WasteCare Ltd

Battery Treatment Facility, Halifax

OPERATING TECHNIQUES

May 2023

Date: HxOPTN.v15
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CONTENTS

TABLES

APPENDICES

DRAWINGS

Drawing Number	Drawing Title	Scale
ST16653-001	Site Location Plan	1:20,000
ST16653-002	Permit Boundary Plan	1:2,500
HXSP1	Site Layout and Drainage Plan	1:500

1 INTRODUCTION

1.1 WasteCare Limited are applying for a variation to the bespoke installation permit at Units 1-6 North Dean Business Park, Stainland Road, Halifax, HX4 8LR. The site location and permit boundary of the facility are shown on drawings ST16653-001 and ST16653-002 respectively.

1.2 The facility will sort batteries into their different chemistries. Alkaline batteries and batteries with zinc or manganese chemistry (referred to as alkaline batteries in this application) will then be deconstructed in a hammermill to facilitate the recovery of four fractions, specifically ferrous metal, non-ferrous metal, mixed paper and plastic and black mass. The other types of batteries separated into their different types will be sent for offsite recycling and recovery. This includes batteries containing fluids, e.g. lead acid batteries, will not be treated on site but will be bulked up for treatment elsewhere.

1.3 The facility will accept up to 25,000 tonnes per annum of hazardous and non-hazardous batteries. A full list of the battery types that may be accepted on site is given in the Operating Techniques.

1.4 The storage and treatment (sorting) of mixed batteries (hazardous waste) of more than 10 tonnes per day means this activity falls under Schedule I Part II of the Environmental Permitting (England and Wales) Regulations 2016, making it an 'installation':

Section 5.3 Part A(1) (a)

Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving one or more of the following activities—

(ii) physico-chemical treatment

Section 5.6 Part A(1) (a)

Temporary storage of hazardous waste with a total capacity exceeding 50 tonnes pending any of the activities listed in Sections 5.1, 5.2, 5.3

1.5 Treatment of batteries will be carried out in accordance with Best Available Techniques. Furthermore, small items of waste electrical and electronic equipment (WEEE) will also be accepted at the site. These will be treated to remove the batteries and sort them for recycling. Treatment of WEEE is carried out using Best Available Treatment, Recovery and Recycling Techniques (BATRRT).

1.6 The treatment and storage of waste batteries will also comply with Part A of Annex III to the Batteries Directive, specifically: treatment and storage areas will have impermeable surfaces with weatherproof covering in appropriate areas or suitable containers. The recycling process is designed to allow battery recycling through the site to meet the efficiency required by Annex III, Part B of the Batteries Directive, that is recycling at least 65% by average weight of lead-acid batteries, 75% by average weight of nickel cadmium batteries and 50% by average weight of other batteries.

1.7 The site is operated in accordance with an Environmental Management System (EMS), which meets the requirements of the Environment Agency's Guidance (https://www.gov.uk/guidance/develop-a-management-system-environmental-permits) and is accredited to ISO 14001. The key features of the EMS are described in Section 3.

1.8 Permitted wastes, including the European Waste Catalogue (EWC) references, are detailed in Section 4. Waste acceptance procedures will be employed at the site to ensure that only permitted wastes are accepted at the site. Waste acceptance procedures are detailed in Section 5.

1.9 All waste storage and treatment activities will be undertaken in a manner that ensures environmental protection at all times. Details of the waste treatment process and the robust site infrastructure provided to ensure environmental protection during normal and abnormal operational scenarios are discussed in Sections 6, 7 and 8.

1.10 Environmental monitoring and record keeping will be undertaken and completed in accordance with the EMS and the conditions of the environmental permit. Further information on this is provided in Section 9.

2 REGULATED ACTIVITIES

2.1 The site is classed as an installation under the Environmental Permitting (England and Wales) Regulations 2016

2.2 The installation activities, waste operations and Directly Associated Activities (DAAs) are set out in table 2:1 below.

Table 2:1 Installation Description

Activity	Schedule 1 classification	Limits of prescribed activity, including WFD Annex I and II Codes
Listed Activities		
Storage of hazardous wastes	Section 5.6 Part A (1) (a) for the *"Temporary storage of hazardous waste with a total capacity exceeding 50 tonnes pending any of the activities listed in Sections 5.1, 5.2, 5.3…"*	**R13:** storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it was produced) The maximum quantity of mixed batteries pending sorting on site at any one time will be 2,000 tonnes. Hazardous batteries will be stored in appropriate covered storage areas following sorting. Waste types will be as set out in Section 4.
Recovery of hazardous wastes	5.3 Part A (1) (a) (ii) for the *"Recovery or a mix of recovery and disposal of hazardous waste with a capacity exceeding 10 tonnes per day involving… physico-chemical treatment"*	**R3:** recycling/reclamation of organic substances which are not used as solvents **R4:** recycling/reclamation of metals and metal compounds **R5:** recycling/reclamation of inorganic materials other than metals or metal compounds

Table 2:1 Installation Description		
Activity	**Schedule 1 classification**	**Limits of prescribed activity, including WFD Annex I and II Codes**
		R13: storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it was produced) **D15**: storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where the waste is produced) Annual throughput for the site of 25,000 tonnes per annum. The site has the ability to treat 100 tonnes per day of hazardous wastes. Waste types will be as set out in Section 4.
Waste Operations		
Recovery of non-hazardous wastes	Not applicable	**R3:** recycling/reclamation of organic substances which are not used as solvents **R4:** recycling/reclamation of metals and metal compounds **R5:** recycling/reclamation of inorganic materials other than metals or metal compounds **R13:** storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it was produced) The site has the ability to treat 100 tonnes per day of non-hazardous wastes. Waste types will be as set out in Section 4.
[Directly Associated Activities]		
Storage of wastes generated on site	Not applicable	**R13:** storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it was produced) The maximum quantity of black mass pending removal from site at any one time will be 100 tonnes. The maximum quantity of ferrous and non-ferrous metal pending removal from site at any one time will be 35 tonnes.

3 SITE MANAGEMENT

3.1 The site will be operated in accordance with WasteCare Limited's Environmental Management System (EMS).

3.2 The EMS includes an Environmental Policy that makes a commitment to compliance with relevant legislation and the conditions of the Environmental Permit as well as seeking continuous improvement in environmental matters.

3.3 Written procedures are provided for all aspects of site operations to ensure that activities are carried out in a manner which will secure legal compliance and protect the environment. These will include procedures for pre-acceptance checks, waste acceptance and rejection, waste handling and treatment and waste dispatch.

3.4 Site operations will be audited internally and externally on an annual basis to confirm compliance with the written procedures, review progress and set targets for continuing improvement over the coming year.

3.5 Environmental issues will be a factor in purchasing of equipment and any infrastructure improvements, ensuring high levels of protection. Where possible equipment offering better energy efficiency and lower emissions will be selected.

3.6 A record will be kept of the skills necessary for each role and training needs will be assessed on an annual basis. All staff will be trained with regards to the Environmental Permit and Environmental Management System ensuring that they have an understanding commensurate with their post.

3.7 An induction will be provided for contractors and visitors on site, giving an introduction to health and safety and environmental issues on site and ensuring that they are aware of any site-specific requirements and are able to carry out their duties without harm to the environment.

3.8 A preventative maintenance programme will be in place with all site infrastructure and equipment inspected on a regular basis and serviced in accordance with the manufacturer's recommendations. Records will be kept of all inspections and any necessary repairs or maintenance will be noted, with timescales for these to be carried out.

4 PERMITTED WASTES

4.1 A list of EWC codes for acceptable wastes is provided in Table 4:1, below. It is likely that the loads of mixed batteries which are classified as hazardous waste will commonly comprise approximately 80-85% alkaline batteries which are non-hazardous when separated out.

Table:4.1: Permitted Wastes	
EWC Code	**Waste Type**
16	**Wastes not otherwise specified in the list**
16 02	**Waste from electrical and electronic equipment**
16 02 13*	Discarded equipment containing hazardous components other than those mentioned in 16 02 09 to 16 02 12
16 02 14	Discarded equipment other than those mentioned in 16 02 09 to 16 02 13
16 02 15*	Hazardous components removed from discarded equipment
16 02 16	Components removed from discarded equipment other than those mentioned in 16 02 15
16 06	**Batteries and accumulators**
16 06 01*	lead batteries
16 06 02*	Ni-Cd batteries
16 06 03*	mercury-containing batteries
16 06 04	alkaline batteries (except 16 06 03)
16 06 05	other batteries and accumulators
19	**Wastes from waste management facilities, off site waste water treatment plant and the preparation of water intended for human consumption and water for industrial use**
19 12	**Wastes from mechanical waste not otherwise**
19 12 11*	Other wastes (including mixtures of materials) from mechanical treatment of waste containing dangerous substances. (WEEE sorted for recycling)
19 12 12	Other waste (including mixtures of materials) from mechanical treatment of waste other than those mentioned in 19 12 11 (WEEE sorted for recycling)
20	**Municipal Wastes (Household waste and similar commercial, industrial and institutional wastes) Including separately collected fractions**
20 01	**separately collected fractions (except 15 01)**
20 01 21*	Fluorescent tubes and other mercury containing waste
20 01 33*	Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries
20 01 34	batteries and accumulators other than those mentioned in 20 01 33
20 01 35*	Discarded electrical and electronic equipment other than those mentioned in 20 01 21 and 20 01 23 containing hazardous components
20 01 36	Discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35.

5 WASTE ACCEPTANCE PROCEDURES

Pre-Acceptance

5.1 The waste types to be accepted on site arise from the centralised collection of household batteries at designated drop-off centres through national battery collection schemes. These schemes target the collection of mixed household batteries. Deliveries will be made by WasteCare from their other UK waste transfer stations and from third parties.

5.2 All deliveries from third parties will be pre-notified to WasteCare for agreement. Batteries to be delivered from other WasteCare facilities will be notified to the site manager, with waste pre-acceptance checks being undertaken at the consigning site

5.3 As part of the pre-acceptance checks applied to all suppliers a check list is used to ensure all relevant data is captured. This data sheet is included as Pre-acceptance Checks. Typically, data is gathered as a desk based exercise and will include photographs of the waste batteries, company website checks and phone calls.
WasteCare apply the precautionary principle for all materials, and therefore all mixed loads will be over-classified as hazardous waste on the assumption they contain Lithium batteries.
All pre-acceptance information is inspected by a competent person, experienced and trained in the identification of hazardous batteries.

Acceptance

5.4 Materials to be processed at the site will be transported by a registered Waste Carrier and accompanied by a 'Waste Transfer Note' in accordance with the legal requirements of the Duty of Care for waste (non-hazardous waste) or a consignment note in accordance with the Hazardous Waste Regulations 2005 (hazardous waste). Waste will not be accepted if for any reason there is insufficient storage capacity available or if the site is inadequately manned.

Insufficient storage capacity means that the maximum storage capacity in the individual storage locations as per table 6.6 (page 20) would be reached or the total quantity of waste on site would exceed 1671 tonnes, if further wastes were accepted onto site .

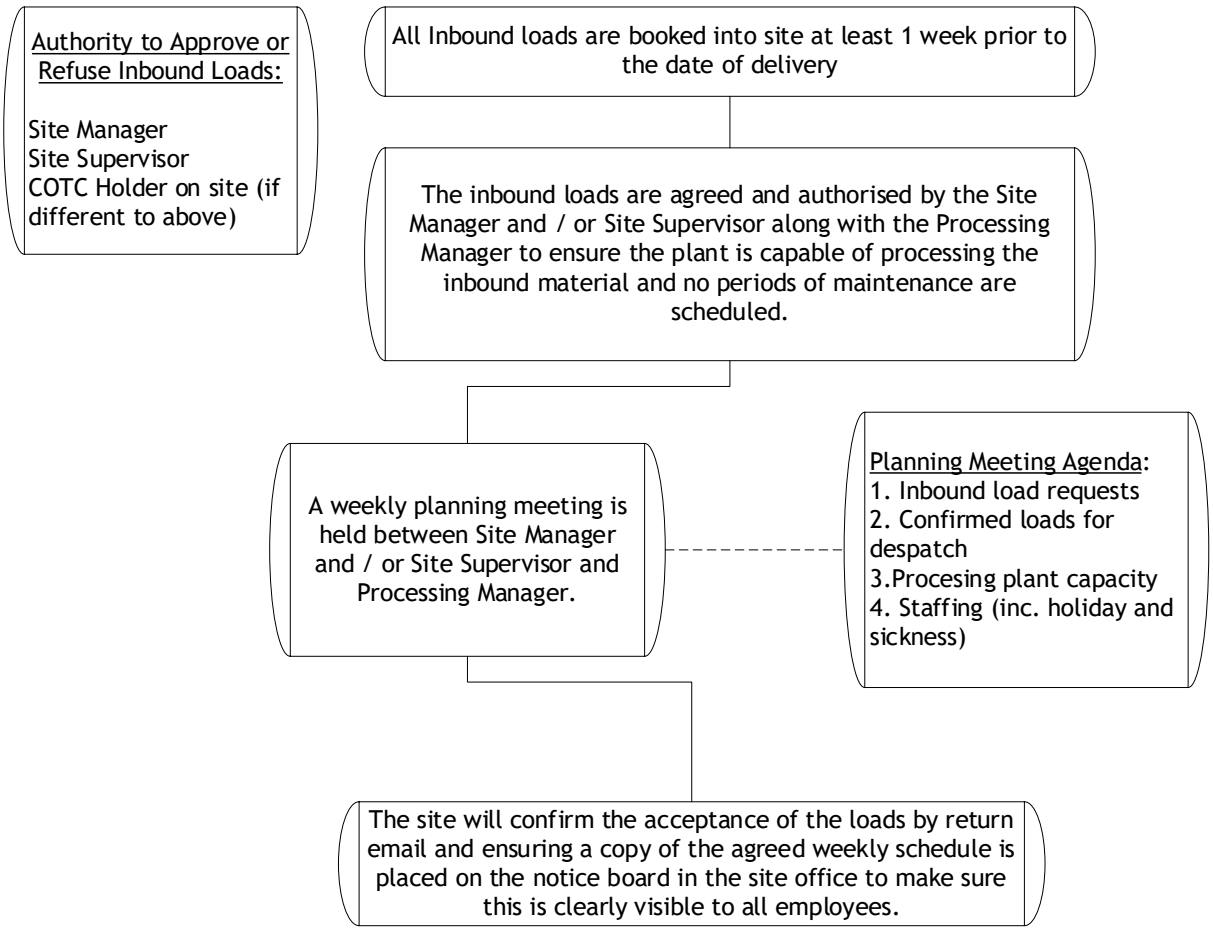
The company computer system records all inbound and outbound wastes, this along with a manual weekly stock count ensure that the site can monitor stock levels. All WasteCare sites operate a site escalation procedure (See Appendix 1: SOP-GP-ENV-7) which is in place to support the site with issues including stock, the issues are escalated to the Senior Management to ensure the issue is rectified, this includes supporting the Site Manager to refuse loads if there is no capacity on site.

5.5 A HNC qualified technician will be present to accept all hazardous waste loads. Due to the nature of loads accepted at the facility it is more appropriate to have a technician available, involved in multiple activities, than a dedicated chemist.

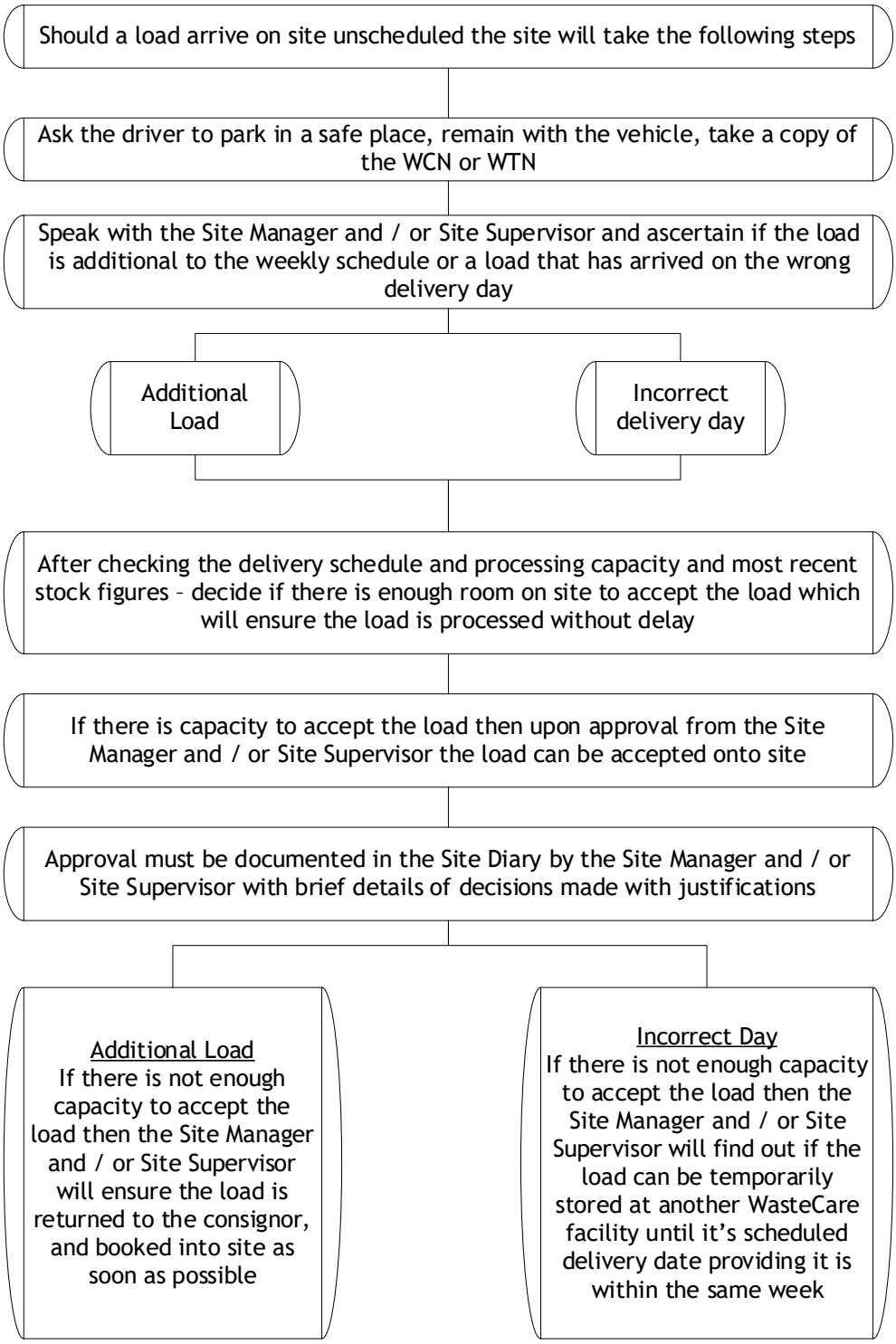
5.6 All battery waste deliveries are pre-arranged with booking slots designated. Prior to delivery the quantity of material expected is recorded. A combination of these measures allow the operations team to schedule all deliveries to allow sufficient capacity for unloading and prevent backlogs in delivery. This system allows the operator to manage throughput of the facility to ensure that the permitted and operational capacities are efficiently controlled. The flow charts below show the processes for controlling the acceptance of wastes on site.

5.7 Daily walk round stock checks and storage area inspections are also used to make certain that the site has capacity to accept the daily scheduled deliveries

Waste Acceptance Controls



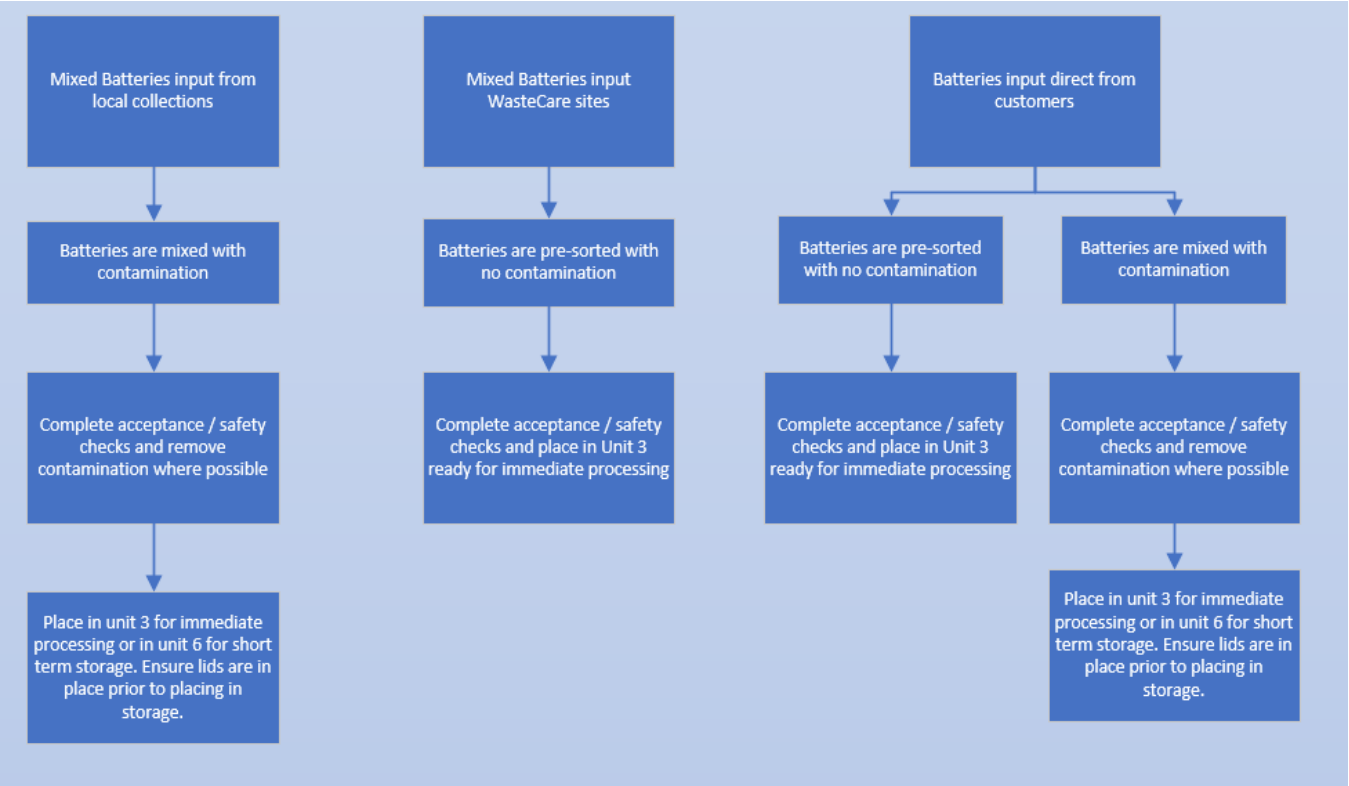
Waste Acceptance Controls Unscheduled Deliveries



5.8 Incoming waste deliveries will be met at the site entrance where acceptance checks will be carried out. Transfer or consignment notes will be reviewed and where possible each load will be subject to visual inspection to ensure it appears in line with the pre-acceptance information.

5.9 Loads will initially be inspected by suitably trained personnel to ensure that only permitted waste is accepted and to establish that the wastes are safe to offload. This will include checking the integrity of containers and pallets and looking for any signs of damage to packaging or batteries. Where the contents can be easily checked, such as battery boxes, an inspection will be undertaken of each box to ensure that the box actually contains the type of batteries expected. If the load consists of many smaller packages, then the initial inspection will only cover the packaging condition. Weighing equipment is provided on site in the form of scales. All battery pallets (or otherwise) will be weighed on arrival to site. Typically, vehicles delivering material for processing will be backloaded with processed battery streams. The time on site will enable ample capacity to weigh all pallets unloaded before the vehicle has left site. In all cases, including where vehicles are not backloaded, all material accepted will be weighed before the vehicle is permitted to leave site.
Batteries arrive on site from three different origins, the batteries will be handled & checked differently depending on where they originate from, see process flow below:

Halifax Feedstock acceptance checks



5.10 Subject to delivery passing the initial acceptance checks, waste will then be directed to the waste reception area for unloading.

5.11 Any discrepancies found as a result of the checks detailed above will result in:

- referral to the technically competent manager;
- referral to the producer site, to confirm the nature of the waste load;
- a written record being made in the site log to record the nature of the waste and the action taken; and
- referral to the Environment Agency in the case of possible breaches of legislation or imminent pollution.

5.12 Where waste is not in compliance the load will be rejected and will be returned to the waste producer where possible. Where this is not possible the waste will be directed to the quarantine area and arrangements will be made for it to be removed to a permitted site as soon as possible.

5.13 Loads (or part loads) may be rejected or placed in quarantine following their unloading in the waste reception area when:

- the container is highly contaminated with WEEE without prior consent;
- the container is highly contaminated with burnt or unidentifiable batteries without prior consent;
- the container is highly contaminated with non-battery material; or
- the container is highly contaminated with water.

In relation to loads contaminated with water, the containers that contain water will be taken to the external covered area next to the waste acceptance area, photos will be taken and the waste producer notified. Rather than put the container back onto the vehicle and back on the road, to minimise risk the water will be pumped from the containers into IBC's using a chemical resistant pump with a filter on the inlet to prevent batteries being pumped into the IBC. The IBC will be pH tested to ascertain whether the liquid is acidic or alkaline. The IBC will be labelled accordingly and despatched from site to our treatment site in Liverpool. The waste producer will receive a surcharge and will be asked to collect the batteries if they cannot be treated on site.

Thorough checks will be made on all containers of batteries received on site prior to being placed in storage, if the batteries are showing signs of water or moisture within the container, the batteries will be placed into a new clean, dry container, the original label will be transferred to the new container prior to being placed in storage, this enables the operative time to inspect the contents and remove all water and moisture from around the batteries.

5.14 The WasteCare non-conformance procedure, which is included in the EMS, will be followed in all non-conformance events.

5.15 Records will be kept for each load arriving on site including details of:

- date of delivery;
- the waste producer;
- quantity of waste;
- waste type;
- pertinent details regarding the waste appearance (smell, colour and physical form);
- classification under the List of Waste Regulations;
- six figure code according to the European Waste Catalogue; and
- waste carrier name, address and registration number.

5.16 All pre-acceptance and acceptance documentation will be made available for inspection by authorised officers of the Environment Agency on request.

6 WASTE STORAGE AND PROCESSING

General - Drums and boxes are stored in accordance with SGN5.06 BAT indicative point 15. This includes a maximum stack height of 2 pallets of drums (based on the height of a 205l drum on each pallet) and 3 battery boxes, with an arrangement in rows to allow access on all sides. Empty containers are stored for re-use or disposal and in accordance with SGN5.06 BAT indicative point 15, however they can be stacked to a maximum height of 3 pallets when required.

Wastes and recovered materials are stacked to ensure all labels are visible, inspection by access rows are free at all times and fork lift access to storage areas is free to ensure that if required safe removal of wastes can be easily carried out to allow full detailed inspections. Site Health and Safety rules apply at all times.

6.1 The waste treatment process is undertaken in two phases. The initial phase sorts the mixed waste stream into the different component streams listed below in Table 6.1.

Table 6:1: Battery Types to be Accepted and Sorted

Description	Includes	Classification
Zinc/manganese (often referred to as alkaline batteries)	Alkaline Zinc chloride Zinc air Oversize zinc/manganese	Non-hazardous
NiCad	Dry NiCad Wet NiCad	Hazardous
Lead Acid	Dry (VRLA – plastic case) Dry-Cyclon (steel case) Wet	Hazardous
Lithium Ion	Laptop and cells Power tools Mobile phones Video cameras E-cigarettes	Non-hazardous
Lithium Ion Polymer	Tablet/laptop Mobile phone	Non-hazardous
Lithium Primary	Coin cells Non-coin cells	Non-hazardous
Nickel Metal Hydride (NiMH)	All sizes	Non-hazardous
Button cells	Zinc air Silver oxide Alkaline	Hazardous Non-hazardous
Non-battery material	Small WEEE Water filters (incidental to battery loads only) Light bulbs (including CFL) Printer ink cartridges (incidental to battery loads only) General litter (incidental to battery loads only)	Non-hazardous, except small mixed weee and compact fluorescent lamps, which are hazardous

6.2 The second phase treats only the non-hazardous portable alkaline batteries to separate the different components for recovery:

- black mass;
- ferrous metal;
- non-ferrous metal; and
- paper and plastic.

6.3 A site layout plan is provided as drawing reference HXSP1.

Waste Reception

6.4 Wastes will be unloaded in the waste reception area and transferred to the storage area for wastes pending treatment. Pre-sorted loads of alkaline batteries will be stored separately as these will be introduced to the process via a hopper connected to the conveyor that transfers portable alkaline batteries to the second phase of the treatment plant.

6.5 All sorted batteries will be weighed using pallet scales. The scales are calibrated annually by a third party and checked daily using battery boxes of sand of known weights, as well as confirming zero readings when unloaded. These daily checks will be recorded, signed for and filed.

6.6 Occasionally, staff will encounter a battery that they will not be able to identify. Any such batteries will be quarantined for further assessment. Site personnel will also have access to the internet so that they can investigate the chemistry or application of any unknown batteries after placing them in quarantine.

6.7 The facility has a laboratory, equipped with tools, scales and a voltage meter, where further work can be undertaken to try and establish the chemistry of the battery. Its weight can also be checked and visual inspection will establish if it is sealed. The battery cells may be removed from any casing to try and help establish its chemistry as this may be shown on individual cells in a pack. Magnets can also be used to establish if the battery casing is magnetic.

Quarantine Area

6.8 A quarantine area surrounded by concrete walls has been established to receive items that may need to be returned or require special control measures. The quarantine area provides a storage area of 25m^2. Batteries will be removed from this area within 48 hours following receipt. The batteries will either be correctly classified and correctly packaged and stored in the correct area or returned to the waste producer.

Waste Processing

6.9 The majority of batteries received at site are from public collection points and are suited to mechanical sorting due to the types of batteries in the mix. There are two separate phases at the facility.

Phase 1 – Sorting

6.10 The sorting phase will be undertaken in Unit 3 as shown on drawing HXSP1.

6.11 Sorting processes at the facility will utilise mechanical sorting equipment to sort batteries by size before presenting batteries to sorting personnel on conveyors for manual sorting by chemistry, where automated sorting is not possible.

6.12 A fork lift truck with a rotator will tip containerised batteries into the hopper at the start of the sorting line. The hopper will feed a conveyor for the manual removal of non-battery items such as litter and plastic bags. The batteries will then pass over a vibrating table with an initial small grid, which will allow the button cells to be separated. These will drop through the grid directly into and appropriate button cell box. The remaining batteries will pass over a larger grid which will separate the oversize batteries from standard household batteries. This sort is purely by size and not chemistry, type or weight.

6.13 The medium sized batteries will then pass along a conveyor, where batteries will be hand sorted according to chemistry. The portable alkaline batteries, which are suitable for further treatment, will be collected at the end of the conveyor.

6.14 Large batteries will also be sorted by hand and transferred to the appropriate storage areas.

6.15 Sorted batteries will be stored in appropriate containers as set out in Table 6.2 below.

Table:6:2: Battery Storage

Battery types	Container type	Maximum Storage capacity (tonnes)
Mixed batteries	UK and EU approved plastic drum or box	535
Lithium	UK and EU approved plastic drum or box	195
Portable, Industrial, dry & wet NiCad	large fibre bags with weatherproof covering & weather proof containers	120
Lead acid	Plastic battery boxes	200
Nickel Metal Hydride	UK and EU approved plastic drum or box	50
Alkaline	UK and EU approved plastic drum or box	960

6.16 Different types of batteries will be stored separately at the locations shown on Drawing HXSP1. Bunkers will be used to store Ni-Cad batteries in bulk bags, Lithium Ion and Lithium primary batteries packed in vermiculite in lined and sealed drums, mixed batteries and alkaline batteries prior to despatch off site, each with the following capacities:

- Bunker 1: Lithium 65 tonnes
- Bunker 2: Lithium 65 tonnes
- Bunker 3: Lithium 65 tonnes
- Bunker B: Alkaline Batteries 300 tonnes
- Bunker C: Alkaline Batteries 120 tonnes
- Bunker D: Alkaline Batteries 100 tonnes

- Bunker E: Mixed Batteries 80 tonnes
- Bunker F: Alkaline Batteries 80 tonnes
- Bunker G: Alkaline Batteries 80 tonnes
- Bunker H: Alkaline Batteries 80 tonnes
- Bunker I: NiCd Batteries 120 tonnes
- Bunker K: Alkaline Batteries 200 tonnes

6.17 The battery reception area has storage for 24 pallet spaces (25 tonnes) with dimensions of 12m x 2.5m

6.18 Batteries will be stored in appropriate areas and containers as set out in Table 6.3 below.

Table:6.3: Battery Storage Areas

Storage Area	Battery Type	Storage weight (tonnes)	Storage Arrangements
Reception Area	Mixed Batteries	25	UK and EU approved sealed plastic drum or lidded box. No overnight storage in this area.
Unit 3	Mixed batteries	30	UK and EU approved sealed plastic drum or lidded box
Unit 3	Sorted Batteries	30	UK and EU approved sealed plastic drum or lidded box
Unit 4	Lead Acid	200	In battery boxes stacked 3 high
Unit 5	Nickel Metal Hydride	50	UK and EU approved sealed plastic drum or lidded box or bulk bag
Unit 6	Mixed batteries	400	UK and EU approved sealed plastic drum or lidded box
Bunker 1	Lithium Ion / Lithium ion Polymer	65	Packed in sand / vermiculite in sealed drums on pallets, stacked 2 high
Bunker 2	Lithium Ion / Lithium ion Polymer	65	Packed in sand / vermiculite in sealed drums on pallets, stacked 2 high
Bunker 3	Lithium Primary / Lithium Button Cells	65	Packed in sand / vermiculite in sealed drums on pallets, stacked 2 high
Bunker B	Alkaline batteries	300	UK and EU approved sealed plastic drum or lidded box or bulk bag
Bunker C	Alkaline batteries	120	UK and EU approved sealed plastic drum or lidded box or bulk bag
Bunker D	Alkaline batteries	100	UK and EU approved sealed plastic drum or lidded box or bulk bag
Bunker E	Mixed Batteries	80	UK and EU approved sealed plastic drum or lidded box
Bunker F	Alkaline batteries	80	UK and EU approved sealed plastic drum or lidded box or bulk bag
Bunker G	Alkaline batteries	80	UK and EU approved sealed plastic drum or lidded box or bulk bag

Bunker H	Alkaline batteries	80	UK and EU approved sealed plastic drum or lidded box or bulk bag
Bunker I	NiCd (portable and Industrial)	120	In bulk bags with weather proof covering, stacked 2 high
Bunker K	Alkaline batteries	200	UK and EU approved sealed plastic drum or lidded box or bulk bag

**No mixed batteries are stored in Unit 3 or Reception Area overnight / outside of operational hours

6.19 Wet lead acid and wet NiCad could be viewed as incompatible and will not be stored together or adjacent to each other.

6.20 All recovered battery streams will be sent for recycling.

6.21 WEEE and residual waste will be stored separately in suitable bags or sealed containers. Where possible these wastes will be sent on for recycling. Paper, plastic and similar wastes may be sent for energy recovery.

6.22 All staff involved in sorting will be trained to classify batteries into the correct category and chemistry. Training will consist of a mixture of tool box talks and documents that are posted around site. The training room at the site is also stocked with various types and chemistries of batteries to assist training sessions on battery classification by type and chemistry, as well as safety. A notice board in the sorting area will be used to reinforce the key messages for staff working on battery sorting.

Phase 2 – Treatment of Portable Alkaline Batteries

6.23 Portable alkaline batteries will be transferred via enclosed conveyor to the hammermill, located in treatment building as shown on drawing HXSP1. The treatment process is designed to separate out the following material streams as listed in Table 6:4 below:

Table:6:4: Recovered Material Streams from Treated Batteries

Material Stream	%	Fate
Black mass & paper/plastic	**73**	**Recycling & Energy recovery**
Ferrous metal	**25**	**Recycling**
Non-ferrous metal	**2**	**Recycling**

6.24 To ensure other types of battery to not enter the hammermill there is a process in place which includes the sorting of unknown / damaged / unidentifiable batteries by the operators on the sorting line.

The operators are trained to pick out any batteries that they cannot be readily identified as Alkaline & Zinc Chloride batteries and place them into a container for fine sorting later, this ensures that the operators do not let any batteries progress to the feed hopper without knowing what they are.

The Unknowns / Unidentifiable and damaged batteries are then fine sorted by the site supervisor to establish the chemistry type of the battery, the supervisor will establish the correct route for the batteries and if he / she cannot confidently identify the batteries then these will be quarantined and the Technical Director will personally assess the batteries. The Technical Director will consult third party battery recyclers for assistance if required.

6.25 Batteries will be crushed within the enclosed hammermill and removal of ferrous metals by a drum magnet (metals fall into a container equipped with a hood to prevent emissions of dust and / or gas), the resultant material

passes onto a vibro-separator via a sealed conveyor belt. The vibro-separator allows for the grading of materials, in this instance sorting the treated materials by particle size. The resultant mixed material will pass over a drum magnet to remove any ferrous metal before being treated by a vibro-separator to remove the black mass fraction from the remaining material. The black mass will pass through the screen and will be collected in an enclosed conveyor and passed via a screw mechanism into sealed bags.

6.26 Once the black mass stream has been separated it is transferred into a feed chute via an Archimedes screw. The Archimedes screw is a totally enclosed system which is used to prevent fugitive emissions. The black mass feed chute is connected directly into UN bags, meaning that there will be no emissions produced during filling. Two bags are provided at the bagging area; only one will be filled at any one time with the filling switching automatically to the other bag when the first bag is full. The system includes a counter pressure ring which seals the bag to the system during filling and prevents fugitive emissions. The feed of black mass into the UN bags is controlled using the SCADA PLC control system.

Once filling of a bag is completed, the system will notify site operatives, allowing for the bag to be sealed and removed. The remaining paper and plastic that is recovered at the end of the process falls into a container that is equipped with a hood. This will ensure that there will be no emissions of dust or gas at the final stage of the process.

6.27 The alkaline battery treatment plant will treat between 2.5 and 4.5 tonnes of batteries per hour, depending on the feedstock.

6.28 Recovered material streams will be stored in appropriate bags or stillages at the location shown on drawing HXSP1.

Table:6:5: Recovered Material Storage arrangements

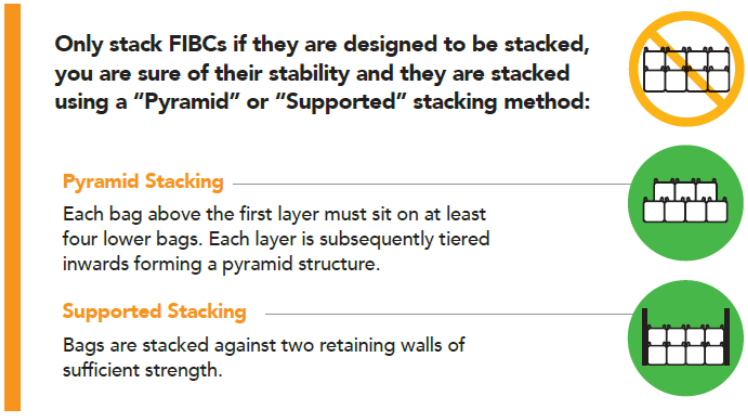
Material	Conversion rate	Quantity Stored	Location	Stored Dimensions (l) x (w) x (h)	Maximum storage time
Black Mass & paper / plastic (bags)	Each bag of Black mass weighs 1 tonne. Volume = 1m^3	200t (200m^3)	Inside Unit 1 building	12m x 9m x 2m	6 Months
Ferrous Metal (stillages)	Each stillage of metal weighs 1 tonne. Volume = 1m^3	100t (100m^3)	Bunker A: 3 sided concrete block bunker	13m x 4m x 2m	6 months
Non Ferrous Metal (stillages)	Each stillage of metal weighs 1 tonne. Volume = 1m^3	50t (50m^3)	Bunker A: 3 sided concrete block bunker	13m x 2m x 2m	6 months

6.29 Safe stacking of bulk bag procedures will apply at all times, ensuring bags are stable using a layering system making sure that bag weight is evenly distributed. Only UN approved bags are used when stacking black mass this ensures that load weights are adhered to.

An example of the UN marking on the bulk bags is: UN 13H4/X/0915/IND/71447444/**1809**/1005

The **1809** within the UN marking above denotes the stacking test load in kilograms i.e. 1.8 times the maximum permissible gross weight that may be stacked on top.

The bulk bags are stacked 2 high where the load in the top layer spread between 4 bottom layer bags, using the Pyramid method see picture below:



**taken from FIBC Safe Handling Guidelines v2 published by the Flexible Intermediate Bulk Container Association July 2017.

The site operates in accordance with HSE guidance HSG76

6.30 There is an air blade system installed, which will decrease the level of contamination on the metal, paper and plastic streams coming from the plant. However we will take grab samples directly underneath the chute which will enable us to analyse the waste stream before it has chance to settle out in the stillage.

Also, the stillages are quite small and are removed from site every couple of days so this prevents a build-up of black mass within the waste streams. There are in-house test methods to analyse the recovered material streams for black mass contamination, the in-house test method references are:

1. Determination of Metals by ICP OES - LIT test method
2. EK WI LAB 017 - XRF Procedure and Maintenance (Initial Revision)

6.31 Table 6.6 below details the storage arrangements for all wastes and recovered materials on site

Table:6:6: All Wastes & Recovered Material Storage arrangements			
Location	**Maximum Quantity Stored**	**Maximum Quantity Stored (tonnes)**	**Waste Type**
Reception	25t (25m^3)	25	Batteries (mixed)
Unit 1	200t (200m^3)	200	Black Mass from Battery treatment plant
Unit 3	30t (30m^3)	30	Batteries (mixed) Stored in sealed drums prior to sorting.
Unit 3	30t (30m^3)	30	Batteries (sorted)
Unit 3	5t (5m^3)	5	WEEE, water filters, printer ink cartridges, general litter, light bulbs
Unit 4	200t (200m^3)	200	Batteries (lead Acid)
Unit 5	50t (50m^3)	50	Batteries (Nickel Metal hydride)
Unit 5	1t (6m^3)	1	Loose Cardboard (rarely stored on site)
Unit 5	50t (50m3)	50	Small mixed weee for processing
Unit 6	400t (400m^3)	400	Batteries (mixed)
Bunker 1 behind Unit 6	65t (65m^3)	65	Batteries – Lithium Ion (inc. Lithium Ion Polymer)
Bunker 2 behind Unit 6	65t (65m^3)	65	Batteries – Lithium Ion (inc. Lithium Ion Polymer)
Bunker 3 behind Unit 6	65t (65m^3)	65	Batteries – Lithium Primary (inc. button cells)
Bunker A	150t (150m^3)	150	Metal fragments from Battery treatment plant
Bunker B	300t (300m^3)	300	Batteries – Alkaline
Bunker C	120t (120m^3)	120	Batteries – Alkaline
Bunker D	100t (100m^3)	100	Batteries – Alkaline
Bunker E	80t (80m^3)	80	Batteries (mixed)
Bunker F	80t (80m^3)	80	Batteries – Alkaline
Bunker G	80t (80m^3)	80	Batteries – Alkaline

Bunker H	80t (80m^3)	80	Batteries – Alkaline
Bunker I	120t (120m^3)	120	Batteries - NiCad
Bunker J	5t (100m^3)	5	Empty plastic drums / boxes for reuse
Bunker K	200t (200m^3)	200	Batteries – Alkaline
Pallet Store	3t (20m^3)	3	Pallets

7 DESIGN MEASURES TO PROVIDE ENVIRONMENTAL PROTECTION

General

7.1 The site and the infrastructure has been designed to provide environmental protection for land, water and air.

Groundwater and Surface Water Protection Measures

7.2 All areas where waste batteries and other wastes will be received, stored or treated will be provided with impermeable concrete surfacing and bunding, the concrete surfaces drain to a sealed drainage system.

7.3 The initial hazardous waste sorting operations will take place in a fully enclosed building whilst the subsequent non-hazardous waste treatment plant will be located in a Dutch barn style building (open on one side). However, the secondary treatment plant is an enclosed system and doesn't need to be in a fully enclosed building.

7.4 All water from the main buildings and concrete yard area will drain to the sealed sump on site with a capacity of 124,000 litres. The sump will be checked on a daily basis and will be emptied by tanker when required or on a daily basis especially during winter and periods of heavy rainfall. Clean rain water run-off from external areas and building roofs will also drain into the sump on site. The site drainage is shown on drawing HXSP1.

7.5 All water from the bunkers behind unit 6 and at the front of unit 6 will drain to a sealed sump, the ground slopes towards the sump. The water is manually pumped from this area to ensure the area remains clear.

Air Quality Protection Measures

7.5 The system has been designed with lift tube and screw conveyors which generate much less dust than standard conveyor belts. The treatment process has been enclosed as far as possible to prevent fugitive emissions of dust or odour.

The plant design has been considered against COMMISSION IMPLEMENTING DECISION (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council. Specifically, the design was considered against BAT14.

Extract as below:

BAT 14. *In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given below. Depending on the risk posed by the waste in terms of diffuse emissions to air, BAT 14d is especially relevant.*

The design has been reviewed against 14d in relation to the containment, collection and treatment of diffuse emissions and the design is in line with BAT recommendations as the equipment has been fully enclosed and uses sealed conveyors as per the BAT example.

In addition, an abatement system has been developed using an air extraction system that meets Section 6.1 of the BAT conclusions.

The extract points are identified on the attached drawing Extraction layout Hx v2.

It is necessary to have discharge chutes where the separated materials are directed into their appropriate containers. Extraction points will be installed at the opening of each one of these outlets.

With regard to the emissions to air the proposed abatement design has been reviewed against BAT 41.

Extract as below:

BAT 41. *In order to reduce emissions of dust, organic compounds and NH3 to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below.*

We have installed a closed loop system / circular system which is under slight negative pressure under normal operation. During normal operating conditions all emissions will be fed through the carbon filter system, from there the scrubbed air is fed back into the head chute of the crusher as part of the closed loop system.

The system has been designed with baffle valves across the extraction system. These can be opened and closed to balance the flow, creating optimal flow rates to facilitate the negative pressure closed loop system within the plant.

WasteCare has engaged with several LEV specialists, all of whom have proposed similar options. We have chosen Inprotec as the design was similar to the other proposals but they are a local firm, therefore the installation, improvements and maintenance are more convenient. The selected supplier who has vast experience in this area have designed this system based on good industrial practise and environmental standards, for example EH40. We have also provided them with analysis of the materials to ensure the system is fit for purpose.

Inprotec recommended the bag / carbon filter and confirmed that it was the best abatement system to use for the wastes involved in the process. We also have the option to add a trace heating system to the LEV ducting, however the specialist have confirmed that this is not likely to be needed, the LEV system has been designed in such a way that it can be easily installed if required.

The system will have the ability to add an additional carbon filter if deemed necessary (upon commissioning). The advice we have received to date is that this will not be necessary, but we have left this optional as part of the commissioning

During commissioning we will do carbon monitoring to determine the saturation point. From this we will be able to determine how long the carbon lasts, from this information the PLC will be programmed to prevent the plant running without appropriate abatement. This will eliminate human error. We will establish the Planned Preventative Maintenance programme during the commissioning phase.

Regarding the spent carbon stream we have two options, the best option is for the carbon to go to our physico chemical treatment site in Liverpool, if for whatever reason this is not an option we can send the carbon to our HTI in East Kent for incineration and energy recovery.

If there are any issues with the abatement system the plant will remain un-operational until any issues are resolved. We plan to add the abatement system to the Scada programme, this means that we can add a PPM schedule to the Scada programme which will alert the engineer, the engineer will shut the plant down and carry out the maintenance prior to re-starting the plant. Using the Scada system also means we can set alerts, so that an engineer will be alerted if the daily

inspection hasn't been completed in the set timeframe, the Scada system will stop the plant until the engineer completes the inspection and enters the correct code to re-start the plant. The Scada system is currently programmed to alert to all areas of the plant where there is monitor / control in place, currently this is speed of equipment, incorrect weights, if a stillage is not in the correct place and blockages in the plant. The Scada system removes human error and has been built, installed and programmed by specialist engineers.
We are able to program the Scada system to alert to pressure build up / loss of pressure and increase in temperature once these have been determined through the commissioning phase.
We think that using the Scada system in this way vastly reduces the risk of inspections and issues with the abatement system and plant being missed, because if anything happens the plant will automatically shut down preventing any damage to the plant and emissions to atmosphere.

7.6 Air Quality Monitoring & Analysis

The plant operator and on site engineers will always carry a hand held ammonia analyser during commissioning and ongoing operation. This will enable any leakage to be identified. Checks for leaks will also be completed hourly during commissioning, this will be reviewed after the commissioning phase where a leak test check procedure with a record keeping system will be implemented. If a leak of any kind (dust, vapour, steam) is identified the plant will be shut down immediately and remain so until the issue has been rectified. The plant operator and engineer both have the ability to shut the plant down if a leak is detected. Once the leak has been sealed and rectified, the plant can only be switched on by the Site Manager or Head Engineer, this ensures that all safety protocols have been adhered to prior to commencing the treatment of the batteries. The plant operator will continue to monitor the plant whilst it is running to ensure no further leaks are found, this close monitoring will continue for 1 hour and then normal monitoring will assume.

The hand held gas detector is detailed below:

BW GASALERT EXTREME NH3-EXT GAS DETECTOR (YELLOW)

BW Technologies offer the GasAlert Extreme as a single gas detector for the detection of ammonia (NH3). This particular version of the GasAlert Extreme comes with a yellow casing and is able to detect a particularly high range of ammonia gas.

You can have confidence that the GasAlert Extreme is a reliable instrument due to its robust, water-tight casing. It also features an in-built concussion-proof boot. BW has designed the detector to be comfortable, making it both compact and light in weight.

This ammonia detector is suitable for various industries and applications and can be used securely using a password-protection feature for the settings on the GasAlert Extreme.

The downloading of data requires the use of a USB drive which must be purchased separately.

KEY FEATURES

- Using the on/off function will save both battery life and sensor life
- Ability to change sensors and battery in the field
- Compatible Accessory - BW MicroDock II automatic bump test and calibration station
- English, Portuguese, Spanish, French and German - available languages
- Displays real-time gas concentrations on the LCD screen
- Capable of logging data
- GasAlert Extreme compatible with the Sampler motorised pump
- Ability to carry out full-function tests for battery, sensor and alarms

Specifications

Measuring Range: 0-400 ppm

Size: 1.1 x 2.0 x 3.75 in / 2.8 x 5.0 x 9.5 cm

Weight: 2.9 oz / 82 g

Alarms: Visual, vibrating, audible (95 dB), Low, High, STEL, TWA

Typical Battery: 1.5 year battery life (typical) with replaceable 3V battery

Operating Temp: -4 to 104°F / -20 to +40°C

Relative Humidity: 15 – 90%

Ratings: EMI/RFI: Complies with EMC Directive 89/336/EEC

IP Rating: IP 66/67

The handheld detector is externally calibrated every 6 months.

Sample point SP1 is located at the point that emissions have passed through the carbon filter, prior to being recirculated back into the plant as part of the closed loop system. We will work with our current environmental monitoring contractor to install the required sampling equipment. The sample point will be installed into the ducting, the sample point will be sealed, this ensures samples of the air are taken without a release to atmosphere, the sampling will monitor the air quality and confirm that the carbon filter is operating correctly.

This contractor completes our stack emissions monitoring at our other facilities and will help us assess the requirements using the H1 air emissions assessment methodology as required by WID. We will work with this contractor throughout the 6-8 week commissioning period to ensure we benchmark against H1 guidance during the commissioning phase.

Environmental Monitoring Specialists have been commissioned to recommend, design, install and monitor the equipment required to monitor the emissions passing monitoring point SP1

The proposed sampling point (SP1) is identified on the attached drawing Extraction layout Hx v2

Their proposals is as follows:

Battery Plant Commissioning Testing Plan

Emission Point	Parameter	Day 1		Day 2		Day 3	
Post Filter	Particulate CEMS	Continuous throughout					
	Total VOCs	Continuous throughout					
	Heavy Metals		x		x		x
	Ammonia	x		x		x	
	Total Particulate Matter	x		x		x	
	PM10 & PM25	x		x		x	
Pre Filter	Total VOCs	x	x	x	x	x	x
	Heavy Metals		x		x		x
	Ammonia	x		x		x	
	Total Particulate Matter	x		x		x	
	PM10 & PM25	x		x		x	

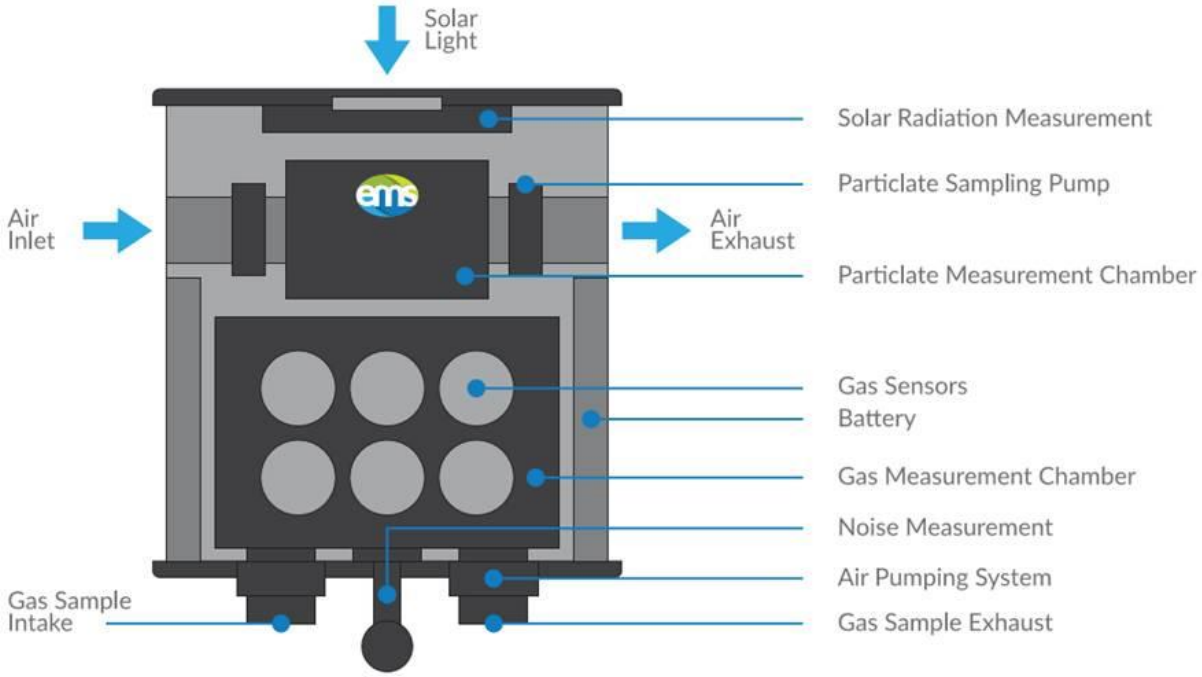
The monitoring standards are set out in the table below:

MCERTS Periodic Monitoring	Standard Method	Duration	Accreditation
Total Particulate Matter	BS EN 13284-1	60 minutes	MCERTS
PM10 & PM2.5 Particulate Fraction	BS EN 13284-1	60 minutes	-
Heavy Metals	BS EN 14385	60 minutes	MCERTS
Ammonia	BS EN 14791	60 minutes	MCERTS
Total VOCs	BS EN 12619	Continuous	MCERTS
Continuous Monitoring	**Probe Model**	**Duration**	**Detection**
Particulate	Sintrol S304	Continuous	0.01 mg/m^3

During commissioning a two-tier monitoring programme will be used. The environmental monitoring will use the following equipment to monitor relevant emissions levels against BAT requirements:

The range of ambient air monitors that we have installed uses state-of-the-art technology to provide reliable, accurate and industry accepted method of monitoring environmental data in real-time. Measurement methods are based on cross-technology comparison which allows the best sensors to be picked for each application.

The monitor type is show below:



DustSonde

Parameter	Unit	Technique/Working Principle
PM10	ug/m3	Laser Scattering
PM2.5	ug/m3	Laser Scattering
Temperature	°C	Capacitive Sensing
Humidity	%	Capacitive Sensing

OdourSonde

Parameter	Unit	Technique/Working Principle
HN3	ppm	
NO2	ppm	Electrochemical Sensing
SO2	ppm	Electrochemical Sensing

Both monitors continuously transfer real-time data to an online platform. This real-time monitoring enables us to view trend, track and download data for effective management and process optimisation.

The monitors also have an internal battery back-up.

In addition, personal monitoring will be used to benchmark personal exposure against published occupational exposure levels. This will take the form of monitoring will be undertaken to determine the employee's time- weighted-average (TWA) exposure to concentrations of inhalable zinc chloride, inhalable/ respirable manganese dioxide and total inhalable particulate created during waste recycling process activities to be quantified. The survey will be performed as an integral element of the assessment of the risk associated with this activity, in terms of substances

hazardous to health, as required under the Control of Substances Hazardous to Health Regulations 2002 (as amended) (COSHH) (Section 7 Reference.1).

Inhalable zinc chloride, inhalable and respirable manganese dioxide and total inhalable dust:

TWA samples will be collected following the procedures described in NIOSH 7300 (Section 7, Reference 3) and MDHS 14/4 (Section 7, Reference 4) using gravimetric sample pumps. For inhalable zinc chloride, inhalable manganese dioxide and total inhalable dust sampled air was drawn through 25 mm. diameter mixed cellulose ester (MCE) filters contained in Institute of Occupational Medicine (IOM) sample heads. For respirable manganese, sampled air will be drawn through 25 mm. diameter MCE filters and polyurethane foam insert plugs contained in IOM sample heads. Suitable tubing will be used to connect each sample head to a sample pump, with flow rates adjusted to 2.0 litres/ min. The sample heads will be positioned within the breathing zone of each employee surveyed. Sampling will be performed over a representative interval of the normal day- shift, in order to critically compare the analytical results obtained with the 8- hour TWA WELs for inhalable zinc chloride, inhalable and respirable manganese dioxide, and with the 8- hour TWA threshold for total inhalable dust applicable under COSHH.

Flow rates will be measured prior to, and upon conclusion of the sampling periods using a flowmeter of traceable accuracy, and mean sampling flow rates will be determined. Field (control) blanks will also be obtained during the survey. The samples will be subsequently analysed by inductively coupled plasma and atomic emission spectrometry (ICP- AES) for zinc chloride, inhalable and respirable manganese dioxide, and by gravimetric analysis using a precision microbalance for total inhalable dust, using a UKAS accredited laboratory.

7.7 Identification of possible emissions into the closed loop abatement system

The alkaline batteries that are to be treated in the hammermill use potassium hydroxide (KOH) as the electrolyte. Zinc – carbon batteries traditionally use either ammonium chloride (NH_4Cl) or zinc chloride ($ZnCl_2$) as the electrolyte. Both types have used zinc as the anode (the - electrode where oxidation takes place) and manganese dioxide (MnO_2) as the cathode (the + electrode where reduction takes place). However, due to the different electrolytes used, the chemical reactions at each electrode will be different. Only the zinc – carbon batteries that use NH_4Cl as the electrolyte have the potential to produce ammonia (NH_3) gas. [Review of a typical batch of batteries at the site revealed that over 90% of the batteries that will be processed through the plant are alkaline batteries and it is likely that batteries containing ammonium chloride will be only a very small percentage].

The oxidation reaction at the anode involves zinc metal changing oxidation state from 0 to +2 and liberating 2 electrons (e^-) per atom. The reaction at the anode is represented by the following chemical equation:

$$Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e^-$$

The reduction reaction at the cathode involves the manganese in the manganese dioxide changing oxidation state from +4 to +3 requiring one electron per atom. The reaction at the cathode is represented by the following chemical equation:

$$2MnO_{2(s)} + 2e^- + 2NH_4Cl_{(aq)} \rightarrow Mn_2O_{3(s)} + 2NH_{3(aq)} + H_2O_{(l)} + 2Cl^-_{(aq)}$$

Therefore, the overall electrochemical reaction in the battery can be represented by the following chemical equation:

$$Zn_{(s)} + 2MnO_{2(s)} + 2NH_4Cl_{(aq)} \rightarrow Mn_2O_{3(s)} + \begin{pmatrix} ZnCl_{2(s)} + 2NH_{3(aq)} \\ or \\ Zn(NH_3)_2Cl_{2(s)} \end{pmatrix} + H_2O_{(l)}$$

If the aqueous (aq) ammonia forms a ligand with the zinc a solid (s) compound called zinc diamine chloride ($Zn(NH_3)_2Cl_2$) is formed.

Water (H_2O) undergoes auto-ionisation to form hydrogen ions (H^+) and hydroxide ions (OH^-). When ammonia gas dissolves in water (e.g. aqueous ammonia) it will react with the hydrogen ions to form ammonium ions (NH_4^+), which can be represented by the following chemical equations:

$$H_2O_{(l)} \Leftrightarrow H^+_{(aq)} + OH^-_{(aq)}$$

$$NH_{3(aq)} + H^+_{(aq)} \Leftrightarrow NH^+_{4(aq)}$$

These reactions are reversible and the point at which the equilibrium between the forward reaction and the reverse reaction is achieved can be dependent on external influences. For instance, in basic solutions (solutions with pH greater than 7 where the concentration of hydroxide ions exceeds the concentration of hydrogen ions) there will be higher concentrations of dissolved / aqueous ammonia than ammonium ion. Additionally, the solubility of ammonia gas will decrease with increasing hydroxide ion concentration (i.e. increasing pH) and also with temperature. Therefore, at high pH and high temperature ammonia gas will become liberated and become gaseous.

Zinc diamine chloride, a possible by-product of the electrochemical reaction in the zinc – carbon batteries which use ammonium chloride as the electrolyte, degrades at high temperatures, generally above 300°C and can be represented by the chemical equation below:

$$Zn(NH_3)_2Cl_{2(s)} \xrightarrow{T>300^oC} 2NH_{3(g)} + ZnCl_{2(S)}$$

In the presence of a basic solution at elevated temperature, the ammonia will be liberated as a gas. Note that the other possible products from the zinc – carbon batteries involve the production of aqueous ammonia which, if still present at the time of processing, would also be liberated as a gas at elevated temperature and pH.

Ammonium chloride can also go through thermal decomposition at elevated temperatures, generally reported to be above 340°C. The reaction is reversible upon cooling and can be represented by the following chemical equation:

$$NH_4Cl_{(S)} \Leftrightarrow NH_{3(g)} + HCl_{(g)}$$

The reaction at the manganese dioxide cathode in zinc – carbon batteries with ammonium chloride electrolyte, as discussed previously, is summarised by the following chemical equation:

$$2MnO_{2(s)} + 2e^- + 2NH_4Cl_{(aq)} \rightarrow Mn_2O_{3(s)} + 2NH_{3(aq)} + H_2O_{(l)} + 2Cl^-_{(aq)}$$

However, this can be broken down further into a two-step process, represented by the following equations:

$$2NH_4Cl_{(s)} + 2e^- \rightarrow 2NH_{3(aq)} + H_{2(aq)} + 2Cl^-_{(aq)}$$

$$2MnO_{2(s)} + H_{2(aq)} \rightarrow Mn_2O_{3(S)} + H_2O_{(l)}$$

Therefore, hydrogen gas is generated as an intermediate in the reduction reaction. This hydrogen then reacts with the manganese dioxide and is converted to water. The battery design retains the hydrogen gas for the electrochemical reaction to occur. However, it is possible that during the recycling process hydrogen gas may be evolved by the reaction of ammonium chloride at the manganese dioxide cathode, though this requires the electrochemical cell to be complete and a supply of electrons to be available from the anode. [It is considered that the proportion of batteries which might fall into this category will be very small and no significant hydrogen will be evolved.]

Heat is not used in the process and it is considered that ammonia, which is very soluble in water, will remain in solution in most circumstances and will be removed from site within the black mass. Potentially the operation of the plant may generate some heat, [however it will be ensured that the temperature within the hammermill is kept below 300 degrees centigrade to prevent liberation of ammonia as a gas]. This will mean that ammonium chloride and zinc diamine chloride will not undergo thermal decomposition, and ultimately minimise the potential for gaseous ammonia and HCl to be produced in the hammermill.

As previously stated, each waste stream will be tested during the commissioning phase and a WM3 assessment will be completed to confirm whether they should be managed as hazardous or non-hazardous waste streams.

Areas of the process with the potential to release dust / ammonia will be sealed. The hammermill is enclosed, preventing any emissions of dust or gas from escaping. The drop out points within the system for ferrous and non-ferrous metals will be provided with a hood. The hood will extend from the containers to the chutes where the ferrous and non-ferrous metals will drop out. This will provide an airtight seal, ensuring that no ammonia or dust will be released. The drop out point for paper and plastics will also be sealed using a hood, which will be attached from the container to the chute. As described above black mass is transferred directly into a bag, which will be clamped in place to prevent fugitive emissions. This will provide an airtight seal.

8 OPERATIONAL CONTROLS TO PROVIDE ENVIRONMENTAL PROTECTION

8.1 Without controls the amenity of the surrounding locality may be negatively impacted as a result of the storage and treatment of permitted wastes on site. However, operations will be undertaken in a manner compliant with relevant guidance and the EMS, ensuring good housekeeping and minimising any potential impacts. Further commentary is provided in the Accident and Amenity Risk Assessment.

A site management and monitoring regime is in place which requires thorough inspections of the site at regular intervals. An inspection of the site will be undertaken on a daily basis by a member of staff nominated by site management. During the inspection, observations will be made for any dust that may have collected on site or at the boundary. Daily olfactory testing will be undertaken on a walk around the site perimeter by an office-based member of staff who is less familiar with the normal odours of the operational facility. Staff carrying out inspections will be provided with training and correct PPE so that they understand the potential environmental and personal health

impacts and how to minimise them. All inspections will be recorded; noting the wind direction, weather conditions and any odour or dust observed.

Regular training will be provided to staff ensuring that they are aware of the hazards on site and potential impacts on their personal health. The staff will take part in regular health surveillance monitoring and independent health checks.

In the event that emissions of dust are observed on or off site, or a noticeable odour is detected at the site boundary, an investigation will be undertaken by site staff to determine the source of the emissions. Site management will be notified. Remedial actions for dust / odour will be triggered as necessary.

Small areas of dust that are identified during daily inspections will be dampened using a fine misting of water before being cleaned via sweeping. This will prevent further accumulation and the potential for the dust to migrate. If larger amounts of dust are identified during daily inspections (that have the potential to become airborne / escape beyond the site boundary in significant quantities that may impact upon those on site and nearby receptors), a mechanical sweeper will be used to sweep the affected areas and site management will be informed. Operations will halt in the event of significant emissions of dust.

** Black mass should not be present in site dust, if Black Mass is found, operatives must report this to the Site Manager immediately**

The presence of odour would be confirmed by a member of site staff undertaking a sniff test. The Site Manager would be informed. The initial response to odour would involve the undertaking of further sniff tests at the boundary and around the site to determine whether the odour is originating from the site. If the odour is found to originate at the site, site staff will undertake further olfactory tests to determine the exact source of the odour. The odorous material will be quarantined and prioritised for removal from the site. Odorous wastes may be placed into the UN bags and sealed.

The battery recycling plant will be inspected, and should this be the source of dust or odour it will be temporarily shut down whilst any seals or damage to the enclosure is repaired.

Odour

8.2 Wastes accepted at the site are generally low odour and are not expected to cause any issues during receipt and storage. Waste treatment has been designed as an enclosed system in order to minimise any emissions.

8.3 Olfactory monitoring will be undertaken at the site boundary at least once a day by a trained member of staff to ensure that odour is not detectable.

8.4 If an odour problem is identified or a complaint received, the Site Manager shall be informed and investigations will be undertaken in order to identify the source of the odour and provide any necessary mitigation.

Noise

8.5 The sorting activity will be undertaken within an enclosed building, which will provide noise attenuation. Further treatment will be carried out using enclosed equipment in a Dutch barn style building.

8.6 In order to minimise noise all plant will be maintained in accordance with the manufacturer's recommendations and will be subject to regular servicing.

8.7 The site is located on an industrial estate with the closest residential receptor some 300m away. Treatment activities will be restricted to the working day and will not take place overnight.

Particulates

8.8 Particulate emissions of carbon black should not arise from the operation of the hammermill and vibrating screen. In order to minimise the risk of particulates the system has been designed with state of the art conveyors which minimise disturbance of dust and the system will be fully housed or covered. Along with an abatement system which operates under negative pressure to ensure all emissions are removed and captured from the process. The system has been designed to ensure zero diffuse emissions including particulates, vapour, fumes and steam.

Leaks and Spillages

8.9 All plant and equipment will be serviced and maintained in accordance with the manufacturer's recommendations, minimising the risk of spills from site plant.

8.10 Any liquids stored on site for plant maintenance will be kept in appropriate lidded containers in bunds or drip trays.

8.11 The large on-site sump will provide sufficient capacity for the collection of fire water at the site. The sump has a capacity of up to 124m3.

8.12 The sump and the drainage system will be inspected regularly and maintained as required so that they remain fit for purpose.

8.13 In the event that there is a spillage this will be contained using absorbent materials. Fragments and black mass are heavier than air, so therefore settle on whatever surface they land on. They can be easily swept up and returned to the correct container without any emissions to atmosphere or risk to human health. We also have an industrial vacuum on site which is capable to collecting all dusts and particulates, it is also used at the end of every shift to clean down all machines and conveyor belts. The vacuum is fitted with a Hepa filter which ensures all fine particles are captured. Depending on the nature of the material the waste (including solids) will be returned to the process or will be placed in a sealed container pending collection and removal to a permitted site.
To ensure particles are not disposed by the breeze, the operatives will spray a fine mist of water, damping the area down prior to sweeping the whole area.

8.14 Spillages on privately owned road, with shared access.

The access road to site from Stainland Road is wholly owned by WasteCare Ltd, the following businesses have a right of access:

MJB Excavation & Plant Hire
Yorkshire Water
Gama Healthcare Ltd

MJB Excavation currently have an environmental permit which incorporates the full length of the private access road. MJB have agreed to sweep the road on a daily basis using water from their site to ensure the road remains clean, tidy and the dust levels from their activities do not carry onto the road. Spillages of water, liquids, stones, soil and aggregates from the their activities remain the responsibility of MJB.

9 MONITORING AND RECORD KEEPING

9.1 The site will be inspected on a daily basis with staff carrying out a visual and olfactory assessment around the site boundary to check for emissions of contaminated run-off, odour and particulates.

9.2 Site inspections will include the condition of site infrastructure to check that the road drains and drains around unit 6 are sealed with a plastic liner, the condition of tanks, pipework and secondary containment infrastructure.

9.3 Should any issues be noted these will be raised with site management and appropriate remedial action will be agreed. Details of the inspection and any remedial action will be recorded in the site log.

9.4 The site log will be made available to warranted officers of the Environment Agency on request. Should any incident have the potential to cause significant emissions the Environment Agency will be informed by telephone and remedial action will be agreed with the local environment officer.

9.5 Records will also be kept on site, in either electronic or hard copy format, recording:

- pre-acceptance details for each waste stream;
- waste transfer notes or consignment notes for incoming and outgoing wastes;
- details of any rejected loads and any associated remedial action taken to prevent potential pollution;
- details of inspections of plant or infrastructure and any maintenance required;
- details of visits by the pest control contractor and any action taken; and
- details of any complaints received and the action taken to resolve them.

10 SITE CLOSURE PLAN

10.1 The Site Closure Plan has been developed to ensure the site will be safely decommissioned without causing pollution or harm and the site is returned to a satisfactory state, that is, a similar condition to that which existed prior to permit issue.

10.2 All raw materials will be removed from site in an appropriate manner. Where possible these will be returned to the supplier, possibly under a sale or return agreement, otherwise they will be sent for reuse or recycling at a suitable permitted facility.

10.3 Where possible, all waste materials will be processed through the plant and removed from site for recovery. All remaining wastes will be removed from site and will be recycled or disposed of in accordance with the requirements of The Waste (England and Wales) Regulations 2011, or the relevant waste legislation at the time of decommissioning.

10.4 Appropriate contingency plans will be in operation in case of any spillage/leak or fire of the materials or waste.

10.5 All process plant will be emptied and if necessary cleaned prior to dismantling to minimised the potential for fugitive emissions.

10.6 It is important that the drainage provisions are removed at the final stage of decommissioning, such that cleaning and other drainage water generated during the decommissioning process can be managed.

10.7 Soils samples will be undertaken, if appropriate, so that the condition of the site at decommissioning can be compared to that at commencement of the facility. However inspection and maintenance of the concrete surfacing at the site will be the main mechanism for ensuring no pollution occurs and where records show high standards of containment throughout the life of the site sampling may not be necessary.

10.8 The methodology used to decommission process plant, conveyors, pipework and other structures will minimise the impact of:

- noise;
- odour; and
- disturbance to the environment.

10.9 Protection of the environment will be a priority and no risk to air, land, water or human health will be experienced during closure and decommissioning of the site, which will be subject to the Environmental Management System requirements.

Appendix 1

Quality Management System Standard Operating Procedure					
Site Escalation Procedure					
Document ID	SOP-GP-ENV-7 Site Escalation Procedure	Version	4.0	Status 1) Issued 2) Under Review 3) Draft	Issued
		Date	23.02.23		

Our site permit compliance is extremely important to the company and events that lead to the site becoming non-compliant need to be addressed before the site breaches the conditions of their permit.

The process below details what a Site Management Team should do when any member of the team is concerned about a potential permit breach. The Site Management Team must highlight any concerns / issues at the earliest opportunity.

If you are unhappy with the way the site is operating which may breach the conditions of the site permit, you have been made aware of waste due to be delivered that does not have a final destination identified, you have concerns about the volume of waste currently on site or you are worried about a potential incident that may affect the staff on site and / or your local environment, then follow these simple steps:

STEP 1

Discuss your concerns with your Line Manager directly.

Ask your Line Manager for assistance, design and implement an action plan to resolve the issue which include clear deadlines.

This might resolve the issue within a short time frame.

STEP 2

If you find that Step 1 did not resolve the problem, and / or the deadlines have passed or you feel that you have not received the support you require.

Then contact Helen Kellett, QHSE Director without delay, and report your concerns. The Director of QHSE and Compliance Services will ensure that the site gets the support required to alleviate any concerns and resolve the issue.

You can raise your concerns by calling Helen on 07795 400071.

Because it is not always possible to answer a call, then use any or all of the following options:

1. Leave a voicemail message on the number above.
2. Send a quick text message
3. Send an email to helen.kellett@wastecare.co.uk
4. Contact another member of the QHSE Team and ask them to contact Helen.

Other members of the team are: Jordan Thompson, Caroline Shelton and Phil Emmerson.

STEP 3

If you find that Step 2 did not resolve the problem or you feel that you have still not received the support you require.

Then contact Peter Hunt, Managing Director without delay, and report your concerns.

You can raise your concerns by calling Peter on 07796 612543.

Because it is not always possible to answer a call, then use any or all of the following options:

1. Leave a voicemail message on the number above.
2. Send a quick text message
3. Send an email to peter.hunt@wastecare.co.uk

Operating Procedures are controlled documents, if you wish to suggest a change to them please contact the QHSE Team.

This section is to be completed by a member of staff who has been trained and a trainer who explained the process.

Trainee confirms that he/she has been trained, fully understands the work instruction and is going to abide by it.

The training is to be recorded on the Training Matrix and a signed copy of the Operating Procedure is to be kept in the training files.

Trainee's name:		Signature:		Date:	
Trainer's name:		Signature:		Date:	