Mastermelt Refining Services Limited

EPR/BL1312IE/VO14

Non-Technical Summary

Report prepared by:

Sean Critchlow
Environmental Safety, & Quality Manager
Mastermelt Refining Services Limited

8th January 2025

1. Project Background

Mastermelt Refining Services are a leading global precious metal recycling company, with wider sites in the Mastermelt Group strategically located across America, Europe and Asia. We recover precious metals from industrial waste streams, jewellery, manufacturing scrap and end of life products, thus playing a key role in the sustainable circular economy.

Mastermelt have identified significant areas of opportunity to support our wide customer base in the ever emerging Hydrogen (H2) industry through two predominant applications:

Fuel Cells:

Fuel Cells are slowly moving from proof-of-concept stage, to deployment stage in stationary applications such as generators, and back-up power (motorway lighting towers). Other areas for Fuel Cells use are still in early development stages for thing such as transport (HGV's, cars, planes).

Electrolysers:

Electrolysers are very much 'now' in the H2 industry, with electrolysis of water used to produce Hydrogen or Green Hydrogen to be used as a fuel to replace greenhouse gas emitting forms of fuel in various industries.

2. Platinum Group Metals

Both of the above H2 industry areas require Platinum Exchange Membrane (PEM) technology, and associated Platinum Group Metals (*Platinum, Palladium, Rhodium, Ruthenium, Iridium, Osmium*) used as coatings in the PEM technology. Platinum and Iridium are currently the predominantly used PGM's in the H2 industry, and in particularly within the next 2 – 7 years the use of Platinum in PEM's will be significant – e.g. starting up from 10kg of raw Platinum per year currently used, to 1MT per year circa 2030.

Catalyst Coated Membrane's (CCM) are particularly important in PEM Electrolysers, facilitating the electrochemical reactions to take place and enabling H2 to be produced. The CCM's are predominantly coated with Iridium on the Anode and Platinum on the Cathode. The splitting of the water molecule and passing of H+ through the membrane produces a very harsh acidic environment and therefore all key cell parts, the porous transport layer and bi-polar plates need to be coated with PGM's to deter corrosion.

The trajectory of Platinum and Iridium use for the above components will be significant in the next 1 – 6 years, H2 industry is targeting 1-4 gigawatt factories PEM producing companies, and for each

successful PEM operation, there will be a ten-fold scale up from 2 – 3KG to 20 – 30KG of Iridium per year, at a minimum.

3. Description of Waste

We will be receiving the metallic H2 waste from our customer base, predominantly from recycling partners under the non-hazardous EWC Code: *19-12-03 - Non-Ferrous Metals*, from the *19 - Materials From Waste and Water Treatment* heading & *19 12 – Mechanical Treatment of Waste* sub-heading.

We are already permitted to receive this EWC code under our Permitted List of Wastes table under our PPC Permit EPR/BL1312IE/V013. We are not requesting any additional permitted throughput volumes on our PPC Permit and the permitted annual site throughput remains at 2,500 tonnes across all permitted activities.

Other EWC codes will be reviewed for applicability as and when customer and market enquiries come through.

Projected indicated volumes are between 200 – 300T over an annual basis for onsite treatment.

4. How Mastermelt Will Enable the Recycling of H2 PGMs – Technology Used

Mastermelt have approved a CAPEX investment for a Ano-Cycle cleaning system consisting of a fully integrated unit and additional process tank operations, with the processing steps below:

a. Using a crane, between 50 – 120KG of material will be loaded into the first bath containing Ano-Cycle (*KOH / Potassium Hydroxide*) salts, electrical heaters will heat the salts to between 200 – 220°C prior to material being submerged in the salts. The material will be sub-merged for 10 minutes.

b. The load will then be moved on to the second step Quench Bath, with the material submerged in ambient water for a period of 2 minutes to cool the material.

c. The material will then leave the Ano-Cycle plant enclosure and will move onto the third stage bath, consisting of 20% Sulphuric Acid heated to 60°C, and will be submerged for a period of 10 minutes

d. After stage 3, the material will then be moved on to a separate rinse tank consisting of cold water only with the material submerged for 2 minutes

e. Per 1 x 50 – 120KG load of the material, steps a – d will be repeated until the PGM coating has been fully removed from the material. This will be verified via a handheld XRF analyser.

De-sludging procedure:

Material being processing through the Ano-Cycle cleaning plant will be processed on an individual customer, batch-by-batch basis therefore it is imperative that the system is cleaned and de-sludged of the PGM containing material, with the de-sludging steps as follows:

a. The crane hook will be attached the sludge tray that is located at the bottom of the step a) Ano-Cycle tank, with the PGM material settled within the tray.

b. The sludge tray is then lifted in an upwards trajectory, moved across and lowered and emptied inwards into sludge collection drum.

c. The collected PGM containing sludge is then processed through our in place Section 2.2 A (1)(a) – Cyanide Dissolution/Precipitation process and then through DAA Thermal Treatment (ashing down) process to produce a PGM containing sweep. There are no proven or future anticipated environmental risks from the downstream Cyanide Dissolution and Thermal Treatment (ashing down) processes, we have been receiving the PGM containing sludge from a third party customer for treatment for the last 1-2 years and have successfully proven treatment with no adverse environmental impact.

d. The washing of the sludge itself under our Section 2.2 A (1)(a) – Cyanide Dissolution/Precipitation process is a very straightforward process in that we are solely washing the sludge (adding water, mixing cold and settling) to remove the Caustic content. We then filter the solution and collect the 'clean' sludge for the Thermal Treatment (ashing down) process. By removing the caustic content of the sludge, the environmental risk is much lower for the Thermal Treatment (ashing down) process, and the spent caustic based solution is collected and contained and sent offsite as hazardous waste by our Waste Contractor under our Cyanide/Alkaline waste stream – 11 03 01*.

e. The PGM sweep is then sent out to a further End Refiner to produce raw PGM products to be further used in industry and products.

MASTERMELT

MASTERMELT REFINING SERVICES
Staden Lane, Ashbourne Road
Buxton SK17 9RZ

+44 (0)1298 766 900
info@mastermeltgroup.com
www.mastermeltgroup.com

VAT: GB 732 5397 27
Reg No. 4029877
Reg Add: 2 Leman St, London E1W 9US

GOLD 2022 ecovadis Sustainability Rating

LBMA

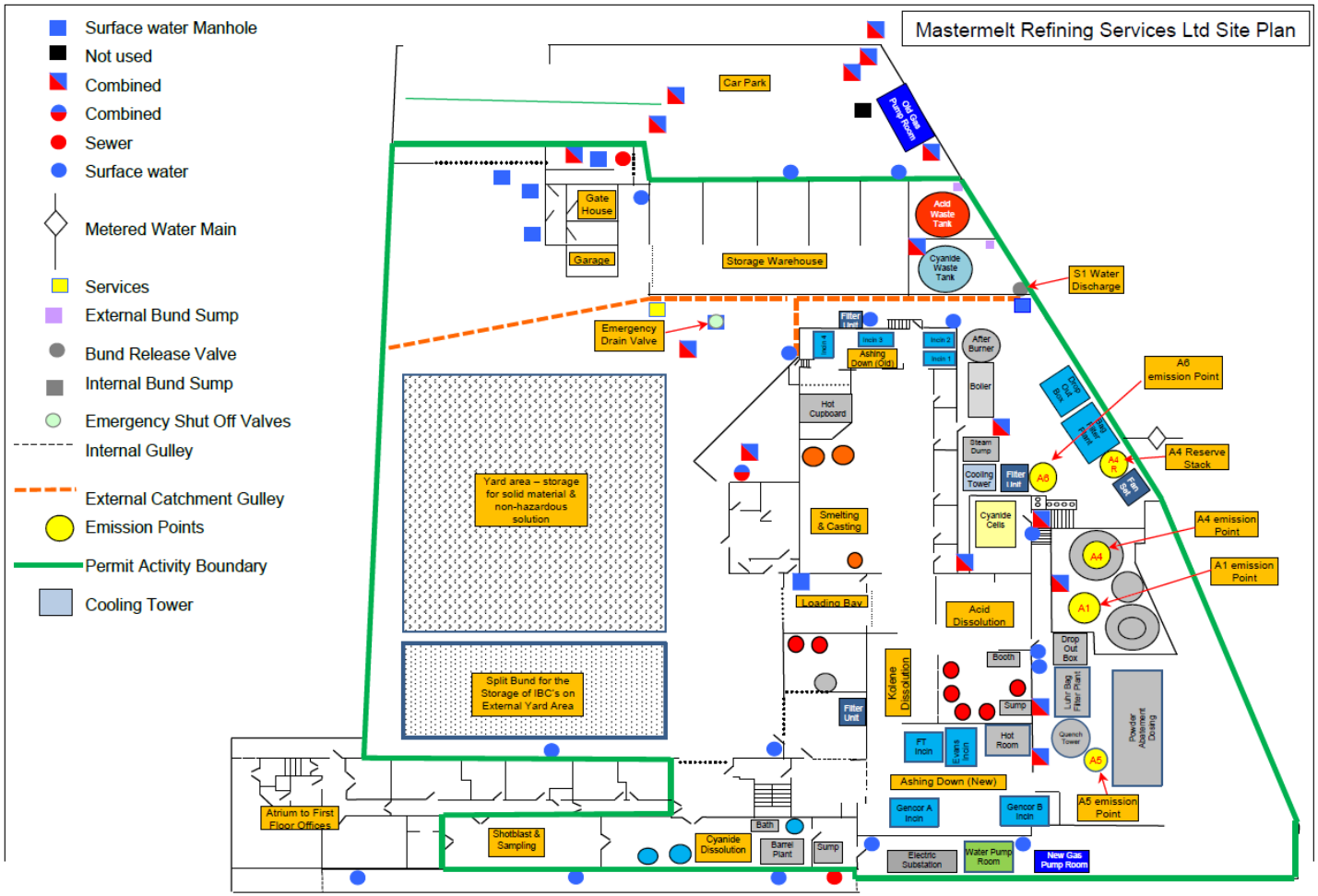
LPM LONDON PLATINUM & PALLADIUM MARKET

Precious Metal Reclamation

Non-Technical Summary - Reference 1			
Permit Schedule	Permit Activities	Summary	Request
Section 2.2 A(1)(a)	Additional Chemical Stripping Process – using Potassium Hydroxide	Mastermelt have identified significant areas of opportunity from new industry sectors *(green hydrogen generation, electrochemical, electroplating)* for the recovery of PGMs *(platinum group metals)* used as coatings in Platinum Exchange Membrane technology.	Mastermelt wish to request to formalise this additional process as a new permitted activity on permit – EPR/BL1312IE
Conclusion of Compliance	1. The Ano-Cycle Cleaning system is proven technology used in industry, with other companies within our industry sector utilising this technology for the recovery of precious metals. 2. H1 Risk Assessment review undertaken for the addition of Sulphuric Acid used within the process and emitted through our A1 Emissions Point – coming back as below reportable levels and no further action required 3. MCERTS monitoring of emission stacks under Schedule 3 – Emissions Monitoring confirms ongoing annual compliance with permitted ELV limits 4. No increase in Hazardous Waste accepted to our facility as part of this process		
Supporting Evidence	1. H1 Risk Assessment – No revised risk assessments as the feed stocks remain consistent 2. A1 report forms submitted under condition 3.5 Monitoring – Compliance with Emission Limit Values		

Non-Technical Summary - Reference 2			
Permit Schedule	Permit Activities	Summary	Request
Schedule 7 – Site Plan	Section 2.2 A(1)(a)	Update of the site plan only to provide an accurate representation of the site layout, specific change being the new Ano-Cycle processing area	Update PPC permit site plan
Conclusion of Compliance	Not applicable – Update of the site plan only to provide an accurate representation of the site layout		
Supporting Evidence	Updated site plan (See pasted below)		

MASTERMELT



MASTERMELT REFINING SERVICES
Staden Lane, Ashbourne Road
Buxton SK17 9RZ

+44 (0)1298 766 900
info@mastermeltgroup.com
www.mastermeltgroup.com

VAT: GB 732 5397 27
Reg No. 4029877
Reg Add: 2 Leman St, London E1W 9US

LBMA LPM LONDON PLATINUM & PALLADIUM MARKET

Precious Metal Reclamation

5. Environmental Risk Assessment

Environmental Hazard & *Receptors*	What is the Risk?	Hazard Potential	Likelihood of Occurrence	Risk Rank	Control Measures in Place	Responsibility	Post Control Measures		
							Hazard Potential	Likelihood of Occurrence	Risk Rank
Point Source Emissions to Water – *Buxton Sewage Treatment Works – River Wye, Staden Lane Industrial Estate*	Material spillages during unloading has the potential to interact with surface water and, ongoing external receptors	Low	Unlikely	Low	1. Incoming material is a solid metal – with no associated environmental hazards codes 2. Trained Goods In operators, holding valid Fork Lift Truck Licenses	Operator	Low	Low	**NEGLIBLE**
Odour – *Employees, Visitors,*	Odorous materials have the potential to cause negative fugitive emissions to employees and others	Low	None	Low	1. No associated odours with the 19-12-03 EWC code – solid metal 2. Ano-Cycle Step.1 & Step.2 bath are sited in a fully enclosed unit under Local Exhaust Ventilation extraction to capture the steam from the Step.2 bath.	Operator	Low	Low	**NEGLIBLE**

Neighbouring Businesses				3.	The Sulphuric Acid cleaning tank has been designed with suitable tank lip Local Exhaust Ventilation connected to the A1 emissions point			

Environmental Hazard - *Receptors*	**What is the Risk?**	**Hazard Potential**	**Likelihood of Occurrence**	**Risk Rank**	**Control Measures in Place**	**Responsibility**	**Post Control Measures**		
							Hazard Potential	**Likelihood of Occurrence**	**Risk Rank**
Point Source Emissions to Air – *Atmosphere, Ozone Layer, Neighbouring Businesses*	Emissions from the Ano-Cycle processing both in the Step. 2 Salt Bath and the Step. 3 Sulphuric Bath have the potential to negatively impact the environment – via air emissions	High	Possible	High	1. The Step. 2 Ano-Cycle Quench Bath are steam only and will be vented through a new dedicated roof vent, mirroring our current permitted Cyanide Dissolution Process *"emissions to air from the cyanide dissolution process consist of steam only and these are vented directly to atmosphere via a roof outlet fan"*. There are no point source emissions or diffuse emissions anticipated from the Step 1. Molten salt	Operator	Medium	Unlikely	**NEGLIBLE**

					bath therefore no associated abatement. 2. The associated emissions from the Step. 2 Sulphuric Acid process bath will be connected via a new header duct – into our A1 Emissions Point which is our Chemical Based Scrubber with caustic neutralisation.				

Environmental Hazard - *Receptors*	What is the Risk?	Hazard Potential	Likelihood of Occurrence	Risk Rank	Control Measures in Place	Responsibility	Post Control Measures		
							Hazard Potential	Likelihood of Occurrence	Risk Rank
Fugitive Emissions to Water - *Buxton Sewage Treatment Works – River Wye, Staden*	Contaminated process solution run off (Alkaline Solution / Acid Solution / Contaminated Water Solution) has potential to negatively impact the environment if uncontrolled via surface water drains	High	Unlikely	Low	1. All processing steps involving any solution are undertaken within a building – which is fully bunded to prevent any uncontrolled release to site receptors. 2. There are no surface or foul water drains internally that can be contaminated with any process liquid contaminants. Adequate floor containment only drainage has been installed around the	Operator	Medium	Low	**NEGLIBLE**

Lane Industrial Estate					Ano-Cycle enclosed unit to capture any spillages with this area though this is unlikely due to it being a contained unit. 3. The processing and washing of the PGM containing sludge under the Section 2.2 A(1)(a) Cyanide Dissolution/Precipitation process is undertaken in a dedicated area of site (*see site plan)* fully bunded with a collection sump (1000L) – no receptors. 4. Post-processing solution of any type are stored in UN approved containers all times.				

Environmental Hazard - *Receptors*	What is the Risk?	Hazard Potential	Likelihood of Occurrence	Risk Rank	Control Measures in Place	Responsibility	Post Control Measures		
							Hazard Potential	Likelihood of Occurrence	Risk Rank
Noise and Vibration - ***Employees, Visitors, Neighbouring Businesse***	Onsite delivery of the material and the Ano-Cycle treatment process	Low	Unlikely	Low	1. Site located on an active industrial estate – with no anticipated significant change in delivery regularity 2. All processing operations carried out within enclosed building 3. Fans/motors to be maintained under our PPM maintenance schedule ensuring noise/vibration is kept to a minimum	Operator	Low	Low	**NEGLIBLE**
Pests / Vermin / Litter/ Dust - ***Employees, Visitors, Neighbouring Businesse***	No onsite risk of any of the fugitive pollutants per the Environmental Hazard	Low	None	Low	1. Material streams for the Ano-Cycle plant do not contain materials that's liable to decay therefore attracting pests. 2. Ongoing housekeeping regime for the external Yard and twice daily site inspections	Operator	Low	Low	**NEGLIBLE**