


EPR APPLICATION VARIATION

The Royal Mint Limited
EPR/KP3135KV

Prepared by:
Sol Environment Ltd

Date:
March 2023

Project or Issue Number:
SOL_21_P049_RYM

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1	First Submission to NRW	8th March 2023	SB	SR

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NON-TECHNICAL SUMMARY

This document has been prepared on behalf of The Royal Mint Ltd (‘*The Applicant*’ hereafter) by Sol Environment Ltd and provides supporting evidence as required by Environmental Permit Application Forms Part C2 and C3 issued by Natural Resources Wales (NRW).

The Royal Mint site is located at The Royal Mint, Pontyclun, Llantrissant, South Wales, CF72 8YT.

The existing surface treatment and plating processes carried out by the Royal Mint are permitted as a Part A(1) Installation, as defined by Schedule 1, Section 2.3A(1)a ‘Surface Treatment of Metals’ and S5.3A(1)(b)(ii) of the EPR Regulations and regulated in accordance with the conditions established by Environmental Permit EPR/KP3135KV/V005.

The Royal Mint is making this application to carry out a ‘Normal’ Variation of their existing EPR permit under The Environmental Permitting (England and Wales) Regulations 2016 (as amended) to:

- Include the installation a Printed Circuit Board (PCB) Processing Facility that can process approximately 4,000 tonnes per annum of printed circuit boards and selected electronic and electrical equipment residues using the following key stages:
    - De-soldering and associated scrubbing plant;
    - Component / Board Separation;
    - Board Shredding and Processing;
    - Surface Gold Reactor and associated scrubbing plant; and
    - Granulation and Separation.

Phase 2 of the project will involve the installation of a small-scale pyrolysis and syngas generation plant for treatment of the resultant granulated circuit board substrate however this will be addressed as a separate variation once the R&D for the project has progressed.

In 2021 a ‘Normal’ variation was made under Regulation 20 of The Environmental Permitting (England and Wales) Regulations 2016 (as amended) to change the following aspects of the plant. This Permit Variation has now been granted and included the following activities:

- The Installation of a new Listed Activity (Direct Brass Plating Line), within the building formally occupied by the former Nickel Plating 2 line[1];
- Introduction of a new treatment process for the destruction of cyanide effluent;
- Increasing the Installation Boundary to include the installation and operation of a directly associated activity gas fired CHP plant;
- Formal removal of the metal casting process and the associated emission point A14; and

1 Please note the following activities are no longer operational as a result of the 2021 permit variation; Zinc Plating Line 1, Copper Plating Line 2, Copper Plating line 3, Cyanide Treatment Room 2.

- To address a number of minor operational changes that have been implemented within the Installation since the determination and issuance of the previous permit iteration.

All aspects of this variation (SOL_21_PO49_RYM) assumes that all of the above changes have been completed and relies on the fact that the metal casting process has been fully decommissioned and removed from the site. The majority of the location of the PCB processing plant falls within the footprint of the former metal casting plant (MRB) building. This application does not require any additional land or expansion of the existing Installation Boundary however due to the addition of an Installation Activity the application requires a baseline report. Therefore the sites existing Site Condition Reports have been included within *Annex E – Site Condition Report.*

The Royal Mint operate and maintain a formal environmental management system which has been certified to meet the requirements of the International Standard BS EN ISO14001:2004. The changes brought about by this permit variation will not result in any functional or material changes to the existing environmental management system (EMS), however it will introduce a number of new operations and work instructions relating to the operation of the plant.

Due to processing more than 10 tonnes per day of hazardous waste, the Printed Circuit Board (PCB) Processing and Recovery Plant meets the definition of a Section 5.3 'Disposal or Recovery of Hazardous Waste' Part A(1)(ii) Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment as defined by the Environmental Permitting Regulations.

Pre-application discussions were carried out with Andi Kemp from Natural Resources Wales.

Emissions to Air

This permit variation introduces three new emissions points which includes the following[2]:

- De-soldering scrubbing plant (A32);
- Surface gold reactor scrubbing plant (A33); and
- Dust Extraction Plant (A34).

All emissions from the new emissions points are small scale and minor in their nature. The scrubbing plants (A32 and A33) have all been specified to abate acid gas emissions to below the BAT ELV / EAL levels and are low volume in their nature, as such the emissions are considered to be negligible and have been screened from assessment. Accordingly, it is concluded that there will be no adverse impacts to air emissions resulting from this permit variation.

Odour

There are no emissions to odour arising from this permit variation.

2 Please note, A1, A2, A3, A4, A7 and A8 will be decommissioned which has been addressed in the 2021 permit variation.

Emissions to Controlled Water and Sewer

There will be no change to emissions to controlled water or sewer as a result of this permit variation. Any waste water / effluent is contained and transferred off site for further treatment using third party specialist waste contractors.

Any releases to controlled water via W1 will remain as currently permitted.

Any emissions to sewer via S1 will remain as currently permitted. All emissions to sewer will remain in accordance with the sites current Trade Effluent Discharge consent (Ref No. TE409).

All new activities relating to the PCB storage processing line are located within the former buildings and do not give rise to any contaminated or potentially contaminated discharges. All process and storage areas are fully enclosed, therefore any spillages / runoff will be effectively contained within the building and tankered off site.

Emissions to Land

There are no emissions to land arising from the Installation.

1 INTRODUCTION

This document has been prepared on behalf of The Royal Mint Ltd (*'The Applicant'* hereafter) by Sol Environment Ltd and provides supporting evidence as required by Environmental Permit Application Forms Part C2 and C3 issued by Natural Resources Wales (NRW).

The Royal Mint site is located at The Royal Mint, Pontyclun, Llantrissant, South Wales, CF72 8YT.

The existing surface treatment and plating processes carried out by the Royal Mint are permitted as a Part A(1) Installation, as defined by Schedule 1, Section 2.3A(1)a *'Surface Treatment of Metals'* and S5.3A(1)(b)(ii) of the EPR Regulations and regulated in accordance with the conditions established by Environmental Permit EPR/KP3135KV/V005.

The Royal Mint is making this application to carry out a '*Normal*' Variation of their existing EPR permit under The Environmental Permitting (England and Wales) Regulations 2016 (as amended) to:

- Include the installation a Printed Circuit Board (PCB) Processing Facility that can process approximately 4,000 tonnes per annum of printed circuit boards and selected electronic and electrical equipment residues using the following key stages;
    - De-soldering and associated scrubbing plant;
    - Component / Board Separation;
    - Board Shredding and Processing;
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In 2021 a '*Normal*' variation was made under Regulation 20 of The Environmental Permitting (England and Wales) Regulations 2016 (as amended) to change the following aspects of the plant. This Permit Variation has now been granted and included the following activities:

- The Installation of a new Listed Activity (Direct Brass Plating Line), within the building formally occupied by the former Nickel Plating 2 line[3];
- Introduction of a new treatment process for the destruction of cyanide effluent;
- Increasing the Installation Boundary to include the installation and operation of a directly associated activity gas fired CHP plant;
- Formal removal of the metal casting process and the associated emission point A14; and

3 Please note the following activities are no longer operational as a result of the 2021 permit variation; Zinc Plating Line 1, Copper Plating Line 2, Copper Plating line 3, Cyanide Treatment Room 2.

- To address a number of minor operational changes that have been implemented within the Installation since the determination and issuance of the previous permit iteration.

All aspects of this variation (SOL_21_PO49_RYM) assumes that all of the above changes have been completed and relies on the fact that the metal casting process has been fully decommissioned and removed from the site. The majority of the location of the PCB processing plant falls within the footprint of the former metal casting plant (MRB) building. This application does not require any additional land or expansion of the existing Installation Boundary however due to the addition of an Installation Activity the application requires a baseline report. Therefore the sites existing Site Condition Reports have been included within *Annex E – Site Condition Report.*

The Royal Mint operate and maintain a formal environmental management system which has been certified to meet the requirements of the International Standard BS EN ISO14001:2004. The changes brought about by this permit variation will not result in any functional or material changes to the existing environmental management system (EMS), however it will introduce a number of new operations and work instructions relating to the operation of the plant.

Due to processing more than 10 tonnes per day of hazardous waste, the Printed Circuit Board (PCB) Processing and Recovery Plant meets the definition of a Section 5.3 'Disposal or Recovery of Hazardous Waste' Part A(1)(ii) Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment as defined by the Environmental Permitting Regulations.

The remainder of this application support document is structured accordingly:

- Section 2: Provides specific nature of the proposed changes associated with the variation application;
- Section 3: Provides specific nature and detailed description of the emissions to air and water associated with the installation;
- Section 4: Provides details of all monitoring associated with the Installation;
- Section 5: Provides an Environmental Impact and Assessment of the varied Installation.

All technical appendices associated with the Installation are included within the following:

- Annex A: Site Plans;
- Annex B: Process Schematic;
- Annex C: Environmental Risk Assessment;
- Annex D: EMS Summary; and
- Annex E: Site Condition Report.

The Site location, Installation Boundary and Site Layout is provided overleaf in Figure 1.1, 1.2, 1.3 and 1.4.

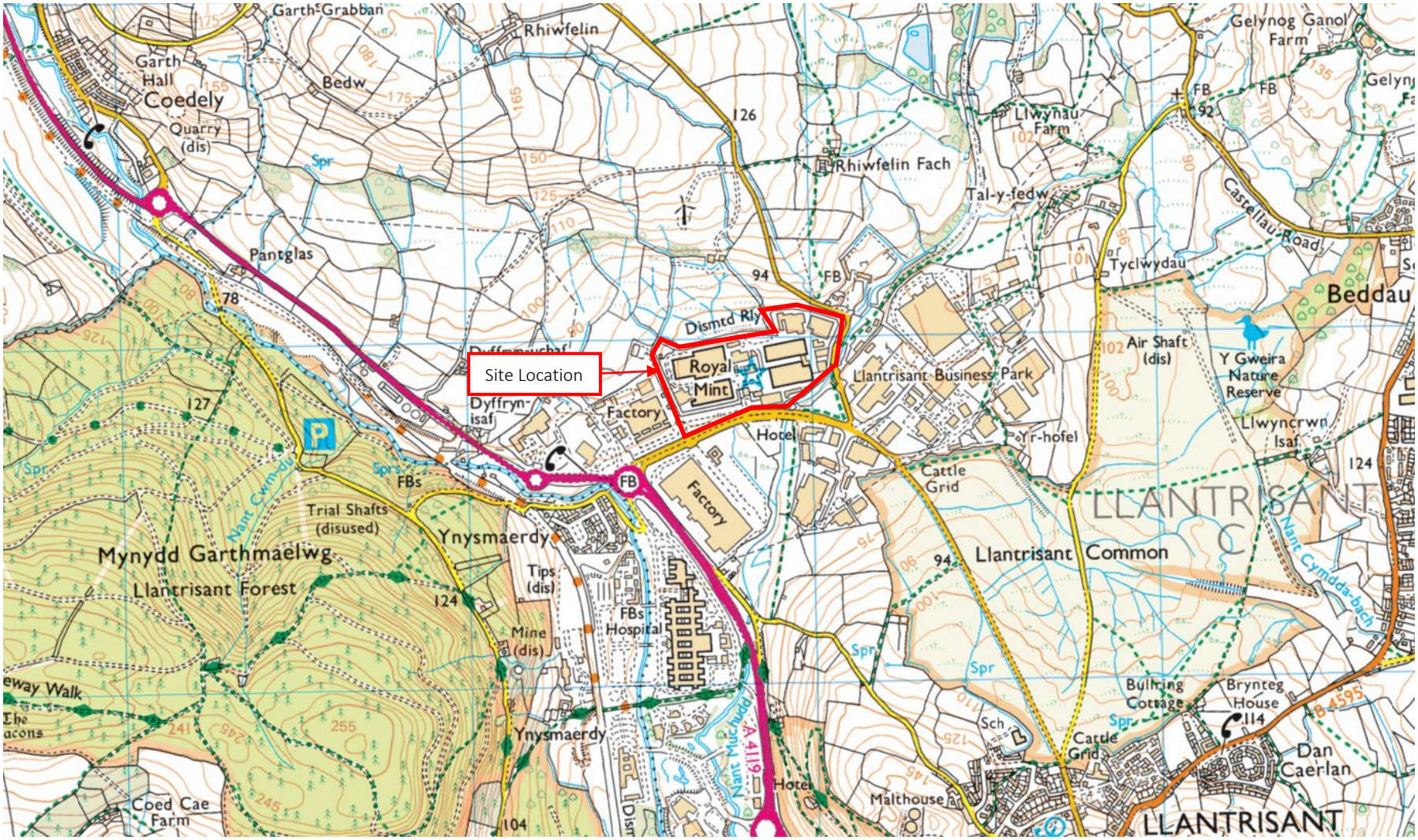

Figure 1.1: Site Location (OS license Ref: 100062750)

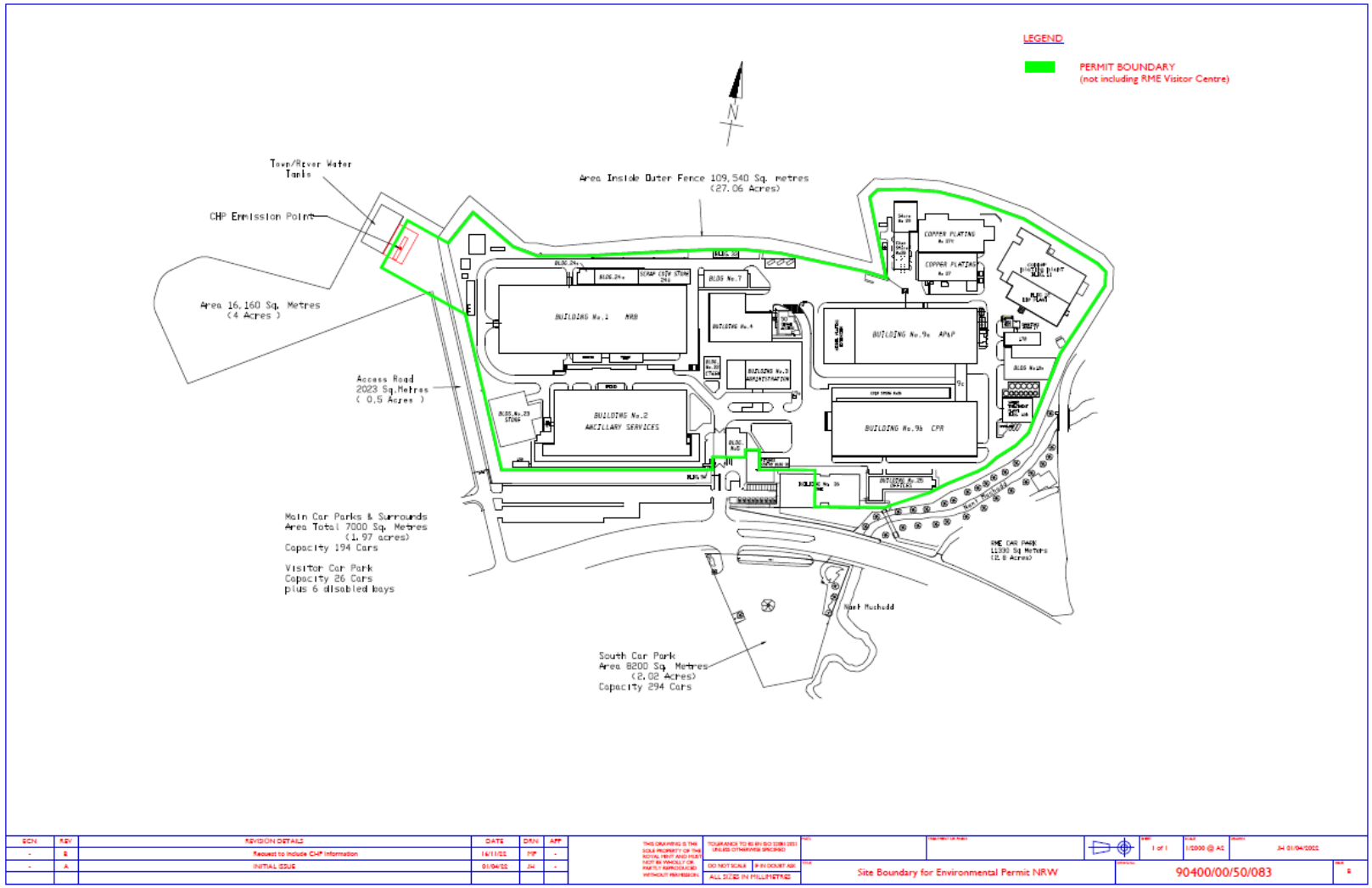

Figure 1.2: Installation Boundary

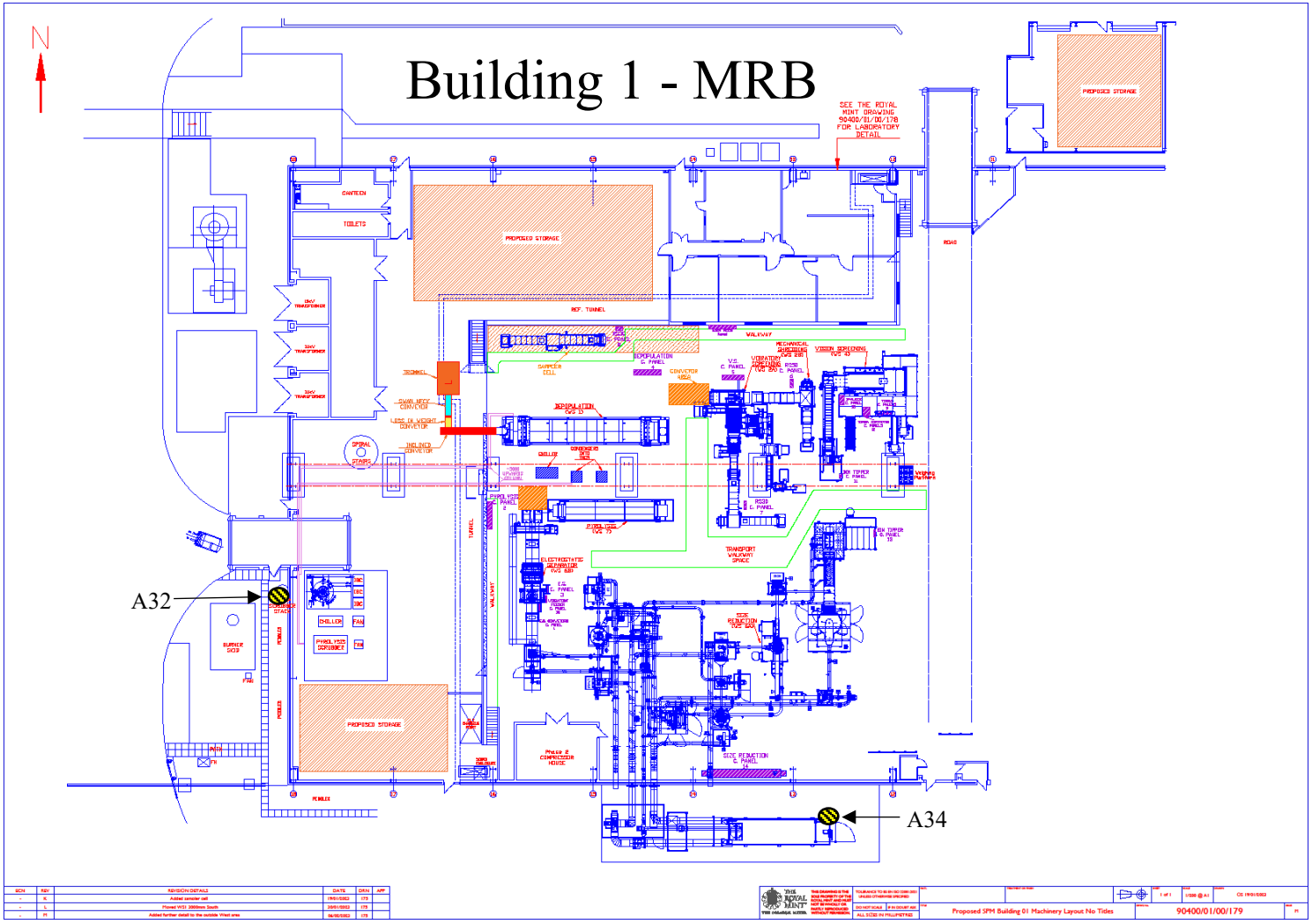

Figure 1.3: Site Layout – MRB Building

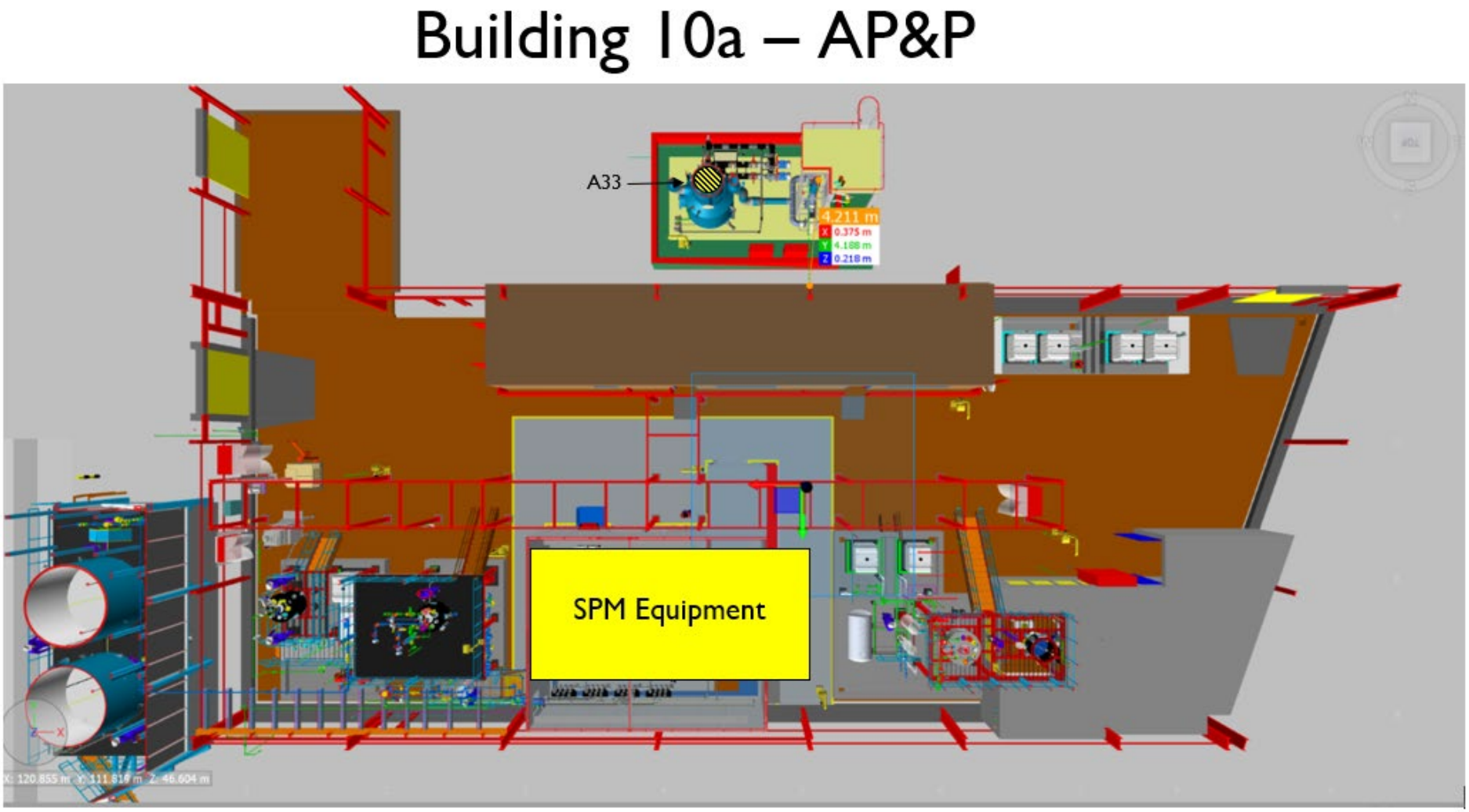

Figure 1.4: Site Layout – Surface Gold Reactor

2 DESCRIPTION OF VARIED CHANGES

2.1 Description of the Proposed Changes

The Royal Mint is making this application to carry out a '*Normal*' Variation of their existing EPR permit under The Environmental Permitting (England and Wales) Regulations 2016 (as amended) to:

- Include the installation a Printed Circuit Board (PCB) Processing Facility that can process approximately 4,000 tonnes per annum of printed circuit boards and selected electronic and electrical equipment residues using the following key stages;
    - De-soldering and associated scrubbing plant;
    - Component / Board Separation;
    - Board Shredding and Processing;
    - Surface Gold Reactor and associated scrubbing plant; and
    - Granulation and Separation.

Due to processing more than 10 tonnes per day of hazardous waste, the PCB Processing and Recovery Plant meets the definition of a Section 5.3 '*Disposal or Recovery of Hazardous Waste'* Part A(1)(ii) Disposal or recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment as defined by the Environmental Permitting Regulations.

Any changes to the Listed Activities as result of the above changes are depicted in Table 2.1 in RED.

Table 2.1: Permitted Activities

Activity reference	Activity listed in Schedule 1 of the EP Regulations	Description of specified activity	Limits of specified activity
A1	S2.3A(1)(a)	Surface treatment of metals	From receipt of raw materials to despatch of finished products and waste
A2	Section 5.3A(1)(ii)	Printed Circuit Board Processing and Recovery Facility R4 – Recycling / reclamation of metals and metal compounds R5 – recycling / reclamation of other inorganic materials R13 – Storage of wastes pending any of the operations numbered R1 to R12	From receipt of raw materials to dispatch of processed waste

Directly Associated Activity			
A3	S5.4A(1)(a)(ii)	Effluent treatment	From receipt of effluent until discharge to public sewer
A4	NA	Drainage of surface water	Handling and storage of site drainage prior to discharge of uncontaminated surface water into controlled waters
A5	NA	Annealing and burnishing	From receipt of raw materials to dispatch of finished products and waste
A6	NA	Heat treatment of tool dies	From receipt of raw materials to dispatch of finished products and waste

All PCB processing activities carried out at the site i.e. reception, associated storage are included within the Installation Boundary of the site.

2.2 Details of the Installation

2.2.1 Installation Boundary

No additional land is being added to the Installation Boundary as a result of this permit variation application. A figure showing the existing Installation Boundary is provided in Section 1, Figure 1.2.

All activities take place within the single Installation Boundary. No processing or storage activities take place in any area not previously consented or permitted under the existing permit. All chemicals are stored, used and processed above ground and without potential pollution to the underlying land and groundwater. No '*relevant hazardous substances'* are proposed to be stored on site as part of the process.

However, due to the addition of an Installation Activity the application requires a baseline report. Therefore the sites existing Site Condition Reports have been included within *Annex E – Site Condition Report.*

2.2.2 Site Infrastructure and Design

There will be no changes to the site infrastructure or design of the installation. The majority of the proposed process will take place within the existing (and former) MRB building as shown in Figure 1.3, with the Surface Gold Reactor being located in an existing building to the east of the site as shown in Figure 1.4. Please refer to *Annex A – Site Plans* for more information.

All aspects of site drainage will remain unchanged. All drainage systems on the main site are as per the original permit application document and discharge under consent to the River Nant Muchudd.

The current site drainage plan is included within *Annex A – Site Plans.*

2.2.3 Raw Materials and Storage

Waste Feedstocks

A detailed list of European Waste Catalogue (EWC) codes that cover the PCB's that will be accepted by the proposed process is provided in Table 2.2 below.

Table 2.2: Permitted Feedstock EWC Codes and Types

Waste Code	Description
16	**OTHER WASTES FROM INDUSTRIAL PROCESSES**
16 02	**electrical and electronic equipment**
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
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 12	**wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 11*	other wastes (including mixtures of materials) from mechanical treatment of waste containing dangerous substances
TOTAL	**Maximum of 4,000 tonnes per annum**

The incoming PCB's will be stored within one of the dedicated storage areas within the MRB Building. The introduction of waste derived feedstocks onto the site has generated the need for specific inspection, approval and acceptance procedures which will be included within the sites EMS .

Raw Materials

The new processing plant requires the introduction of the raw materials and chemicals provided within Table 2.3 overleaf.

Table 2.3: Raw Material Storage

Chemical	Volume / Quantity stored on site	Volume / Mass used per annum
Printed Circuit Boards	Stored within the dedicated storage areas within the MRB Building	4,000 tonnes approx
Glacial Acetic Acid (98% conc)	Liquid form. 30m^3 Holding Tank	380,000 litres
Hydrochloric Acid (36% conc)	This will be stored in 2 x 1m^3 IBCs within the Surface Treatment Plant building	85,000 litres
Calcium Chloride	Stored in 25kg sacks in Royal Mints existing chemical store building	17,000 kg
Sodium Chlorate	Stored in 25kg sacks in Royal Mints existing chemical store building	12,000 kg
Sodium Chlorate (solution)	This will be stored in 2 x 1 m^3 IBCs within the Surface Treatment Plant building	14,000 litres
Sodium Carbonate (solution)	This will be stored in 2 x 1 m^3 IBCs within the Surface Treatment Plant building	380,000 litres
Iron(ii) Chloride (solution)	This will be stored in 2 x 1 m^3 IBCs within the Surface Treatment Plant building	14,000 litres
Sodium Hydroxide	This will be stored in 2 x 1 m^3 IBCs within the Surface Treatment Plant building, and 2 x 1 m^3 IBCs within in building 1 (Scrubbers and potential neutralisation)	30,000 litres

2.3 Description of the Process

The proposed PCB processing line consists of the following processes:

- PCB Reception;
- De-soldering;
- Component / Board Separation;
- Board Shredding;
- Optical Sorter;

- Surface Gold Reactor; and
- Board Processing.

Please find a process schematic overleaf summarising the proposed process.

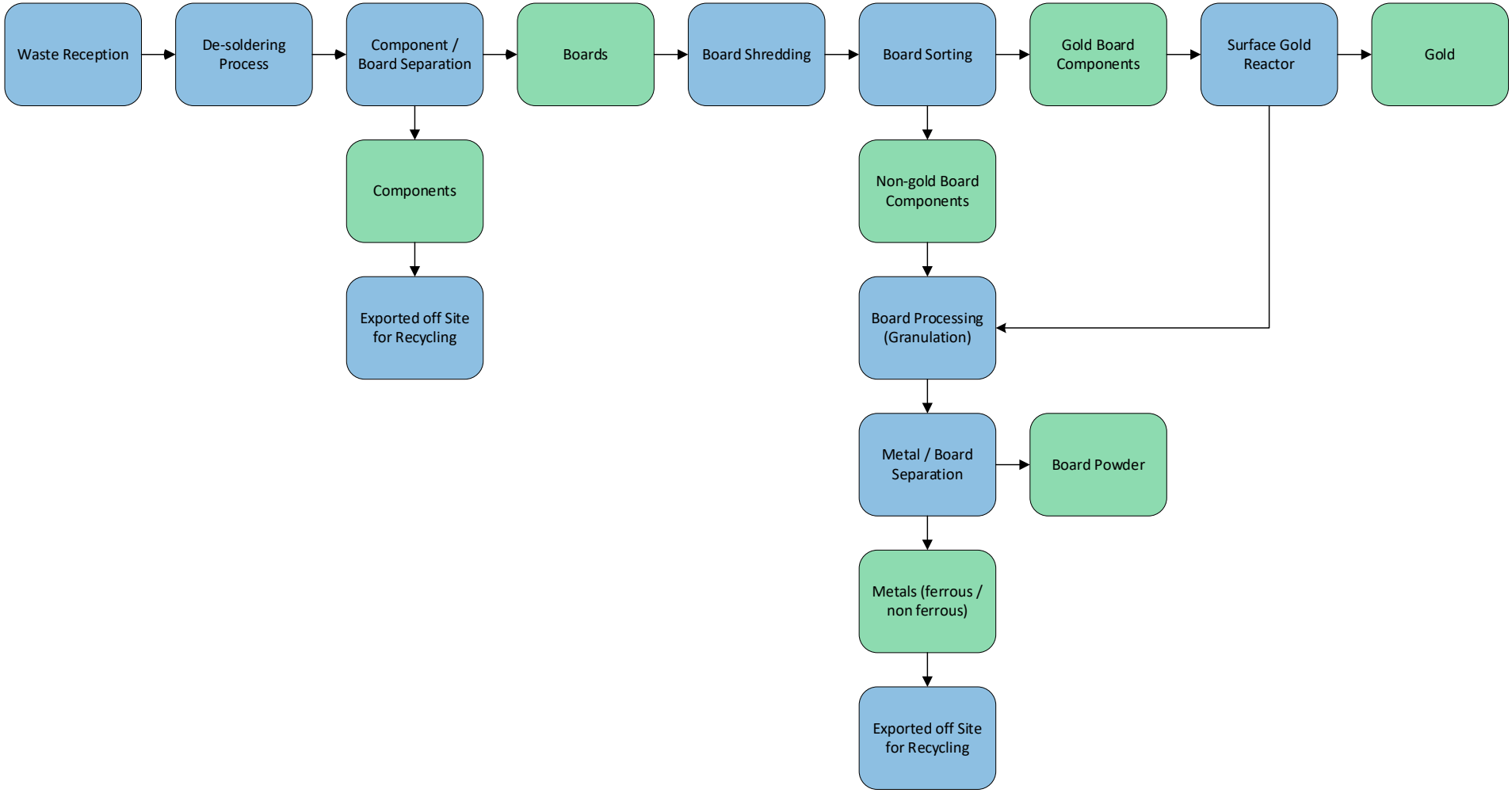

Figure 2.1: Simplified Process Schematic

Reception

The incoming PCB's will be stored within one of the dedicated storage areas within the MRB Building. All PCB's will be received and inspected in accordance with the sites dedicated acceptance procedure (EWP 4.5.4 – Waste Receipt Procedure) which will be included within the sites EMS once operational.

The PCBs will be processed on a first-in first-out basis.

De-soldering

The de-soldering process will take place within a rotary drum which operates at 1 – 24 revs per minute and heats the PCB's to 230 - 250^{o}C. The heating and agitation of the boards causes the solder to melt and the components fall off the board.

The hot air collected from the process will be treated via a scrubber prior to release to air. This will be via a new emission point (Emission Point A32).

The de-populated boards will then be transferred to the next part of the process.

Figure 2.2: Rotary Drum

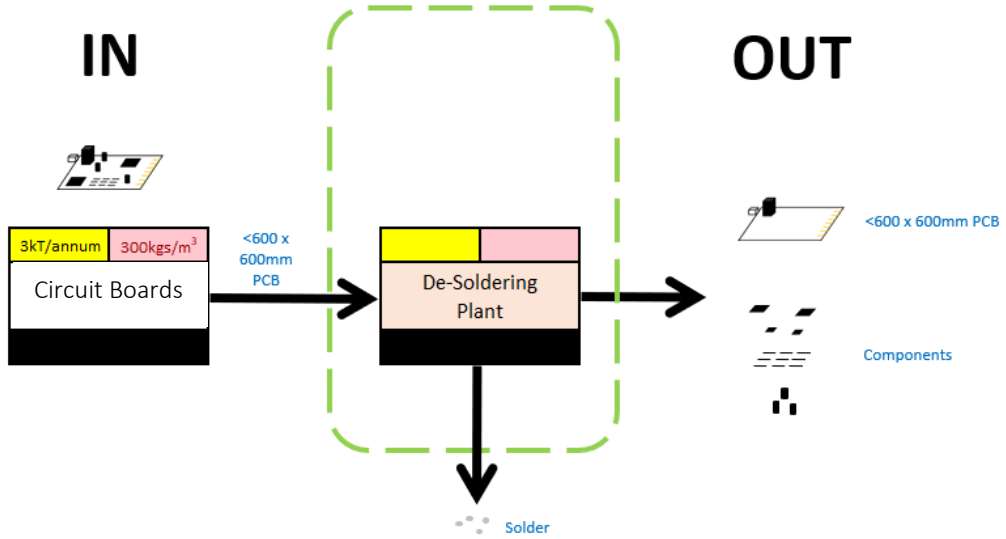

Figure 2.3: De-soldering Process Schematic

Component / Board Separation

This part of the process uses multi size screening to separate the board from the components of the board. The separation system separates the de-soldered components from the circuit boards into 10 streams from 3 sieves comprised of:

- Sieve 1:
    - <4mm fines;
    - <16mm small IC's, capacitors, coils and non-granulatable plugs;
    - <40mm large IC's and granulatable plugs;
    - <110mm frames, connectors, daughter cards; and
    - >110mm stripped printed circuit boards including fixed items.
- Sieve 2:
    - <3.5mm large IC's and granulatable plugs.
- Sieve 3:
    - Corrugation and ramps to separate frames, connectors and daughter cards.

The board is then transferred to a shredder and the components will be exported off site for further processing / recycling.

Please note, the capacitors are aluminium foil and resin bead type capacitors not electrolytic capacitors potentially containing polychlorinated-biphenyls which may be found in older complete equipment.

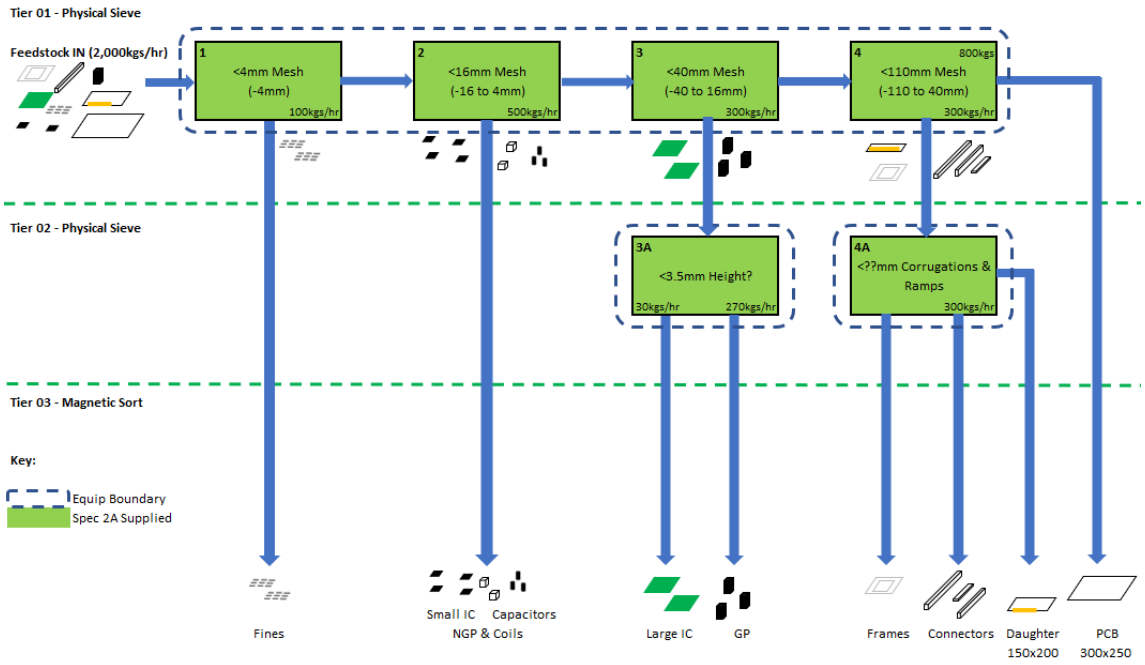

Figure 2.4: Separator System

Board Shredding

The boards are then transferred to three shredders where they are shredded to 40 x 40mm:

- Shredder 1 – input >40mm, output <40mm;
- Shredder 2 – input <40mm, output <6mm; and
- Shredder 3 – input <40mm and >4mm, output <6mm.

Optical Sorter

The shredded board is then transferred to an optical sorter which will separate the gold portion of the boards from the non-gold portion.

The gold containing portion is then transferred to the surface gold reactor and the non-gold containing portion is transferred to the granulation line.

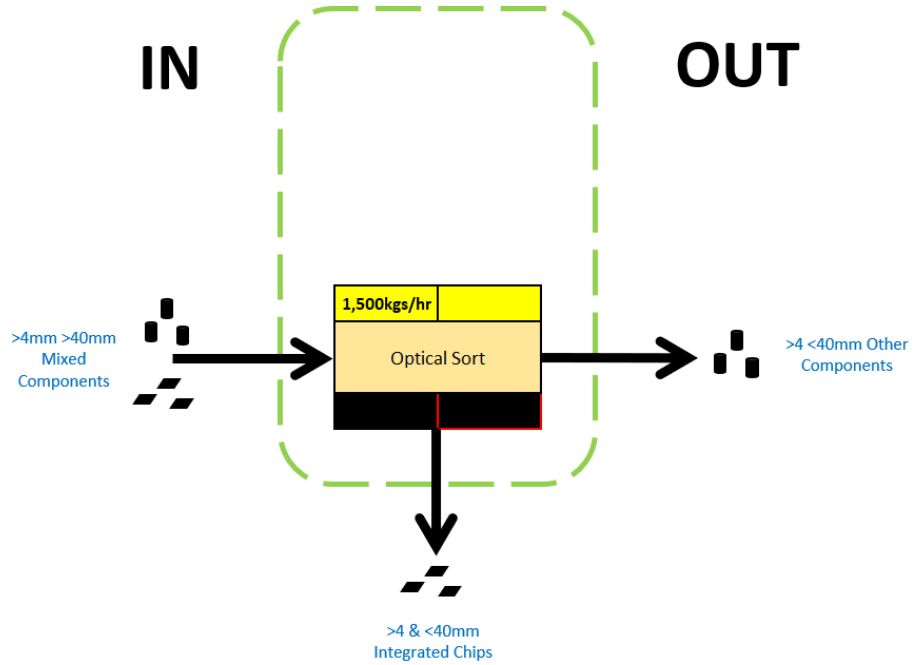

Figure 2.5: Optical Sorter Process Schematic

Dust Extraction System

The main processing equipment within the MRB Building is extracted via a dedicated dust extraction system. All dusts are returned back to the process to recover any precious metals content.

Surface Gold Reactor

The surface gold reactor uses acetic acid to dissolve the gold into a solution which is then treated in a pH balancing system to extract the gold.

The incoming material will be loaded into a reactor vessel and the proprietary solution is added to the reactor vessel, which will dissolve the surface gold into the solution. This proprietary solution contains glacial-acetic acid and hydrochloric acid.

The process operates at ambient temperature therefore no heating or cooling is required within the reactor vessel.

The treated printed circuit board components will be unloaded from the reactor vessel and neutralised and dried.

The solution will be transferred to a tank where the gold is precipitated out. The solution is then transferred to a suitable filter for gold removal as a powder.

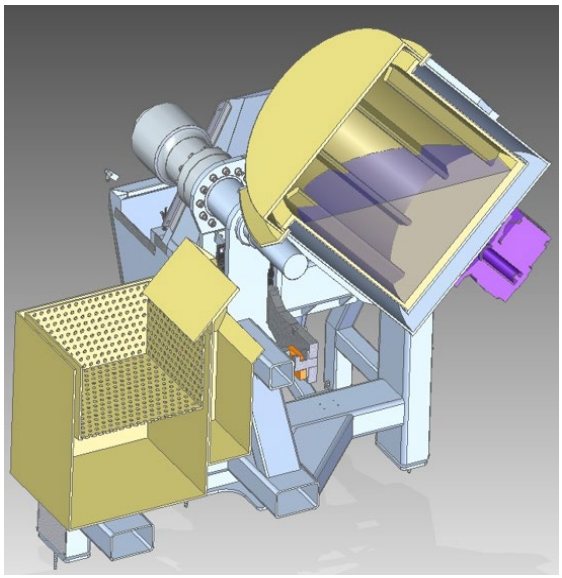

Figure 2.6: Surface Gold Reactor

The fume from this part of the process is treated via a scrubber prior to release to air. This will be via a new emission point (A33). The ventilation scrubbing system will be designed to remove acidic vapours and chlorine from the fume.

Approximately 5,300m^3/h of extracted fume will be scrubbed in a two-stage packed column using sodium hydroxide. A duty / standby pump will circulate the scrubbing liquid which will be monitored and purged when required.

Gas monitoring will ensure that the necessary parameters are met.

The basic structure of the scrubber will comprise a container for the scrubbing fluid, an absorption column filled with packing material, spray nozzles for the distribution of the scrubbing fluid in the column, a circulation pump for the transport of the scrubbing fluid to the spray nozzles, a ventilator for the priming of the air contaminated with acid / chlorine gas and a demister for the removal of drops of washing fluid from the cleaned air (pure gas).

Board Processing

The non-gold portion of the boards is transferred from the optical sorter to a granulation line where the material is stage size reduced to <1mm to give total liberation of circuit board laminates, but free metal is recovered at the size at which it becomes liberated.

The material is then passed through an eddy current separator and magnet to separate the ferrous and non-ferrous portion and gravity separation for copper alloy recovery.

The processing line consist of the following:

- Hammer Mill – to reduce particle size from <40mm down to 10mm;
- Magnetic Sorter – to remove ferrous materials;
- Turbo Mill Grinder – to reduce particle size from <10mm down to <2mm;

- Air Vibration Separator – to remove aluminium and copper-rich mixed-metals from non-ferrous metals and fibre;
- Aluminium Separator – to remove of aluminium from copper-rich mixed metals; and
- Electrostatic Separator – to remove residual trace metals from the <1mm fibre.

The separated metals are then transferred off site for further processing / recycling. As part of Phase 2 of the project the granulated circuit board powder will be transferred to the proposed pyrolysis plant which will be addressed in a separate permit variation. Prior to this, the granulated circuit board powder will be used as part of the R&D activities on site.

2.4 Energy Efficiency

Energy required by the site is imported in the form of electricity from the National Grid. Royal Mint monitors its energy use and costs closely and maintains an energy balance record each month which is summarised in the annual reporting to NRW as part of the annual pollution inventory reporting

The estimated maximum demand for the proposed process is approximately 1,900 MWh/year, i.e. equivalent to approximately 500kW continuous load.

All plant and equipment have been chosen both on ability to perform and on its energy efficiency. Royal Mint have an operation and maintenance programme in place to undertaken routine inspections and checks.

Plant will be monitored to ensure that no plant is operating ineffectively leading to the loss of energy. Regular maintenance will take place on site and any inefficient plant will be replaced

2.5 Environmental Management System

Royal Mint currently hold three ISO certifications associated with Quality, Environment and Energy.

All three including the Environmental Management System are certified by BSI. The environmental management certificate (Ref: EMS 84940) has been in place since August 2005.

To cover the three standards there is a hierarchy of procedures. The integrated procedures (IMP's) detailed within *Annex D – EMS Summary* are procedures that cover the common elements of the three standards.

The safety management procedures (SMP's) also detailed in *Annex D – EMS Summary* cover both Health Safety and Environment.

The Environmental Management Procedures (EMP's) that cover specifics with the current environmental permit and the ISO14001 standard that are not covered by the other procedures are also detailed within the EMS Summary.

Finally, there are the Environmental Working Procedures (EWP's) that cover specific operations with the Environment Management System.

The EMP's and EWP's will be updated to include the specific operations relating to the proposed PCB Processing and Recovery Plant.

Royal Mints Safety Management System is also certified to ISO 45001.

Fire Prevention Plan

The site will be accepting printed circuit boards only. No other WEEE wastes will be accepted on site. The PCBs are coated in bromine which is a fire retardant material resulting in there being a very low combustion risk from the material. Due to this, a Fire Prevention Plan is not considered appropriate for the site and has not been included within the application.

The site has been designed to allow active fire fighting. The site has a dedicated fire hydrant ring which is connected to a mains water supply and would provide a continuous supply of water in the event of a fire.

3 EMISSIONS AND THEIR ABATEMENT

3.1 Emissions to Air

This permit variation introduces three new emissions points which includes the following[4]:

- De-soldering scrubbing plant (A32);
- Surface gold reactor scrubbing plant (A33); and
- Dust Extraction Plant (A34).

Table 3.1 below details the existing emission points on site. Please note, A1, A2, A3, A4, A7 and A8 have been decommissioned which has been addressed in the 2021 permit variation.

Table 3.1: Emission Parameters – Existing

Parameter / Sources	A9	A10	A15, A16	A17 to A21 & A25 to A27	A22	A23, A24	A30, A31
Stack height (m)	15	15	16	10/15.1	15.1	15.1	10
Stack exit diameter (m)	0.75	0.65	0.90	0.25	0.30	0.30	0.20
Temperature of release (K)	289	Ambient	293	335	311	352	294
Actual flow rate (Am^3/s)	7.0	5.2	10.1	0.84	1.3	1.0	0.84
Normalised flow rate (Nm^3/s) (a)	6.7	4.8	9.3	0.68	1.1	0.80	0.68
Emission velocity at stack exit (m/s)	15.9	15.6	15.9	17.1	17.8	14.7	17.1
Emission Concentrations (mg/Nm^3)							
H_2SO_4	-	0.50	0.50	0.50	0.50	0.65	0.50 (A30)
HCN	1.2	-	-	-	-	-	1.2 (A31)

Table 3.2 below details the proposed emissions points that relate to the scrubbing plants as a result of this permit application. Table 3.3 below details the proposed dust extraction emission point as a result of this permit variation.

4 Please note, A1, A2, A3, A4, A7 and A8 will be decommissioned which has been addressed in the 2021 permit variation.

Table 3.2: Emission Parameters – Proposed Scrubbers		
Parameter / Sources	A32	A33
Stack height (m)	16	15
Stack exit diameter (m)	0.75	0.75
Temperature of release (°K)	300	350
Actual flow rate (Am^3/s)	7.0	7.0
Emission velocity at stack exit (m/s)	15.9	15.9
Emission Concentrations (mg/Nm^3)		
Products of combustion (NOx, CO)	<0.01	<0.01
Copper	<0.01	<0.01
Zinc	<0.01	<0.01
Lead	<0.01	<0.01
Bromine	<2.5	<2.5
HCl	N/A	N/A
Acetic Acid	N/A	N/A
Chlorine	N/A	N/A

Table 3.3: Emission Parameters – Dust Extraction Emission Point	
Parameter	Dust Filter (A34)
Number of units	1
Stack height (m)	13.2
Flue exit diameter (m)	1.12
Temperature of release (°C)	Ambient
Emission velocity at flue exit (m/s)	14.1
Emission Concentrations (mg/Nm^3)	
Total suspended particles	5

3.2 Emissions to Controlled Water

There will be no change to emissions to controlled water as a result of this permit variation.

Any emissions to via W1 will remain as currently permitted.

3.3 Emissions to Sewer

There will be no change to emissions to sewer as a result of this permit variation.

Any emissions to via S1 will remain as currently permitted. All emissions to sewer will remain in accordance with the sites current Trade Effluent Discharge consent (Ref No. TE409).

3.4 Emissions to Land

There will be no change to emissions to sewer as a result of this permit variation.

3.5 Noise

The location of the proposed process is in two existing repurposed building, and internally uses equipment specifically for the PCB reprocessing process. The processing plant and associated equipment has been designed in accordance with best practice and to ensure that internal noise does not present an issue to the employees at the site under the Control of Noise at Work Regulations and to ensure that noise breakout does not lead to noise nuisance at the identified sensitive receptors.

Appropriate preventative maintenance will be provided for the plant to ensure no deterioration of plant or equipment that would give rise to increases in noise.

The location of the site is in an active industrial site and therefore background noise levels are already high resulting in the impact from the proposed plant being minimal in comparison.

Therefore, during normal operating conditions there are no potential emissions of noise or vibration that are considered to have the potential to impact the environment.

Due to the above, noise is screened out as low risk and further assessment is not required.

3.6 Emissions of Waste

Table 3.4 below provides information on the wastes and quantities that will be exported off site as a result of the process.

Table 3.4: Waste Arisings and Disposal

Substance	Quantity (TPA)	Fate
Tin Alloy	90	R4
Spent Lixiviant (Acetic)	800	R6
Scrubber De-soldering	310	R5
Neutralisation Liquid	85	R6
Ferrous Mag	300	R4
Aluminum	150	R4
Copper	750	R4
Mixed Metals	60	R4
Integrated Circuit and Surface Mount Devices	600	R5
Bromine / Oil	145	R5

4 ENVIRONMENTAL MONITORING

4.1 Impacts to Air

All emissions on air monitoring will take place as currently permitted.

It is not proposed that any routine or periodic monitoring is required for the new scrubbed sources. The Royal Mint would like to request that air emissions samples are taken from each of these new sources as part of an approved Improvement Condition to validates a) that the BAT ELVs are being met and b) the modelled impacts are negligible.

4.2 Impacts to Controlled Water

There are no additional impacts to controlled water arising from this permit variation.

All emissions to controlled water will be monitored as per the existing permit requirements.

4.3 Impacts to Sewer

There are no additional impacts to controlled water arising from this permit variation.

All emissions to sewer will be monitored as per the existing permit requirements.

4.4 Impacts to Land

There are no impacts to land arising from this permit variation.

5 BAT JUSTIFICATION

All plant and equipment has been designed in accordance with BAT and will comply with the relevant standard and guidance requirements.

The following BAT demonstration is based on the EU BAT Conclusions on Waste Treatment published August 2018. The BAT demonstration is summarised in the following table and details the indicative BAT requirements that apply to the proposed process.

Table 5.1: Guidance Review – BREF Waste Treatment		
BAT Reference	BAT Conclusion	Justification
BAT 1	In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates the features provided within the BREF document.	Royal Mint have an Environmental Management System in place that is accredited to three ISO certification and meets the requirements of the BREF.
BAT 2	In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques provided within the BREF document.	Royal Mint will implement the following on site: • Waste Acceptance Procedures (EWP 4.5.4 – Waste Receipt Procedure); • A tracking system and inventory; • Waste segregation; and • Ensure waste compatibility during waste inspection.
BAT 3	In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of waste water and waste gas streams, as part of the environmental management system (see BAT 1), that incorporates all of the features provided within the BREF document.	Royal Mint will ensure that an inventory is kept on site detailing waste water and waste gas steams from site.
BAT 4	In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques provided within the BREF document.	The following is carried out on site to reduce the environmental risk associated with the storage printed circuit boards: • Optimised storage locations; • Adequate storage capacity; • Safe storage operation; and • Dedicated hazardous waste storage.
BAT 5	In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures.	All handling and transfer of PCB's is carried out by competent staff and documented via the sites acceptance procedures and management system. Any spillages on site will be detected via the sites site walkover procedure and managed accordingly.
BAT 6	For relevant emissions to water as identified by the inventory of waste water streams (see BAT 3), BAT is to monitor key process parameters (e.g. waste water flow, pH, temperature, conductivity, BOD) at key locations (e.g. at the inlet and/or	Any waste water / effluent is contained and transferred off site for further treatment using third party specialist waste contractors. There is no waste water treatment on site. There are no process emissions to controlled waters.

	outlet of the pretreatment, at the inlet to the final treatment, at the point where the emission leaves the installation).	
BAT 7	BAT is to monitor emissions to water with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	There are no process emissions to controlled waters.
BAT 8	BAT is to monitor channelled emissions to air with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	The necessary monitoring will be carried out by Royal Mint as specified by NRW.
BAT 9	BAT is to monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs with solvents, and the physico-chemical treatment of solvents for the recovery of their calorific value, at least once per year using one or a combination of the techniques given in the BREF guidance note.	N/A – no solvents are processed on site.
BAT 10	BAT is to periodically monitor odour emissions	There are no emissions to odour arising from this permit variation. Printed circuit boards are not odorous wastes and all processing takes place within existing buildings on site. There is potential of odour from the use of acetic acid which is used within the surface gold reactor however this will be controlled by the use of the scrubber.
BAT 11	BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year.	The annual consumption of water, energy and raw materials and generation of residues and waste waters will be monitored at least annually.
BAT 12	In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1).	There are no emissions to odour arising from this permit variation. Printed circuit boards are not odorous wastes and all processing takes place within existing buildings on site. There is potential of odour from the use of acetic acid which is used within the surface gold reactor however this will be controlled by the use of the scrubber.
BAT 13	In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one or a combination of the techniques given in the BREF Guidance.	There are no emissions to odour arising from this permit variation. Printed circuit boards are not odorous wastes and all processing takes place within existing buildings on site.

		There is potential of odour from the use of acetic acid which is used within the surface gold reactor however this will be controlled by the use of the scrubber.
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 in the BREF guidance.	There is not expected to be any emissions to odour and dust arising from this permit variation. Printed circuit boards are not odorous in nature and all processing takes place within existing buildings on site. All dusts will be captured in dedicated extraction plants. The main processing equipment within the MRB Building is extracted via a dedicated dust extraction system. All dusts are returned back to the process to recover any precious metals content. There is potential of odour from the use of acetic acid which is used within the surface gold reactor however this will be controlled by the use of the scrubber.
BAT 15	BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g. start-ups, shutdowns) by using both of the techniques given in the BREF Guidance.	N/A – there is no flaring on site.
BAT 16	In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use both of the techniques given in the BREF Guidance.	N/A – there is no flaring on site.
BAT 17	In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of the environmental management system (see BAT 1).	The location of the proposed process is in two existing repurposed buildings, and internally uses equipment specifically for the PCB reprocessing process. The processing plant and associated equipment has been designed in accordance with best practice and to ensure that internal noise does not present an issue to the employees at the site under the Control of Noise at Work Regulations and to ensure that noise breakout does not lead to noise nuisance at the identified sensitive receptors. Appropriate preventative maintenance will be provided for the plant to ensure no deterioration of plant or equipment that would give rise to increases in noise. The location of the site is in an active industrial site and therefore background noise levels are already high resulting in the impact from the proposed plant being minimal in comparison. Therefore, during normal operating conditions there are no potential emissions of noise or vibration that are considered to have the potential to impact the environment.

		This is considered BAT for site and a noise and vibration management is not considered necessary.
BAT 18	In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given in the BREF Guidance.	Noise and vibration emissions are reduced on site via the following measures: • Appropriate location of equipment within existing industrial buildings; and • Operational measures that include: - Inspection and maintenance of the processing equipment; - Closing of doors and windows of enclosed areas, if possible; - Equipment only operated by experienced staff; - Processing only taking place during daytime hours; and - No processing relating to this variation operated at night. • Low noise equipment used where possible.
BAT 19	In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given in the BREF Guidance.	There are no process emission to controlled waters therefore there are no emission to soil and water. The following measures are in place to reduce emission to soil and water: • Water Management – a water mass balance will be maintained on site. • Impermeable Surface – all storage is within existing industrial buildings with impermeable services. • Techniques to Reduce Failures from Tanks and Vessels – all tanks will have the necessary secondary containment. • Roofing over Storage – all storage is within existing industrial buildings. • Adequate Drainage Infrastructure – all new activities relating to the PCB storage processing line are located within the former buildings and do not give rise to any contaminated or potentially contaminated discharges. All process and storage areas are fully enclosed, therefore any spillages / runoff will be effectively contained within the building and tankered off site. • Design and Maintenance Provisions to Allow Detection and Repair of Leaks – regular monitoring is carried out for potential leaks.
BAT 20	In order to reduce emissions to water, BAT is to treat waste water using an appropriate combination of the techniques given in the BREF Guidance.	Any waste water / effluent will be contained and transferred off site for further treatment using third party specialist waste contractors.

BAT 21	In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all of the techniques given below, as part of the accident management plan (see BAT 1).	Royal Mint uses the following techniques to prevent or limit environmental consequences of accidents and incidents: • Protection measures; • Management of accidental emissions i.e spillage procedures and containment of fire water; and • Incident / accident system – all accidents will be recorded in the site diary etc.
BAT 22	In order to use materials efficiently, BAT is to substitute materials with waste.	This is currently not suitable for the proposed process but will be reviewed regularly if options become available.
BAT 23	In order to use energy efficiently, BAT is to use both of the techniques given in the BREF guidance.	Royal Mint monitors its energy use and costs closely and maintains an energy balance record each month which is summarised in the annual reporting to the EA as part of the annual pollution inventory reporting.
BAT 24	In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan (see BAT 1).	Where possible, packaging will be reused for storage.
General BAT conclusions for the mechanical treatment of waste		
BAT 25	In order to reduce emissions to air of dust, and of particulate-bound metals, PCDD/F and dioxin-like PCBs, BAT is to apply BAT 14d and to use one or a combination of the techniques given in the guidance.	The main processing equipment within the MRB Building is extracted via a dedicated dust extraction system. All dusts are returned back to the process to recover any precious metals content.
BAT 26 – BAT 28	BAT conclusions for shredding metal waste	N/A
BAT 29 – BAT 30	BAT conclusions for the treatment of WEEE containing VFCs and/or VHCs	N/A
BAT 31	BAT conclusions for the mechanical treatment of waste with calorific value	N/A
BAT 32	BAT conclusions for mechanical treatment of WEEE containing mercury	The likelihood of the incoming waste containing any liquid mercury is low. All required equipment will have the necessary extraction and abatement systems. Mercury levels can be periodically measured if required.
BAT 33 – BAT 37	BAT conclusions for the biological treatment of waste	N/A
BAT 38	BAT conclusions for the anaerobic treatment of waste	N/A
BAT 39	BAT conclusions for the mechanical biological treatment (MBT) of waste	N/A
BAT conclusions for the physico-chemical treatment of waste		

BAT 40	In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures	Royal Mint will monitor waste as part of the sites waste acceptance procedure (EWP 4.5.4 – Waste Receipt Procedure).
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 provided within the BREF document.	The main processing equipment within the MRB Building is extracted via a dedicated dust extraction system. All dusts are returned back to the process to recover any precious metals content.
BAT 42 – 44	BAT conclusions for the refining of waste oil	N/A
BAT 45	BAT conclusions for the physico-chemical treatment of waste with calorific value	N/A
BAT 46 – 47	BAT conclusions for the regeneration of spent solvents	N/A
BAT 48 – BAT 49	BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil	N/A
BAT 50	BAT conclusions for the water washing of excavated contaminated soil	N/A
BAT 51	BAT conclusions for the decontamination of equipment containing PCBs	N/A
BAT 52 – BAT 53	BAT conclusions for the treatment of water-based liquid waste	N/A

6 IMPACTS TO THE ENVIRONMENT

6.1 Impacts to Air

Given the small / minor nature of the new emissions sources, no additional impacts from the site are anticipated. It is requested that the NRW grant an improvement condition that requires the evaluation, modelling and impact assessment of these new emissions points within 3 months of the plant being fully commissioned and completed.

6.2 Impacts to Controlled Water

There are no impacts to water arising from this permit variation.

All emissions to controlled water are within the existing permitted consents / emission limit values.

6.3 Impacts to Sewer

There are no impacts to sewer arising from this permit variation.

All emissions to sewer are within the existing permitted consents / emission limit values.

6.4 Impacts to Land

There are no impacts to land arising from this permit variation.