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EUROPEAN METALS RECYCLING LIMITED

UNIT 2-12 DUDDESTON MILL TRADING ESTATE

BAT ASSESSMENT

OCTOBER 2024

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1 INTRODUCTION

1.1.1 European Metal Recycling Limited have commissioned Wardell Armstrong LLP to prepare a permit variation application for Unit 2-10 Duddeston Mill Trading Estate, Duddeston Mill Road, Saltley, Birmingham, B8 1AP. The site is operated by EMR under Environmental Permit EPR/JB3509MS.

1.1.2 The site is currently permitted as, a small scale waste processing facility which is used to test and optimise shredding and sorting operations to improve recycling rates and for Electric Vehicle (EV) battery recycling by shredding and recovering metal casing, plastics and blackmass. The previous intention was to send blackmass elsewhere for further recovery.

1.1.3 European Metal Recycling Ltd (EMR) are now looking to build a pilot plant which will allow them to assess the practicality of recovering metals from battery units or black mass recovered from lithium ion batteries and other similar wastes.

1.1.4 Up to 10 tonnes of battery units will be treated per day with a capacity to treat up to 3,050 tonnes per year.

1.1.5 The site is already permitted to shred batteries though there is a change to the shredding process and associated abatement for emissions to air. Shredding will be carried out in a primary and secondary shredder followed by granulation, before being screened.

1.1.6 The shredded and granulated batteries will then undergo chemical treatment to recover copper and nickel as metals, manganese oxide and lithium cobalt sulphate. [redacted]

1.1.7 [redacted]

1.1.8 In their pre-application advice the Environment Agency have advised that the metallurgical treatment of the blackmass should be considered the production of inorganic chemicals and falls within the scope of Schedule 1, Section 4.2 (a) (v) of the Environmental Permitting (England and Wales) Regulations 2016, rather than as a waste treatment activity..

1.1.9 The report provides the Best Available Techniques (BAT) assessment.

1.1.10 Section 2 provides the specific BAT considerations for the acceptance, storage and treatment of hazardous wate.

1.1.11 Section 3 demonstrates that the facility will comply with the BAT in line with the European Commission BREF Note on Speciality Inorganic Chemicals (SIC). This is considered the most appropriate BREF Note due to the relatively small quantities of substance to be produced. The BREF note on non-ferrous metals has also be taken into consideration since metals, a metal salt and metal Oxide are produced as products during the process.

1.1.12 The Environment Agency guidance '*How to Comply with you Environmental Permit Additional Guidance for: The Inorganic Chemicals Sector (EPR 4.03)'* which includes indicative BAT and guidance for activities regulated under Schedule 1, Section 4.2 (a) (v) has been used as the basis for this assessment.

1.1.13 The BREF Note presents BAT at two levels, generic BAT valid for the whole SIC sector, and specific BAT valid for the particular process or group of processes. Therefore, this BAT assessment includes a combination of generic BAT elements and specific BAT elements which are relevant to the operations to be undertaken at EMR's facility.

2 COMPLIANCE WITH BAT REFERENCE DOCUMENT FOR WASTE TREATMENT

2.1.1 This section describes how the site will comply with specific BAT considerations for the acceptance, storage and treatment of waste.

2.1.2 Waste will continue to be accepted on site in accordance with the existing waste pre-acceptance and acceptance procedures and the extant permit conditions.

Table 2.1 Compliance with BAT for Waste Treatment

Ref	Consideration	Measures implemented
BAT 1	In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS)	The site will be operated in accordance with an EMS. The EMS includes procedure to ensure compliance with relevant legislation and the conditions of the Environmental Permit as well as seeking continuous improvement in environmental matters. This forms part of EMR's integrated management system which is ISO14001 accredited.
BAT 2	Site pre-acceptance and acceptance procedures, waste tracking, sorting of waste, waste segregation and managing the quality of outputs	EMR Ltd will ensure they have received pre-acceptance information and characterisation before accepting wastes at the facility. This will include chemical composition, the process producing the waste, tonnage and its physical state. Any special storage or other information regarding the handling of the waste and potential incompatibilities will be made known to the facility in the pre-acceptance stage. Samples will be tracked and accounted for at all times. All samples will be representative of the waste.
BAT 6&7	Monitoring emissions to water	The only emission to water is a small quantity of boiler blowdown (<2 litres/hr) which will be discharged to foul sewer.
BAT 8	Monitoring of point source emissions to air	Abatement of emissions to air are provided for the shredder, leaching and electrowinning process and for the kiln. All stack emission points will be monitored in accordance with the requirements of the environmental permit and shall not exceed the BAT AELs
BAT 9	Monitor emissions from regeneration of solvents, treatment of solvents and use of solvents to decontaminate equipment containing POPs	Solvents used in the process are recovered and reused in the process within the fully enclosed system. There will be no emissions to air from this process.
BAT 10	Odour monitoring where a nuisance at sensitive receptors is expected or has been substantiated.	All activities will be located within a sealed building with state of the art equipment and sealed pumping systems to minimise odours from any chemicals. Shredding of batteries is not anticipated to give rise to any fugitive odour emissions. No significant odour is anticipated.

Table 2.1 Compliance with BAT for Waste Treatment		
Ref	**Consideration**	**Measures implemented**
BAT 11	Monitor energy, raw material and water use	Electricity supply for the site will be derived from connection to the electricity grid and will be metered, with records kept regarding use of electricity. Energy usage will be reviewed at least once every four years and potential energy savings will be identified and implemented where possible. A list of raw materials used at the site will be maintained and reviews will take place at least once every four years and will look at any available substitutes and consideration for their implementation will be made during this review. Raw materials will be purchased in a manner that facilitates waste reduction and recycling. The regular review of raw materials will include steps to ensure that if any substitutions for raw materials become available, they are evaluated and reviewed for potential uptake and use. Where improvements in raw material use can be achieved without excessive cost or reduction in the quality of the product these will be implemented. EMR will review water use at least once every four years to identify whether or not any increased efficiencies can be made. Water used in the process is recirculated and reused.
BAT 12	Odour Management Plan in place	All activities will be located within a sealed building with state of the art equipment and sealed pumping systems to minimise odours from any chemicals. Shredding of batteries is not anticipated to give rise to any fugitive odour emissions. An odour management is not considered necessary.
BAT 14	Minimise sources of diffuse emissions to air in particular of dust, organic compounds and odour	Storing, treating and handling waste and material that may generate diffuse emissions will be undertaken enclosed buildings. Water is fed into the shredder and local air extraction is provided for the shredder with emissions via a wet scrubber and UV photo-oxygenator to prevent emissions of dust and VOC. A schedule of preventative maintenance will be followed to ensure all equipment is in good working order and will minimise the likelihood of leaks. Good housekeeping measures will be employed on site including regularly cleaning the whole waste treatment area (halls, traffic

Table 2.1 Compliance with BAT for Waste Treatment		
Ref	**Consideration**	**Measures implemented**
		areas, storage areas, etc.), conveyor belts, equipment and containers.
BAT 17	Noise Management Plan where nuisance at sensitive receptors is expected or has been substantiated.	A noise impact assessment has been undertaken for the site. This demonstrated that the plant not cause noise impact at nearby receptors.
BAT 18	reduce noise by one, or a combination of appropriate location, proper operation and maintenance of plant, low noise equipment, noise attenuation.	Modern and well maintained plant will be employed at the site which will minimise any noise. Site staff and management will monitor for noise and vibration during the operation of the site and if any complaints or issues are discovered, they will be investigated and remedial action taken. No idling policy in place of any vehicles. The site is on an existing industrial estate.
BAT 19	[redacted]	[redacted]
BAT 20	Treatment of wastewater	The only waste water is a small quantity of boiler blowdown. See BAT 19
BAT 21	Limit emissions from incidents by protecting plant from malevolent acts, effective controls, prevention of fire, incident management plan, logging incidents and learning from incidents	The process has local bunding and is protected from malevolent acts as it is inside industrial units which can be locked when the site is unmanned. The whole site has appropriate fencing and lockable gates. A fire prevention plan is in place. The management system includes management of incidents and should an incident or non-compliance occur records will be kept. These will be reviewed on an annual basis to identify whether updates to the management system are needed to prevent further issues.
BAT 22	reduce raw material use by substituting waste	The main aim of the process is to recycle usable compounds from waste. Raw materials are those that are essential to the process. These will be reviewed on a regular basis to make savings where possible.
BAT 24	Reuse of packaging	IBCs will be cleaned and reused as far as possible.

Table 2.1 Compliance with BAT for Waste Treatment		
Ref	**Consideration**	**Measures implemented**
BAT 25	Reduce emissions to air of dust, and of particulate-bound metals, PCDD/F and dioxin-like PCBs	Water injection into the Shredder - The waste to be shredded is damped by injecting water into the shredder. Local air extraction is provided and a wet scrubber is used to minimise emissions in line with BAT 25.
BAT 26	Inspect shredder feed and remove dangerous items	Waste pre-acceptance and acceptance procedures are in place and loads will be inspected prior to shredding. Batteries will be fully discharged prior to shredding.
BAT 27	Plans in place in order to prevent deflagrations and to reduce emissions when deflagrations occur	Water will be fed into the shredders to control dust and minimise the risk of fire. Inputs to the shredder will be inspected. Off-gas is collected from the primary shredder, secondary shredder, shredder discharge screen, hammer crusher and hammer discharge screen. The off-gas is drawn through a wet off-gas scrubber then a UV photo-oxygenator via an exhaust fan and is then discharged to the shredder off-gas stack
BAT 28	In order to use energy efficiently, BAT is to keep the shredder feed stable.	A stable feed to the shredder will be maintained.

3 COMPLIANCE WITH INDICATIVE BAT FOR PRODUCTION OF INORGANIC CHEMICALS

3.1.1 The table below sets out the way in which the site will comply with BAT requirements for inorganic chemicals.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
1 . MANAGING YOUR ACTIVITIES		
1.1 Environmental Performance Indicators	BAT is to monitor and benchmark environmental performance, and review this at least once a year. Plans for minimising environmental impacts should be incorporated into on-going Improvement Programmes.	EMR LTD will implement and maintain an Environmental Management System, (EMS) and maintain their ISO accreditation. The EMS will be reviewed annually. Nonconformities, recommendations for improvements and observations identified will be recorded and completed within specific timeframes. Environmental objectives will be set annually and monitored and reviewed annually.
1.2 Accident Management	BAT is to consider ways to reduce the risks and consequences of accidents, and whether or not they are covered by the COMAH regime.	An Accident Management Plan is available as part of the EMS and Risk assessment The AMP sets out the control measures which will be in place to minimise the risk of accidents, or minimise the impact from accidents if they do occur. The site is not subject to COMAH as only small quantities of hazardous substances are stored and used.
1.3 Energy Efficiency	BAT is to assess the environmental impact of each process and choose the one with the lowest environmental impact.	Specialist equipment is used to recover metals from black mass to produce Critical Minerals metal products to improve the circular economy of EV battery manufacture. The environmental impact of the process is therefore minimal as it recovers finite earth metals and enhances recovery and recycling of batteries. Equipment is specially designed to reuse water and raw materials as far as possible and emissions from the machinery are designed to be minimal. Energy use will be minimised as far as practical.
1.4 Efficient use of raw materials and water	BAT is to reduce the use of all raw materials and intermediates, substitute less harmful materials or those which can be more readily abated and when abated lead to substances that are more readily dealt with, understand the fate of by-products and contaminants and their environmental impact.	<u>Raw Materials</u> Raw material selection is fixed by the chemistry and chemical engineering design of the process. The substances used as reagents are fundamental to the production of

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
		metals and metal salts and oxides in the pilot facility, and will only be used in the required quantities in order to execute the process and achieve the final product. The quality and composition of the raw materials used will be checked with the suppliers every four years by reference to manufacturer's data to ensure that raw materials with low environmental impact are being used. Checks will also be carried out whenever a raw materials supplier is changed. <u>Water Usage</u> A water meter is installed to monitor water use. Records will be kept of water usage and these will be reviewed annually with targets set for reduction where appropriate. Water use will be reviewed at least once every four years to assess whether any improvements can be made.
1.5 Avoidance, recovery and disposal of wastes	BAT is to demonstrate that the chosen routes for recovery or disposal represent the best environmental option. Consider avenues for recycling back into the process or reworking for another process wherever possible. BAT is where you cannot avoid disposing of waste, provide a detailed assessment identifying the best environmental options for waste disposal.	The aim is to recover as much metal as possible. A screener will be placed after the shredder to collect copper and aluminium components for recycling with the blackmass going on to be processed to recover other metals. Raw materials are reused as far as possible. Residual waste will be sent of site to an appropriately permitted site.
2. OPERATIONS		
2.1 Design of a new process	BAT is to design the process using suitable techniques to prevent pollution and to minimise it at source. Suitable techniques should be reviewed throughout the process including the design of the process, storage and handling of raw materials, products and wastes, plant systems and equipment, reaction stage, separation and isolation, purification and/or final product preparation, chemical process controls, analysis.	The process has been designed to contain and control particulate emissions from the processing plant and equipment, with appropriate abatement fitted at each process point which has potential for escape of emissions. Non-routine/unplanned emission releases (e.g. spillages, shut downs, off-specification products) will be managed in accordance with the Risk Assessment. Localised bunding is provided around process vessels and the site has impermeable surfacing to prevent emissions to land or surface water.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
		Appropriate storage is provided for all raw materials, products, incoming wastes and outgoing wastes.
2.2 Storage and handling of raw materials, products and wastes	BAT is to store reactive chemicals in such a way that they remain stable, such as under a steady gas stream, for example. If chemical additions are necessary then tests should be carried out to ensure the required chemical composition is maintained. Inhibitors may also be added to prevent reactions. BAT is to vent storage tanks to a safe location. BAT is to use measures to reduce the risk of contamination from large storage tanks. In addition to sealed bunds, use double-walled tanks and leak detection channels. BAT is to use HAZOP studies to identify risks to the environment for all operations involving the storage and handling of chemicals and wastes. Where the risks are identified as significant, plans and timetables for improvements should be in place.	The raw materials will be stored separately in sealed bags/containers in dedicated storage areas. IBCs containing chemicals will be bunded and stored on an impermeable surface with a sealed drainage system. Chemical tanks have automated dosing systems and valves to prevent the manual handling of chemicals which can increase spills and accidents. In the event of a spill, the contents will be vacuumed and directed to the tank. Any piping will be bunded. The bunding will be sloped and contain drain points, which enables direction of any potential spills from piping into bunded areas. An initial HAZOP study has been undertaken. The aim is for the HAZOP process to be completed by the end of November with all actions arising completed by January 2025.
2.3 Plant systems and equipment	BAT is to formally consider potential emissions from plant systems and equipment and have plans and timetables for improvements, where the potential for substance or noise pollution from plant systems and equipment has been identified. BAT is to carry out systematic HAZOP studies on all plant systems and equipment to identify and quantify risks to the environment. BAT is to choose vacuum systems that are designed for the load and keep them well maintained, and to install sufficient instrumentation to detect reduced performance and to warn that remedial action should be taken.	Emissions from the plant and equipment to be used has been assessed and show that the potential environmental impact is low. Plant and equipment is state-of-the-art and will be maintained in accordance with manufacturer's recommendations. Any faults or damage to equipment will be repaired by a suitably qualified engineer. Automatic high and low levels switches are provided in tanks to control pumps. An initial HAZOP study has been undertaken. The aim is for the HAZOP process to be completed by the end of November with all actions arising completed by January 2025.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
2.3.1 Purging	Assess the potential for the release to air of VOCs and other pollutants along with discharged purge gas and use abatement where necessary.	Emissions to air from the shredder and granulator may include fine particulates and VOCs from the battery electrolyte. This will be discharged to atmosphere via a wet scrubber to remove dust and VOCs and a UV photo oxygenator to remove any residual VOCs. The process is a continuous process and purging between batches should not be required.
2.4 Reaction Stage	BAT is to have a clear understanding of the physical chemistry, evaluate options for suitable reactor types using chemical engineering principles. BAT is to select the reactor system from a number of potentially suitable reactor designs – conventional stirred tank reactor (STR), process-intensive or novel-technology - by formal comparison of costs and business risks against the assessment of raw material efficiencies and environmental impacts for each of the options. BAT is to undertake studies to review reactor design options based on process-optimisation where the activity is an existing activity and achieved raw material efficiencies and waste generation suggest there is significant potential for improvement. The studies should formally compare the costs and business risks, and raw material efficiencies and environmental impacts of the alternative systems with those of the existing system. The scope and depth of the studies should be in proportion to the potential for environmental improvement over the existing reaction system. BAT is to maximise process yields from the selected reactor design, and minimise losses and emissions, by the formalised use of optimised process control and management procedures (both manual and computerised where appropriate). BAT is to minimise the potential for the release of vapours to air from pressure relief systems and the potential for emissions of organic solvents into air or water, by formal consideration at the design stage - or formal review of the existing arrangements if that stage has passed.	The facility is a pilot facility which will seek to understand the viability of EV battery recycling. Renewable Metals Pty Ltd (RM) has recognised the rapidly growing demand to recycle lithium ion batteries (LIB). During 2022 and 2023, RM successfully piloted a process to produce copper cathode, nickel cathode, lithium sulphate and manganese oxide from shredded batteries. The process is based on standard metallurgical processes that are well understood. RM is currently undertaking a subsequent phase of work to de-risk the technology, which involves the design, construction and operation of a Lithium Battery Recycling Demonstration Plant. The Demonstration Plant aims to process lithium ion batteries and recover saleable, refined metal products. As this is a pilot plant the process will continually be reviewed and improved to make the chemical processes as efficient as possible to allow maximum recovery of metals from the black mass The raw materials used in the process will be monitored. Process yields will be maximised from the pilot plants and improvements shall be made where needed in accordance with the site's EMS and review processes for the Pilot Plant. Potential for the release of vapours to air from pressure relief systems and the potential for emissions of organic solvents into air are minimised by scrubber

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
		systems. Monitoring of the pH of the scrubber liquor will allow appropriate dosing to control the pH and minimise emissions. Monitoring will be undertaken in accordance with the Environmental Permit and shall meet the BAT-AELs.
Minimisation of liquid losses from reaction systems	BAT is to use the features that contribute to a reduction in waste arisings from clean-outs	All associated pipework slopes back to the reactors or to a drain point within the pipework bunding. There is sufficient headroom under the reactors for collection of all concentrated drainage in drums or other suitable vessels. As far as possible liquids are recirculated and reused on site. The process is continuous with a limited range of products so there is no regular clean out between batches.
Minimisation of vapour loss	BAT is to review your operating practices and review vent flows to see if improvements need to be made. BAT is to consider opportunities to enhance the performance of abatement systems.	Operating practices will be continually reviewed and improved as part of the Pilot Facility process. Reviewing and reporting will be done in accordance with the Site's EMS. EMR are ISO 140001 accredited.
2.5 Separation Stage	You should where appropriate: 1. Choose your separation technique following a detailed process design and HAZOP study. Follow formal operating instructions to ensure effective separation and minimisation of losses. Adhere to design conditions such as heat input, reflux flows and ratios, etc. 2. Install instrumentation to warn of faults in the system, such as a temperature, pressure or low coolant-flow alarms.	Automatic warning alarm systems are in place on all automated pieces of equipment. High level and low level alarms and pressure alarms are fitted on all tanks and pumps where appropriate. High weight alarms are also implemented on processes that have automatic weighing systems. High level switched will also automatically cut off systems when tanks are in danger of exceeding the safe capacity. The plant will be operated in accordance with written procedures.
Solid Liquid Separation	You should where appropriate: 1. Use techniques to minimise, re-use and/or recycle rinse water, and to prevent breakthrough of solids.	Wet shredding of batteries is undertaken, scrubber water is fed to the shredding process water tank, all process water from shredding is sent to hydrometallurgy and eventually recirculated.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
	2. Install instrumentation or other means of detecting malfunction as all of the techniques are vulnerable to solids breakthrough 3. Consider installing "guard" filters of smaller capacity downstream which, in the event of breakthrough, rapidly 'clog' and prevent further losses. 4. Have good management procedures to minimise loss of solids, escape of volatiles to air and excessive production of wastewater.	Products are recovered by electrowinning and precipitation and systems are designed to maximise recovery of these products. There are no liquid products. Water and other liquids are recirculated in the process meaning that there is minimised production of wastewater.
2.7 Chemical Process Controls	BAT is to monitor the relevant process controls and set with alarms to ensure they do not go out of the required range.	Automatic warning alarm systems are in place on all automated pieces of equipment. High level and low level alarms and pressure alarms are fitted on all tanks and pumps where appropriate. High weight alarms are also implemented on processes that have automatic weighing systems. High level switches will also automatically cut off systems when tanks are in danger of exceeding the safe capacity. Automatic dosing of chemicals will be monitored closely and alarm features are fitted to these systems.
2.8 Analysis	BAT is to analyse the components and concentrations of by products and waste streams to ensure correct decisions are made regarding onward treatment or disposal. Keep detailed records of decisions based on this analysis in accordance with management systems.	The filter cake will be analysed to ensure it is correctly classified and disposed of to a permitted facility.
3. EMISSIONS AND MONITORING		
3.1 Point source emission to air	Formally consider the information and recommendations in the BREF on Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector (see Reference 1, Annex 2) as part of the assessment of BAT for point-source releases to air, in addition to the information in this note. 2. The benchmark values for point source emissions to air listed in Annex 1 should be achieved unless we have agreed alternative values. 3. Identify the main chemical constituents of the emissions, including VOC speciation where practicable.	The H1 Screening Tool assessment has been carried out to assess the emissions to air. See the H1 assessment and Technical Note ST20383-008 V1 for further detail. Emissions to air are expected to meet the lower BAT-EAL for dust (i.e.5mg/m^3), Emissions of VOCs will be well within the benchmark at 20mg/m^3. Ammonia from the scrubber for the leaching and electrowinning process may be above the BAT-AEL for inorganic chemicals. However the H1 assessment indicates that this will not impact nearby receptors.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
	4. Assess vent and chimney heights for dispersion capability and assess the fate of the substances emitted to the environment.	
3.2 Point source emission to water	BAT is to control all emissions to avoid a breach of water quality standards as a minimum and use appropriate measures to minimise water use and emissions to water.	There are no point source emissions to surface water, the activities are contained in bunds within a building benefitting from an impermeable floor and sealed drainage system. There is a very small discharge to foul sewer from boiler blowdown.
3.3 Point source emissions to land	BAT is to use appropriate measures to minimise emissions to land.	There are no point source emissions to land, the activities are contained within a building benefitting an impermeable floor and sealed drainage system.
3.4 Fugitive emissions: Fugitive emissions to air	BAT is to identify all potential sources and develop and maintain procedures for monitoring and eliminating or minimising leaks. BAT is to choose vent systems to minimise breathing emissions (for example pressure/ vacuum valves) and, where relevant, should be fitted with knock-out pots and appropriate abatement equipment. BAT is to use the following techniques (together or in any combination) to reduce losses from storage tanks at atmospheric pressure: • maintenance of bulk storage temperatures as low as practicable, taking into account changes due to solar heating etc. • tank paint with low solar absorbency • temperature control • tank insulation • inventory management • floating roof tanks • bladder roof tanks • pressure/vacuum valves, where tanks are designed to withstand pressure fluctuations • specific release treatment (such as adsorption condensation)	The process largely takes place in fully contained vessels to prevent fugitive emissions. Local air extraction to abatement is provided at the shredder. All tanks are within the building and therefore protected from extremes of weather.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
3.4 Fugitive emissions: Fugitive emissions to surface water, sewer and groundwater	BAT is to provide hard surfacing in areas where accidental spillage or leakage may occur, e.g. beneath prime movers, pumps, in storage areas, and in handling, loading and unloading areas. The surfacing should be impermeable to process liquors. BAT is to drain hard surfacing of areas subject to potential contamination so that potentially contaminated surface run-off does not discharge to ground. BAT is to hold stocks of suitable absorbents at appropriate locations for use in mopping up minor leaks and spills, and dispose of to leak-proof containers. BAT is to take particular care in areas of inherent sensitivity to groundwater pollution. Poorly maintained drainage systems are known to be the main cause of groundwater contamination and surface/above-ground drains are preferred to facilitate leak detection (and to reduce explosion risks). BAT is to consider additional measures could be justified in locations of particular environmental sensitivity. Decisions on the measures to be taken should take account of the risk to groundwater. BAT is to carry out surveys of plant that may continue to contribute to leakage should also be considered, as part of an overall environmental management system. In particular, you should consider undertaking leakage tests and/or integrity surveys to confirm the containment of underground drains and tanks.	The facility is located inside a building, and flooring comprises of impermeable surfacing throughout, impervious to spillages of materials or liquids. Spill kits and a vacuum system are available on site to manage any spills and leaks. The Environmental risk assessment classes risk of emissions to groundwater as low as all operations are contained in above ground tanks within bunding inside a building with a sealed impermeable surface and contained drainage system.
3.5 Odour	BAT is to manage the operations to prevent release of odour at all times.	The Pilot facility that is regulated under the Production Inorganic Chemicals will solely deal with batteries which are not anticipated to be a source of odour. Chemicals will be stored in appropriate sealed containers and handling of these substances shall be automated where possible
3.6 Noise and Vibration	BAT is to install particularly noisy machines such as compactors and pelletisers in a noise control booth or encapsulate the noise source. BAT is to where possible, without compromising safety, fit suitable silencers on safety valves. BAT is to minimise the blow-off from boilers and air compressors, for example during start up, and provide silencers.	A Noise survey has been undertaken and indicates that the site will cause a noise impact.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
	3.7 Monitoring	
Monitoring and reporting of emissions to air	BAT is to carry out an analysis covering a broad spectrum of substances to establish that all relevant substances have been taken into account when setting the release limits. The need to repeat such a test will depend upon the potential variability in the process and, for example, the potential for contamination of raw materials. Where there is such potential, tests may be appropriate. BAT is to monitor more regularly any substances found to be of concern, or any other individual substances to which the local environment may be susceptible and upon which the operations may impact. This would particularly apply to the common pesticides and heavy metals. Using composite samples is the technique most likely to be appropriate where the concentration does not vary excessively. BAT is to monitor releases of substances that are more difficult to measure and whose capacity for harm is uncertain, particularly when combined with other substances, then "whole effluent toxicity" monitoring techniques can be appropriate to provide direct measurements of harm, for example, direct toxicity assessment.	The technology supplier has provided information on all potential emissions to air. The H1 screening tool assessment has concluded that the emissions to air do not present a significant risk to the environment and no further air quality modelling is required. Monitoring will be undertaken as required by the Environmental Permit.
Monitoring and reporting of waste emissions	BAT is to monitor and record: • the physical and chemical composition of the waste • its hazard characteristics • handling precautions and substances with which it cannot be mixed	The filter cake will be analysed so that it can be properly classified and disposed of. Make up of the coarser residual waste will also be recorded.
Environmental monitoring beyond the installation	BAT is to consider the following when drawing up proposals when environmental monitoring is needed: • determinants to be monitored, standard reference methods, sampling protocols • monitoring strategy, selection of monitoring points, optimisation of monitoring approach • determination of background levels contributed by other sources • uncertainty for the employed methodologies and the resultant overall uncertainty of measurement	At this stage it is not expected that monitoring beyond the installation boundary will be required. A daily visual/olfactory assessment will be made at the site boundary to check for any dust, odour or noise issues.

	Table – 3.1 Compliance with indicative BAT for the Production of Inorganic Chemicals	
Guidance Section	**Consideration**	**Measures implemented**
	• quality assurance (QA) and quality control (QC) protocols, equipment calibration and maintenance, sample storage and chain of custody/audit trail • reporting procedures, data storage, interpretation and review of results, reporting format for the provision of information.	

4 SPECIFIC REQUIREMENTS FOR WATER USE

4.1.1 Water use at the Site will be minimal, given the nature of the site and its activities. Boiler water will be taken from the mains and will be subject to treatment to soften it and minimise corrosion. A small amount of blowdown will be directed to foul sewer.

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4.1.2 Water used on site will be directed into the hydrometallurgical process and will be reused indefinitely. Water will evaporate in the crystalliser and will be captured and condensed for reuse.

4.1.3 There will be some losses via emissions to air or entrained in products and waste materials. This will be made up from mains water as indicated in Table 4.1 below.

Table 4.1 – Predicted Water Usage

Process	Use	Quantity (kg/hr)	Operating time (hours/ annum)	Total (kg/annum)
Leach residue	Water entrained in leach residue	9.20	7920	72,864
Screen oversize	Water entrained in screen oversize	0.50	7920	3,960
Manganese product	Manganese product	1.31	7920	10,375
Shredder off-gas scrubber	Water exiting the shredder off-gas stack	12.7	3960	50,292
Process off-gas scrubber	Water exiting the process off-gas stack	22.0	7920	174,240
Kiln off-gas scrubber	Water exiting the kiln off-gas stack	2.12	7920	16,790
Boiler blown	Water exiting as boiler blowdown to sewer	1.75	7920	13,860
				TOTAL 342,382

4.1.4 Water use will be monitored and reviewed at least once every four years and where options to further reduce water use become available these will be implemented.

5 USE OF ENERGY

5.1 Compliance with BREF Note on Energy Efficiency

5.1.1 In order to comply with the BAT conclusions on energy efficiency, EMR will have an energy efficiency and management system incorporated into their Environmental Management System. This will include a commitment from senior managers to use energy efficiently and to seek to reduce carbon emissions where possible.

5.1.2 Communications will be made to staff to raise awareness of the energy policy and encourage employee engagement.

5.1.3 Energy use will be reviewed at least once every four years and targets for efficiencies will be set, seeking continuous improvement and reduction in emissions.

5.1.4 Where new plant is being purchased energy efficiency will be an important consideration and all processing plant, will be designed with expert input to ensure the most efficient schemes are adopted. This will include optimising layouts.

5.1.5 All plant will be part of the planned preventative maintenance programme and will be properly maintained so as to operate without excessive use of energy. Staff will receive training so that procedures are followed correctly and idling of plant or inefficient loads are avoided.

5.1.6 All energy use will be recorded so that quantitative comparisons can be made and energy savings can be properly assessed.

5.2 Specific Energy Consumption

5.2.1 To allow benchmarking and assessment of progress against any energy efficiency targets that are set the specific energy consumption will be calculated each year. This will be established during the first year of operation when energy use will be recorded against production in order to provide a baseline for energy usage and carbon emissions.

5.2.2 Targets will be set to reduce energy use as appropriate.

5.2.3 Anticipated energy usage for the site is provided in Table 10, this will be revised and updated when there is data from the first year of operations.

Table 5.1 – Predicted Energy Usage				
Energy source	**Use**	**Quantity (kWh)**	**Operating time (hours/ annum)**	**Total (kWh/annum)**
Electricity	Shredding plant	224	3960	887,040
Electricity	Hydrometallurgical plant	155	7920	1,227,600
Electricity	For steam boiler	500	7920	3,960,000
Diesel	For temporary site power	50	1440	72,000
				TOTAL 6,146,640

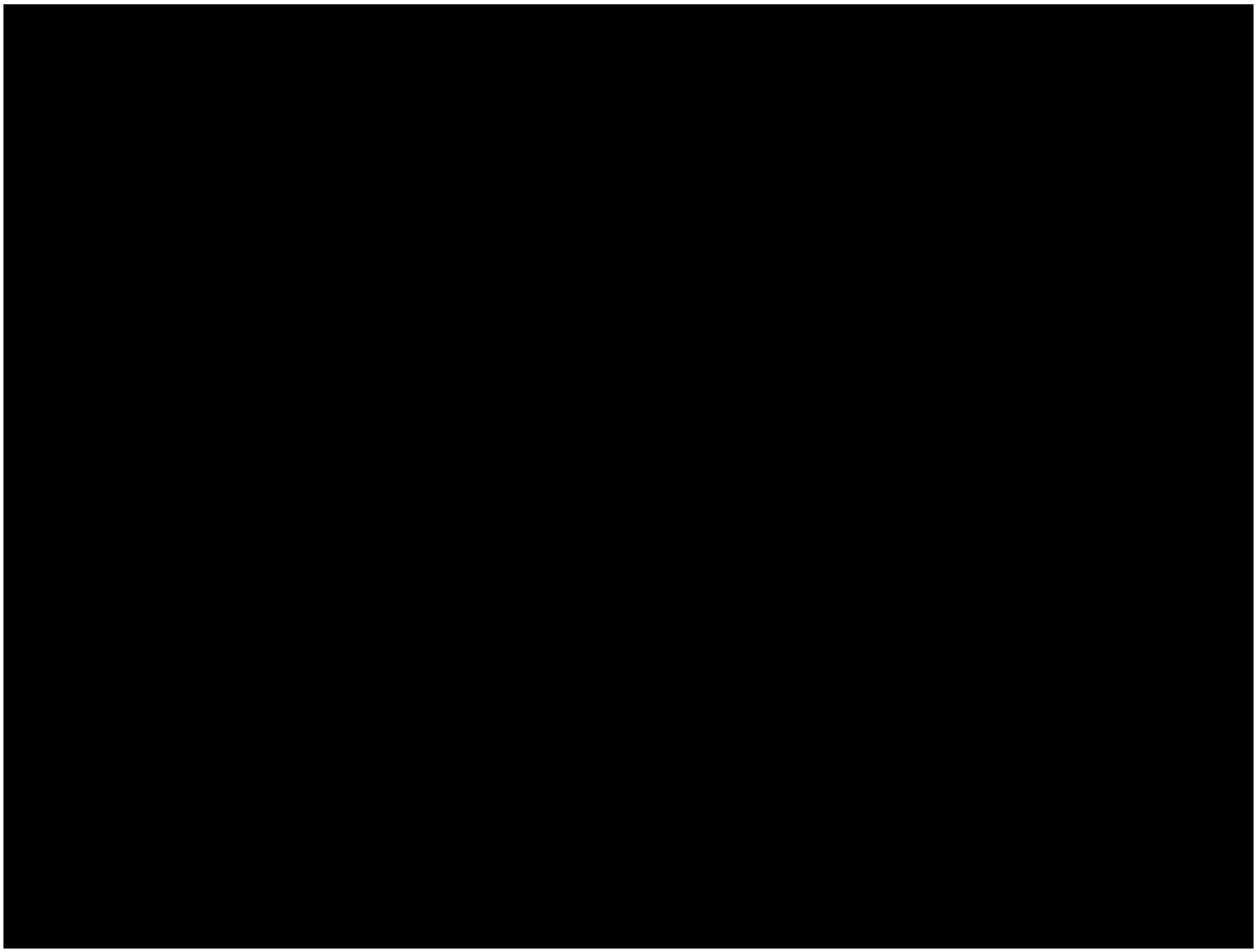
6 RAW MATERIALS AND WASTE

6.1 Table 6.1 sets out the annual raw material usage. Materials will be stored in IBCs, with solid materials in bags. Materials will be stored with appropriate bunding to capture any leaks or spills.

6.2 Chemicals that may react together will be stored in separate areas to prevent them coming into contact with each other.

6.3 An inventory will be maintained to record the quantity of material on site and material usage.

6.4 Raw material usage will be reviewed at least once every 4 years to ensure that the best available environmental options are being utilised and raw material use is being minimised.



6.4.1 Wastes from the process will comprise a coarser material following shredding and screening and a filter cake comprising residual solids from the metal extraction process.

6.4.2 Aluminium and copper will be extracted at the screener and will be sold as a by product.

6.4.3 The residual solids will be disposed of at an appropriately permitted site.

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