregated and rejected.

Packaged Material Deliveries

2.2.14 The containers will be off-loaded and stored in the waste storage area. During the off-loading process, the general condition of the containers or pallets will be noted and repackaged or made safe if necessary (this is covered in the document ref. **'IMS-4-01.01.06-BM Offloading of Packaged Wastes' procedure**).

2.2.15 The consignment will be checked against the expected material description and each container 25L or above will be sampled. Samples will be taken using a dip tube, or similar, to obtain a representative sample. All containers will be resealed after sampling. The chemist will undertake any necessary tests including pH, flammability, odour, physical state, and code the drum with the process code to denote the intended route. Samples of all waste received and used for acceptance assessment shall be retained for two weeks.

2.2.16 If appropriate, more tests will be carried out to determine the best process route. In this instance, the container will be labelled appropriately to denote that it is waiting further testing. Once the sample has been analysed and the best process route identified, the container will be coded as appropriate and stored in the relevant bay.

2.2.17 Once the load has been checked, the containers will be stored in the relevant bay within the waste storage area awaiting processing or transfer and any conflicting labels will be sprayed out or removed. Only compatible materials will be stored together in each bay. Material will not be stored on site for longer than 6 months.

2.2.18 If the material differs greatly from the load expected, the containers will be stored in the quarantine area until more information has been received from the producer or further tests have been carried out to identify the material and process route. Once this has been verified, the load will either be re-located to the appropriate storage area or rejected.

Waste Aerosols

2.2.19 These may be accepted at the site. They will be segregated from other wastes and provided with dedicated storage. On receipt aerosols, visual inspection will be carried out to check for any sign of leak or significant damage and such aerosols will be segregated and dealt with appropriately dependent upon the issue identified (e.g. repackaged, allowed to vent). This is addressed in the document ref. **'IMS-4-01.01.09-BM Acceptance and Storage of Aerosols' procedure.**

Waste Tracking

2.2.20 Packaged waste will be tracked around site using a tracking system which stores the information electronically.

2.2.21 All waste material received in a container will be issued with a tracking number on arrival onto site. For smaller containers (<25L) or pallets, one tracking number per pallet may be issued. The movement of each container will be recorded and stored within this electronic system and the tracking process will be complete once the material has been processed or removed from site.

2.2.22 Bulk (tanker or skip) material will be tracked using written records which will include the quantity, location and a unique code or number relating to the delivery. The tracking process will be complete once the material has been off-loaded from the tanker or skip.

2.2.23 The tracking system will be checked regularly to ensure that any packaged material is removed from site within 6 months of arrival.

2.3 Storage

2.3.1 Waste storage is provided for bulk and packaged wastes in appropriate areas with segregation of incompatible materials. Where storage is in the open, wastes will be contained within packaging or larger containers suitable for the contents therein. Packaged wastes, which may be hazardous, stored in the open will be in suitable UN approved containers designed for such storage. Two storage areas will be used for this purpose on the site (see Permit Boundary Plan - 5827-CAU-XX-XX-DR-V-1804 for more details of the storage areas around the site).

Waste Storage 01

2.3.2 Waste Storage 01 is the existing (former) Compound F, now renamed as part of this permit variation application. It is an open, fully bunded area with a capacity of 375 pallets equivalent (PEq). It is intended to be used for the storage of compatible hazardous and non-hazardous materials awaiting further processing or transfer off-site (refer to the drawing mentioned in Section 2.3.1 above).

2.3.3 Spillages in this area will be contained and cleaned up accordingly following the document ref. **'IMS-4-05-09-13-KNY Spillage and Leakage – Incident Controller Checklist**.' Rainwater will be collected in the sump area provided and pumped out as required and treated or disposed of appropriately.

2.3.4 The following materials may be stored in this area, ensuring that only compatible materials are stored in the vicinity of each other:

- Aerosols in UN approved enclosed containers

- Skips of residues intended for off-site reuse, recovery, or disposal
- Oily rags in enclosed containers
- Packaged waste, non-hazardous and hazardous. Hazardous waste will be stored in UN approved containers

2.3.5 The packaged waste will be stored at a maximum height of 2 metres.

Waste Storage 02

2.3.6 Waste Storage 02 is the drum store, new renamed as part of this permit variation application. This is a covered, fully bunded area that is intended to serve as the packaged waste recovery storage building. It will be divided into two sections where materials may be temporarily stored (<1 working day within the inspection and repackaging area) or <6 months in the Storage bays.

2.3.7 Storage bays will be individually segregated and slope backwards, ensuring that any spilled liquid is contained within the bay and incompatible material will not be in contact with each other. The area is intended for the storage of hazardous and non-hazardous materials, awaiting further processing or transfer off-site.

2.3.8 The inspection and repackaging area will be separately bunded and used for the inspection and repackaging or bulking of non-hazardous waste materials.

2.3.9 Capacity of the two areas are broken down below:

- Reception, inspection, repackaging 84 PEq.
- Quarantine bay 64 PEq.
- Non-hazardous (3 bays) 96 PEq. per bay
- Flammable bay 64 PEq.
- Alkali bay 64 PEq.
- Harmful/toxic/environmentally hazardous bay 64 PEq.
- Acid bay 64 PEq.

2.3.10 The packaged waste will be stored at a maximum height of 2 metres.

3.0 PROCESS DESCRIPTION

3.1 Physical and physico-chemical Treatment of Aqueous and Inorganic Wastes

3.1.1 The Operator proposes that inorganic wastes, in aqueous or solid form, brought to the site will undergo different treatment processes such as pH adjustment, chemical precipitation, reduction, oxidation, blending and filtration, (including inspection, storage of palletised packaged wastes, reagents, and solids, as well as the use of filter press for processing) for recovery or disposal purposes. These activities will occur within enclosed buildings (i.e., Waste Processing 01, 02 and 06).

3.1.2 The physical aspect of the proposed activities will cover the inspection, storage, and processing (e.g., dismantling and sorting, separation, bulking or shredding) of hazardous and non-hazardous materials for recovery or offsite disposal. These activities will take place in Waste Processing 01 and 02 buildings respectively.

3.1.3 The buildings referred to above will have appropriate air extraction and mitigation systems to handle the processed materials and potential off-gases (see the Sampling and Emissions Points Plan - 5827-CAU-XX-XX-DR-V-1805 in the drawing section of this report for details and **Appendix 2** for summary of emission points and their corresponding grid references).

3.1.4 As seen on the permit boundary plan (ref. 5827-CAU-XX-XX-DR-V-1804), Waste Processing '01, 02, and 06' will have separate processes and bunded tank areas or storage bays. More details on the activities the Operator will carry out within these buildings is discussed below in this section.

3.1.5 Following waste pre-acceptance processes (as discussed in **Section 2** above), wastes characterisation will be carried out prior to waste acceptance and may be enhanced by laboratory and pilot trials to determine the optimal process route (from those available) to best recover most resource from the waste concerned. Such trials will direct subsequent processing of the waste.

3.1.6 These wastes may be accepted onto the site as packaged, bulk liquids or powdered solids and will be subjected to a series of physical and physico-chemical treatment for recovery and disposal. The aim of these treatment processes will be:

- To recover wastes which can be reused or recovered if gross contaminants are removed;
- To recover wastes which can be reused or recovered if repackaged;
- For processing of inorganic alkali wastes for suitable recovery applications, including aggregate replacement, soil stabilisation, agricultural lime or fertiliser, chemical reagent replacement, or raw materials for chemical manufacture;
- For cleaning of packaging, equipment and similar, for recovery or reuse;

- For removing components from aqueous wastes so that the water may be recovered or reused.

3.1.7 The stages of physical and physico-chemical treatment processes that will be employed will depend on the type of wastes (i.e., inorganic wastes in liquid or solid form) and whether they will require an initial storage prior to treatment (e.g., solids or liquids) for recovery and disposal (see process flow diagram in **Figure 1** below) or immediate treatment (e.g., liquids), see **Figure 2** below.

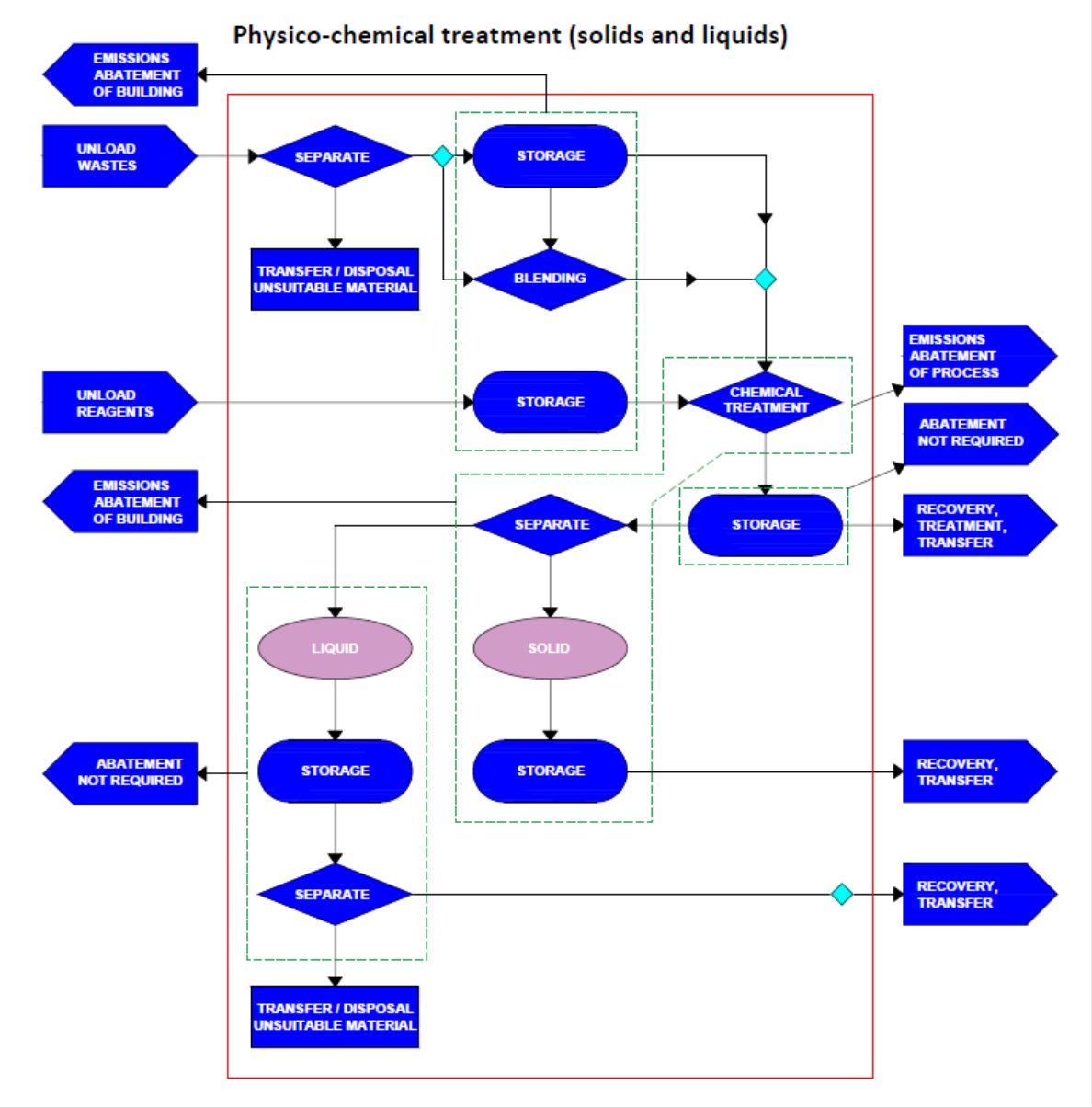

Figure 1: Physico-chemical Treatment Process Flow Diagram for Inorganic solid and liquid waste.

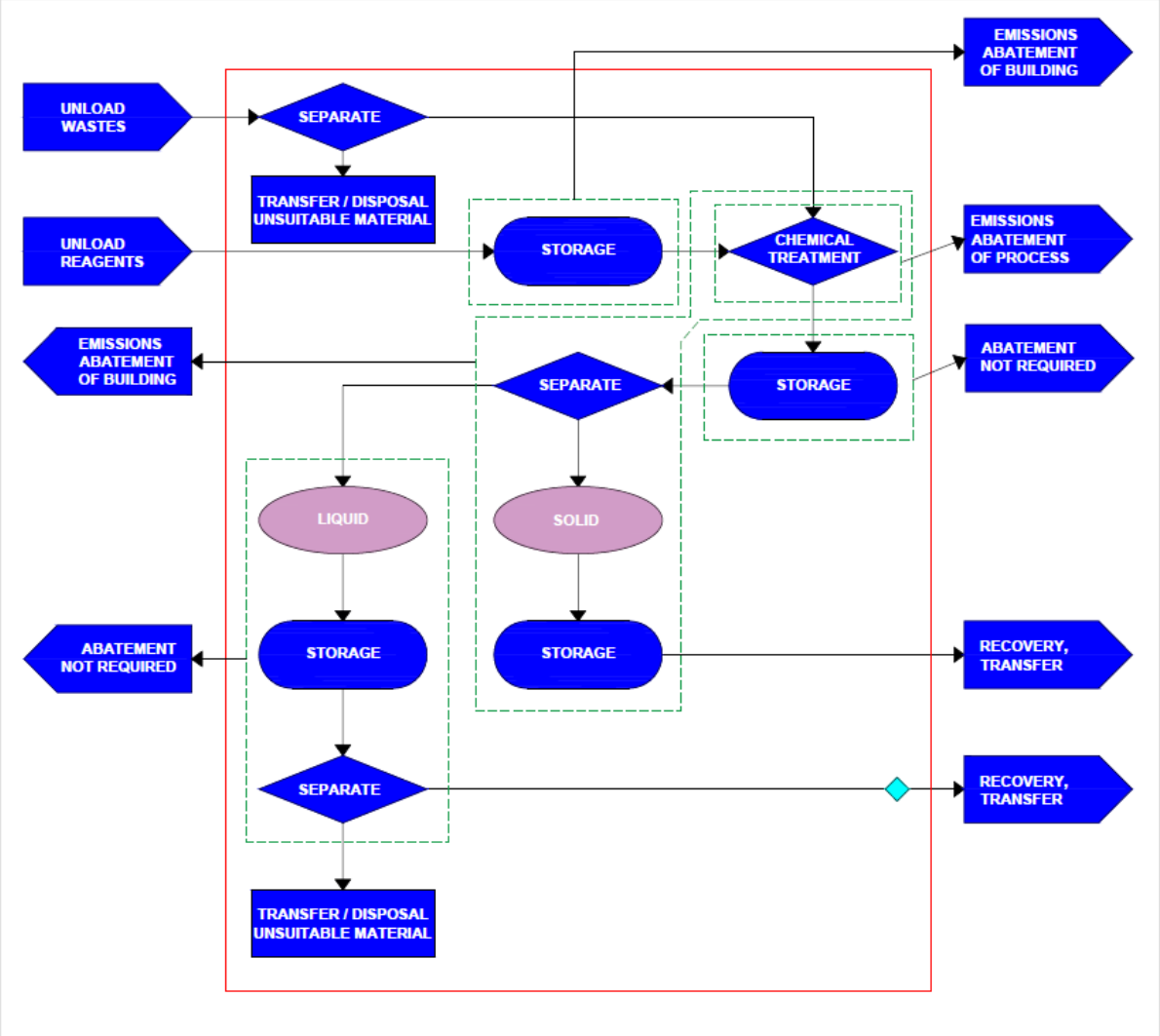

Figure 2: Physico-chemical Treatment Process Flow Diagram for Inorganic liquid waste without initial storage.

Waste Processing 01 and 02

3.1.8 Waste Processing 01 is an existing building, and 02 is a new building, both will undertake the same or similar activities. These buildings are fully enclosed and bunded, intended to be used for the storage, inspection, or processing of waste and each building will be split into 2 separate areas. One area is where the waste material may be stored prior to processing within the buildings.

3.1.9 The storage area in Waste Processing 01 will be split into bays with a capacity of 400 PEq. Storage bays are individually segregated and slope backwards, ensuring that any spilled liquid is contained within the bay and incompatible material will not contact each other. The other area is where the processing will be undertaken. It is not intended that waste will be stored in this area other than that which is awaiting processing.

3.1.10 In the Waste Processing 02 building, one area is where the waste material may be stored prior to processing within the building. The storage area will be split into bays with a capacity of 400 PEq. Storage bays are individually segregated and slope backwards, ensuring that any spilled liquid is contained within the bay and incompatible materials will not contact each other. The other area is where the processing will be undertaken. It is not intended that waste will be stored in this area other than that which is awaiting processing which will be kept to a minimum.

3.1.11 Both buildings are intended for the inspection, storage, or processing (e.g., dismantling and sorting, separation, bulking or shredding) of hazardous and non-hazardous materials before further processing on site for recovery or offsite disposal. Where appropriate, preference will be to dismantle or empty rather than shred to maximise the quality and quantity of recovered materials. Materials will be moved around the building using forklift trucks or similar.

3.1.12 These buildings will house a shredder which is intended to be used for reducing bulk material or segregate packaging from contents, prior to further processing. The shredder will be loaded using a forklift truck. The shredded material will be collected in suitable containers and transferred or repackaged for further recovery or disposal.

3.1.13 These buildings will be suitable for flammable materials. Earthing points will be located within the processing areas which will also house LEV, fume cupboard or similar local extraction equipment for removal of components during waste processing, dismantling, or bulking, as necessary.

3.1.14 Air exiting these buildings will be passed through the proposed extraction hoods (i.e., EP01 and EP09) for the Waste Processing 01 building, and an activated carbon filtration system (i.e., EP02) for Waste Processing 02 building in order to minimise emissions into the atmosphere.

3.1.15 The crushing of metal drums will also be conducted in one of these buildings using a drum crusher. This process will involve rinsing the drum out and then crushing it, after which it will be stored in skips and sent off-site for recovery. Wastewater generated from this process will be collected and sent off-site for further treatment. The same procedure will be applied to the solids when applicable.

3.1.16 The Operator anticipates that up to 100 T of water per year will be required for rinsing the drums depending on how much drums will be rinsed and the material that they are contaminated with. Hence, where possible, the operator will reuse rainwater collected from roofs and bunds for this purpose, which is deemed a sufficient amount for the required activities.

3.1.17 During processing, the doors will be kept closed to minimise noise and maximise control of fugitive emissions. Effluent generated from these activities will be taken off-site for further treatment.

3.1.18 Below are some examples of process flow diagrams illustrating typical waste processing activities that may be undertaken within these buildings.

Separation of mixed materials

3.1.19 Following acceptance and confirmation of acceptability:

- Items may be manually separated into the different materials present to allow further processing or transfer;
- Items may be mechanically separated by use of equipment such as magnets. See **Figure 3** below.

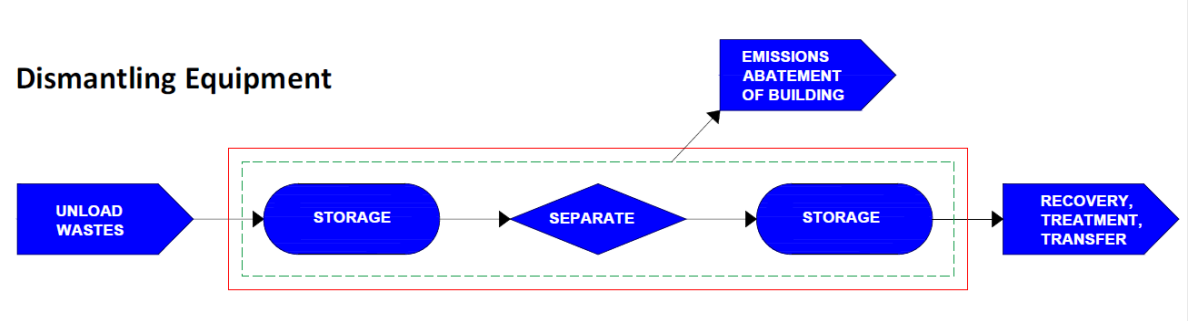

Figure 3: Simple Process Flow diagram illustrating dismantling of mixed waste materials.

Separation of materials received within packages

3.1.20 Following acceptance and confirmation of composition, and if appropriate, compatibility, wastes:

- May be decanted from smaller containers to larger ones to allow subsequent recovery or reuse;
- Residual packaging may be shredded to allow subsequent recovery or disposal;
- Packaged materials may be shredded, with or without washing, so that contents may be collected to allow subsequent recovery or disposal (see process flow diagram illustration in **Figure 4** below);
- Residual packaging may be washed and subsequently compacted or bailed to allow subsequent recovery or disposal. Where appropriate, wastewater generated from this activity will be treated on-site via the biological treatment plant if suitable, or tankered off-site for disposal.

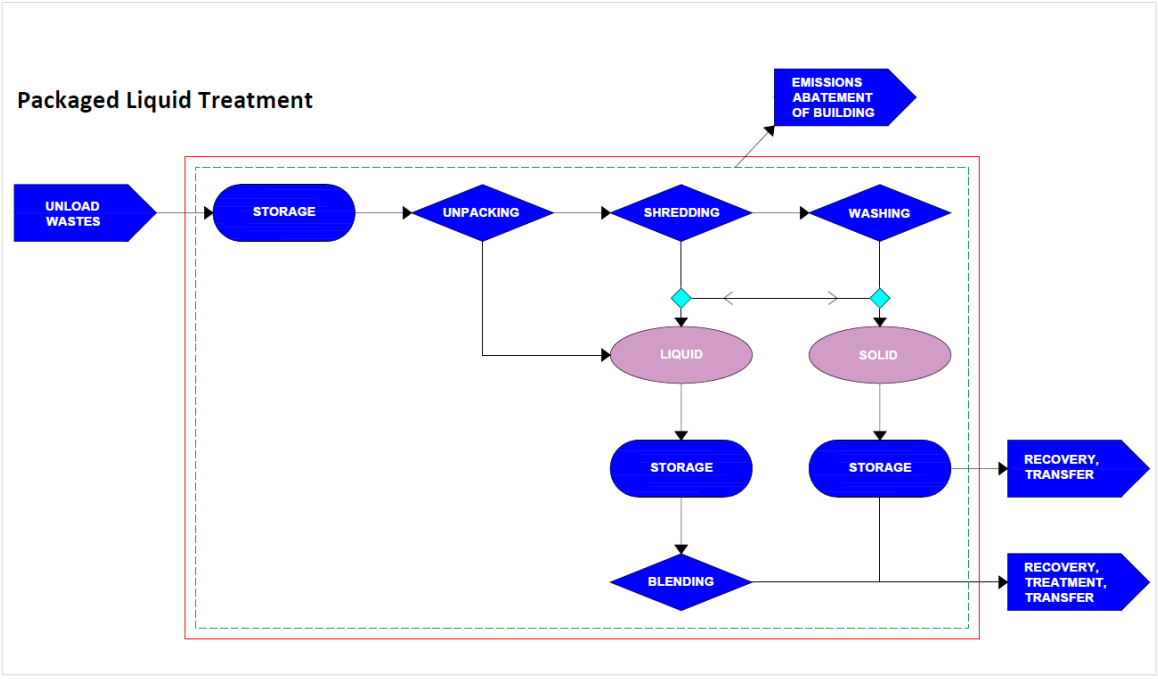

Figure 4: Process Flow diagram for Packaged Liquid Treatment.

Separation of materials received into component parts

3.1.21 Following acceptance and confirmation of acceptability:

- Items may be manually separated into component parts with for example batteries, metals and plastics being separated and re-packaged for recovery or disposal (see process flow diagram illustration in **Figure 5** below);
- Items may be shredded to allow separation of contents from packaging to provide distinct waste streams for further processing or transfer (see process flow diagram illustration in **Figure 6** below).
- Washing may be an integral part of this process.

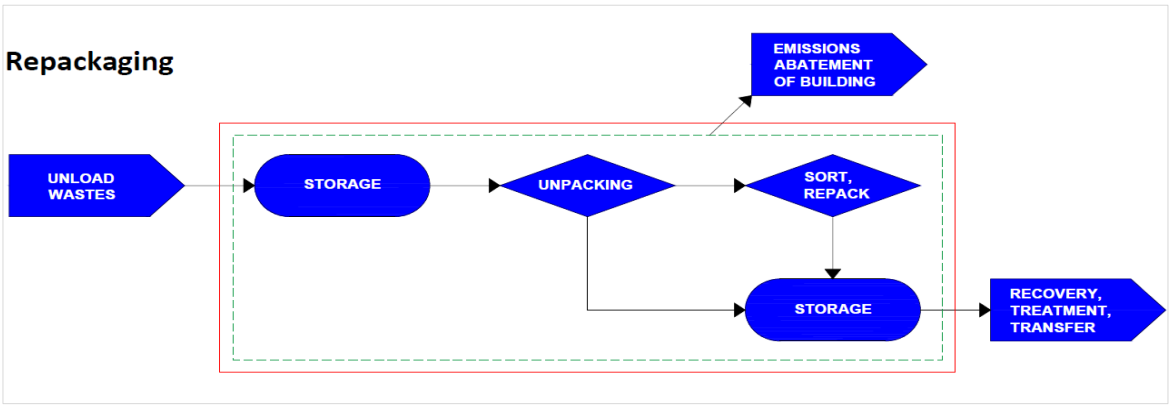

Figure 5: Process Flow diagram for Repackaging for recovery treatment or disposal.

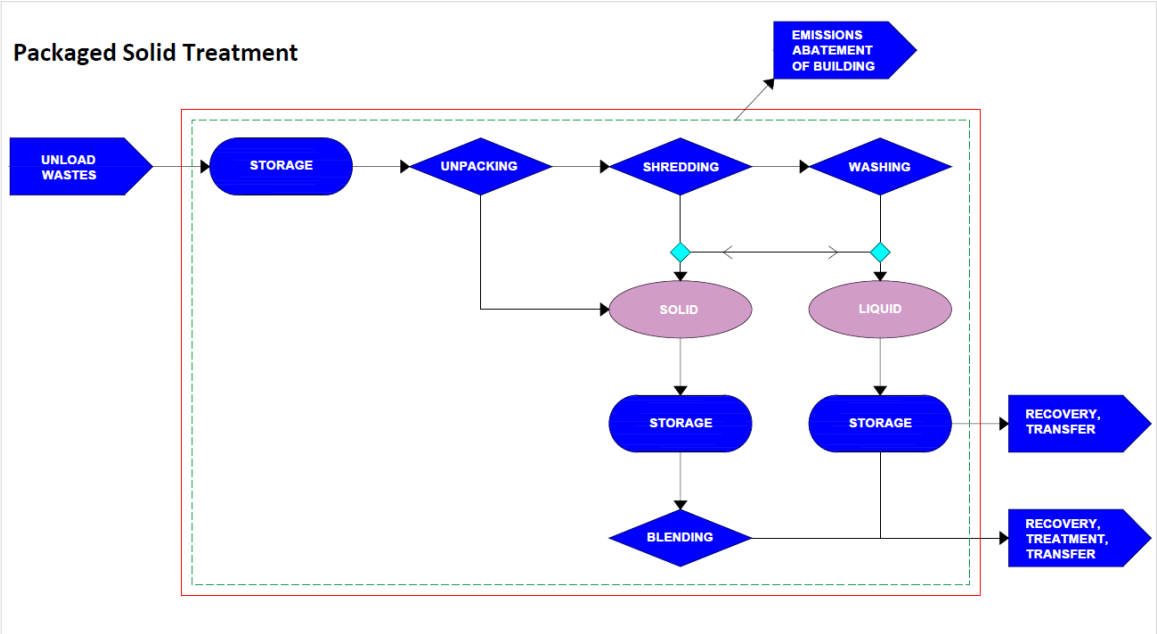

Figure 6: Process Flow diagram for Packaged Solid Treatment.

Hydrochloric Acid waste containing Iron in packaged or bulk.

3.1.22 Following acceptance and confirmation of composition and compatibility, bulk and packaged liquid wastes will be pumped via a filter into a storage tank and blended where the resulting mixture may:

- Be transferred off-site as a reagent suitable for wastewater applications;
- Be processed on-site to initiate the precipitation of iron salts (e.g. ferrous sulphate by the addition of sulfuric acid) and subsequent filtering, with washing, to produce ferrous sulphate solids for reuse, and the remining filtrate will be removed off-site for suitable treatment or, if appropriate and avoiding the filtration stage, a ferrous sulphate solution (see **Figure 7** below);
- Residual packaging or filter solids will be washed prior to further treatment or transferred off-site.

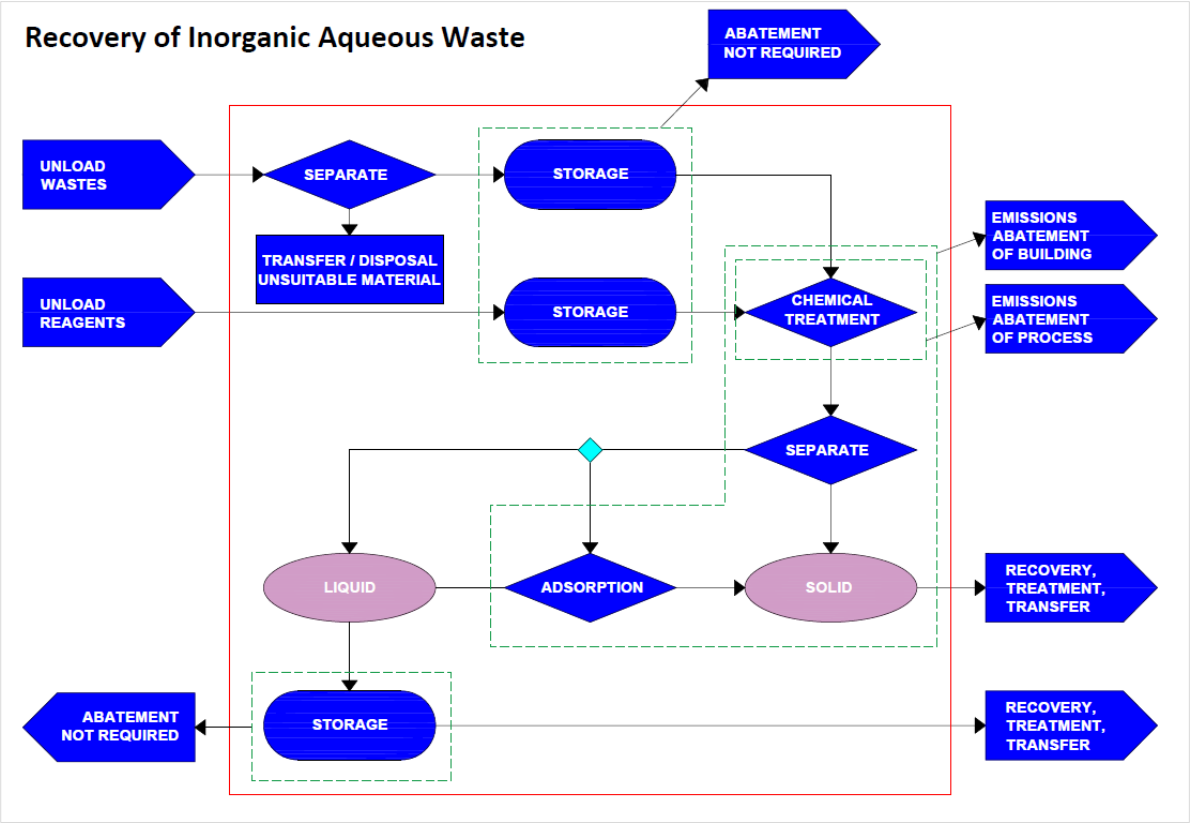

Figure 7: Process Flow Diagram for Recovery of Inorganic Aqueous Waste.

Hydrochloric Acid waste containing Iron and Zinc in packaged or bulk

3.1.23 Following acceptance and confirmation of composition, compatibility and treatability, bulk and packaged liquid wastes will be pumped via a filter into a storage tank and blended where the resulting mixture may:

- Be transferred off-site as a reagent suitable for wastewater applications;
- Be processed on-site to cause the precipitation of iron salts (e.g. ferrous sulphate by the addition of sulfuric acid) and subsequent filtering, with washing, to produce ferrous sulphate solids for reuse;
- Filtrate may be further processed to cause the precipitation of zinc salts (e.g. the addition of sodium carbonate to precipitate zinc carbonate), with washing and subsequent filtering to produce solids with a high concentration of zinc suitable for recovery (see **Figure 8**).
- The remainder filtrate will be removed off-site for suitable treatment.
- Residual packaging or filter solids will be washed prior to further treatment or transfer.

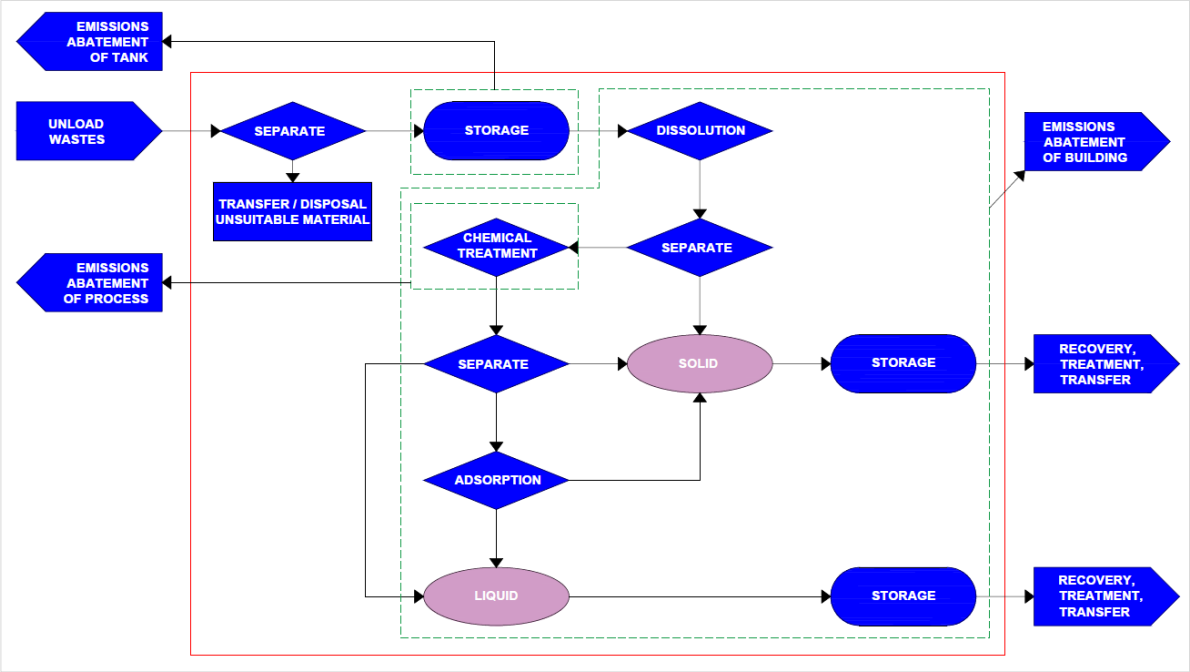

Figure 8: Process Flow Diagram for Recovery of Inorganic Solid Waste.

Waste Processing 06

3.1.24 This is a new area that will consist of a group of enclosed self-bunded buildings intended to treat aqueous wastes, which may be in either liquid or solid form. The wastes brought to the site can include packaging materials, bulk liquids, or powdered solids. Each type of waste may undergo an individual treatment stage or a combination of multiple stages, depending on the specific waste, to maximise recovery and disposal where applicable. The stages may include:

- Simple separation by filtration/separation including screening, filter bags/screens and sand filtration;
- Blending;
- Dissolution;
- pH adjustment to reduce acidity or alkalinity within wastes;
- Chemical oxidation/reduction;
- Chemical precipitation;
- Separation by extraction, sedimentation or flotation;
- Stabilisation of wastes to reduce leaching of components of concern;
- Solidification to improve handling properties;
- Conditioning (e.g. to reduce dustiness);
- Washing (with water or other reagents) to clean or capture components of interest;
- Complex separation by centrifuge, filter presses or membrane filtration;
- Adsorption by use of activated carbon, ion exchange resins or similar;

3.1.25 For this building, the Operator proposes installing two stack emission points (i.e., EP06 and EP11) equipped with activated carbon filters, and a scrubber (EP10); these will be responsible for discharging abated air into the atmosphere. See the Sampling and Emissions Point Plan (ref. 5827-CAU-XX-XX-DR-V-1808) for a closer view of the positioning of the respective air extraction and mitigation systems.

3.1.26 There will be dust filtration on the silos that will take powder waste. In addition, during processing, site operators will shut doors to reduce noise and maximise fugitive emissions control.

3.1.27 Wastes being processed at any stage may be 'As Received' or from another process undertaken on site. Below are examples of the type of aqueous and inorganic wastes, as well as solids and sludge that will potentially by treated on site through selected physico-chemical treatment process routes for recovery or disposal.

3.2 Physico-chemical Treatment of Solids and Sludge

3.2.1 The physico-chemical treatment of solids and sludge will include preparing and conditioning of air pollution control residues (APCr), etc. and storage of solids and sludge in enclosed self-bunded buildings, including mixing, washing, filtering, precipitating out, filter pressing and drying for recovery/export of product off-site.

3.2.2 All proposed activities will occur within Waste Processing '02 and 06'. However, the filter pressing of solids and sludge, as well as drying for recovery or transfer off-site, will be conducted in Waste Processing '04, 05 and 06'. Please refer to **Sections 3.3** and **3.4** below for further details.

3.2.3 Figures 9 and 10 are some examples of process flow diagrams illustrating typical waste processing activities that may be undertaken under physico-chemical treatment of solids and sludge for recovery and disposal purposes.

Air pollution control residues containing recoverable components.

3.2.4 Following acceptance and confirmation of composition, compatibility and treatability, bulk and packaged wastes will be transferred via a filter into a storage silo where:

- Waste will be mixed with water to form a solution;
- Appropriate reagents may be added to adjust pH, cause precipitation reactions, and promote filtration;
- Filtration will be carried out to separate solid and liquid (See **Figure 9** below for process flow diagram illustration);

- Solid products from filtration may be suitable for reuse or recovery or transferred for subsequent treatment or disposal;
- Liquid products (filtrates, permeates, concentrates) may be suitable for further treatment or use on site or transferred for reuse/recovery or treatment or disposal;
- Components recovered may include heavy metals (as solutions), salts of calcium, potassium, sodium, or other elements for use in chemical manufacture or as fertiliser.

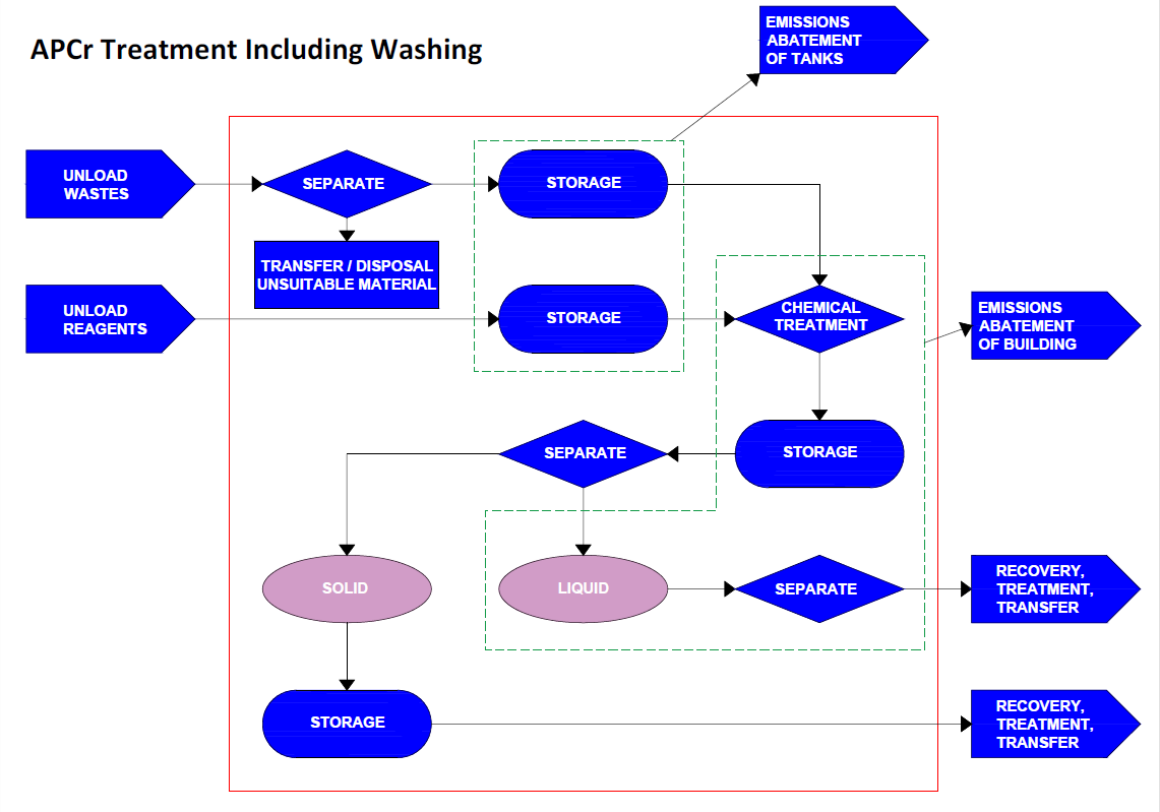

Figure 9: Process Flow Diagram for Air Pollution Control Residues Treatment with Washing.

Air pollution control residues (APCr) containing significant alkalinity (e.g., cement kiln dust).

3.2.5 Following acceptance and confirmation of composition, compatibility and treatability, bulk and packaged wastes will be transferred via a filter into a storage silo where:

- Waste will be conditioned with water to produce a non-dusty solid and stored (e.g., within any of the 100m^3 capacity APCr Silos per Table 1 below) to await removal from site to the end user;
- Waste will be conditioned with water to produce a non-dusty solid for disposal;

- Waste may be chemically conditioned by the addition of suitable aqueous reagent or waste to produce a solid for recovery or disposal. See **Figure 10** below for process flow diagram.

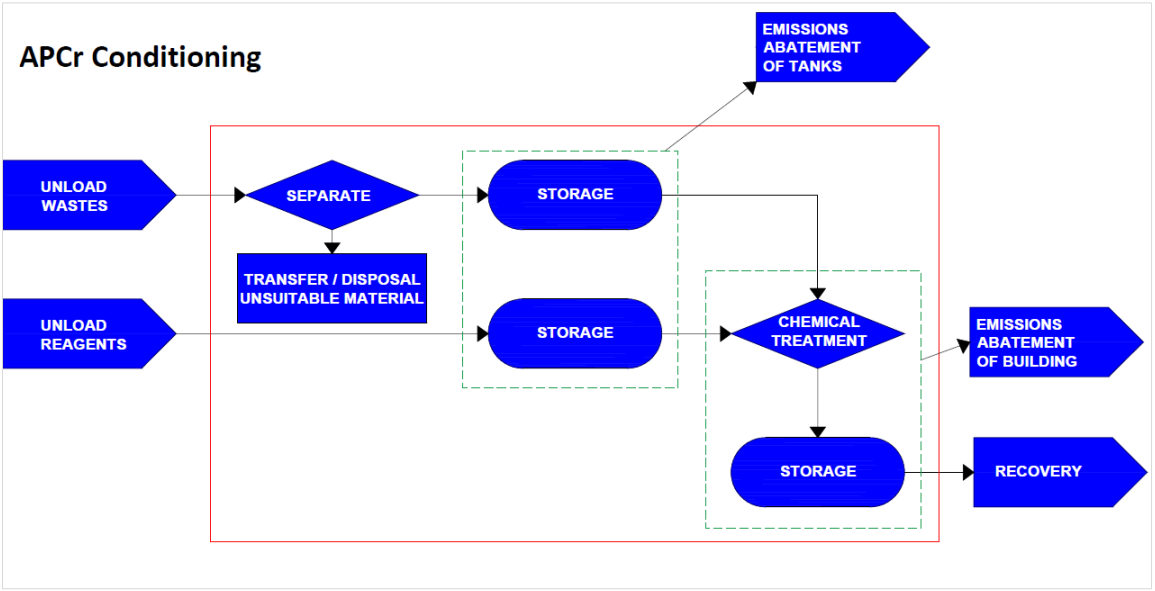

Figure 10: Process Flow Diagram for Air Pollution Control Residues Conditioning.

3.2.6 The total storage capacity of up to 2,450 m^3 across tanks/vessels/silos will be provided on the site to serve the physical and physico-chemical treatment of aqueous and inorganic wastes, solids and sludges processing activities. As mentioned in **Section 3.1.2** above, there will be bunded tank areas where tanks will be placed to facilitate efficient allocation of tanks to different areas for optimal operations. Additional provision of up to 200 m^3 will be available to store packaged wastes and reagents within bunded segregated storage areas or skips. **Table 1** summarises the list of tanks for the various use, their capacity and respective emission points.

3.2.7 Below is an indicative list of raw materials which will be required for the Physico-chemical Treatment of Aqueous and Inorganic wastes process:

- Ferric/ Ferrous chloride
- Ferrous sulphate
- Sulphuric acid
- Phosphoric acid
- Sodium hydroxide
- Sodium carbonate
- Hydrated lime
- Ion exchanged clays
- Activated carbon

Table 1: List of Tanks within the Waste Processing 06.

Item purpose	Item type/function	Capacity	Tag Number	Emission Points[3]
Storage	Effluent tank	100m³	P06-TS-1 1	EP34
Storage	Product tank	100m³	P06-TS-1 2	EP35
Storage	Product tank	100m³	P06-TS-1 3	EP36
Storage	Reagent tank	50m³	P06-TS-1 4	EP37
Storage	Bulk tank	100m³	P06-TS-1 5	EP38
Storage	Bulk tank	100m³	P06-TS-1 6	EP39
Storage	Treated Residue tank	100m³	P06-TS-1 7	EP40
Storage	Effluent tank	100m³	P06-TS-2 1	EP41
Storage	Product tank	100m³	P06-TS-2 2	EP42
Storage	Product tank	100m³	P06-TS-2 3	EP43
Storage	Reagent tank	50m³	P06-TS-2 4	EP44
Storage	Bulk tank	100m³	P06-TS-2 5	EP45
Storage	Bulk tank	100m³	P06-TS-2 6	EP46
Storage	Treated Residue tank	100m³	P06-TS-2 7	EP47
Storage	Treated residue tank	100m³	P06-TS-3 1	EP48
Storage	Effluent tank	100m³	P06-TS-3 2	EP49
Storage	Slurry tank	100m³	P06-TS-3 3	EP50
Storage	Slurry tank	100m³	P06-TS-3 4	EP51
Storage	Slurry tank	100m³	P06-TS-3 5	EP52
Storage	APCr Silo	100m³	P06-LS-3 6	EP53
Storage	APCr Silo	100m³	P06-LS-3 7	EP54
Storage	APCr Silo	100m³	P06-LS-3 8	EP55
Process	Reaction vessel	50m3	P06-TP-1 1	n/a
Process	Reaction vessel	50m³	P06-TP-1 2	n/a
Process	Reaction vessel	50m³	P06-TP-1 3	n/a
Process	Reaction vessel	50m³	P06-TP-2 1	n/a
Process	Reaction vessel	50m³	P06-TP-2 2	n/a
Process	Reaction vessel	50m³	P06-TP-2 3	n/a
Process	Acid Tank	50m³	P06-TP-3 1	n/a
Process	Building	n/a	P06-ZP-1 1	n/a
Process	Building	n/a	P06-ZP-2 1	n/a
Process	Building	n/a	P06-ZP-3 1	n/a
Process	Air handling unit	n/a	P06-AP-0 1	n/a
Process	Air handling unit	n/a	P06-AP-0 2	n/a

[3] *See **Appendix 2** for the grid references of the listed emission points.*

3.3 Metal and Inorganic Salts Recovery

3.3.1 It is proposed that the site will carry out metal recovery activities from waste materials that contain heavy metals, including 'critical metals'. The treatment processes involved will look to concentrate the target metal(s) in the waste being processed so as to produce a material suitable for final recovery and reuse (by others). To achieve this, multiple stages of aqueous chemistry (pH control, targeted precipitation and redox reactions, temperature control) with settlement, extraction and/or filtration at appropriate stages will be utilised. These operations will be undertaken within the proposed '**Waste Processing 04**' area shown on the permit boundary plan (ref. 5827-CAU-XX-XX-DR-V-1804).

3.3.2 The treatments will involve precipitation reactions driven by pH control and/or the addition of suitable reagents to favour targeted reactions. Temperature changes, such as warming and cooling, may be required, as well as separation techniques, such as dissolution, liquid-liquid extraction, sedimentation, filtration, or electrolysis (overview of the Metal recovery process can be seen in **Figure 11** below). In addition, inorganic salts recovered from this process will be transferred off-site for further treatment.

3.3.3 The processing vessels for metal recovery operations will be in a bunded building, which will include a combination of reactors and storage tanks, with filter presses appearing as rectangular shaped structures (see plan ref. 5827-CAU-XX-XX-DR-V-1807 for more details on the interior of this building).

3.3.4 The Operator proposes to install one stack emission point (i.e., EP04) equipped with activated carbon filter in the process building, including air extraction systems via wet scrubbers (EP13 and EP14) to abate air exiting the building and minimise emissions into the atmosphere.

3.3.5 Below is an indicative list of raw materials which will be required for the Metals and inorganic salts recovery process:

- Sulphuric acid
- Sodium sulphate
- Sodium hydroxide
- Sodium carbonate
- Paraffin
- Kerosene
- Flocculant
- Activated carbon
- Ion exchange clays
- Sodium bisulphate
- Sodium oxalate
- Oxalic acid

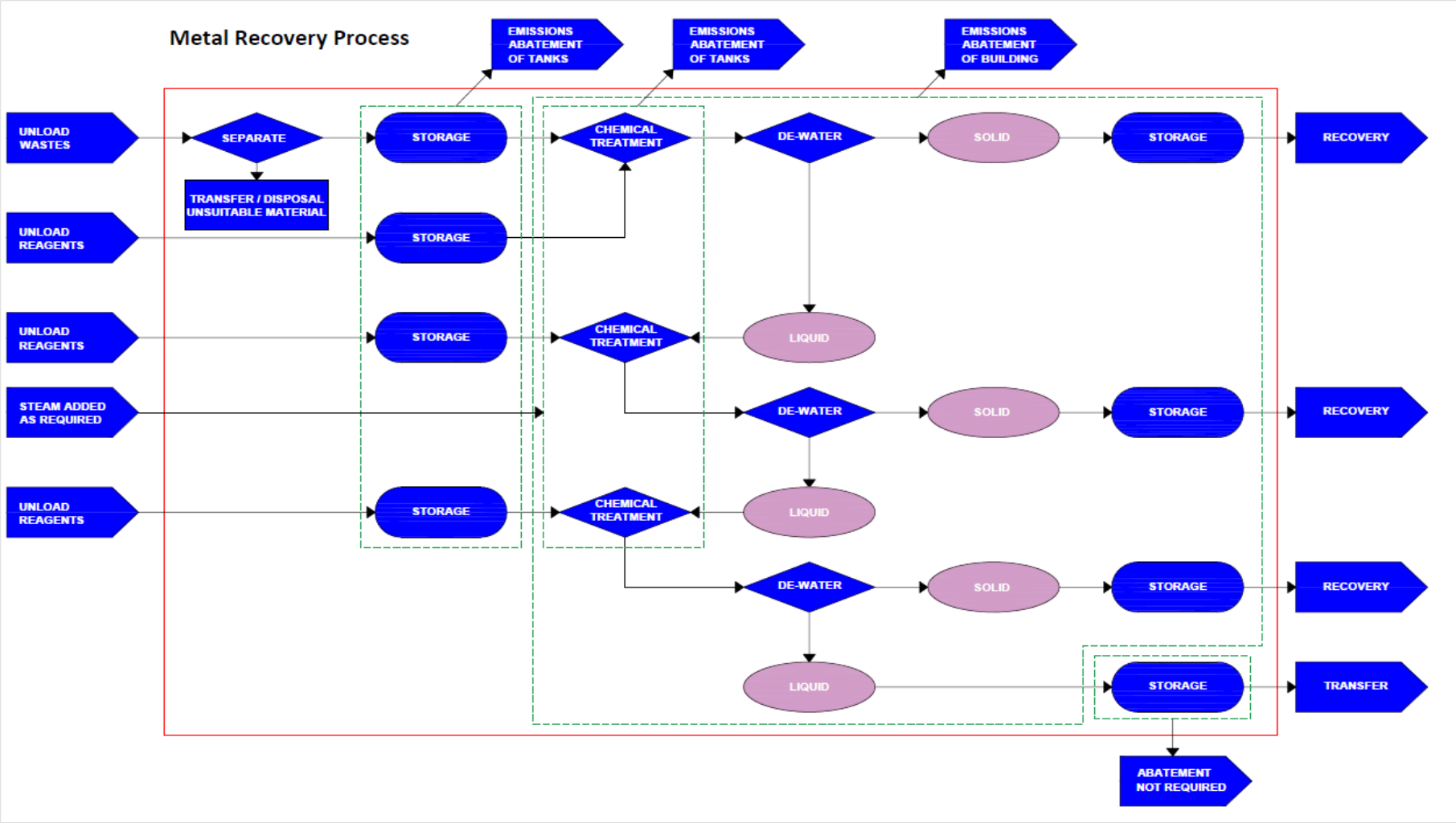

Figure 11: Overview Process Flow Diagram for Metal Recovery Process.

3.3.6 This area will have up to 820 m^3 storage capacity for wastes and effluents within 20 tanks. Additional provision of up to 200 m^3 will be available to store packaged wastes, reagents and residues in skips within bunded areas with appropriate segregation. **Table 2** summarises the list of tanks for the various use, their capacity and emission points.

Table 2: List of Tanks within the Waste Processing 04.

Item purpose	Item type/function	Capacity	Tag Number	Emission Points[4]
Process	Air handling unit (carbon filter)	n/a	P04-AP-0 1	EP04
Process	Air handling unit (scrubber)	n/a	P04-AP-0 3	EP13
Process	Air handling unit (scrubber)	n/a	P04-AP-0 2	EP14
Storage	Reagent tank	30m³	P04-TS-0 3	EP15
Storage	Offload tank	100m³	P04-TS-0 1	EP16
Storage	Offload tank	100m³	P04-TS-0 2	EP17
Storage	Filtrate tank	100m³	P04-TS-0 4	EP18
Storage	Reagent tank	50m³	P04-TS-0 5	EP19
Storage	Reagent tank	50m³	P04-TS-0 6	EP20
Storage	Reagent tank	30m³	P04-TS-0 7	EP21
Process	Precipitation vessel	30m³	P04-TP-1 1	EP22
Process	Precipitation vessel	30m³	P04-TP-1 2	EP23
Process	Precipitation vessel	30m³	P04-TP-1 3	EP24
Process	Precipitation vessel	30m³	P04-TP-2 1	EP25
Process	Precipitation vessel	30m³	P04-TP-2 2	EP26
Process	Precipitation vessel	30m³	P04-TP-2 3	EP27
Process	Precipitation vessel	30m³	P04-TP-3 1	EP28
Process	Precipitation vessel	30m³	P04-TP-3 2	EP29
Process	Precipitation vessel	30m³	P04-TP-3 3	EP30
Process	Tank	30m³	P04-TP-3 4	EP31
Process	Tank	30m³	P04-TP-3 5	EP32
Process	Tank	30m³	P04-TP-3 6	EP33
Process	Metal Recovery Building	n/a	P04-ZP-0 1	n/a
Process	Filter Press	n/a	P04-FP-1 1	n/a
Process	Filter Press	n/a	P04-FP-2 1	n/a
Process	Filter Press	n/a	P04-FP-3 1	n/a

[4] *See **Appendix 2** for the grid references of the listed emission points.*

3.4 Drying

3.4.1 The Operator proposes to add a drying phase to further treat inorganic wastes having gone through the physico-chemical treatment before final recovery or disposal where applicable.

3.4.2 This activity will be conducted within a new enclosed building referred to as '**Waste Processing 05**' on the permit boundary plan (ref. 5827-CAU-XX-XX-DR-V-1804). It will be used to store feedstocks such as filter cakes (from other physico-chemical treatment activities operated elsewhere by FCC or by others) for drying and dried residues. Storage of up to 300 T for wet cake and containers (skips) for dried materials will be provided.

3.4.3 This building will house a GPD 14W 190 Single Condenser paddle dryer or similar (an indicative drawing of the proposed paddle dryer is included in **Appendix 1** of this report).

3.4.4 As mentioned in **Section 1.3.1** above, wet solids will be dried in enclosed unit equipped with a heated paddle, or similar means of providing heating, which through contact with the wet solids drives off water as steam and produce a granular, low dust, 10 % moisture solid for recovery or disposal at a suitable site. The steam generated in this process will either be discharged via a low stack or transformed into condensate and released to sewer under the discharge consent currently in place at the site. The solids will be stored within RORO skips to await recovery or disposal. Wastes that will be dried are non-flammable and inorganic.

3.4.5 The proposed dryer will require 3 T/hr of steam, which will be generated specifically for this purpose using a standalone small gas or electric boiler unit. Alternatively, a heat pump (i.e., membrane vapour recompression) based plant is under consideration, which replaces the paddle drier system, where after initial heating the vapour compressed, can be used to heat further material to minimise energy requirement.

3.4.6 The drying complex will have one stack emission point (i.e., EP05) equipped with a dust/carbon filtration system responsible for removing fugitive dust or VOCs prior to release into the atmosphere.

3.4.7 Below (**Figure 12**) is an example of process flow diagram illustrating drying of wastes before recovery.

<u>Drying of solid waste</u>

Following acceptance and confirmation of composition, and if appropriate, compatibility and treatability, solid wastes will be transferred via hopper into an indirect, low agitation, contact drier designed and operated to minimise dust formation.

- Material is heated and moved through the drying unit by paddles or similar within an enclosed vessel to remove water;

- Heating temperature is below 180° C, heating is supplied by steam or hot oil produced on site;
- Displaced air containing water and small amounts of particulates is condensed with the remaining air and discharged via an activated carbon filter;
- Hot dry material leaving the dryer is cooled and then stored to await removal for recovery.

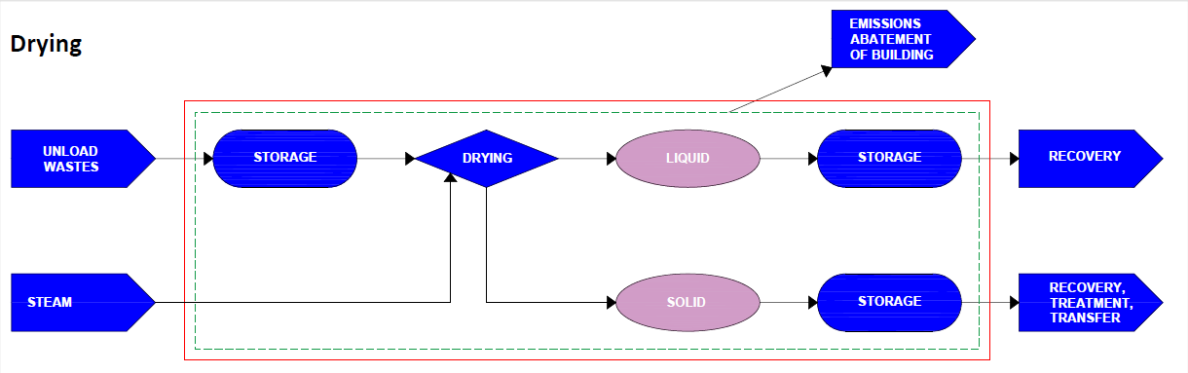

Figure 12: Process Flow Diagram for Drying waste prior to recovery or disposal.

4.0 REVIEW AGAINST BAT CONCLUSIONS

4.1 Overview

4.1.1 This section (**Table 3**) is a review against 'Establishing Best Available Techniques (BAT) Conclusions for Waste Treatment, under Directive 2010/75/EU of the European Parliament and of the Council' (2018).

4.1.2 In addition, Sector Guidance Note (SGN IPPC 5.06) 'Guidance for the Recovery and Disposal of Hazardous and Non-Hazardous Waste' has also been used as reference for this BAT review.

Table 3: Review Against BAT Conclusions

BAT Conclusion Number	Description	Applicable to LTP	Brief comments on how compliance with BAT will be achieved.
	Overall Environmental Performance		
1	In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates all of the following features: I) Commitment of the management, including senior management; II) Definition, by the management, of an environmental policy that includes the continuous improvement of the environmental performance of the installation; III) Planning and establishing the necessary procedures, objectives and targets, in conjunction with financial planning and investment; IV) The implementation of procedures; V) Checking performative and taking corrective action; VI) Review, by senior management, of the EMS and its continuing suitability, adequacy and effectiveness; VII) Following the development of cleaner technologies; VIII) Consideration for the environmental impacts from the eventual decommission of the plant at the stage of designing a new plant, and throughout its operating life; IX) Application of sectoral benchmarking on a regular basis; X) Waste stream management; XI) An inventory of waste water and waste gas streams;	Yes	• The site operates under an ISO 14001 accredited environmental management system (EMS); audits of the performance of key plants, and all maintenance will be carried out in compliance with the standard requirements and reviewed at the required frequency by senior management to demonstrate top management engagement with the management system and to drive continual improvement in its overall environmental performance. • The site's management system is audited externally as part of the ISO 9001 and ISO 14001 accreditation. It also operates and is audited against ISO 45001 and ISO 50001.

	XII) Residues management plan; XIII) Accident management plan; XIV) Odour management plan; XV) Noise and vibration management plan.		
2	In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques detailed in 'BAT 2 Table 'best available techniques (BAT) conclusions for waste treatment industries (BREF), under Directive 20/10/75/EU, from the Official Journal of the EU' summarised below: I) Pre-acceptance procedures II) Waste Acceptance procedures III) Waste tracking and inventory IV) Output quality management system V) Ensure waste segregation VI) Waste compatibility prior to mixing or blending of waste VII) Sorting of incoming solid waste	Yes	<u>Pre-acceptance and Waste Acceptance procedures</u> • See **Section 2.0** of this report for details on pre-acceptance and waste acceptance procedures the operator has as part of its management system. <u>Waste tracking and inventory</u> • See **Section 2.0** of this report for details on this as part of the operator's management system. <u>Output Quality Management System</u> • As mentioned in BAT 1 above, the site's management system is externally verifiable to ISO 9001 standards. • Treatability studies and associated analytical work undertaken by the operator will be to good laboratory standards allowing tracking of samples and results against the relevant enquiry, selection of appropriate test methods and appropriate calibration of equipment used. • Where third party analyses are required, this shall be to recognised standard and where practicable undertaken by a UKAS or MCERTS accredited laboratory. Analytical details shall be maintained for six years. <u>Ensure waste segregation</u> • Waste storage for bulk and packaged wastes will be provided in appropriate areas, segregating incompatible materials to ensure only compatible materials are stored near each other. Waste deemed not acceptable will be stored within a quarantine area pending removal from site.

			• Additional storage for packaged wastes, reagents and residues in skips will be provided in bunded areas with appropriate segregation. • See **Section 2.0** of this report for more details on how the operator segregates wastes. <u>Waste Compatibility</u> • Waste pre-acceptance and waste acceptance procedures, sampling, testing and analysis procedures will be in place to ensure that only waste types permitted are accepted onto site. • On-site verification, storage and control procedures will be undertaken to ensure that the materials accepted are consistent with the analysis and description supplied at the pre-characterisation stage. • Samples of all waste received and used for acceptance assessment shall be retained for two weeks. • More details have been provided in **Section 2.0** of this report above. <u>Sorting of Incoming waste</u> • Pre-acceptance process will be undertaken as normal to characterise wastes prior to acceptance and may be enhanced by laboratory and pilot trials to determine the optimal process route to best recover most resource from the waste in question. This will direct subsequent processing of the waste. • In each case, outputs for recovery or reuse are determined by the specifications required for subsequent processing or use and demonstrated by appropriate quality control procedures (refer to the example of flow diagrams in Section 3.0 of this report demonstrating typical wastes that may be treated on-site before recovery or disposal).

			• Wastes received in packages for treatment may require de-packaging or shredding to allow subsequent processing with empty containers being washed, compacted, and/or disposed of separately.
3	In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system.	Yes	• Existing inventory with be updated to capture any waste water and waste gas streams associated with the addition of the new activities, where applicable. • Additionally, the proposed stack emissions point will be equipped with appropriate air cleaning systems to minimise emissions into the atmosphere. See **Appendix 2** of this report for the summary of emission points and their grid references, and **Appendix 4** for summary document providing justification for the identification and selection of emission control equipment and how it meets BAT. Upon commencement of operations for each process monitoring of air emissions will be undertaken to confirm effectiveness of abatement and to undertake an Air Emissions Risk Assessment.
4	In order to reduce the environmental risk associated the with storage of waste, BAT is to use all of the techniques given below a) Optimised storage location b) Adequate storage capacity c) Safe storage operations d) Separate area for storage and handling of packaged hazardous waste	Yes	<u>Adequate storage capacity</u> • Total storage capacity in the Physico-chemical Treatment and Recovery area for wastes will be up to 2,450m^3 across tanks, vessels, and silos, including 200m^3 storage for packaged wastes and reagents within fully bunded segregated storage areas or skips. • The area for Metal and Inorganic Salts recovery will have up to 820 m^3 storage for wastes and effluents within 20 tanks, including additional storage of 200m^3 for packaged wastes, reagents and residues in skips. • Details of the secondary containment calculations for the applicable tank capacity(ies) and bund associated with the

			relevant buildings has been provided in **Appendix 5** of this report. <u>Safe storage operations</u> • In addition, the site will have two main waste storage areas for packaged or containerised wastes. These areas will be fully bunded. <u>Optimised storage location</u> • Some of these areas will be further split into bays/sections to provide adequate storage for materials that may be stored temporarily (i.e., <1 working day) or <6 months). Storage bays will be individually segregated and slope backwards, ensuring that any spilt liquid is contained within the bay and cleaned accordingly, and incompatible materials will not contact each other. <u>Separate area for storage and handling of packaged hazardous waste</u> • The site contains a number of areas for waste storage and processing where compatible wastes (e.g., alkalis and acids) may be stored. Storage is determined by compatibility which means, for example, alkaline wastes may be stored together, whether classified as hazardous or non-hazardous. The site operators will store packaged waste at a maximum of 2m height.
5	In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures. Handling and transfer procedures aim to ensure that wastes are safely handled and transferred to the respective storage or treatment. Including the following elements:	Yes	<u>Handling and transfer of waste are carried out by competent staff</u> • Only staff trained and authorised to complete this task may do so. • Staff undertaking the pre-acceptance and acceptance assessment of wastes shall have a minimum qualification of

	I) Handling and transfer of waste are carried out by competent staff; II) Handling and transfer of waste are duly documented; III) Measures are taken to prevent, detect and mitigate spills; IV) Operation and design precautions are taken when mixing or blending wastes;		HNC in chemistry or a related subject or be supervised by such an individual. <u>Handling and transfer of waste are duly documented</u> • The operator has developed an Enquiry system where it documents/records details of the waste characteristics, process route and any special instructions, including details of consignment notes, and associated weight records which shall be maintained for six years. <u>Measures are taken to prevent, detect and mitigate spills</u> • The Environmental Risk Assessment report ref. 5827-CAU-XX-XX-RP-V-0302 prepared for the proposed activities, highlights emergency spill pads and/booms will be provided should a spillage or leak occur, including spill action plan with the training of all relevant staff on implementing the plan and in the use of spill pads and booms, will be available. • Also, a Planned Preventative Maintenance (PPM) programme will be put in place for all critical equipment and infrastructure. Regular inspection of surface integrity, container and bunding integrity. All tanks and pipework will be above ground and will undergo routine visual inspections to identify any leaks (this is covered in the document ref. **IMS-4-04-01-02-KETP procedure specifying waste storage tank and pipework inspection regime**). • See **Appendix 3** of this report for a summary document on Leak detection and Repair protocol. <u>Operation and design precautions are taken when mixing or blending wastes</u> • According to the 'Environmental Risk Assessment' report ref. 5827-CAU-XX-XX-RP-V-0302 prepared for the site, the following measures will be put in place:

			• **VOCs and Wet Scrubber** for emissions control. These are designed to capture and neutralise odorous or acid/alkali compounds potentially emitted during the treatment process prior to release into the atmosphere. • **Self-Bunded Buildings/Areas** which contains the process and prevents leaks or spills from reaching the surrounding environment, minimising the risk of odour emissions.
	Monitoring		
6	For relevant emissions to water as identified by the inventory of waste water streams, BAT is to monitor key process parameters at key locations (e.g. at the inlet and/or outlet of the pretreatment, at the inlet to the final treatment, at the point where the emission leaves the installation).	Yes	• Not applicable to the physical and physico-chemical treatment of aqueous and inorganic wastes, solids and sludge, including the metals and inorganic salts recovery process. However, steam generated during the drying phase will be discharged from the installation either via a low stack or transformed into condensate prior to release into sewer (permitted by the Discharge Consent currently in place at the site).
7	BAT is to monitor emissions to water with at least the frequency detailed in BAT 7 'best available techniques (BAT) conclusions for waste treatment industries (BREF), under Directive 20/10/75/EU, from the Official Journal of the EU'	No	See response to BAT 6 above.
8	BAT is to monitor channelled emissions to air with at least the frequency detailed in BAT 8 'best available techniques (BAT) conclusions for waste treatment industries (BREF), under Directive 20/10/75/EU, from the Official Journal of the EU' and in accordance with EN Standards. If EN standard are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	Yes	See response to BAT 3 above.

9	BAT is to monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs with solvents, and the physico-chemical treatment of solvents for the recovery of their calorific value, at least once per year using one or a combination of the techniques given (refer to BAT table).	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
10	BAT is to periodically monitor odour emissions.	Yes	• Odour risk from the physico-chemical treatment of aqueous and inorganic wastes, solids and sludge as well as metals and inorganic salts recovery and drying is addressed in the 'Environmental Risk Assessment' report ref. 5827-CAU-XX-XX-RP-V-0302 and considered a low risk to receptors if control measures are implemented. • Regular inspection and maintenance via routine inspections of equipment and ventilating systems, as well as implementing odour monitoring will be conducted by staff trained by Site Management. • Refer to the Odour Management plan report ref. 5827-CAU-XX-XX-RP-V-0310 included in this application for more details.
11	BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year.	Yes	• The Operator will keep Safety Data Sheets (SDS) for the types of reagents that will be used and will monitor the quantity of materials used, including the volume of waste produced. This will provide data for regular reviews of raw materials usage. All product documentation will be checked against the order prior to acceptance.
	Emissions to air		

12	In order to prevent, or where that is not practicable, to reduce odour emissions, BAT is set up, implement and regularly review an odour management plan, as part of the environmental management system, that includes all of the following elements: a) Protocol for containing actions and timelines; b) Protocol for conducting odour monitoring as set out in BAT 10; c) Protocol for response to identified odour incidents, e.g. complaints d) An odour prevention and reduction programme designed to identify the source(s); to characterise the contributions of the sources; and to implement prevention and/or reduction measures.	Yes	See response to BAT 10 above.
13	In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one of more a combination of the following techniques given below: a) Minimise residence time of potentially odorous waste in storage or in handling systems (e.g., pipe, tank containers) in particular in anaerobic conditions b) Using chemical treatment c) Optimising aerobic treatment	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
14	In order to prevent or, where that is not practicable, to reduce emissions to air, in particular of dust, organic compounds and odour. BAT is to use an appropriate combination of the techniques given below: a) Minimizing the number of potential diffuse emissions sources b) Selection and use of high integrity equipment c) Corrosion prevention	Yes	<u>Minimizing the number of potential diffuse emissions sources</u> • Stack emission points within the proposed enclosed buildings, will be equipped with air cleaning systems where vented air will be passed through wet scrubbers or activated carbon, appropriate for the processed materials and potential off-gases. The same will be applicable to the various tanks within the different waste processing areas discussed in this report.

	d) Containment, collection and treatment of diffuse emissions e) Dampening f) Maintenance g) Cleaning of waste treatment and storage areas h) Leaks detection and repair (LDAR) programme		See **Appendix 2** of this report for summary of emission points and their grid references. • Housekeeping measures (e.g., closing doors, windows, cleaning, etc) will be adopted. • Speed limit is in place at the site to control traffic and dust generation. Speed ramps are also in place to enforce speed limit. • Dust created due to vehicular movements around site will be supressed with water where required. <u>Containment, collection and treatment of diffuse emissions</u> • Enclosed self-bunded buildings will have air cleaning systems (such as wet scrubber and VOCs scrubber) in place for this purpose. • Storage and mixing tanks sited within bunded areas will have vented air collected for discharge via acid or alkali gas scrubbers as appropriate. Filter presses and similar housed within the buildings will have venting via the same gas scrubbers. • See **Appendix 4** of this report for the summary document providing justification for the identification and selection of emission control equipment and how it meets BAT. <u>Maintenance</u> • Plants will be maintained following the manufacturer's recommendations. Emissions of particulates will be controlled in accordance with Site management procedures (see BAT 10 response for reference).

			Dampening • Dust created due to vehicular movements around the site will be dampened/supressed with water where required. Cleaning of waste treatment and storage areas • A housekeeping checks procedure will be created for this purpose as part of the management system in place for the site.
15	BAT is to use flaring only for safety reasons or for non-routine operation conditions (e.g. start-ups, shutdowns) by using techniques below a) correct plant design b) Plant management	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
16	In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use the techniques detailed below: a) Correct design of flaring devices b) Monitoring and recording as part of flare management	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	Noise and Vibration		
17	In order to prevent, or where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan as part of the environmental management system.	Yes	• Noise and vibrations assessed in the 'Environmental Risk Assessment' document ref. 5827-CAU-XX-XX-RP-V-0302, indicates that noise and vibration impacts from the activities of the physico-chemical treatment of aqueous and inorganic wastes, solids and sludge, including metal and inorganic salts recovery and drying are likely to be of low impact to sensitive receptors if control measures are implemented. The report referenced will be added to this application. • Operations take place inside a building, further attenuating noise.

			• Noise levels will be a consideration in purchasing new equipment with quieter models used where cost effective. • A Noise Management Plan document ref. 5827-CAU-XX-XX-RP-V-0311 has been prepared as part of this variation application to demonstrate how BAT 17 will be met. A noise assessment will be carried out as well.
18	In order to prevent or where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given below. a) Appropriate location of equipment and buildings b) Operational measures c) Low-noise equipment d) Noise and vibration control equipment e) Noise Attenuation	Yes	• The enclosed buildings will provide some attenuation. Doors will be kept closed. Plants will be operated by trained staff and maintained in line with the manufacturer's recommendations. Noise levels will be a consideration in purchasing new equipment with quieter models used where cost effective. See response to BAT 17 above.
	Emissions to water		
19	In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given below: a) Water management b) Water recirculation c) Impermeable surface d) Technique to reduce the likelihood and impact of overflows and failures from tanks and vessels e) Roofing of waste storage and treatment areas f) Segregation of water streams g) Adequate drainage infrastructure	Yes	<u>Water management</u> • Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying. <u>Impermeable surface</u> • All tanks or a combination of tanks in these areas shall be within bunded areas on impermeable concrete, designed in line with the CIRIA 'Containment systems for the prevention of pollution: Secondary, tertiary and other measures for industrial and commercial premises' (C736;2014) and HSE standards for storing chemicals. See **Appendix 5** of this report

	h) Design and maintenance provisions to allow detection and repair of leaks i) Appropriate buffer storage capacity		for details on secondary containment calculations for the applicable tank capacity and bund associated with the relevant buildings. • The bunded areas will have sumps for collecting rainwater and any contaminated liquid from spillages/leaks and disposed of appropriately (this is covered in the document ref. **IMS-4-04.19.02-KETP for procedure on Sump Integrity Check**). The bunds will be inspected regularly (this is covered in the document ref. **IMS-4.02.04.02-BM procedure for Daily Site Checks that covers bund inspection**). All surface water collected in bunds will pass through the treatment facility. <u>Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels</u> • Storage tanks will be equipped with online level monitoring, using radar or ultrasonic monitoring control with three alarm levels for alerting staff when maximum capacity is reached, including an Automatic Feed Shut Off (AFSO) system to protect against tank overflow, or power failure. <u>Roofing of waste storage and treatment areas</u> • The appropriate roofing style will be constructed, including storing and treating wastes in such manner that will prevent contact with rainwater and thus minimise the volume of contaminated run-off water where applicable. <u>Segregation of water streams</u> • Surface water from site roads and non-waste areas will flow to the existing storage tank for reuse or discharge to river or sewer as appropriate. Rainwater within bunded areas will be

			removed and processed as per the contents of the tanks in the associated tank farm. <u>Adequate drainage infrastructure</u> • Adequate drainage infrastructure is in place on site for the collection of rainwater and surface waters within a central surface water storage tank for reuse or discharge to river or sewer as appropriate. See **Appendix 6** of this report for the site's Drainage Plan. • Interceptors will be available at various locations on site to capture suspended solids, fuel or engine oils (from vehicle leaks); it will also be capable of being utilised for the capture of contaminated water in the event of a spill or fire (i.e., firewater). This collected water may be reused within the site activities subject to appropriate composition and need, and if the water is unsuitable or not required, this will be stored and if appropriate, discharged to sewer following the existing discharge consent in place at the site. Waste oils/fuels will be removed and transferred to an appropriate facility. <u>Design and maintenance provisions to allow detection and repair of leaks</u> • A Planned Preventative Maintenance programme will be put in place for all critical equipment and infrastructure. Regular inspection of surface integrity, container and bunding integrity. All tanks and pipework will be above ground and will undergo routine visual inspections to identify any leaks. This is covered in the document ref. **IMS-4-04-01-02-KETP procedure specifying waste storage tank and pipework inspection regime**.

			• See **Appendix 3** of this report for details on leak detection and repair protocol. <u>Appropriate buffer storage capacity</u> • As mentioned in BAT 4 response above, the total storage in the Physico-chemical Treatment and Recovery area for wastes will be up to 2450m^3 within tanks/vessels/silos, including 200 m^3 storage for packaged wastes and reagents within fully bunded segregated storage areas or skips. This will provide enough buffer storage capacity with some tanks having two to three additional tanks (see **Table 1 and 2** of this report for example). This applies to the Metal and Inorganic Salts recovery area with up to 500m^3 storage for wastes and effluents within 8 tanks, including additional storage of 200m^3 for packaged wastes, reagents and residues in skips.
20	In order to reduce emissions to water, BAT is to treat waste water using an appropriate combination of techniques.	Yes	<u>Physico-chemical treatment</u> The following physico-chemical treatment will be utilised in the treatment of aqueous and inorganic wastes, including solids and sludge, and metal recovery: • Adsorption • Precipitation • Chemical oxidation • Chemical reduction • Evaporation • Ion exchange <u>Solid removal</u> Solid removal examples that will be used includes: • Filtration • Floatation

	Emissions from accidents and incidents		
21	In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all for the techniques given below, as part of the accident management plan (See BAT 1) a) Protection measures b) Management of incidental/accidental emissions c) Incident/accident registration and assessment system	Yes	• An 'Environmental Risk Assessment' is provided as report ref. 5827-CAU-XX-XX-RP-V-0302. Risks from dust, odour, noise, other fugitive emissions, accidents and fire are considered to be 'low' from the proposed site activities. • The company's Integrated Management System will include an 'Accident Management Plan' for the proposed activities, with written procedures for handling, investigating, communicating and reporting environmental complaints and implementation of appropriate actions. • See **Appendix 4** of the report ref. 5827-CAU-XX-XX-RP-V-0305 for details on accident management procedures.
	Material Efficiency		
22	In order to use materials efficiently, BAT is to substitute materials with waste	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	Energy Efficiency		
23	In order to use energy efficiently, BAT is to use both of the techniques given below: a) Energy Efficiency plan b) Energy balance record	Yes	<u>Energy Efficiency Plan</u> • Housekeeping measures, including maintenance and operational procedures, will be in place for all areas to cushion the machinery breakdown that can impact the environment or compromise the operator's ability to undertake operations/ activities. A planned preventive maintenance (PPM) programme will cover all equipment significantly impacting the plant's energy consumption or energy conservation. Where applicable, automated equipment monitoring, including auto shut-off, will be used to minimise unnecessary run time.

			• Appropriate training of staff and monitoring will be undertaken to ensure the obligations under ISO 50001 are met. <u>Energy balance record</u> • Energy consumption information will be collated and reported in accordance with the permit as well as the requirement of the ISO 50001 standard in place at the site.
	Reuse of packaging		
24	In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan (see BAT 1).	Yes	• It may be necessary for some residues to be taken off-site for further recovery or disposal; due consideration will be given to the Waste Hierarchy. • Any packaging e.g. pallets etc. will be returned to the supplier for efficient recycling and re-use where appropriate. The Operator will (where applicable) re-use clean packaging and/or recycle at a suitable facility to reduce the quantity of waste sent for disposal. • Containers and drums will be sent to the appropriate recycling or disposal facility.
	General BAT conclusions for the mechanical treatment of waste		
25	In order to reduce emissions to air of dust, and of particulate-bound metals, PCDD/F and dioxin-like PCBs, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the mechanical treatment in shredders of metal waste		
26	In order to improve the overall environmental performance, and to prevent emissions due to accidents and incidents, BAT is to use BAT 14g and all of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
27	In order to prevent deflagrations and to reduce emissions when deflagrations occur, BAT is to use technique a. and one or both of the techniques b. and c. given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.

28	In order to use energy efficiently, BAT is to keep the shredder feed stable.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the treatment of WEEE containing VFCs and/or VHCs		
29	In order to prevent or, where that is not practicable, to reduce emissions of organic compounds to air, BAT is to apply BAT 14d, BAT 14h and to use technique a. and one or both of the techniques b. and c. given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
30	In order to prevent emissions due to explosions when treating WEEE containing VFCs and/or VHCs, BAT is to use either of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the mechanical treatment of waste with calorific value		
31	In order to reduce emissions to air of organic compounds, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the mechanical treatment of WEEE containing mercury		
32	In order to reduce mercury emissions to air, BAT is to collect mercury emissions at source, to send them to abatement and to carry out adequate monitoring.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	General BAT conclusions for the biological treatment of waste		
33	In order to reduce odour emissions and to improve the overall environmental performance, BAT is to select the waste input.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
34	In order to reduce channelled emissions to air of dust, organic compounds and odorous compounds, including H_2S and NH_3, BAT is to use one or a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.

35	In order to reduce the generation of waste water and to reduce water usage, BAT is to use all of the techniques given. below:	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the aerobic treatment of waste		
36	In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
37	In order to reduce diffuse emissions to air of dust, odour and bioaerosols from open-air treatment steps, BAT is to use one or both of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the anaerobic treatment of waste		
38	In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the mechanical biological treatment (MBT) of waste		
39	In order to reduce emissions to air, BAT is to use both of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the physico-chemical treatment of solid and/or pasty waste		
40	In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures.	Yes	See Response to BAT 2 above.
41	In order to reduce emissions of dust, organic compounds and NH_3 to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	Yes	Adsorption and wet scrubbing will be utilised in the physico-chemical treatment of solid wastes.

	BAT conclusions for the re-refining of waste oil		
42	In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures (see BAT 2).	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
43	In order to reduce the quantity of waste sent for disposal, BAT is to use one or both of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
44	In order to reduce emissions of organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given. below.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the physico-chemical treatment of waste with calorific value		
45	In order to reduce emissions of organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the regeneration of spent solvents		
46	In order to improve the overall environmental performance of the regeneration of spent solvents, BAT is to use one or both of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
47	In order to reduce emissions of organic compounds to air, BAT is to apply BAT 14d and to use a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil		
48	In order to improve the overall environmental performance of the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil, BAT is to use all of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
49	In order to reduce emissions of HCl, HF, dust and organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.

	BAT conclusions for the water washing of excavated contaminated soil		
50	In order to reduce emissions of dust and organic compounds to air from the storage, handling, and washing steps, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the decontamination of equipment containing PCBs		
51	In order to improve the overall environmental performance and to reduce channelled emissions of PCBs and organic compounds to air, BAT is to use all of the techniques given.	No	Not applicable to the physical and physico-chemical treatment of aqueous and inorganics waste, solids and sludge, including the metals and inorganic salts recovery, as well as drying.
	BAT conclusions for the treatment of water-based liquid waste		
52	In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures (see BAT 2).	Yes	• As mentioned in BAT 2 above, part of the waste pre-acceptance and acceptance procedure will involve sampling and testing, among others, of the waste types to ensure they fall within the permitted wastes accepted onto the site and a suitable process route identified. • Pre-acceptance samples will undergo suitable analysis by the site or laboratory chemist and may also be analysed at a third party laboratory. • If appropriate, more tests will be carried out to determine the best process route. In this instance, the container will be labelled appropriately to denote that it is waiting further testing. Once the sample has been analysed and the best process route identified, the container will be coded as appropriate and stored in the storage area before treatment.
53	In order to reduce emissions of HCl, NH3 and organic compounds to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given.	Yes	• Adsorption and wet scrubbing will be utilised in the physical and physico-chemical treatment of aqueous and inorganic wastes, as

			well as solids and sludge, including metals and inorganic salts recovery, as well as drying.

5.0 REFERENCES

1. Best Available Techniques (BAT) reference document for waste treatment, IED 2010/75/EU (Integrated Pollution Prevention and Control) (Updated October 2018).

2. Best Available Techniques (BAT) Conclusions for Waste 'Establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament of the Council. (updated August 2018).

DRAWINGS

5827-CAU-XX-XX-DR-V-1804	Permit Boundary Plan
5827-CAU-XX-XX-DR-V-1805	Sampling and Emission Point Plan
5827-CAU-XX-XX-DR-V-1807	Sampling and Emission Point Plan – Waste Processing 04
5827-CAU-XX-XX-DR-V-1808	Sampling and Emission Point Plan – Waste Processing 06

RIVER AIRE

DISCHARGE

STOCKING LANE

TRUNDLES LANE

Surface Water Storage

Waste Processing 07

INT 01

EP07

P07-ZP-01

Sewer Connection

Effluent

Waste Processing 02

EP02

P02-ZP-01

Waste Storage 02
(packaged only)

S02-ZS-01

General Storage 01

GS1-OS-01

General Storage 02

GS1-ZS-02

Packaged
Waste
Offloading
Area

Tanker
Holding
Area

Waste Processing 06

INT 02

EP26

EP06

EP16

P06-ZP-11

P06-ZP-21

P06-ZP-31

Surface Water Storage

INT 03

Waste Processing 03

EP03

P03-ZP-01

Waste Storage 01

S01-OS-01

Reception
Area

EP05

Diesel

EP11 EP01

Waste Processing 01

P01-ZP-01

Weighbridge

Waste Processing 05

P05-ZP-01

EP08

B01-ZP-01

EP18

B01-ZP-02

Boiler Complex

FIRE TANK

SUB

SUB

PUMP HOUSE

MANOEUVRING

YE Equipment
Transformer

Switchroom

Weighbridge

Switchroom
Transformer
YE Equipment

Offices and Labs

EP14

EP24

EP04

INT 04

P04-ZP-01

WEELAND ROAD

Gas Main

Water Main

Waste Processing 04

Water Main

NOTES

1. DO NOT SCALE FROM THIS DRAWING, WORK FROM FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

LEGEND

- OWNERSHIP BOUNDARY
- PERMIT BOUNDARY
- H — HYDRANT

REV	MODIFICATIONS	BY	RE	AP	DATE
P03	LEGEND AMENDED	EJD	JC	AS	06.08.25
P02	HYDRANTS ADDED TO DRAWING	EJD	JC	AS	28.07.25
P01	ISSUED FOR INFORMATION	EJD	JC	AS	10.07.25

CLIENT: FCC Environment

PROJECT: KNOTTINGLEY WASTE TO RESOURCE FACILITY

TITLE: PERMIT BOUNDARY PLAN

PURPOSE OF ISSUE			STATUS
FOR INFORMATION			S2
DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	JC	AS
DATE	SCALE @ A1	JOB REF:	REVISION
10.07.2025	1:750	5827	P03

DRAWING NUMBER: 5827-CAU-XX-XX-DR-V-1804

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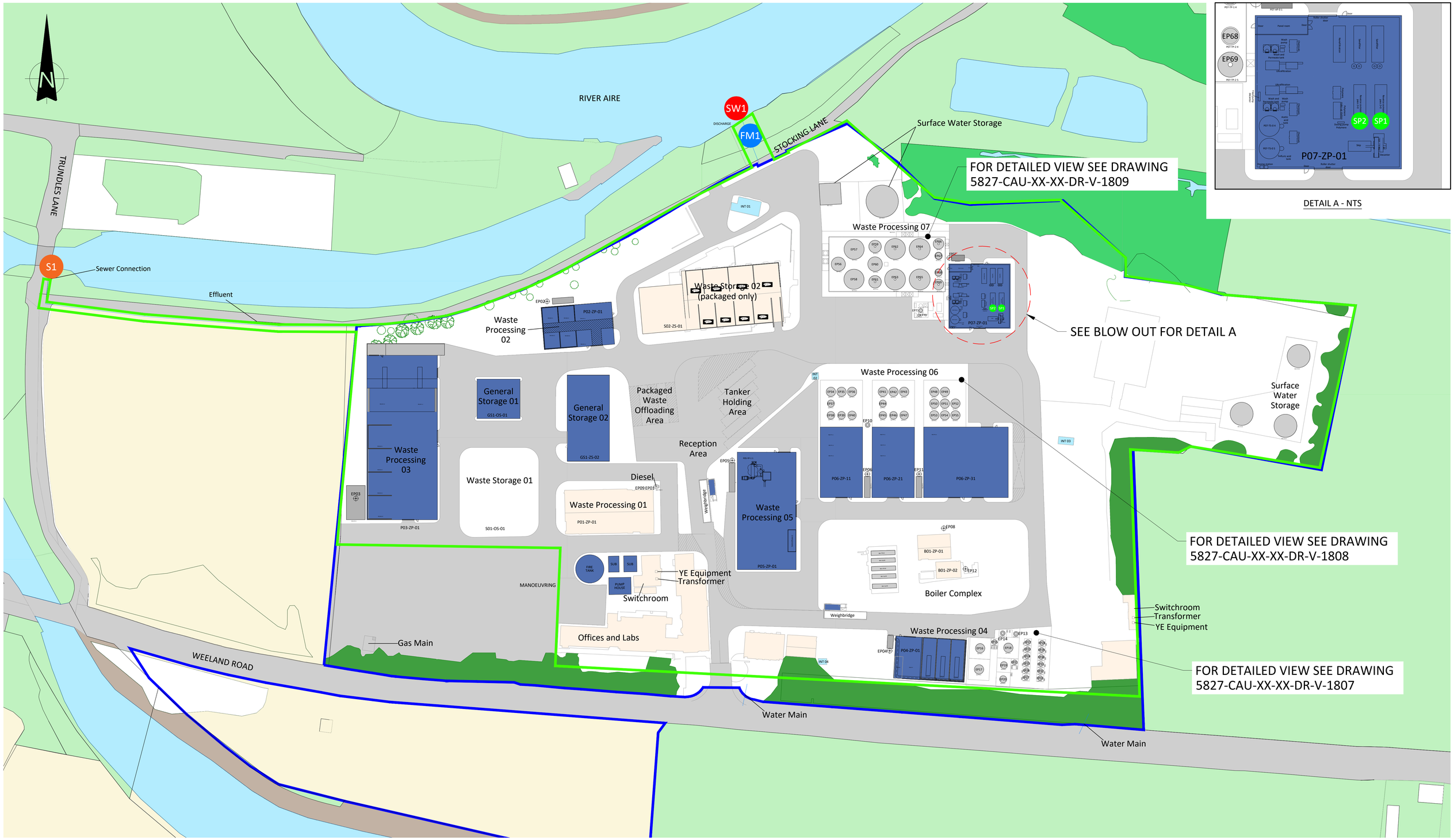

NOTES

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2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

LEGEND

- OWNERSHIP BOUNDARY
- PERMIT BOUNDARY
- BUILDINGS
- SW1 SURFACE WATER MONITORING
- S1 FOUL WATER MONITORING
- SP SAMPLING POINTS
- FM FLOW METER

REV	MODIFICATIONS	BY	RE	AP	DATE
P03	EP NUMBERS ADDED	EJD	JC	AS	17.12.25
P02	PERMIT BOUNDARY AMENDED	EJD	JC	AS	06.08.25
P01	ISSUED FOR INFORMATION	EJD	JC	AS	10.07.25

CLIENT: FCC Environment

PROJECT: KNOTTINGLEY WASTE TO RESOURCE FACILITY

TITLE: SAMPLING AND EMISSION POINT PLAN

PURPOSE OF ISSUE	STATUS
FOR INFORMATION	S2

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	JC	AS

DATE	SCALE @ A1	JOB REF:	REVISION
10.07.2025	1:750	5827	P03

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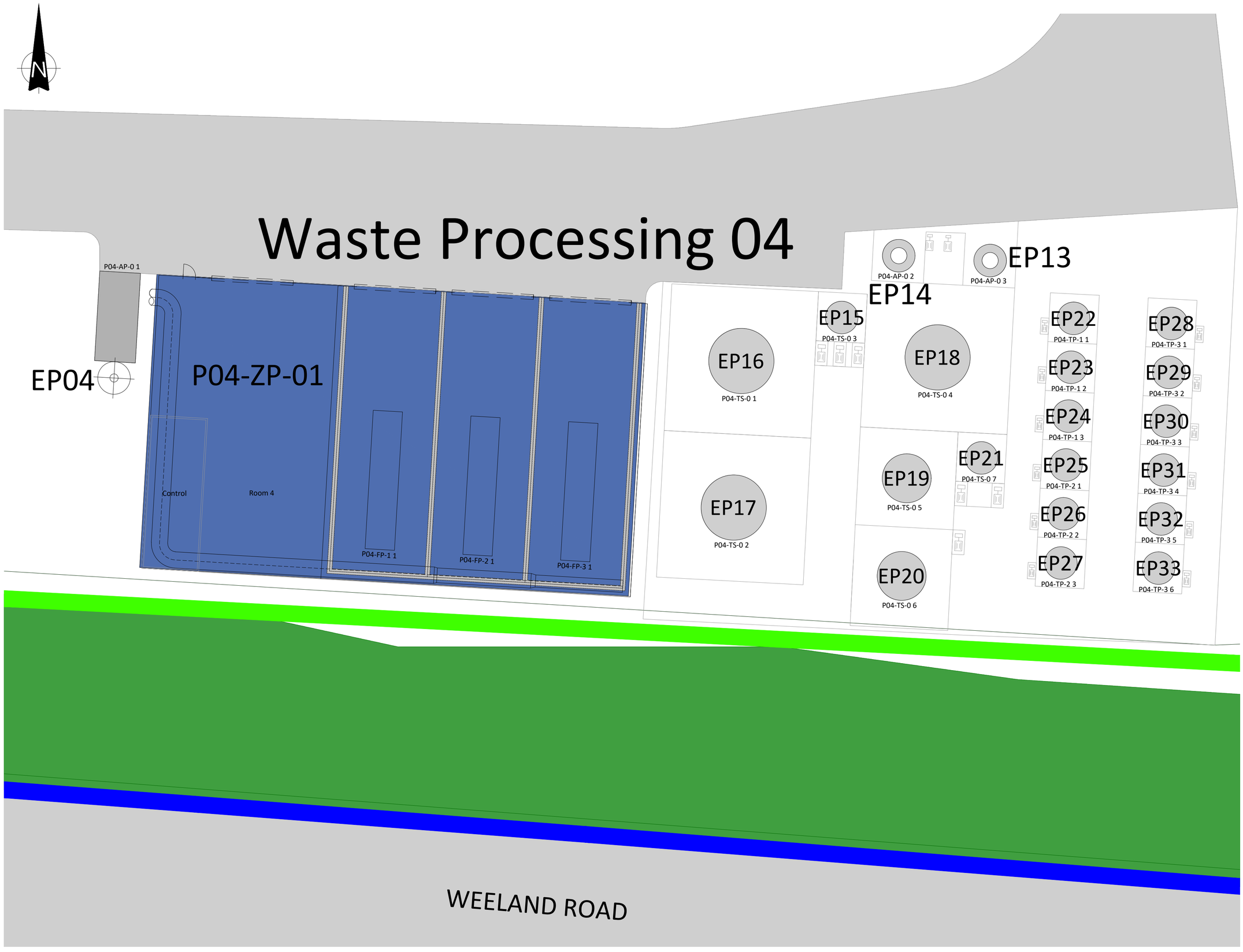
Waste Processing 04



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LEGEND

- OWNERSHIP BOUNDARY
- PERMIT BOUNDARY
- BUILDINGS

REV					
P01	ISSUED FOR INFORMATION	EJD	JC	AS	17.12.25
REV	MODIFICATIONS	BY	RE	AP	DATE

PURPOSE OF ISSUE: FOR INFORMATION
STATUS: S2

CLIENT: FCC Environment

PROJECT:
KNOTTINGLEY WASTE
TO RESOURCE FACILITY

TITLE:
SAMPLING AND EMISSIONS
POINT PLAN - WASTE PROCESSING 04

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	JC	JC
DATE	**SCALE @ A2**	**JOB REF:**	**REVISION**
16.12.2025	NTS	5827	P01

DRAWING NUMBER: 5827-CAU-XX-XX-DR-V-1807

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Waste Processing 06

INT 02

EP34 EP35 EP36
P06-TS-1 1 P06-TS-1 2 P06-TS-1 3

EP37
P06-TS-1 4

EP38 EP39 EP40
P06-TS-1 5 P06-TS-1 6 P06-TS-1 7

EP41 EP42 EP43
P06-TS-2 1 P06-TS-2 2 P06-TS-2 3

EP44
P06-TS-2 4

EP45 EP46 EP47
P06-TS-2 5 P06-TS-2 6 P06-TS-2 7

EP48 EP49
P06-TS-3 1 P06-TS-3 2

EP50 EP51 EP52
P06-TS-3 3 P06-TS-3 4 P06-TS-3 5

EP53 EP54 EP55
P06-LS-3 6 P06-LS-3 7 P06-LS-3 8

EP10

P06-TP-1 1
P06-TP-1 2
P06-TP-1 3

P06-TP-2 1
P06-TP-2 2
P06-TP-2 3

P06-TP-3 1

EP06

EP11

P06-ZP-11

P06-AP-0 1

P06-ZP-21

P06-AP-0 2

P06-ZP-31

NOTES

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LEGEND

BUILDINGS

REV	MODIFICATIONS	BY	RE	AP	DATE
P01	ISSUED FOR INFORMATION	EJD	JC	AS	17.12.25

PURPOSE OF ISSUE: FOR INFORMATION
STATUS: S2

CLIENT: FCC Environment

PROJECT:
KNOTTINGLEY WASTE
TO RESOURCE FACILITY

TITLE:
SAMPLING AND EMISSIONS
POINT PLAN - WASTE PROCESSING 06

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
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16.12.2025	1:200	5827	P01

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5827-CAU-XX-XX-DR-V-1808

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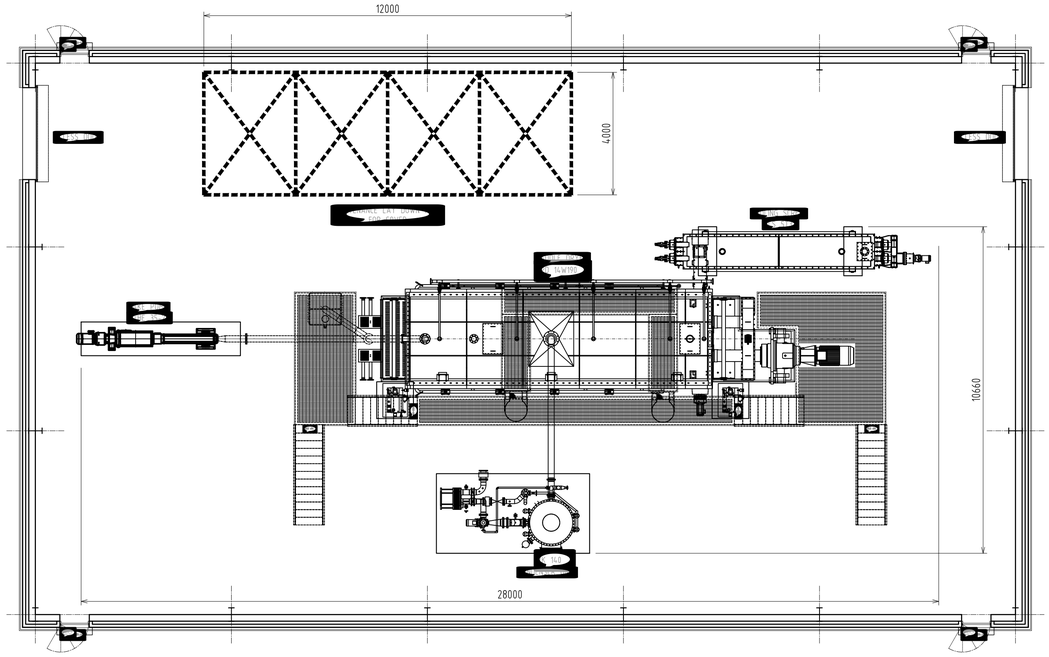
APPENDIX 1

Indicative drawing of the proposed GPD 14W 190 Single Condenser Paddle Dryer



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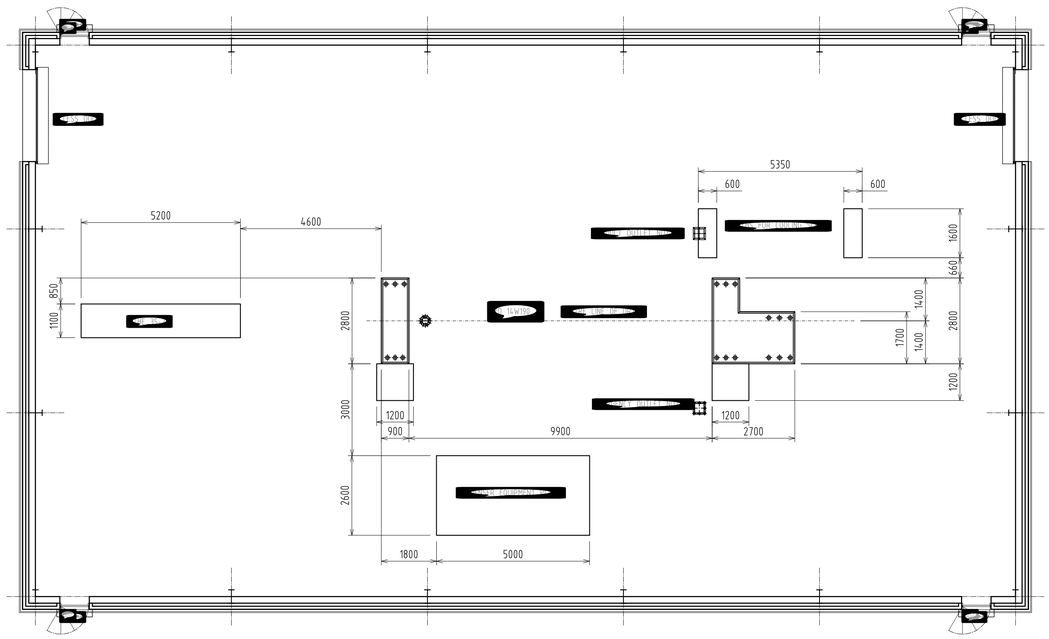

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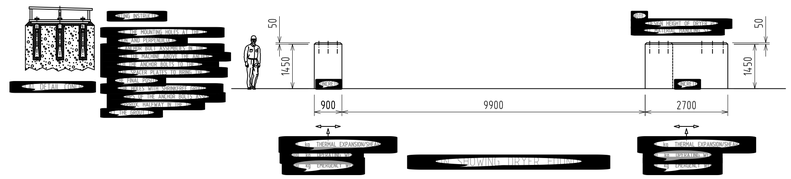

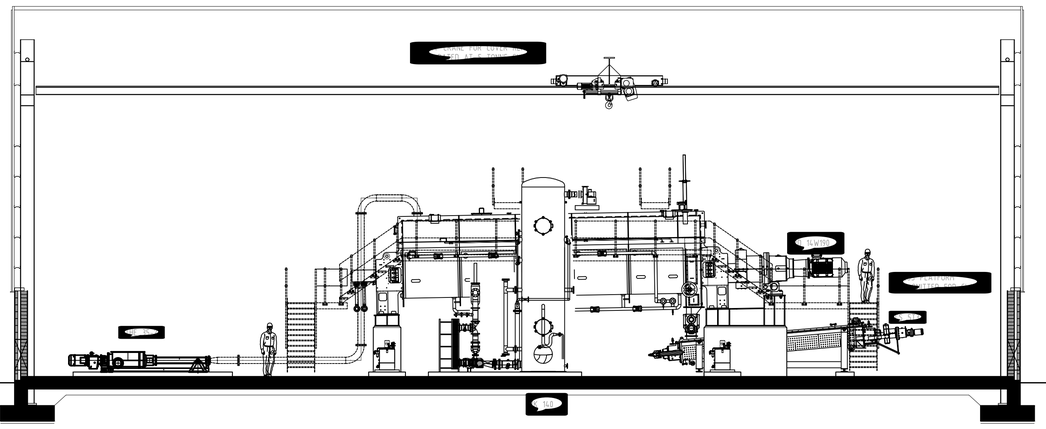

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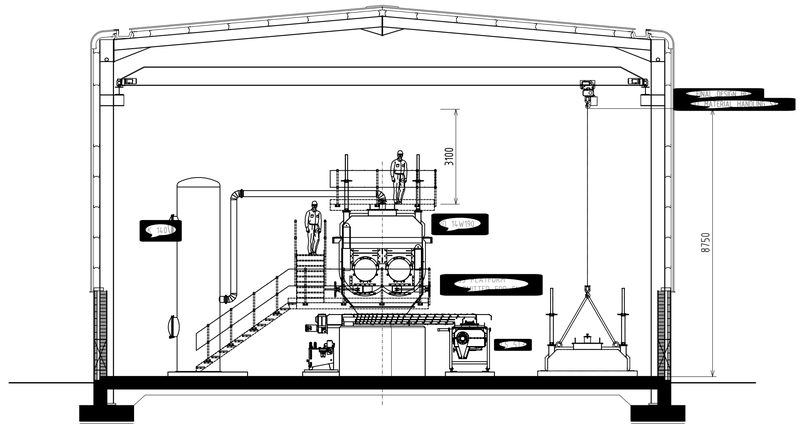

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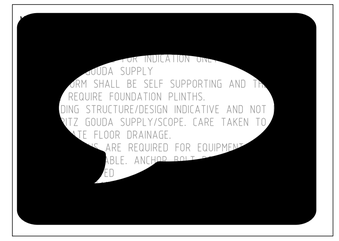

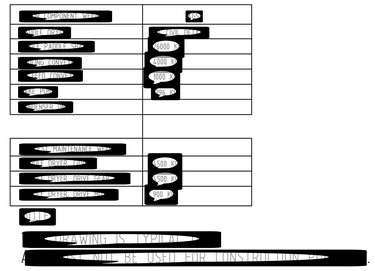

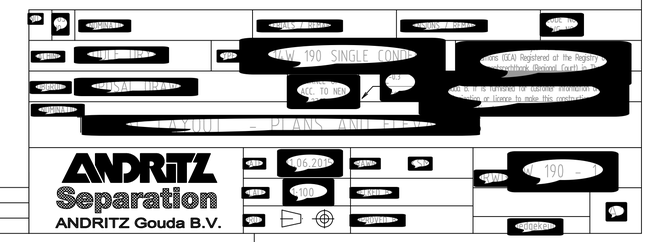

APPENDIX 2

Summary of emission points and their corresponding Grid references.

ID NEW	ID OLD	TANK ID	Grid References
SW1			SE 51236 23988
S1			SE 50944 23920
SP1			SE 51349 23903
SP2			SE 51345 23903
SITE WIDE			
EP01	EP01	GS1-TS-01	SE 51202 23827
EP02	EP02		SE 51155 23906
EP03	EP03		SE 51074 23822
EP04	EP04		SE 51301 23757
EP05	EP05		SE 51234 23838
EP06	EP06		SE 51292 23832
EP07		P07-AP-0 1	SE 51326 23924
EP08	EP08		SE 51324 23809
EP09	EP11		SE 51193 23826
EP10	EP26		SE 51292 23853
EP11	EP16		SE 51314 23832
EP12	EP18		SE 51333 23792
EP13	EP24	P04-AP-0 3	SE 51355 23764
EP14	EP14	P04-AP-0 2	SE 51349 23764
WASTE PROCESSING 04			
EP15		P04-TS-0 3	SE 51346 23761
EP16		P04-TS-0 1	SE 51339 23758
EP17		P04-TS-0 2	SE 51339 23749
EP18		P04-TS-0 4	SE 51352 23758
EP19		P04-TS-0 5	SE 51350 23751
EP20		P04-TS-0 6	SE 51349 23745
EP21		P04-TS-0 7	SE 51354 23752
EP22		P04-TS-1 1	SE 51360 23761
EP23		P04-TS-1 2	SE 51360 23758
EP24		P04-TS-1 3	SE 51360 23755
EP25		P04-TS-2 1	SE 51359 23752
EP26		P04-TS-2 2	SE 51359 23749
EP27		P04-TS-2 3	SE 51359 23746
EP28		P04-TS-3 1	SE 51366 23760
EP29		P04-TS-3 2	SE 51366 23757
EP30		P04-TS-3 3	SE 51366 23754
EP31		P04-TS-3 4	SE 51365 23751
EP32		P04-TS-3 5	SE 51365 23748
EP33		P04-TS-3 6	SE 51365 23745
WASTE PROCESSING 06			

EP34	P06-TS-1 1	SE 51276 23867
EP35	P06-TS-1 2	SE 51280 23867
EP36	P06-TS-1 3	SE 51285 23867
EP37	P06-TS-1 4	SE 51276 23862
EP38	P06-TS-1 5	SE 51276 23857
EP39	P06-TS-1 6	SE 51280 23857
EP40	P06-TS-1 7	SE 51285 23857
EP41	P06-TS-2 1	SE 51298 23867
EP42	P06-TS-2 1	SE 51303 23867
EP43	P06-TS-2 3	SE 51307 23867
EP44	P06-TS-2 4	SE 51298 23862
EP45	P06-TS-2 5	SE 51298 23857
EP46	P06-TS-2 6	SE 51303 23857
EP47	P06-TS-2 7	SE 51307 23857
EP48	P06-TS-3 1	SE 51320 23867
EP49	P06-TS-3 2	SE 51324 23867
EP50	P06-TS-3 3	SE 51320 23862
EP51	P06-TS-3 4	SE 51324 23862
EP52	P06-TS-3 5	SE 51329 23862
EP53	P06-LS-3 6	SE 51320 23857
EP54	P06-LS-3 7	SE 51324 23857
EP55	P06-LS-3 8	SE 51329 23857

WASTE PROCESSING 07		
EP56	P07-TS-0 3	SE 51279 23922
EP57	P07-TS-0 2	SE 51286 23928
EP58	P07-TS-0 1	SE 51286 23915
EP59	P07-TP-1 1	SE 51295 23929
EP60	P07-TP-0 1	SE 51295 23921
EP61	P07-TP-2 1	SE 51295 23914
EP62	P07-TP-1 2	SE 51303 23928
EP63	P07-TP-2 2	SE 51303 23915
EP64	P07-TP-1 3	SE 51314 23928
EP65	P07-TP-2 3	SE 51314 23915
EP66	P07-TP-1 5	SE 51322 23930
EP67	P07-TP-1 4	SE 51322 23926
EP68	P07-TP-2 4	SE 51322 23918
EP69	P07-TP-2 5	SE 51322 23913
EP70	P07-TS-0 6	SE 51322 23913
EP71	P07-TP-3 2	SE 51314 23902

APPENDIX 3

Leak Detection and Repair Protocol

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Leak Detection and Repair Plan

Provisions to prevent accident releases of pollutants to the Environment are described in the BAT document. This document summarises those activities.

Ensuring adequate monitoring and maintenance of equipment forms part of the Integrated Management System and associated procedures to be employed on the site. The application and suitability of these systems are audited both internal and by external auditors to maintain the British Standard certifications issued to the facility.

To mitigate against the risks of leakage of reagents and wastes the Knottingley Waste to Recovery facility provides:

- That operational areas are on impermeable surfaces with kerbing or bunding as appropriate to protect non operational areas. Daily site walkovers will take place to monitor the condition of the impermeable floors, kerbing and bunding to visually identify any wear or damage that may lead to loss of containment and identify any need for remedial action. The need for such action is logged, appropriate immediate action undertaken (e.g. additional temporary containment measures or cessation of activities in an area) and a defect report raised to instigate a suitable repair or modification to ensure the area concerned remains fit for purpose.
- That tanks, process equipment and vessels, ducting and pipework, other than associated with site drainage system and spill collection sumps, are above ground and within the impermeable area. Additional containment is provided within the main process areas with internal bunding of the buildings, including those storing reagents or wastes, tanks either individually bunded or grouped within a specific bunded area. Daily site walkovers will inspect tanks, process vessels, and pipework for signs of damage or leak, or unusual odours or other signs of leakage, and identify any need for remedial action. The need for such action is logged, appropriate immediate action undertaken (e.g. temporary repairs or cessation of use) and a defect report raised to instigate a suitable repair, modification, or replacement to ensure the equipment concerned remains fit for purpose. An Engineering Protocol will be developed and employed to ensure the routine maintenance inspection of tanks, process equipment and vessels and pipework in line with good practice. Engineering works identified, or undertaken as routine servicing and inspection, will be undertaken by suitably qualified staff or contractors.
- That the use of underground sumps will be avoided and limited to blind sumps for the collection of rainwater or spillages in impermeable areas or interceptors for the cleaning of (potentially) contaminated surface waters. Such sumps will be observed as fit for purpose and subject to an annual integrity test.

- That the site drainage system is such that all waters not within a tank or building bunds, are collected at a central point prior to being pumped to surface water or sewer as appropriate. Monitoring of this water provides an additional indication that a leak may have occurred and will prompt an investigation and appropriate action to remedy any relevant issue.
- That in addition to routine monitoring staff are trained in 'near miss and incident reporting' which allows for reporting of issues outside of formal daily or other routine inspections. An electronic incident management system is used to record these reports and instigate action by the relevant individuals– 'see it, say it, sorted' approach. Near miss and incident reports, with associated actions are collated and reviewed monthly to identify any negative trends or learning lessons.
- That the practices and procedures highlighted form part of the Integrated Management System which is subject to internal and external independent audit on an annual basis which may identify correct actions or opportunities for improvement.

APPENDIX 4

Identification and Selection of Emission Control Equipment Summary Document

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Identification and selection of Emission Control equipment: FCCE Knottingley Waste to Resource Facility

The use of the Best Available Techniques approach requires the identification of potential emissions to air and, where appropriate and practicable their control. The Best Available Techniques (BAT) Reference Document for Waste Treatment (2018) highlights the best available techniques for such control based upon the activities undertaken. This information, together with equipment selection and performance information from suppliers, knowledge of the waste treatment processes to be employed at the site and of existing experience has informed the selection of appropriate emissions control techniques to be employed at the facility.

All buildings where waste processing occurs are designed to operate as far as practicable as enclosed, with air being extracted through an appropriate or precautionary emission control system. The operation of the building, extraction and emission control system will be such as to maximise their ability to control emissions and complement waste pre-acceptance, acceptance and operational measures to minimise emissions to air.

Where activated carbon is chosen as the primary emission control technique, the carbon grade for each individual application will be selected, with advice from the supplier, to be the most suited for the range of substances required to be removed. Where practicable, carbon will be removed for regeneration once spent, as opposed to appropriate disposal.

The choice of wet scrubber configuration and associated operating conditions for each individual application will be selected, with advice from the supplier, to be the most suited for the range of substances required to be removed.

The choice of fabric filtration unit, filter media and its operating conditions for each individual application will be selected, with advice from the supplier, to be that most suited.

Where wastes are stored in buildings in an unpackaged form, emission control equipment will be operated continuously and during times of maintenance or equipment failure stocks minimised.

Where emission control is required for process tanks or vessels or waste treatment activities are being undertaken within a building, the emission control system will be in operation. During time of maintenance or equipment failure waste processing operations will cease.

Equipment will be maintained and operated in line of good practice with appropriate monitoring and routine maintenance undertaken as applicable.

Compliance with the BAT Reference Document and the Appropriate measures document has been highlighted in the appropriate documents of this permit variation application.

Control of organic emissions

Waste Processing 1

Air emissions from this building (P01-ZP-01) will contain organic substances at low concentration from bulking operations from small containers to larger containers involving organic solvents such as methanol and the shredding of retail containers and contaminated packaging. These activities are undertaken within hooded areas where air is extracted to minimise the occupational health risk to employees and visitors. The extracted air is cleaned within an activated carbon filter which is highlighted within the BAT Reference Document and known in practice to be the best technique for such emission control. Efficiency of removal exceeds 90 %.

The building is fitted with doors, and the extraction of air maintains the building under negative pressure when in use.

No processing vessels or storage tanks area associated with this activity.

Waste Processing 2

Air emissions from this building (P02-ZP-01) may contain organic vapours at very low concentration from bulking operations from small containers to larger containers involving non-volatile organic or organic substances containing wastes e.g., water-based paints and detergents and the shredding of retail containers and contaminated packaging. Inorganic wastes with very low risk of emissions are also processed in this area and exclude those that may generate gaseous emissions e.g., strong acids for which an alternative process area is provided. Wastes maybe processed anywhere, this coupled with the low risk of emissions of organic substances has resulted in the selection of activated carbon filtration as the means of emission control as highlighted in the BAT Reference Document as the most practicable technique. Efficiency of removal is expected to exceed 90 % and is the most efficient technique available for this duty.

No processing vessels or storage tanks are associated with this activity.

Waste Processing 3

Air emissions from this building (P03-ZP-01) may contain dusts and organic vapours at very low concentration from shredding and storage operations associated with non-hazardous wastes such as contaminated water-based paint containers. Waste processed are not putrescible and residence time within the building is limited to a maximum of 7 days.

Two complementary emission control systems are used. A recirculation system employing fabric dust filtration and carbon filtration, which acts to clean air and return it to the building and an air extraction system to remove potential nuisance odours or organic substances prior to emission to air via the emission point. The latter ensures

negative pressure within the building as a whole, the former allows extraction of air from specific process areas and allows air to be recirculated and therefore minimising the need for space heating.

Fabric filtration for dusts is identified as a best practicable technique within the BAT Reference Document and is expected to achieve > 95 % removal of particulates. The use of activated carbon to control the emission of organic substances at low levels is highlighted in the BAT Reference Document as the best practicable technique. Efficiency of removal is expected to exceed 90 %. Both fabric filtration and activated carbon adsorption are the most efficient techniques available for their identified duties.

The building is fitted with doors, and the extraction of air maintains the building under negative pressure, this is maintained 24/7 due to the presence of unpackaged wastes.

No processing vessels or storage tanks are associated with this activity.

Control of inorganic emissions

Waste Processing 4

These activities include a building (P04-ZP-01) and an associated tank farm with mixing vessels with wastes being processed limited to inorganic solutions or solids with negligible volatile organic composition. Emission control is therefore to manage the potential presence of acid or alkaline inorganic gases specifically hydrogen chloride, sulfur dioxide and ammonia which may result from storage or processing activities of wastes or reagents containing these dissolved gases.

The use of appropriate wet scrubbing techniques is highlighted in the BAT reference document as the best practicable and most efficient means of dealing with air emissions of inorganic acid or alkaline gases. Two such scrubbing systems are to be provided, one suited for acid and one suited for alkaline gases for the tank farm and mixing vessels. Scrubbing for acid gases will be by use of a sodium hydroxide solution and of alkaline gases by a sulfuric acid solution with monitoring of these reagents being undertaken to ensure neutralising capacity is available.

All storage tanks and mixing vessels will be connected to an appropriate scrubber based upon their contents and negative pressure will be maintained 24/7 while material is present in the associated tank or vessel.

A building is used for the final filtration and processing and storage of recovered products. There is negligible risk of emissions from these activities, but the building will be maintained under negative pressure and activated carbon filtration used to clean the removed air as a precautionary measure.

Waste Processing 5

These activities are undertaken in a building (P05-ZP-01) which houses a drying unit for inorganic solid wastes. The unit is enclosed, and the presence of volatile organic materials will be negligible, however the warming of wastes may result in some odours. The building will therefore be maintained under negative pressure with activated carbon being used to clean the air removed as a precautionary measure.

Waste Processing 6

These activities are spread across three buildings each with an associated tank farm with mixing vessels present within the buildings and within the tank bunds. Tank storage is provided for liquid and solid (powder) wastes and reagents. Waste processing is limited to solid and liquids with limited inorganic solutions or solids with negligible volatile organic composition. Emission control is therefore to manage the potential presence of acidic inorganic gases, specifically hydrogen chloride and sulfur dioxides from vessels containing liquids and dusts from vessels holding powder wastes or reagents

Buildings P06-ZP-11 and ZP-21 are concerned with dealing with aqueous and solid inorganic wastes which may be acidic or alkaline and require reagents such as calcium hydroxide or sulfuric acid. Wastes and reagents may be bulk powders or liquids or packaged solids and liquids. Wet scrubbing utilising sodium hydroxide as a reagent is provided for storage vessels, reaction and mixing vessels.

The buildings are provided with an activated carbon filter to deal with what will be negligible emissions from the processing and storage activities in these buildings, but will allow the buildings to be kept under negative pressure.

Building P06-ZP-31 is concerned with the processing of Air Pollution Control (APCr) derived wastes from Energy from Waste facilities, cement kilns and similar, by washing and filtering or conditioning. The potential for emissions to atmosphere is considered negligible as the mixing of APCrs with reagents is undertaken within enclosed equipment within a building. The building is provided with an activated carbon filter to deal with what will be negligible emissions from the processing and storage activities in the building but will allow the buildings to be kept under negative pressure.

Within the associated tank farm, storage vessels or mixing vessels holding liquids, except for reagent inorganic acids, are not extracted as the potential for emissions to atmosphere are negligible – the wastes concerned being aqueous solutions of calcium hydroxide or sodium carbonate-based powders with negligible organic or other volatile components. Reagent acid storage tanks are extracted and scrubbed by a sodium hydroxide scrubber shared with the adjacent building (P06-ZP-21).

Tank storage for powders is equipped with self-cleaning fabric filters with captured dusts returned to the storage tank or removed. Fabric filters are identified within the BAT Reference Document as the best practicable technique for this application.

The use of wet scrubbing techniques with appropriate reagents is highlighted in the BAT Reference Document as the best practicable and most efficient means of dealing with air emissions of inorganic acid gases.

Control of inorganic and organic emissions

Waste Processing 7

Waste processing activity 7 is associated primarily with the treatment of landfill leachates to recover ammonia and return clean water to productive use in the environment. There are three distinct processing activities:

- Membrane filtration, reverse osmosis and ultrafiltration with the potential for nanofiltration, all of which are undertaken in a building (PO7-ZP-01), the equipment is sealed with no open vessels;
- Ammonia stripping and scrubbing and associated storage of the recovered aqueous ammonia solution;
- Biological treatment of landfill leachate and similar biodegradable wastes with where practical, waste substituting for reagents.

Leachate received at the facility will be from predominately closed landfills where stabilisation of the organic content has occurred. Leachate from open landfills may be received and will be partially or fully stabilised from closed cells and not operational areas. Stabilised leachate has a very low presence of volatile organic substances but does contain dissolved ammonia. The emission control rationale is therefore as follows:

- Membrane filtration units are housed within a building kept under negative pressure using an activated carbon filtration system to deal with fugitive odours should they occur. The selection of activated carbon filtration as the means of emission control is highlighted in the BAT Reference Document as the most practicable technique for such emissions. Efficiency of removal is expected to exceed 90 % and is the most efficient technique available for this duty.
- The ammonia stripping and scrubbing unit is sealed process except for a minimal air bleed and the storage tank for the recovered product. The air bleed may be a source of odour from the concentrate leachate being processed so is equipped with an activated carbon filter, the ammonia storage tank is equipped with a wet scrubber unit utilising a sulfuric acid solution to deal with displaced air.
- The biological treatment activity consists of a number of tanks where aerobic and anoxic conditions are maintained to sustain a microorganism population by

aeration or not, as appropriate, and the provision of appropriate nutrients – principally within the waste being treated. All tanks are enclosed with venting to remove displaced air (from aerated tanks) or as overfill protection. Operation of similar plants, including BAT compliant facilities, indicates no further emission controls are required.

APPENDIX 5

Secondary Containment

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Containment

The Knottingley Waste to Resource Facility is designed to provide secondary containment for all tank storage and allows for tertiary containment due to the presence of a drainage system which collects runoff waters from the site and holds them prior to release from the facility.

Tank storage areas are associated with:

Waste Processing 4 – Metals and inorganic salts recovery;

Waste Processing 6 – Physical and Physico-chemical treatment of acids and alkalis;

Waste Processing 7 – Physico-chemical and Biological treatment of landfill leachate and aqueous wastes.

Where tanks are within buildings, these are self-bunded, to provide protection to staff working in the building, and the building itself is bunded to allow spill containment.

Bunded storage areas

<u>Waste Processing 4 bund associated with building (P04-ZP-01)</u>

- Total tank capacity within bund: 820 m^3
- Largest tank in the bund: 100 m^3
- Basal area occupied by tanks: 239 m^2 (19 tanks maximum 4 m diameter bases)
- Bund area total: 782 m^2
- Bund height: 1m
- Total capacity: 782 m^3
- Total available capacity: 581 m^3
- **% largest tank: 581 %**

<u>Waste Processing 6 bund associated with building (P06-ZP-11)</u>

- Total tank capacity within bund: 650 m^3
- Largest tank in the bund: 100 m^3
- Basal area occupied by tanks: 88 m^2 (7 tanks maximum 4 m diameter bases)
- Bund area total: 374 m^2
- Bund height: 1m
- Total capacity: 374 m^3
- Total available capacity: 286 m^3
- **% largest tank: 286 %**

Waste Processing 6 bund associated with building (P06-ZP-21)

- Total tank capacity within bund: 500 m^3
- Largest tank in the bund: 100 m^3
- Basal area occupied by tanks: 88 m^2 (7 tanks maximum 4 m diameter bases)
- Bund area total: 374 m^2
- Bund height: 1m
- Total capacity: 374 m^3
- Total available capacity: 286 m^3
- **% largest tank: 286 %**

Waste Processing 6 bund associated with building (P06-ZP-31)

- Total tank capacity within bund: 800 m^3
- Largest tank in the bund: 100 m^3
- Basal area occupied by tanks: 101 m^2 (8 tanks maximum 4 m diameter bases)
- Bund area total: 389 m^2
- Bund height: 1m
- Total capacity: 389 m^3
- Total available capacity: 288 m^3
- **% largest tank 288 %**

Waste Processing 7 bund associated with building (P07-ZP-01)

- Total tank capacity within bund: 4755 m^3
- Largest tank in the bund: 600 m^3
- Basal area occupied by tanks: 517 m^2 (15 tanks, multiple base sizes area occupied)
- Bund area total: 1336 m^2
- Bund height: 1.1 m
- Total capacity: 1469 m^3
- Total available capacity: 952 m^3
- **% largest tank: 159 %**

APPENDIX 6

Site Drainage Plan

Caulmert
engineering environmental planning

Registered Office: InTec, Parc Menai, Bangor, Gwynedd, LL57 4FG
Tel: 01248 672666
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Rising main to river

Pumping well

Hydrobrake at outlet restricting runoff to 19 l/s, the greenfield equivalent 1 in 100 year plus CC discharge rate over a 5.0ha drained area.

Pipe diameters ranging between 450mm and 825mm required to achieve minimum velocities for self-cleansing due to shallow gradients.

CL: 9.6

CL: 10.0

CL: 10.0

CL: 10.2

CL: 10.0

CL: 10.0

CL: 10.2

CL: 10.2

CL: 10.2

CL: 10.3

CL: 10.1

CL: 10.1

CL: 10.2

CL: 10.2

CL: 10.2

CL: 10.3

Attenuation basin.
Invert level: 8.0m AOD
Top level: 10.0m AOD
Bottom area: 2200m^2
Top area: 3000m^2

Excavation required on western side whilst provision of bund on eastern side required due to lower ground levels.

Minimum cover of 600mm across network, assumed below concrete slab

Proprietary treatment systems to be installed across the network upstream of the basin to intercept primarily hydrocarbons. Locations and capacity to be determined based on area served and activity within them.

Linear drains to be embedded in concrete slabs to capture surface water runoff.

N

Project :

Waste to Resource Park

Client :

Axis

Legend :

- Proposed Manholes
- Rising Main
- Gravity Sewer
- Attenuation Basin
- Site Boundary
- Existing Building
- Proposed Building
- Bunded Tank Area
- Proposed Roads
- CL Cover Level

Scale :

0 20 40 60 80 m

Title :

Waste to Resource Park 33 Outline Surface Water Drainage Strategy

Drawing :	Rev :
WHS10192-T01-0001	1

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