Supporting Documentation - Application For Variation of Environmental Permit EPR/KP3536UC

Variation V005

Johnson Matthey PLC

Project number: 60646890
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1. Non-Technical Summary

This document presents the technical supporting documentation in support of an application by Johnson Matthey PLC (JM) to vary Environmental Permit number EPR/KP3536UC.

The permit variation is to cover a number of changes to the site activities including:

- An increase in the capacity of activities AR2 and AR4 to 60,000 kg / annum;
- Installation of additional plant and buildings to the Pilot Plant for activities AR2 and AR4 to achieve the increased throughput;
- Relocation of some of the existing ovens / kilns within the MSC into a new extension to the existing building area – used for activity AR1;
- The introduction of a new Section 4.2 Part A(1) (a) (iv) activity for producing inorganic chemicals (AR5) for Metals Dissolving which is to be located within a new building located within the existing drum store area;
- Extension of the Installation boundary to accommodate the new buildings for activities AR1 and AR2, and the extension of the drum park;
- To extend the range of materials for Activity AR1 in Table S2.1 of the permit to include Tin and Silicon;
- To extend the range of metal salt types for Activity AR1 in Table S2.1 of the permit to include fluoride and ammonium salts;
- To extend the range of materials for Activity AR2 in Table S2.1 of the permit to include Boron Niobium, Cerium, Molybdenum, Tin and Antimony;
- To extend the range of materials for Activity AR4 in Table S2.1 of the permit to include Niobium, Cerium, Molybdenum, Tin and Antimony;
- The installation of additional emission points to air associated with the proposed changes; and
- The addition of a Reverse Osmosis water treatment unit to support activity AR5 with an associated discharge of reject water to the site drainage systems via emission point W1 to the private drainage system, connected to the CF Fertiliser effluent handling system, which discharges to the River Tees via RTO1.

In addition to the above changes, a request is also being made for a minor alteration to the text within the existing permit to reflect minor errors / amendments that have been identified since the Permit was granted.

The proposed changes are understood to constitute a substantial change.

The supporting documentation provides a more detailed explanation of each of the changes required and also presents an assessment of the potential environmental implications associated with the proposed changes.

Reviews have also been undertaken to assess:

- Compliance with Best Available Techniques;
- Environmental risk management at the Installation; and
- Potential Air Quality Impacts.

The assessments demonstrate that through the application of appropriate design and specification of plant supported by site management controls, no significant environmental impacts are anticipated.

2. Introduction

Johnson Matthey PLC ("JM") is applying for a variation to Environmental Permit number EPR/KP3536UC.

The Installation (buildings within the permitted boundary) is currently used for the manufacture of a variety of different metal oxide containing materials including catalysts.

The Installation is currently authorised to operate the activities listed in Table 1:

Table 1 Environmental Permit Activity Definitions

Activity Reference	Activity listed in Schedule 1 of the EP Regulations	Activity Details
AR1	S4.2 A1 (a) (v)	Metal salts raw materials for metal oxide catalysts production
AR2	S4.2 A1 (a) (v)	Metal salts raw materials for production of metal oxides for other uses
AR3	Directly Associated Activity Effluent handling, storage and discharge to the private drainage system.	Sampling, analysis, settling, filtration, decanting and discharge of effluent from production of metal oxide catalysts (activity AR1) and uncontaminated surface runoff.
AR4	S4.2 A1 (a) (v)	Metal salts raw materials for producing metal oxides for other uses

This report provides the necessary technical information in support of an application to the Environment Agency (EA) for a Substantial Permit Variation.

2.1 Applicant Details

Table 2 Applicant Details

Item	Detail
Company Name	Johnson Matthey PLC
Installation Name	Chilton Manufacturing Area
Installation Address	PO Box 1 Belasis Avenue Billingham TS23 1LB
Installation Contact	Simon Roberts Tel: +44 7979 701600 simon.roberts@matthey.com
Registered Office	25 Farringdon Street, London, EC4A 4AB.
Company Registration Number	33774

2.2 Reason for the Application

This application for a variation is being made to reflect the changes listed below:

- To change the name of the Installation from 'Manufacturing Science Centre' to 'Chilton Manufacturing Area';
- An increase in the capacity of activities AR2 and AR4 to 60,000 kg / annum;
- Installation of additional plant and buildings for activity AR2 and AR4 to achieve the increased throughput;
- Relocation of some of the existing ovens / kilns within the MSC into a new extension to the existing building area – used for activity AR1;
- The introduction of a new Section 4.2 Part A(1) (a) (iv) activity for producing inorganic chemicals (AR5) for Metals Dissolving which is to be located within a new building located within the existing drum store area;
- Extension of the Installation Boundary to accommodate the new buildings for activities AR1 and AR2, and the extension of the drum park;
- To extend the range of materials for Activity AR1 in Table S2.1 of the permit to include Tin and Silicon;
- To extend the range of metal salt types for Activity AR1 in Table S2.1 of the permit to include fluoride and ammonium salts;
- To extend the range of materials for Activity AR2 in Table S2.1 of the permit to include Boron Niobium, Cerium, Molybdenum, Tin and Antimony;
- To extend the range of materials for Activity AR4 in Table S2.1 of the permit to include Niobium, Cerium, Molybdenum, Tin and Antimony;
- The installation of additional emission points to air associated with the proposed changes; and
- The addition of a Reverse Osmosis water treatment unit to support activity AR5 with an associated discharge of reject water to the site drainage systems via emission point W1 to the private drainage system, connected to the CF Fertiliser effluent handling system, which discharges to the River Tees via RTO1.

In addition to the above changes, a request is also being made for a minor alteration to the text within the existing permit to reflect minor errors / amendments that have been identified since the Permit was granted.

The proposed changes are considered to represent a Substantial Change; hence this application has been prepared as a Substantial Permit Variation.

3. Proposed Changes to the Environmental Permit

3.1 Changing the Name of the Installation

JM requests that the name of the Installation on the Environmental Permit be changed from 'Manufacturing Science Centre' to '**Chilton Manufacturing Area**'.

3.2 Changes to the Installation Boundary

The proposed changes to the Installation boundary are presented in Appendix A – Figure 1.

The changes are spilt into 2 areas:

3.2.1 Area 1

The inclusion of land to the northwest of the existing MSC and Pilot Plant buildings up to Belasis Avenue, and land to the south and west of the existing tanker loading area at the Installation. This additional land take is required to allow the construction of the additional buildings to increase the size of the Pilot Plant to accommodate the proposed changes to activities AR2 and AR4, and to provide the required access arrangements to these new buildings.

The area of land is currently undeveloped and laid to lawn with some hardstanding and walkways and is entirely within the overall Johnson Matthey site boundary.

A detailed layout plan for this area is presented in Appendix A - Figure 3.

The area of land to the south and west of the existing tanker loading area and incorporates the tanker access roadway and adjacent hardstanding.

The addition of the new building (shown in blue outline in Appendix A - Figure 4) to accommodate the expansion of the AR2 activity will only take up a proportion of this area, with the additional land area proposed to include access roads and pathways, some utility plant equipment (e.g. air handling units), but no specific process activities.

As the activities undertaken within the building will primarily involve handling of dry materials, and will be undertaken entirely within closed systems within the building and over concrete hardstanding, with no below ground process drainage or drainage from within the building, there is not anticipated to be any credible risk of pollution of soil or groundwater occurring within this area. A Qualitative Environmental Risk Assessment has been provided in Appendix B.

JM is in the process of collating soil and, if possible, groundwater samples in this area which will be used to define the baseline for the additional land area. This data will be shared with the Environment Agency prior to commencement of the operational activities within the additional land areas.

3.2.2 Area 2

The inclusion of additional land at the north end of the drum park to incorporate the full drum park and storage area. This is required to allow the construction of the new building to house activity AR5, and to allow the existing drum storage activities to be relocated to the northern end of the area. This land is entirely within the overall Johnson Matthey site boundary.

A detailed layout plan for this area is presented in Appendix A - Figure 4.

The majority of the drum park is already included within the Installation boundary, and this proposed change will extend the boundary to include a small area of additional land to incorporate the entire concrete hardstanding area at the existing drum park and adjacent storage area (currently outside of the permitted Installation boundary). The drum park area will be upgraded to ensure that suitable and sufficient secondary containment is provided to prevent a loss of materials to soil or groundwater.

All activities undertaken within the new metals dissolving activity will be undertaken within the building and over concrete hardstanding which will not have any drainage route into the site drainage systems, any spills or losses will be retained within the building. Liquids for use in the activities will be stored within bulk storage tanks, IBC's or drums all of which will be located within bunded secondary

containment areas, some of which will be within the building. As a result of the proposed containment measures, combined with site management protocols there is not anticipated to be any credible risk of pollution of soil or groundwater occurring within this area. A Qualitative Environmental Risk Assessment has been provided in Appendix B.

As this is only a slight extension to the existing Installation boundary, and the risks posed to soil and groundwater are adequately controlled, it is considered that the existing site condition report for this area and collated baseline data remains appropriate, and no additional intrusive soil and groundwater analysis is proposed.

3.3 Proposed Changes to Activity AR1

3.3.1 Raw Materials

It is proposed to add Tin and Silicon to the listed range of materials for Activity AR1 in Table S2.1 of the permit.

In addition to this, it is proposed to add fluoride and ammonium salts to the listed range of metal salt types for Activity AR1 in Table S2.

The potential implications of the addition of these materials types on the emissions to air from the Installation have been assessed using the H1 screening tool, and subsequent atmospheric dispersion modelling, the details of which are presented in Section 4.

3.3.2 Relocation of Batch Ovens

A number of the existing site electrically fired batch ovens, used under activity AR1 and currently venting via emission points A9 - A11, are proposed to be relocated within the MSC with some being installed within the exiting MSC building. The rest will be moved to a new building extension at the northwest corner of the existing MSC building. The relocation of these ovens will remove some of the sources of emissions of particulates from batch thermal processes from emission points A9 – A11 (however, other batch ovens will remain). The emissions from the ovens will now vent either via the existing A1 – A3 emission point (in compliance with the existing Environmental Permit emission limits, or via a new common vent header to a new emission point A16.

The operations undertaken in these ovens will not change as a result of their relocation. These ovens contain powder in open trays and they have a gas injection system to maintain a controlled atmosphere for product treatment. Furthermore, the nature of the material processed in the ovens means that particulate releases occur principally during a relatively short time period (one hour) during a 20 hour batch treatment cycle.

A programme of emissions testing was completed in 2018, to assess the typical levels of entrainment of powder from a typical batch furnace. The assessment was completed using one of the furnaces proposed for relocation which includes gas injection, using a fine powder and a tray with no lid. This programme of testing demonstrated that the emissions of particulates to atmosphere from the batch ovens (when previously linked to emission points A9 / A10 / A11) are negligible, with emissions levels from all vents being <1 mg/m^3. As such, there is no particulate abatement system downstream of the batch ovens as the emissions have been demonstrated to meet the emission benchmarks stated in the guidance for the Specialty Inorganic Chemicals Sector (EPR 4.03).

The proposed changes will not alter the annual throughout limitations on vanadium and beryllium for activity AR1as listed in Table S3.2 of the Environmental Permit.

The potential implications of relocation of these ovens on air quality has been assessed using the H1 screening tool, and subsequent atmospheric dispersion modelling, the details of which are presented in Section 4.

3.4 Proposed Changes to Activity AR2

3.4.1 Capacity Increase

It is proposed to increase the maximum annual production under activity AR2 from 10,000kg to 60,000 kg/year.

This increase in throughout will be achieved through 2 key changes:

1) The existing equipment installed to undertake activity AR2 will operate more often i.e. with a higher annual online time of around 70%; and

2) A number of additional items of processing equipment will be installed so as to provide additional throughout capacity. These items will be similar to those already installed at the Installation to undertake activity AR2.

The additional process plant used to increase the capacity of Activity AR2 will undertake the same processing stages as the existing plant, typically involving thermal processing, drying and the formulation of metal-based products as detailed in Table 2.

All additional equipment installed will either be a like for like or slightly larger scale version of that already installed at the site. The only exception to this is the addition of a rotary calciner which is a new plant item that will only be used in the new plant area when the roller hearth kiln is not in service for the same duty.

Table 3 Unit Operations Associated with the Capacity Increase to Activity AR2

Process Operations	Description
Material Storage	Raw materials are brought into the facility and stored in suitable sealed containers within appropriate storage areas to prevent exposure to moisture and the extremes of temperature. For Hazardous Materials and Dangerous Goods this will be containment in appropriate UN approved containment. The preference is for feedstocks, intermediates, and products to be stored within the main process building, or other onsite material storage facilities, with some waste materials being stored outside in either covered or uncovered locations in suitable sealed containers with appropriate bunding.
Weighing	To ensure the composition of the final product is correct, all raw materials are weighed using appropriate weigh-scales or added as accurately measured volumes.
Drying	Removal of water from materials by applying energy, typically via heat and / or vacuum, is completed using a variety of equipment items for a range of solid to water ratios. Unit operations used include agitated dryers, tray dryers, and spray dryers, with batch sizes up to 250 litres. The water vapour stream from the drying operations, typically diluted with air, is vented into the extraction system, filtered to an appropriate level for entrained particulates, and vented externally.
Thermal Treatment	Thermal treatment of solids is typically performed on materials at temperatures of up to 1,200°C in batch and continuous furnaces, which are electrically heated. The intent is to generate high temperature chemistry and to modify the phase composition and/or crystallinity of the solid materials. Depending upon the material, evolution of vapours such as water vapour, carbon oxides, and nitrogen oxides may occur. Typically, materials are thermally treated in multiple discrete quantities of up 20 kg.

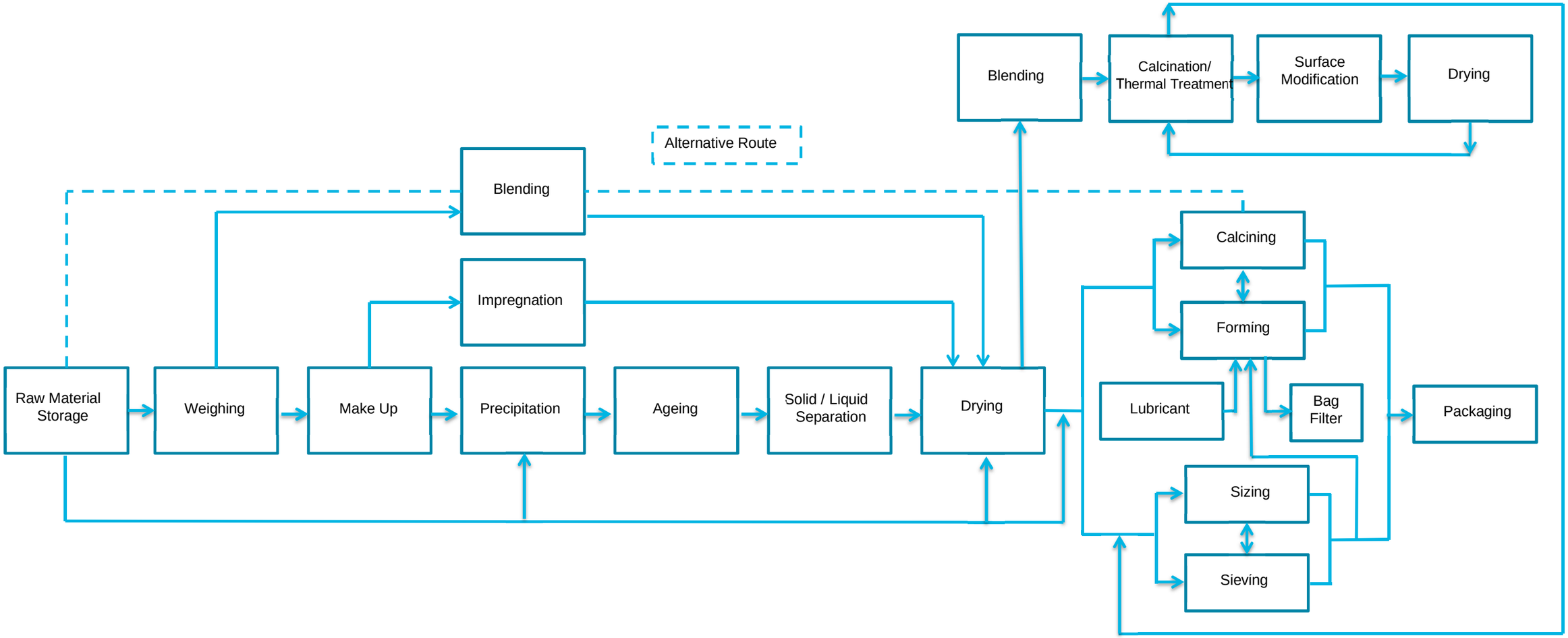
Process Operations	Description
	Evolved gases are extracted from the furnaces via an extraction fan, filtered appropriately for entrained particulates (in the continuous furnace), and vented into the stack system. Note – no filtration for removal of entrained particulates is provided for the batch ovens, as previous assessment has identified that the emissions from these ovens are insignificant i.e. <1mg/m³
Size Adjustment	Many unit operations are employed to modify the particle size and/or distribution of solid materials. Reduction of particle size is undertaken on solids using various milling equipment items in batch and continuous operation. Impact milling is the most typical unit operation employed in the Installation. Throughput through the pilot equipment can be as high as 50 kg/hr. Agglomeration or granulation techniques are also employed in the Installation for the increase in the effective particle size of materials.
Sieving	Separation and classification of solids based on particle size is undertaken using various sieving and classification equipment items. Capability is available to complete separations over a wide range of particle size cuts. Throughput through the pilot equipment can be as high as 50 kg/hr.
Powder Blending	Blending of materials to achieve homogenous mixtures.
Packaging	Materials coming from the unit operations within the Installation are packaged after processing is completed. This can be temporary packaging for intermediates or products, or packaging suitable for transport of the material to another location. All materials require packaging as an intermediate or product in order to provide containment and to prevent ingress of moisture and to protect the material from atmospheric conditions

A process flow diagram detailing the AR2 process is presented in Figure 5.

It should be noted that not all unit operation stages will be applied to all products, and that the unit operation stages required will be determined based on the processing needs for the production of each product.

The proposed changes will not alter the annual throughout limitations on vanadium for activity AR2 as listed in Table S3.2 of the Environmental Permit.

Figure 5. Process Flow Diagram – Activity AR2



3.4.2 Emissions to Air

The new process plant will include the installation of a new common vent header serving emission points A13, A14 and A15. These emission points will be identical to those installed at A9, A10 and A11 for the existing AR2 activities, and will release similar emissions from the process.

The same upstream emissions control systems will be applied to the process activities feeding into emission points A13 – A15, as described in the following sections:

3.4.2.1 Powder Handing Operations

All powder handling activities associated with the new plant will be undertaken within dust booths which are installed with recirculating or once-through systems with in-built HEPA filters with no direct emissions of dust to emissions points A13 – 15.

The control measures for dust abatement are:

- Materials are only transferred within dust booths and there are systems in place to ensure that materials are only transferred when the dust booths and their associated extraction and dust abatement measures are operational;
- F8 fine filters and two H14 HEPA filters (fitted in series) are installed on each dust booth;
- Each HEPA filter is extremely efficient and has a design basis of > 99.97% removal for particulates of > 0.3 µm in size;
- Flow to the dust booth is confirmed by the operator prior to undertaking any material transfers;
- Air flow automatically adjusts via a differential pressure transmitter to compensate for progressive filter burden;
- The systems are subject to planned preventative maintenance ensuring optimum filter performance; and
- Inspections for airborne dust at the exit of the downflow booths are undertaken on a regular basis. Measurements are taken during maintenance activities using the Dispersed Oil Particulate test.

3.4.2.2 Thermal Processing Operations

The capacity expansion will include the addition of electrically heated drying and calcining plant which feed into the common vent header emissions points A13 – 15.

The emissions from such calcining and drying plant will be controlled via the use of H13 HEPA filters.

Table 4 presents a summary of the main emission points with upstream sources of particulates, the abatement techniques used to control particulate emissions, and the predicted peak emission concentrations from each emission point following abatement.

The particulate emissions data presented in Table 4 represent the calculated theoretical hourly average maximum emission concentrations from each source.

Performance of the abatement systems has been based on the required specifications of the systems used at site. i.e. HEPA filters achieving > 99.97% removal for particulates of > 0.3 µm in size.

It should be noted that the assumptions used in calculating these emission concentrations are considered to present a significant overestimate of potential actual emission levels.

Table 4 Summary of Emissions of Particulate Matter

Emission Point Ref	Source	Abatement Technique	Hourly Peak Emission of PM (mg/m³)	BAT- AEL (mg/m³) (1)	Operating Mode (% of Year) (2)
A9	Thermal Processing	HEPA filter	0.000012 (3)	5 – 20 for Particulate Matter	70

Emission Point Ref	Source	Abatement Technique	Hourly Peak Emission of PM (mg/m³)	BAT- AEL (mg/m³) (1)	Operating Mode (% of Year) (2)
A10	Thermal Processing	HEPA filter	0.000012 (3)	5 – 20 for Particulate Matter	70
A11	Thermal Processing	HEPA filter	0.000012 (3)	5 – 20 for Particulate Matter	70
A13	Thermal Processing	HEPA filter	0.000012 (3)	5 – 20 for Particulate Matter	70
A14	Thermal Processing	HEPA filter	0.000012 (3)	5 – 20 for Particulate Matter	70
A15	Thermal Processing	HEPA filter	0.000012 (3)	5 – 20 for Particulate Matter	70

Notes:

(1) Emission benchmarks defined in "How to comply with your environmental permit. Additional guidance for the Inorganic Chemicals Section (EPR 4.03)

(2) Operating mode is the expected upper end of the operating time that emissions are expected to be released.

(3) Emissions to A13/A14/A15 and A9/A10/11 are each released from a single manifold to three separate stacks. The emission release via each stack is assumed to be equal.

3.4.3 Emissions of NOx

Oxides of nitrogen (NOx) are released as a result of heating of materials at high temperatures in the thermal processing equipment.

The new process equipment for undertaking activity AR2 will result in the generation of NOx. Processing for the new products will be year-round.

The emissions of NOx are controlled by primary techniques and no secondary abatement is required.

During the initial stages of a production process, thermal gravimetric analysis (TGA) is undertaken. This is a method of thermal analysis in which changes in physical and chemical properties of materials are measured as a function of increasing temperature (with constant heating rate), or as a function of time (with constant temperature and/or constant mass). Using TGA analysis the emission profile of the process can be understood and the quantity of emissions calculated. This allows the thermal processing equipment to be sequenced such that the peaks of NOx emissions can be managed so that they do not coincide from the different ovens.

For the increased throughout of activity AR2, the site will limit emissions of NOx (to emissions points A9/A10/A11 and A13/A14/A15) to a maximum of 200 mg/m³ (as NO_2) in order to meet the BAT-AEL's. The NOx limit will be met by the use of procedural controls as well as physical controls (i.e. limiting the quantity of material to be processed so that it cannot physically emit >200 mg/m³ (as NO_2).

The emissions from the plant will remain within existing permit emission limits as listed within Table S3.1 of the Permit, with the existing limits for Emission Points A9 – A11 being proposed for emission points A13 – A15,

3.4.4 Addition of Additional Materials to the Activity Definition

It is proposed to add boron, niobium, cerium, molybdenum, tin and antimony to the list of raw material metal salts for Activity AR2 as listed in Table S2.1 of the permit. These additional raw materials will be stored and handled in line with the existing site procedures and management controls.

The potential implications on the addition of these metals to the emissions from the process and environmental impacts have been reviewed in Section 4.

3.4.5 Emissions to Water

The increased throughout to activity AR2 will not lead to any emissions of aqueous effluent to either controlled waters, public sewer, or the onsite private drainage system that connects to the CF Fertilisers effluent plant with ultimate discharge to the River Tees via discharge point RTO1.

3.5 Proposed Changes to Activity AR3

Activity AR3 relates to the effluent handling, storage and discharge to the private drainage system, and includes consideration of the discharge of uncontaminated surface water.

The proposed changes to the Environmental Permit will have a negligible impact on this activity, with the only changes proposed being and increase in the discharge of retentate generated by the demineralised water reverse osmosis units associated with activities AR4 and AR5 leading to up to an additional 6m³ of retentate being discharged per day (a total of 6m³ from AR2, and up to 1m³ from the new RO unit associated with activity AR5).

As this material will be uncontaminated RO plant retentate (i.e. water containing slightly increased concentrations of naturally occurring minerals and salts), which will be discharged into the brackish / saline waters of the tidal River Tees via RTO1, no significant environmental impact is anticipated from this additional discharge.

3.6 Proposed Changes to Activity AR4

It is proposed to increase the maximum annual production under activity AR4 from 10,000kg to 60,000 kg/year.

This increase in throughout will be achieved through more frequent operation of the existing process equipment i.e. a higher annual online time, along with the installation of some additional process equipment to de-bottleneck the initial wet chemistry stages of the process i.e. the addition of additional mixing and precipitation vessels. All additional equipment installed will either be a like for like or slightly larger scale version of that already installed at the site. These additional plant items will not lead to any additional emissions to air.

The proposed changes will not change any of the abatement measures in place at the plant, or their operational efficiency, and predicted emissions to air via Emission Point A12 will be compliant with the emission limits stipulated in Table S3.1 of the Environmental Permit.

The increased plant throughout will increase the quantity of retentate generated by the demineralised water reverse osmosis unit which will be discharged via emission point W1 (to the private drainage system). The quantity of retentate is expected to be less than 6m³ per day.

Liquid effluent generated from the process and scrubber liquors will continue to be removed for offsite disposal by an approved contractor.

3.7 New Activity AR5 – Metals Dissolving Process

Activity AR5 will be a metals dissolving and purifying process designed to process metal and metal salts raw materials so as to generate high quality metal salt solutions. Activity AR5 will primarily be operated for R&D demonstration of the metals dissolving and metal salt production process, with the vast majority of the metal salt solutions generated being sent for metals recovery offsite. However, there is the possibility that some of the metal salt solutions produced may be utilised subsequently as feedstocks in Activity AR4 and subsequently AR2.

It is therefore assumed that activity AR5 will introduce a new Part A1 process to the Installation which is understood to constitute a named activity under the Environmental Permitting Regulations under the following category:

Section 4.2 Part A(1) (a) (iv) activity for producing inorganic chemicals such as: salts (for example ammonium chloride, potassium chlorate, potassium carbonate, sodium carbonate, perborate, silver nitrate, cupric acetate, ammonium phosphomolybdate);

The plant will operate in distinct campaigns, processing one feedstock at a time. During each campaign, the plant is expected to operate continuously for 5 days with 2 days offline. Between each campaign there will be a period of equipment decontamination and reconfiguration.

Annual capacity based on a typical plant availability of 90% (7,920 hours per year) for the plant is estimated to be up to 1,800 tonnes of metal salt solution. However, the plant availability is expected to be much lower than 90%.

The AR5 process is proposed to be installed within a new site building which is to be installed on the southern half of the existing drum park. This building will be within the existing Installation boundary.

Road tanker loading and unloading facilities will also be required as part of the development of this new plant.

3.7.1 Process Description

Activity AR5 will be a metals dissolving process designed to process metal and metal salts raw materials so as to generate high quality metal salt solutions. The process will primarily be operated for R&D demonstration of the metals dissolving and metal salt production process, however, some of the metal salt solutions generated may be utilised for subsequently as feedstocks in Activity AR4 and subsequently AR2.

This activity is still in the initial design phase and could potentially be adjusted as the detailed design of the plant progresses. However, the data presented represents the current basis of design.

It is recognised that as a result of the early stage of design, there may be a requirement for some pre-operational improvement conditions to be included in the Environmental Permit for review and consideration as the design progresses.

It is currently proposed that the AR5 process will be implemented in a number of phases:

- Phase 1 will involve the processing of a mixed metal salt solutions through the process;
- Phase 1 will then see the processing of metals powders and briquettes; and
- Phase 2 will then see the processing of solid metal salt feedstocks being introduced thereafter.

Details on the AR5 activity are presented in Table 5, a process flow diagram providing an overview of the AR5 process is presented in Figure 6.

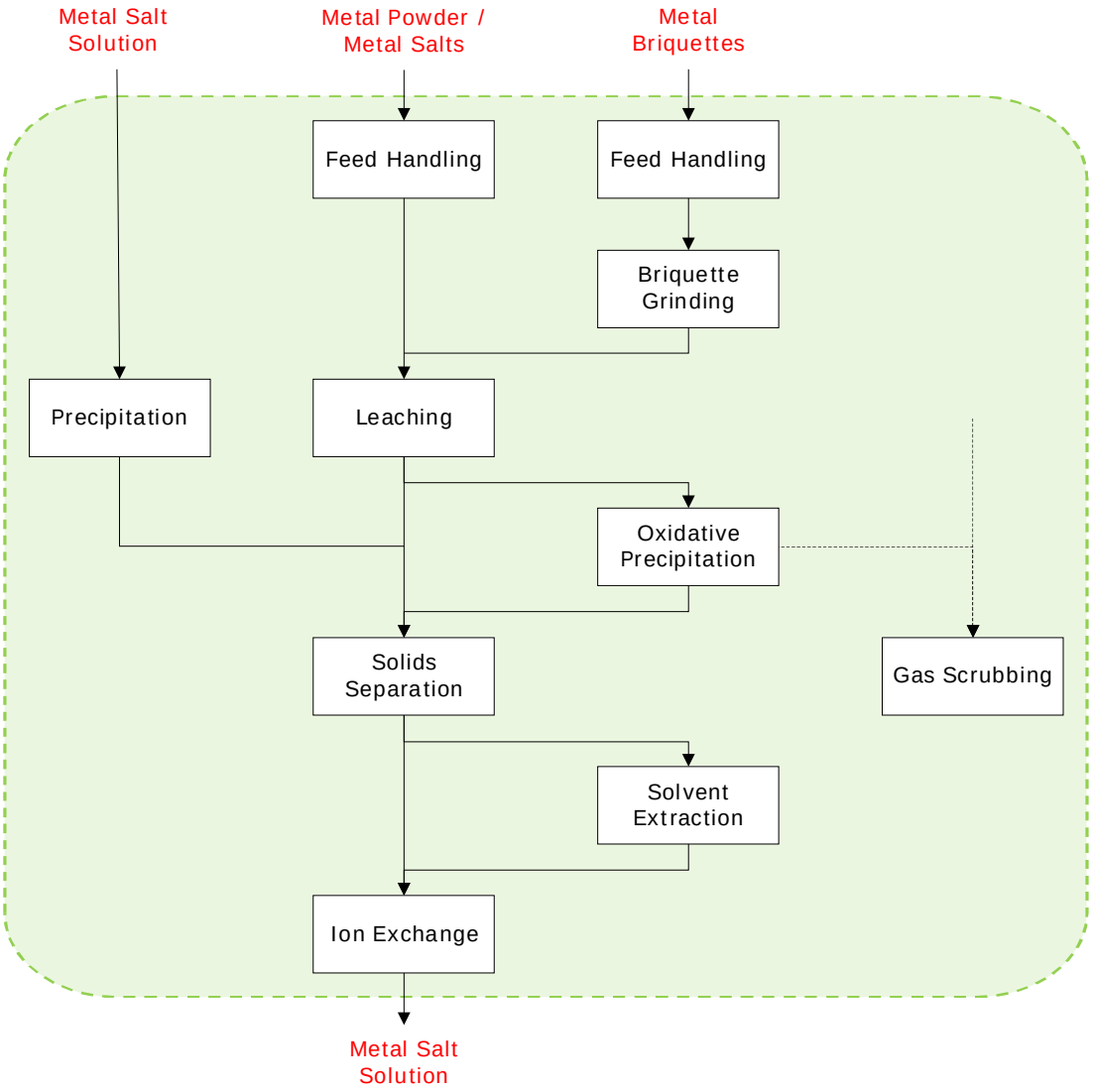
Table 5 Unit Operations Associated with Activity AR5

Process Operations	Description
Material Storage	Metals raw materials will be brought into the facility in the form of powdered metals or briquettes which will be brought to site in Bulk Bags (0.5, 1 or 2 tonne) or within 250kg drums on pallets. These will be stored within the process building or within suitable storage areas on site. All storage areas will incorporate suitable secondary containment and where appropriate bunding. Bulk liquid raw materials will be supplied to site via road tankers and stored on site within suitable bulk tanks with associated secondary containment (bunding). Other liquid raw materials will be brought to site in IBC's or drums and stored within the process building or within suitable storage areas on site. All storage areas will incorporate suitable secondary containment and where appropriate bunding.

Process Operations	Description
	There will also be a number of other materials used within the process e.g. ion exchange resins / grinding media etc. that will be brought to site in smaller quantities (drums / carboys / sacks) and stored appropriately within the process building or within suitable storage areas on site.
Feed Handling	The feed handing plant will receive the solid metal feedstocks from the delivery packaging and prepare them for addition to the process. Solid metal feedstocks will be fed into the process via suitable enclosed powders handling and loading systems e.g. hoppers, from where they will be fed into systems to prepare them for addition to the process e.g. pulping vessels. The quantities of materials added will be carefully monitored and controlled to suit the nature of the specific campaign. The feed handing activities will be undertaken within a suitably enclosed plant areas with suitable dust abatement.
Briquette Grinding	Metal briquettes will follow the same process as the powders with the addition of a briquette grinding stage where the briquettes will be fed into a grinding / milling unit to break up the briquettes and achieve a uniform powder consistency for addition to the process. The briquette grinding activities will be undertaken within a suitably enclosed plant areas with suitable dust abatement.
Leaching	The solid raw materials will be added to a leaching process where they will be mixed into an acid solution where a substitution reaction will occur leading to the generation of the required metal salts in solution. This is undertaken at a temperature below 100°C. Processing of certain solid metal salts will require slightly different process conditions than the other metals being processed and will also require the addition of Sulphur Dioxide (SO_2) to the leaching stage. Off gases from the metals leaching process will be directed to a wet chemical scrubber (using NaOH as the scrubbing media) for the abatement of SO_2 and to also prevent the emission of any trace particulate within the air stream. Metals leaching will lead to the generation of hydrogen as a product of reaction which will be vented via a wet scrubber with water as the scrubbing liquor to emission point A17. As hydrogen is present it is anticipated that the leaching process will be undertaken under a nitrogen blanket which will also be vented via emission point A17. No other waste gases other than SO_2 or H_2 will be generated by the leaching process, with emissions of N_2 associated with the inerting system on the leaching process. As this is a wet process, particulate metals emissions are not anticipated to occur.
Solids Separation	A solids separation stage will be undertaken using a clarifier and filters to remove solids from the process liquors prior to downstream processing.
Ion exchange - purification	The process liquors will then pass through a resin-based ion exchange system to selectively purify the metal salt solution product. The ion exchange process will generate an eluate waste stream which will be collected for offsite disposal as a waste.

Process Operations	Description
	The ion exchange resins will be washed / regenerated as required using dilute acid solutions, with washing / regeneration wastes also being collected for offsite disposal as a waste.
Processing of Solid Metal Salt Feedstocks – additional process stages.	**Leaching** As the leaching process for the solid metal salt feedstock requires the addition of SO_2, an additional wet chemical scrubber will be installed using sodium hydroxide solution as a scrubbing liquor so as to abate any excess SO_2. This will vent to air via emission point A18. The solid metal salt feedstock supplied to the site is expected to contain a number of metals impurities e.g. manganese, magnesium, tin, zinc, iron etc. and hence this will require a number of additional purification stages so as to achieve the desired product quality. **Oxidative Precipitation** The oxidative precipitation step will occur after the leaching stage and will involve the addition of SO_2, O_2 and NaOH so as to react specific metal contaminants within the product to form insoluble solids for subsequent removal in the solids separation stage. A flocculant will be added to the solids separation stage to as to optimise the removal of solids. **Solvent Extraction** Following the solids separation phase the process liquors will undergo 2 consecutive solvent extraction steps so as to remove other impurities from the product. These steps will use a high boiling point (non-VOC) solvent e.g. Shellsol D100 or similar, with a number of proprietary key chemical additives to allow selective separation of metal impurities from the product. The solvent stripping process will operate at a temperature of around 60°C and will have a non-extracted vent to atmosphere (emission point A19) to maintain the process at atmospheric pressure. Losses via this vent will only be breather losses and displacement losses. As the solvent proposed for use in the process is classified as a Non-VOC solvent and has a high boiling point (>238°C) no significant emissions are expected from this emission point. The solvent stripping solution and associated extracted impurities will be collected for disposal offsite as waste. The product will then enter the ion exchange process.
Effluent Collection and Disposal	All process effluents will be collected and stored within dedicated effluent tanks for collection by road tanker for offsite disposal as waste (See Section 3.7.2).
Utilities	The AR5 process will use the existing site utility systems. A new reverse osmosis plant will be installed to supply demineralised water to the AR5 plant activities.

Figure 6. Process Flow Diagram – Activity AR5



3.7.2 Raw Materials and Wastes Storage and Handling

3.7.2.1 Raw Materials - Metals

The AR5 process will process metals which will be supplied to site in either powdered or briquette form. The process is also intended to process metal salts which will also be supplied to site in a wetted powdered form. All deliveries of powdered or briquette raw materials will be delivered to site in bulk bags ranging in size from 500kg to 2 tonnes.

These bulk bags will be stored either within the process building or within suitable covered storage areas on site. All storage areas will incorporate suitable secondary containment where appropriate.

The process can also utilise a mixed metal salt solution as a raw material for the process which will be fed directly into the precipitation stage. This liquid raw material will be stored within an above ground bulk storage tank.

The range of metals species used in the process, and metal salt solutions produced will the same as those listed for Activity AR4 in Table S2.1 of the Permit. i.e. Aluminium, alkali metals (lithium, sodium, potassium and caesium), alkaline earth metals (magnesium and calcium), transition metals (titanium, vanadium, manganese, iron, cobalt, nickel, copper, zinc, zirconium, and tungsten), as a sulphate, nitrate, chloride, phosphate, hydroxide, oxide, carbonate or as a salt of an organic acid (such as acetate, citrate, oxalate).

3.7.2.2 Bulk Storage of Liquids

The AR5 process will include a number of bulk storage tanks, the details of which are presented in Table 6.

Table 6 Bulk Storage Tanks

Material Stored	Volume	Secondary Containment
Acid	10m³	Bund
Acid Dilution Tanks x 2	0.5m³	Bund
Sodium Hydroxide	10m³	Bund
Sodium Hydroxide Dilution Tank	0.1m³	Bund
Mixed Metal Salt Solution (raw material)	25m³	Bund
Product Storage Tank	25m³	Bund
Acidic Effluent Storage Tank	25m³	Bund
Alkaline Effluent Storage Tank (spent scrubber liquors)	2m³	Bund

All bulk storage tanks will be provided with suitable secondary containment bunds with sufficient capacity to prevent a loss in the event of a primary tank failure and provide an impermeable barrier to pollution of soil or groundwater.

All bulk storage tanks will be provided with suitable tank instrumentation which will be specified following completion of a quantified risk assessment (LOPA) to ensure risk of tank overfill is adequately controlled. This expected to include multiple independent level monitoring devices with alarms and/or trip functionality.

Tanker Loading Bay

The AR5 plant will require the provision of suitable road tanker offloading and loading facilities to allow the delivery of liquid raw materials in bulk, and the removal of liquid effluents for offsite disposal.

A tanker loading / offloading bay will be designed and provided for this purpose which will constructed of chemically resistant concrete and will be designed to provide suitable containment for the loading / offloading activities.

Rainwater accumulation within the offloading area or associated sumps will be managed in line with existing site procedures which will ensure that it is uncontaminated prior to pumping out to stormwater drainage systems.

All road tanker loading and unloading activities will be undertaken subject to the requirements of a site management procedure.

Such activities will be supervised by the driver and a JM operative throughout the transfer. Should there be a failure then the transfer can be isolated immediately (e.g. via cessation of pumping and closure of upstream valves) which will limit the quantity of effluent lost to ground. Dry break couplings will be used to prevent small losses of material to the ground when connecting / disconnecting hoses.

A site spill response procedure is in place to deal with any spillage events.

Surface water drains in the vicinity of the loading bay would be covered with a drain cover prior to undertaking any liquid transfer operations.

Spill kits are located in strategic places on the site and will be available in close proximity to the tanker loading / unloading bay.

Non Bulk Storage Areas

Storage areas will be provided within the AR5 plant area and within the existing site drum and materials storage areas for storage of other process and maintenance materials.

Liquid raw materials will be brought to site in IBC's or drums and stored within the process building or within suitable storage areas on site. All storage areas will incorporate suitable secondary containment and where appropriate bunding.

There will also be a number of other materials used within the process e.g. ion exchange resins / grinding media etc. that will be brought to site in smaller quantities (drums / carboys / sacks) and stored appropriately within the process building or within suitable covered storage areas on site.

Suitable segregation will be provided for incompatible materials.

Inspections

The new storage area, bunds and loading bay will be inspected twice daily in line with current site procedures. A checklist is provided to guide the inspections and ensure rainwater is removed in a timely manner. The integrity of spill kits will be included in the operational checks.

Other site storage areas will also be subject to scheduled walkovers and inspections in line with existing site procedures.

3.7.3 Emissions to Air

3.7.3.1 Powder / Raw Materials Handling

All powder handling activities associated with the new plant will be undertaken within fully enclosed materials handling systems or dust booths which will be installed with recirculating or once-through systems with in-built HEPA filters with no direct emissions of dust to emissions points A17 – 19.

The control measures for dust abatement are:

- Materials are only transferred within fully enclosed materials handling systems or dust booths and there are systems in place to ensure that materials are only transferred when the fully enclosed materials handling systems or dust booths and their associated extraction and dust abatement measures are operational;
- F8 fine filters and two H14 HEPA filters (fitted in series) are installed on each fully enclosed materials handling system or dust booth;
- Each HEPA filter is extremely efficient and has a design basis of > 99.97% removal for particulates of > 0.3 µm in size;
- Flow within the air extraction / recirculation and dust abatement system is confirmed by the operator prior to undertaking any material transfers;
- Air flow automatically adjusts via a differential pressure transmitter to compensate for progressive filter burden;
- The systems are subject to planned preventative maintenance ensuring optimum filter performance; and
- Inspections for airborne dust at the exit of the downflow booths are undertaken on a regular basis. Measurements are taken during maintenance activities using the Dispersed Oil Particulate test.

3.7.3.2 Process Emissions

Activity AR5 will have the following emission points to air:

Table 7 Emission Points to Air from A5

Emission Point Reference	Source	Abatement	Potential Emissions
A17	Metals Leaching	Water Scrubber for abatement of trace particulates	Nitrogen Hydrogen
A18	Metals Leaching (Only when processing metal salts)	NaOH Scrubber for abatement of SO_2	Trace SO_2 <5 mg/Nm^3

Emission Point Reference	Source	Abatement	Potential Emissions
A19	Solvent extraction (Only when processing metal salts)	No abatement High boiling point Non-VOC solvent process Operations at <60°C	No significant emissions – Breather and displacement losses only

3.7.4 Emissions to Water

The only discharge to water from the AR5 processes will be a small quantity of retentate from a new demineralised water reverse osmosis unit. The quantity of retentate discharged is expected to be less than 1 m^3 per day.

This retentate will be discharged into the same private drainage system as the W1 discharges for transfer to the CF Fertilisers effluent plant. The drainage system ultimately discharges into the River Tees via discharge point RTO1.

The new discharge from the AR5 process will enter this drainage system in a slightly different location on site which will be referred to as emission point W2. The specific location of emission point W2 (for permit compliance purposes) has yet to be confirmed. However, W2 will be located in immediate proximity to the new Metals Dissolving building – and the specific location will be confirmed to the Environment Agency prior to commencement of discharge.

All process related aqueous wastes (including wash waters and spent scrubber liquors) will be collected into an effluent tank and removed from site by road tanker for offsite disposal as waste.

Stormwater from the building roof will be directed into the existing site drainage systems.

3.7.5 Process Efficiency and Waste Minimisation

As mentioned previously, this activity is still in the initial design phase, and could potentially be adjusted as the detailed design of the plant progresses. At this stage specific opportunities to optimise process efficiency and minimise waste generation have not yet been investigated in detail.

It is proposed that such opportunities be reviewed during the detailed design phase, with further review to be undertaken post commissioning of the plant.

3.8 Proposed Changes to the Site Drum Park

As a result of the construction of the AR5 process building and infrastructure, the existing site drum park will need to be reconfigured.

The majority of the drum park is already included within the Installation boundary, and as discussed in Section 3.2 the Installation boundary will be extended to incorporate a small area of additional land to the northern end of the drum park area so as to incorporate the entire concrete hardstanding area at the existing drum park and adjacent storage area (currently outside of the permitted Installation boundary). The site drum park area will be reconfigured and relocated to sit within the northern end of the area. The area will be upgraded to ensure that suitable and sufficient secondary containment is provided to prevent a loss of materials to soil or groundwater.

The proposed site changes may lead to some increases in the quantities of materials stored in this area, but all storage will be undertaken in line with best practice.

4. Emissions to Air and Air Quality Impact Assessment

A detailed air quality impact assessment has been undertaken to assess the potential implications of the proposed site changes on local air quality. This assessment is presented in Appendix C.

The details of the emission points to air are shown in Tables 8 and 9.

A number of the site emissions points (shown in Grey) have been excluded from the air quality impact assessment as follows:

- A4 and A7 as they are only used for small scale R&D purpose;
- A5 as the spray dryer is no longer installed;
- A17 – as the vent from the metals leaching process will comprise nitrogen and hydrogen – neither of which are classified as environmentally harmful. However detailed process safety assessments will be undertaken during the detailed design of the AR5 activity to ensure that the venting of hydrogen poses no onsite safety risk. The leaching process is a wet process, and as such there are not anticipated to be any emissions of particulate metals however to ensure that no particulates are emitted via emission point A17, a wet scrubber will treat the vented gases prior to discharge. Hence no emission of potentially environmentally harmful materials are predicted from emission point A17;
- A19 is the breather vent from the solvent stripping process which is used solely when processing solid metal salt feedstocks and therefore will only be operational intermittently. The solvent used in the process is proposed to be Shellsol D100 which is classified as a Non-VOC solvent and has a high boiling point (>238°C) hence no significant emissions of VOC or organic solvents are expected from this emission point.

Table 8 Emissions and Emission Sources

Emission Point Ref	Location	Emission Source	Grid Reference	Emissions
A1	MSC	Common vent header from continuous dryer and main ovens (Activity AR1)	446487 522560	NOx, Particulate Matter, Ammonia, Hydrogen Fluoride
A2	MSC		446486 522561	NOx, Particulate Matter, Ammonia, Hydrogen Fluoride
A3	MSC		446485 522564	NOx, Particulate Matter, Ammonia, Hydrogen Fluoride
A4	MSC	Small Scale R&D Use Only	446465 522589	-
A5	MSC	Spray Dryer – No Longer Installed (Activity AR1)	446465 522589	-
A6	MSC	Forming Machine (Activity AR1)	446473 522596	Particulate Matter
A7	MSC	Small Scale R&D Only	446494 522580	-
A8	MSC	Pan coater (drying oven) (Activity AR1)	446460 522566	Ammonia, Particulate Matter
A9	Pilot Plant		446480 522538	NOx, Particulate Matter

Emission Point Ref	Location	Emission Source	Grid Reference	Emissions
A10	Pilot Plant	Common vent header from Local Exhaust Ventilation (LEV) system and thermal treatment process (Activity AR2)	446480 522538	NOx, Particulate Matter
A11	Pilot Plant		446480 522538	NOx, Particulate Matter
A12	Pilot Plant	Wet chemical scrubber (Activity AR3)	446458 522564	Ammonia
A13	Extension to Pilot Plant	Common vent header from Local Exhaust Ventilation (LEV) system and thermal treatment process (Activity AR2)	446453 522557	NOx, Particulate Matter
A14	Extension to Pilot Plant		446452 522557	NOx, Particulate Matter
A15	Extension to Pilot Plant		446451 522557	NOx, Particulate Matter
A16	MSC	Vent header from batch ovens (Activity AR1)	446466 522587	NOx, Particulate Matter, Ammonia, Hydrogen Fluoride
A17	Metals Dissolving	Vent from Metals Leaching Process (Activity AR5)	446583 522394	Hydrogen, Nitrogen
A18	Metals Dissolving	Vent from Metals Leaching Process (Only when processing solid metal salt feedstock) (Activity AR5)	446586 522393	SO_2
A19	Metals Dissolving	Breather vent from Solvent Stripping Processes (Only when processing solid metal salt feedstock) (Activity AR5)	446590 522392	No significant emissions Process uses high boiling point Non-VOC solvent

Table 9 Emission Parameters

Details	Emission Point Details							
	A1 (combined A1, A2, A3)	A6	A8	A9 (combined A9, A10, A11)	A12	A13 (combined A13, A14, A15)	A16	A18
Flow rate (Actual m^3/s)	2.78	0.42	0.13	2.78	2.0	2.78	0.84	0.001
Flow rate (Nm^3/hr)	10,000	1,500	450	10,000	7,200	10,000	3,000	5
Percentage of Year Operational (%)	5	1	5	70	70	70	5	100
Actual duct diameter (m) (for each individual vent stack)	0.3	0.2	0.15	0.3	0.63	0.3	0.28	0.1
Effective stack diameter (assuming a single release point) (m)	0.52	0.2	0.15	0.52	0.63	0.52	0.28	0.1
Efflux velocity (m/s)	13.1	13.3	7.1	13.1	6.4	13.1	13.1	0.2
Emission Temperature (°C)	20	20	20	20	20	20	20	20
Actual Stack height (m)	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
Effective Stack height (m)	0	0	0	0	0	0	0	0
Stack location (x,y)	446486, 522561	446473, 522596	446460, 522566	446480, 522538	446458, 522564	446452, 522557	446466, 522587	446586, 522393
Peak emission concentrations:								
NOx (mg/Nm^3)	113	-	-	123	-	123	113	-
NH_3 (mg/Nm^3)	10	-	-	-	1	-	10	-
HF (mg/Nm^3)	5	-	-	-	-	-	5	-
SO_2 (mg/Nm^3)	-	-	-	-	-	-	-	50
Particulate Matter (mg/Nm^3)	0.039	0.00001	0.00001	0.321	-	0.321	0.039	-
Vanadium (mg/Nm^3)	0.01365	0.0000035	0.0000035	0.016	-	0.016	0.01365	-
Beryllium (mg/Nm^3)	0.00039	0.0000001	0.0000001	-	-	-	0.00039	-
NOx (g/s)	0.31	-	-	0.34	-	0.34	0.094	-
NH_3 (g/s)	0.028	-	-	-	0.002	-	0.0083	-
HF (g/s)	0.014	-	-	-	-	-	0.0042	-
SO_2 (g/s)	-	-	-	-	-	-	-	0.000069
Particulate Matter (g/s)	0.00011	4.2×10^{-9}	1.3×10^{-9}	0.00089	-	0.00089	0.000033	-
Vanadium (g/s)	0.000038	1.5×10^{-9}	4.4×10^{-10}	0.000045	-	0.000045	0.000011	-
Beryllium (g/s)	0.00000108	4.2×10^{-11}	1.3×10^{-11}	-	-	-	0.000000325	-

Details	Emission Point Details							
	A1 (combined A1, A2, A3)	A6	A8	A9 (combined A9, A10, A11)	A12	A13 (combined A13, A14, A15)	A16	A18
Annual average emission concentrations:								
NOx (mg/Nm^3)	10	-	-	10.7	-	10.7	10	-
NH_3 (mg/Nm^3)	10	-	-	-	1	-	10	-
HF (mg/Nm^3)	5	-	-	-	-	-	5	-
SO_2 (mg/Nm^3)	-	-	-	-	-	-	-	50
Particulate Matter (1) (mg/Nm^3)	0.039	0.00001	0.00001	0.321	-	0.321	0.039	-
Vanadium (mg/Nm^3)	0.01365	0.0000035	0.0000035	0.016	-	0.016	0.01365	-
Beryllium (mg/Nm^3)	0.00039	0.0000001	0.0000001	-	-	-	0.00039	-
NOx (g/s)	0.028	-	-	0.03	-	0.03	0.0083	-
NH_3 (g/s)	0.028	-	-	-	0.002	-	0.0083	-
HF (g/s)	0.014	-	-	-	-	-	0.0042	-
SO_2 (g/s)	-	-	-	-	-	-	-	0.000069
Particulate Matter (g/s)	0.00011	4.2×10^{-9}	1.3×10^{-9}	0.00089	-	0.00089	0.000033	-
Vanadium (g/s)	0.000038	1.5×10^{-9}	4.4×10^{-10}	0.000045	-	0.000045	0.000011	-
Beryllium (g/s)	0.00000108	4.2×10^{-11}	1.3×10^{-11}	-	-	-	0.000000325	-

Notes:

(1) Note that for the purposes of this screening assessment the annual average particulate emissions have been assumed to be equivalent to the calculated theoretical hourly average maximum emission concentrations presented in Table 4 so as to present a highly conservative assessment of potential impacts.

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5. Emissions to Controlled Waters and Sewer

The proposed changes to the Environmental Permit will have a negligible impact on the effluent handling, storage and discharge to the private drainage system, with the only changes proposed being and increase in the discharge of retentate generated by the demineralised water reverse osmosis units associated with activities AR4 and AR5 leading to up to an additional 6m³ of retentate being discharged per day (a total of 6m³ from AR2, and up to 1m³ from the new RO unit associated with activity AR5).

As this material will be uncontaminated RO plant retentate (i.e. water containing slightly increased concentrations of naturally occurring minerals and salts), which will be discharged into the brackish / saline waters of the tidal River Tees via RTO1, no significant environmental impact is anticipated from this additional discharge

There are no additional emissions of process effluent to either controlled waters, public sewer, or the onsite private drainage system that connects to CF Fertilisers effluent plant with ultimate discharge to the River Tees via discharge point RTO1.

6. Monitoring

The following updates to the monitoring requirements detailed in Table S3.1 of the Environmental Permit are proposed:

Table 10 Emissions and Emission Sources

Emission Point Ref	Emission Source	Parameter	Limit (Including Unit)	Reference Period	Monitoring Frequency	Monitoring Standard or Method [Note 3]
A1	Common vent header from continuous dryer and main ovens (activity AR1) [Note 4]	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	120 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed Agreed Calculation Method See Note 7	
A2		Particulates	1 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed See Note 7	
A3		Ammonia	10 mg/Nm³	Hourly	Every six months [Note 2]	EN ISO 21877 or CEN TS17337
		Hydrogen Fluoride	5 mg/Nm³	Hourly	Every six months [Note 2]	CEN TS 17340 or CEN TS 17337.
A4	Small Scale R&D Use Only	-	-	-	-	-
A5	Spray Dryer (activity AR1)	Traces of Particulates	No Limit Set	-	-	-
A6	Forming Machine (activity AR1)	Traces of Particulates				
A7	Small Scale R&D Only	-	-	-	-	-
A8	Pan coater (drying oven) (activity AR1)	Traces of Particulates	No Limit Set	-	-	-
		Traces of ammonia, acetic acid	No Limit Set	-	-	-

Emission Point Ref	Emission Source	Parameter	Limit (Including Unit)	Reference Period	Monitoring Frequency	Monitoring Standard or Method [Note 3]
A9	Common vent header from Local Exhaust Ventilation (LEV) system and thermal treatment process (activity AR2) [Note 5]	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	200 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed Agreed Calculation Method See Note 7	
A10		Particulates	1 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed See Note 7	
A11						
A12	Wet chemical scrubber (activity AR3)	Ammonia	10 mg/Nm³	Hourly	Every six months [Note 6]	BS EN 14791 Or TGN M22
A13	Common vent header from Local Exhaust Ventilation (LEV) system and thermal treatment process (activity AR2) [Note 6]	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	200 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed Agreed Calculation Method See Note 7	
A14		Particulates	1 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed See Note 7	
A15						
A16	Vent header from batch ovens (activity AR1)	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	120 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed Agreed Calculation Method See Note 7	
		Particulates	1 mg/Nm³ [Note 1]	Hourly	No Monitoring Proposed See Note 7	
		Ammonia	10 mg/Nm³	Hourly	Every six months [Note 2]	EN ISO 21877 or CEN TS17337
		Hydrogen Fluoride	5 mg/Nm³	Hourly	Every six months [Note 2]	CEN TS 17340 or CEN TS 17337.

Emission Point Ref	Emission Source	Parameter	Limit (Including Unit)	Reference Period	Monitoring Frequency	Monitoring Standard or Method [Note 3]
A17	Vent from Metals Leaching Process	Hydrogen	No Limit Set	-	-	-
A18	Vent from Metals Leaching Process (Only when processing metal salts)	SO_2	50 mg/Nm³	Hourly	Every six months [Note 2]	EN 14791, CEN TS 17021, or CEN TS 17337.
A19	Breather vent from Solvent Extraction Processes (Only when processing metal salts)	-	-	-	-	-

Note 1: reference conditions are those applicable to non-combustion emission sources with no correction for oxygen content.

Note 2: representative sampling shall be arranged during the operations of the process responsible for the emissions of the relevant pollutant. An alternative sampling and testing frequency may be agreed in writing with the Environment Agency if deemed necessary as the relevant process has not been / will not be operated commercially within the reference period.

Note 3: other suitable monitoring standard or method may be used if agreed in writing by the Environment Agency

Note 4: monitoring requirements for this emission source apply to one common sampling point representative of the common vent header emitting through emission points A1/A2/A3.

Note 5: monitoring requirements for this emission source apply to one common sampling point representative of the common vent header emitting through emission points A9/A10/A11.

Note 6: monitoring requirements for this emission source apply to one common sampling point representative of the common vent header emitting through emission points A13/A14/A15.

Note 7: See Section 6.1

6.1 Monitoring Requirements Previously Agreed with the Environment Agency.

Following the introduction of the AR2 and AR4 processes to the site, JM completed a formal response to Permit Improvement Condition 1 which stated:

"The operator shall develop a detailed monitoring programme that includes either MCERTS certification or MCERTS accreditation (as appropriate), for the monitoring equipment, techniques, personnel and organisations employed for the emissions monitoring requirements specified in condition 3.5.1.

A report confirming successful completion of this improvement condition and detailing the monitoring programme shall be submitted to the Environment Agency for review and approval."

6.1.1 Emissions of NOx

As part of the response to IC1, JM proposed an alternative calculation-based methodology for the assessment of emissions of NO_X to air.

For air emissions, the permit includes NOx limits of 120mg/m³ and 200mg/m³ but as the Installation only runs short and variable batches it was proposed not to monitor the air emissions. Instead the proposed approach was to monitor the nitrogen put into the process and calculate the emissions of NOx on the basis of 100% conversion of nitrogen to NOx. By then using the quantities used in each process this would give a batch load for NOx and could be used to calculate total annual load of NOx.

This alternative approach was accepted by the Environmental Agency in EPR Compliance Assessment Report reference KP3536UC/0335596 dated 19/06/2019, with a subsequent review being undertaken in line with an OMA audit as documented in EPR Compliance Assessment Report reference KP3536UC/0347021 dated 27/11/2019.

It is therefore proposed that the same agreed approach to assessment of emissions of NOx be applied to all emissions points linked to the AR1 and AR2 process, including those added by this permit variation.

6.1.2 Emissions of Particulates

As Part of the response to IC1, JM proposed that no monitoring be undertaken for the following reasons:

- They have HEPA filtration on 3 of the 9 exhaust streams;
- The method BS EN 14792 originally stated in the permit is not accurate to the permitted level (1 mg/Nm³); and
- The permit also previously referenced method BS EN 23210 which is for 1-50mg/m³ and for size fractionation. However, JM contacted two different MCERTS specialist contractors, both of which expressed concerns regarding the validity of the results at levels below 1mg/m^3.

This alternative approach was accepted by the Environmental Agency in EPR Compliance Assessment Report reference KP3536UC/0335596 dated 19/06/2019.

It is therefore proposed that the same agreed approach to assessment of emissions of particulates (including particulate metals) be applied to all emissions points linked to the AR1 and AR2 process, including those added by this permit variation.

7. Energy Management

The new processes will require the installation of new thermal processing equipment and other processing systems. These items use electrical energy for heating and power provision and therefore there will be a corresponding increase in electricity use at the site.

All new equipment purchased will be selected to have a high energy efficiency rating where possible.

The thermal processing equipment will be heavily insulated to minimise heat loss which will in turn improve energy efficiency.

8. Noise and Vibration

No significant changes to noise profile are anticipated as a result of the introduction of the new processes.

The Installation is in an industrial setting. However, there is some residential housing and a school in the locality.

All process operations are undertaken within buildings which minimises the potential for noise nuisance at nearby receptors. Process equipment will be selected to avoid the need for hearing protection for employees working within the buildings. JM has limits for occupational noise based on health protection and these will meet all relevant legal limits (85dB(A) 8 hour TWA).

For activity AR5, all equipment with the potential to producing noise will be selected to not exceed the limit of 80 dBA at 1 m, with the exception of housed compressors which may have noise levels <90 dBA at 1 m.

It is likely that the briquette grinding area will exceed this noise limit, hence as part of the design process, options to contain and attenuate the noise generated by the grinding systems will be investigated so as to minimise the potential for offsite nuisance e.g. location within an acoustic enclosure or room.

The site has not received any justifiable noise complaints in relation to the permitted activities, and through the application of appropriate design and specification of plant supported by scheduled maintenance and other site management controls, no significant noise impacts are anticipated.

9. Odour

None of the new materials proposed for use within the processes are considered to be odorous. The materials to be used are of a similar composition to those already on site and do not present a risk of offsite nuisance.

10. Best Available Techniques

A review of the site activities against BAT was submitted as part of the supporting documentation to Permit Variation V003 and updated in support of Variation V004.

This document has been further reviewed and updated to reflect the changes proposed by this Permit Variation and is presented in Appendix D.

11. Site Management Systems

The site has an Environmental Management System (EMS) which is accredited by Lloyds Register Quality Assurance (LRQA) to the ISO14001:2015 standard and therefore has extensive procedures relating to environmental management.

The new activities will be controlled under the requirements of the existing EMS, with site procedures being amended or prepared as required to control the new/ amended activities and to ensure compliance with the Environmental Permit following implementation of the changes proposed.

12. Environmental Risk Management

The proposed changes to the Installation will not result in any changes to the environmental risk profile of the Installation. Although additional materials will be introduced as a result of the introduction activity AR5, and increased throughput through the capacity increase in AR2 and AR4, all materials and processes will be controlled in accordance with existing site management procedures and systems with appropriate containment and control systems being used.

The site's management system incorporates a number of policies and procedure for emergency and incident response and that are relevant to this application.

- Accident, Incident Reporting and Investigation;
- Emergency Response Planning;
- Occupational Disease and Environmental Incidents Procedure;

- Fire Prevention and Control;
- Spill procedures;
- Authorised Discharges to the Environment; and
- Management of Change Processes.

The site has procedures in place for the reporting and investigating of incidents. Incidents and near misses are recorded in an electronic database and investigated and actioned appropriately.

The site has a designated Incident Response Controller and are in regular contact with the emergency services to review emergency procedures.

Any new processes and materials are assessed using the JM Management of Change processes to establish whether the control measures remain adequate or whether further controls need to be implemented. The Management of Change process is also used to review the proposed change against the constraints of the Environmental Permit to determine whether consultation with the EA is required, and whether there is the requirement to submit a request for a minor operational change or a permit variation.

A qualitative assessment of the potential risks to the environment has been undertaken. The assessment includes the potential for release under:

- Normal and abnormal operating conditions;
- Foreseeable emergency and incident events;
- A review of prevention, control and mitigation techniques;
- A review of the pathways and receptors of any releases; and
- An assessment of the potential impacts.

The summary of the findings of the assessment is provided in Appendix B.

13. Additional Changes to the Environmental Permit

There are a number of items in the existing Environmental Permit that require update or correction as listed below:

- Table S1.3 – Improvement conditions IC1, IC2 and IC3 are all now complete.
- Table S3.1 – Emission Point A1 – A3, NOx and Particulate Monitoring - Changes to the monitoring frequency and standard for NOx and Particulates have been agreed with the EA – see Section 6.1. The proposed changes to Table S3.1 are presented in Table 10.
- Table S3.1 – Emission Point A9 – A11, NOx and Particulate Monitoring - Changes to monitoring frequency and standard for NOx and Particulates have been agreed with the EA – see Section 6.1. The proposed changes to Table S3.1 are presented in Table 10.
- Table S3.1 – Emission Point A12 – incorrectly references activity AR3 – should state ‘wet chemical scrubber (activity AR4)‘.
- Table S3.2 – Emission Point W1 – Note text states that that ‘W1 on emission point plan in Schedule 7’ – note that W1 is not currently shown in the figure in Schedule 7.
- Table S4.2 – Reference to activity AR4 – incorrectly states ‘Produced metal oxides for use as catalysts’ - note this should state ‘Produced Metal Oxides for other uses’.
- Table S4.4 – ‘Date of form’ column contains incorrect dates; Air should state a date of ‘01/05/2019’, other performance Indicators should state a date of ‘01/05/2019’.

A mark-up of the required changes to the permit is presented in Appendix E.

Appendix A - Figures

Appendix B - Qualitative Environmental Risk Assessment

Table 11 Environmental Risk Assessment

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Dust emissions to atmosphere – containing hazardous materials (i.e. particulate metals)	Local residents / businesses beyond the installation boundary. Potentially sensitive environmental receptors.	Fugitive emissions being lost to atmosphere from the AR1 extract systems or extraction systems for activities AR2,4 or 5.	The transfer of powders is undertaken within dust booths. Each dust booth has an initial fine filter and two H14 HEPA filters which are highly effective at removing dusts from the atmosphere. The operation of the dust booth is checked prior to commencing the transfer of material. A local alarm will sound should the air flow fail to the dust booth to inform the operator.	The probability of exposure is considered to be very low due to the extensive management procedures in place. HEPA filters are considered to be BAT for the minimisation of dust emissions.	Potential for small quantities of hazardous material to be lost to atmosphere and affect human receptors	Very Low
Loss of primary containment – Activity AR5 Bulk Tanks	Soil / Groundwater under the site or surface water drainage to the River Tees.	Material entering the site drains and passing through the effluent plant to RTO1. Or through unsurfaced ground or damaged hardstanding to underlying soil and groundwater.	All bulk storage tanks will be newly designed and installed to appropriate standards. Secondary containment in the form of bunding will be provided to ensure containment of all tank contents in the event of a failure of primary containment Suitable tank instrumentation which will be specified following completion of a quantified risk assessment (LOPA) to ensure risk of tank overfill is adequately controlled. This expected to include multiple independent level monitoring devices with alarms and/or trip functionality. All containment and control systems will be subject to scheduled inspection and maintenance	The probably of exposure is considered to be very low due to the adequacy of the containment measures provided.	Potential for hazardous materials to result in ground or surface water contamination.	Very Low

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Loss of primary containment – Road tanker loading / unloading.	Soil / Groundwater under the site or surface water drainage to the River Tees.	Material entering the site drains and passing through the effluent plant to RTO1. Or through unsurfaced ground or damaged hardstanding to underlying soil and groundwater.	Dedicated tanker loading areas are used which have been designed and provided for this purpose which will constructed of chemically resistant concrete which provides an impermeable barrier and will be designed to provide suitable containment for the loading / offloading activities. All road tanker loading and unloading activities will be undertaken subject to the requirements of a site management procedure. Such activities will be supervised by the driver and a JM operative throughout the transfer. Should there be a failure then the transfer can be isolated immediately (e.g. via cessation of pumping and closure of upstream valves) which will limit the quantity of effluent lost to ground. Dry break couplings will be used to prevent small losses of material to the ground when connecting /disconnecting hoses. A site spill response procedure is in place to deal with any spillage events. Surface water drains in the vicinity of the loading bay would be covered with a drain cover prior to undertaking any liquid transfer operations. Spill kits are located in strategic places on the site and will be available in close proximity to the tanker loading / unloading bay. All containment and control systems will be subject to scheduled inspection and maintenance.	The probably of exposure is considered to be very low due to the adequacy of the containment measures provided.	Potential for hazardous materials to result in ground or surface water contamination.	Very Low

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Loss of primary containment leading to hazardous powdered material in the waste storage area.	Loss of powdered waste to the ground and onto unmade ground resulting in contamination.	Windblown powders being deposited on unmade ground.	The process results in only small quantities of hazardous waste being generated.(in the region of 1 tonne per year). The waste containing metals is double bagged and then drummed prior to transfer to the drum park. .The site arranges for waste to be removed regularly to avoid the accumulation of waste materials. Regular inspections of the waste storage area is undertaken to identify any damaged containers or leaks.	The probably of exposure is considered to be very low due to the small quantities of waste being stored and to the extensive controls in place.	Potential for hazardous material to result in ground contamination.	Very Low
Loss of primary containment from Bay 31 intermediate storage area, or external raw materials storage areas.	Ground and groundwater.	Loss of hazardous material to ground or drain.	Only small quantities of material are stored in the intermediate storage area or in other external storage areas. The area is of concrete hardstanding. Materials are stored on portable bunds and under covered to prevent rain ingress. Regular inspections are undertaken to check for damaged or leaking containers.	Potential for only small quantities to be lost. The management procedures in place make the risk of exposure very low.	Potential for hazardous materials to result in ground or surface water contamination.	Very Low
Loss of primary containment leading to hazardous powdered material from the waste storage area entering the drainage system.	Powdered materials potentially dissolving or being carried in the drainage system could potentially reach the River Tees.	Material entering the site drains and passing through the effluent plant to RTO1.	The waste storage area is fully sealed and bunded. Any liquid in the waste area is tested prior to being sent to the site's chemical drainage system. The drainage system passes through to the CF Fertilisers effluent plant prior to being discharged to the river via RTO1. Solid waste is firstly double bagged prior to being placed in a drum. Liquid effluent is placed in an IBC. Regular inspections of the waste storage area are undertaken to identify any damaged containers or leaks. The site drains are subject to annual inspection using CCTV.	The probability of exposure is considered to be very low due to the small quantities of waste being stored and the extensive controls in place.	If procedures were to fail there is a small potential of hazardous material entering the drainage system and being discharged to the River Tees via RTO1. Any material would be diluted extensively from the various drainage systems feeding into the CF Fertilisers effluent plant for eventual discharge to the river via RTO1.	Very Low

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Loss of primary containment of raw materials within the MSC (AR1), pilot plant (AR2 and AR4) or the metals dissolving building (AR5).	Soil / Groundwater under the site or surface water drainage.	Spilled materials seeping through building doorways and then being blown onto ground or into the site drains.	Raw materials for the MSC and pilot plant are in powdered form and are delivered to the site in small containers typically of up to 100 litres. Raw materials for activity AR5 can be in 0.5 – 2 tonne bulk bags. All raw materials are stored and used within buildings that are not connected to the site drainage system. The flooring of the building is coated with an epoxy coating. Chemical spill kits are provided, and the operators are trained in the procedures for dealing with any losses. Floor cleaners are available for sweeping up powdered material. The use of forklift trucks is limited within the building so there is little potential for vehicular impacts. Pallet trucks are used for transferring raw materials to the processing areas in small quantities.	The probability of exposure is considered to be extremely low due to there being little potential for spillages to escape the building and there are extensive management controls in place for dealing with spillages.	Potential for hazardous material to result in ground contamination or to enter the surface water system leading to the River Tees.	Very Low
Release of Oxides of Nitrogen to atmosphere	Local residents / businesses beyond the installation boundary. Potential to reach sensitive environmental receptors.	Releases of process emissions from the site extract system to vent stacks.	NOx is released as a result of heating of materials at high temperatures in the thermal processing equipment. The process results in a short term spike of NOx released to atmosphere. Processing can be staggered such that significant concentrations of NOx do not occur as a result of simultaneous operation of several furnaces. Emissions of NOx are vented at height through a number of site stacks with good extraction rates which provide good dispersion. Potential impacts associated with emissions to ai have been assessed using atmospheric dispersion modelling which has demonstrated that even under maximum potential emissions profiles, no significant impacts will occur.	The probability of exposure is considered to be low due to the extensive management systems in place and experienced process operators.	Potential for visible plume and loss of visual amenity. Potential for exposure to NOx to local residents and businesses and sensitive environmental receptors	Very Low

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Noise Nuisance	Local residents / businesses beyond the installation boundary.	Air	All process operations are undertaken within buildings which minimises the potential for noise nuisance at nearby receptors. Process equipment will be selected to avoid the need for hearing protection for employees working within the buildings. JM has limits for occupational noise based on health protection and these will meet all relevant legal limits (85dB(A) 8 hour TWA). For activity AR5, all equipment with the potential to producing noise will be selected to not exceed the limit of 80 dBA at 1 m, with the exception of housed compressors which may have noise levels <90 dBA at 1 m. It is likely that the briquette grinding area will exceed this noise limit, hence as part of the design process, options to contain and attenuate the noise generated by the grinding systems will be investigated so as to minimise the potential for offsite nuisance e.g. location within an acoustic enclosure or room. The site has not received any justifiable noise complaints in relation to the permitted activities, and through the application of appropriate design and specification of plant supported by scheduled maintenance and other site management controls, no significant noise impacts are anticipated.	The site is located in an area with predominantly industrial neighbours. The potential for exposure is limited.	Potential of noise nuisance to the local residents.	Very Low
Odour Nuisance	Local residents / businesses beyond the Installation boundary.	Air / Wind	The materials associated with the new process are not considered to be odorous.	The site is located in an area with predominantly industrial neighbours. The potential for exposure is limited.	Potential of odour nuisance to the local residents.	Very Low

Hazard	Receptor	Pathway	Risk Management	Probability of Exposure	Consequence	Overall Risk
Visual impact	Local residents / businesses beyond the Installation boundary.	Building extract system to atmosphere	Whilst there will be some changes to the site buildings and process vents as a result of the variation, none of these are considered to be out of character with the industrial setting of the area and the existing site structures. There is potential for released of NOx to result in a visible plume. However, the processes result in short term spikes of NOx and these are controlled by staggering thermal processing on site to control the NOx emission concentrations to below the visible threshold	The risk of exposure is considered to be very low due to the extensive management procedures on site and operator experience with similar processes	Potential for short lived visible plume resulting in concern from local residents or businesses beyond the Installation boundary.	Very Low
Fire Risk	Local residents / businesses beyond the Installation boundary. Site personnel and infrastructure.	Emissions of smoke to the air and potentially firewater or foam to site drainage and soil/groundwater and then on to controlled waters.	There is no additional unmanaged risk to fire from the new process. Fire detections across all plant areas. Provision of firefighting water main with adequate flow and pressure. Use of portable extinguishers. Site fire response unit for the Billingham site.	Appropriate design and management actions should allow the early detection of and minimise the risk of fire spreading. Containment infrastructure is in place for firewater management.	Complaints of smoke and odours in the vicinity from local residential receptors. Localised pollution of surface water and soil / groundwater.	Very Low

Appendix C - Air Quality Impact Assessment

Appendix D - BAT Assessment

Appendix E - Proposed Changes to the Permit

Appendix F - List of Directors

The information held in this Appendix is not for inclusion on the Public Register.

Appendix G – Letter of Authority

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