



John McClean

Senior Permitting Officer
National Permitting Service
Environment Agency
Trentside, Scarrington Road,
West Bridgford
Nottingham
NG2 5BR

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Subject of letter: Johnson Matthey response to Platinum on Zeolite
Not Duly Made letter 4 May 2020

Dear Mr McClean,

Further to your letter dated 4 May 2020 and our subsequent video conference please find the responses to your queries in the not-duly-made letter below.

Please submit a justification to demonstrate that the impregnation of platinum onto zeolite followed by drying and calcination meets the requirements for a scheduled S6.4 B (a) process.

Upon detailed review of the activities undertaken in the Proposed PTZ process we believe that the most appropriate activity for the calcination stage to be classed as is a S4.2 A1 (c) activity, as this is manufacturing technique which involves the use of platinum.

Our application to vary the Royston permit stated that the activity should be an S6.4 B (a) process, this was a mistake; although the process does involve coating and drying operations these processes represent no chance to the existing S6.4 B (a) activities currently on the Royston Permit, and which are undertaken at Procat 1.

Lastly to clarify an issue which has arisen during the selection of the process type, we have discovered that there is an administrative error on the Royston Permit whereby the existing calcination activities currently undertake at Fastcat and Zeocat on the Royston site are described as S4.2 A1 (d) activities on the permit, and not S4.2 A1 (c) activities, as they should be. Upon review of historical permits we believe this error is due to the impact of a change in the nomenclature for the activities when the regulations were revised in 2016, and not due to any typographical errors or incorrect selection of activities at the time of the original permit application or any subsequent variations. We are therefore seeking an administrative change to alter the table S1.1 schedule of activities in the permit to amend the current S4.2 A1 (d) activities to be S4.2 A1 (c) activities (and where applicable S4.2 A1 (f) activities, although that clause does not apply to this area, and is only needed for the ECT area), the attached revised permit variation document now has a section B for the proposed admin changes.

Outline the guidance and best practice documents against which the impregnation of platinum onto zeolite followed by drying and calcination would be operated to ensure compliance with the requirements of a scheduled S6.4 B (a) process.

As discussed above, as we believe the calcination activity is a S4.2 A1 (c) process the permitting sector guidance for inorganic chemicals sector 4.03 is the document which defines the appropriate best practice guidance.

You must submit the applications forms A and F1 (which were submitted two variations out of date) in their correct current version

Completed Form A is attached with this response.

Submit an updated copy of Application Form, F1, which correctly references the correct application charge in Tables 2 and 3.

Completed form F1 is also attached. Please note in your not-duly-made letter you state that JM is entitled to a reduction in fees due to the process being an S6.4 Part B activity, however as we now believe that the activity is an S4.2 Part A1 activity the cost should increase due to this fee, and the impact of the habitats assessment fee.

The fee for a normal variation to a S4.2 activity for the production of a single inorganic chemical is £6,604. In addition, the fee for the assessment under the habitats Regulations, as highlighted in your letter, is £779. This comes to a total of £7,383.

As the previous sum paid was £6,682, we need to pay a balance of £701. A cash transfer for this amount will be arranged as soon as we can confirm this correct amount with you.

Outline the uses of the platinum/zeolite material within the Royston site and detail those scheduled activities within Table S1.1 in which the platinum/zeolite material may be used.

Platinum Zeolyte will be used in coating and calcination processes in the Clean Air business unit on the Royston site. The specific scheduled activities within which Platinum Zeolyte will be used is S6.4 B (a) coating and drying in the Fastcat production area, and S4.2 A1 (c) calcination also in the Fastcat production area. Please note that the S4.2 A1 (c) activity is incorrectly referred to as S4.2 A1 (d) in the current version of the Royston permit, we believe due to a historical administrative error, as explained in the response to the first query in the not duly made letter.

Demonstrate that the use of the platinum/zeolite material in other scheduled activities on site does not cause a changed environmental impact requiring a further variation to that/those scheduled activities.

The Platinum Zeolyte product is inert and the processing conditions within the coating and calcination processes in Clean Air (Fastcat) does not lead to any new emissions from PtZ as a raw material. As platinum zeolite is inert it does not interact differently to any other approved raw material at any stage of operations, highlighted in the previous answer, in the Fastcat process. Any material containing PtZ that is waste from Clean air operations is sent for PGM recovery using same recovery processes as currently used for existing Clean air wastes so there will be negligible loss of precious metals and this represents no change to environmental impacts from waste in Fastcat.

Should a further variation to other scheduled activities be required as a result of the use of the platinum/zeolite material, please submit that variation application.

No further variations to scheduled activities are required as per the responses to the previous two questions.

Confirm if the dryer/calcination unit is a new addition to the permitted process and demonstrate, if it is, that it represents BAT.

As the PTZ variation submission was structured in accordance with the Inorganic Chemicals 4.03 sector guidance, this submission should fully demonstrate compliance to the correct requirements of BAT throughout the document. As additional supporting evidence I have reviewed the sector guidance and listed any BAT requirements which specifically relate to the calcination activities.

S4.03 BAT reference	Description of requirement	Demonstration of BAT for Platinum Zeolite Calcination
1.1 Environmental performance indicators	You should where appropriate: 1. Monitor and benchmark your environmental performance, and review this at least once a year. Your plans for minimising environmental impacts should be incorporated into on-going Improvement Programmes. Indicators can be derived using the Horizontal Guidance Note H1 Environmental Risk Assessment (see GTBR Annex 1). It is suggested that indicators are based on tonnes of inorganics produced (tOP) as they provide a good basis for measuring performance within an installation or a single company year on year.	The contribution of the Platinum on Zeolite process will be included in the Process Catalysts Environmental KPIs; including addition of throughput to area UoP, and addition of calcination energy use overall annual energy use. This is included in the H1 assessment and detailed in 2.1 pf the PTZ variation document.
1.3 Energy efficiency	You should where appropriate: 1. Assess the environmental impact of each process and choose the one with the lowest environmental impact. (We recognise that your choice may be constrained, for example, by the integration of processes on a complex site).	There are no credible alternate options for the calcination stage. The electrical energy provided for all processes on the Royston site comes from either CHP, or is imported from certified renewable sources via the national grid. All impacts from this stage have been assessed using the H1 methodology. Please refer to section 2.5 of the PTZ variation document.
2.1 Design of a new process	You should where appropriate: 1. Consider all potential environmental impacts from the outset in any new project for manufacturing chemicals. 2. Undertake the appropriate stages of a formal HAZOP study as the project progresses through the process design and plant design phases. The HAZOP studies should consider amongst other things the points noted above.	Process is designed following the 6-stage hazard study process including the HAZOP study stage.
2.3 Plant systems and equipment	You should where appropriate: 1. Formally consider potential emissions from plant systems and equipment and have plans and timetables for improvements, where the potential for substance or noise pollution from plant systems and equipment has been identified. 2. Carry out systematic HAZOP studies on all plant systems and equipment to identify and quantify risks to the environment. 3. Choose vacuum systems that are designed for the load and keep them well maintained. Install sufficient instrumentation to detect reduced performance and to warn that remedial action should be taken.	Emissions from plant are considered during process design stages and HAZOP study.
2.4 Reaction stage	You should where appropriate: 1. With a clear understanding of the physical chemistry, evaluate options for suitable reactor types using chemical engineering principles.	Consideration of alternate processes was made at the design stage of the calcination process. It is not possible to achieve the fixing of the platinum onto the substrate

	<p>2. Select the reactor system from a number of potentially suitable reactor designs – conventional stirred tank reactor (STR), process-intensive or novel-technology - by formal comparison of costs and business risks against the assessment of raw material efficiencies and environmental impacts for each of the options.</p> <p>3. Undertake studies to review reactor design options based on process-optimisation where the activity is an existing activity and achieved raw material efficiencies and waste generation suggest there is significant potential for improvement. The studies should formally compare the costs and business risks, and raw material efficiencies and environmental impacts of the alternative systems with those of the existing system. The scope and depth of the studies should be in proportion to the potential for environmental improvement over the existing reaction system.</p> <p>4. Maximise process yields from the selected reactor design, and minimise losses and emissions, by the formalised use of optimised process control and management procedures (both manual and computerised where appropriate).</p> <p>5. Minimise the potential for the release of vapours to air from pressure relief systems and the potential for emissions of organic solvents into air or water, by formal consideration at the design stage - or formal review of the existing arrangements if that stage has passed.</p>	<p>via a wet chemical process. The use of a semi-continuous calcination process (rotary calciner) was ruled out as the material morphology did not allow for processing this way. The batch calcination process was therefore selected.</p>
<p>2.7 Chemical process controls</p>	<p>You should where appropriate:</p> <ol style="list-style-type: none"> 1. Monitor the relevant process controls and set with alarms to ensure they do not go out of the required range. 	<p>Temperatures in the calcination oven are measured and linked to a PLC</p>
<p>3.1 Point source emissions to air</p>	<p>You should where appropriate:</p> <ol style="list-style-type: none"> 1. Formally consider the information and recommendations in the BREF on Common Wastewater and Waste Gas Treatment/ Management Systems in the Chemical Sector (see Reference 1, Annex 2) as part of the assessment of BAT for point-source releases to air, in addition to the information in this note. 2. The benchmark values for point source emissions to air listed in Annex 1 should be achieved unless we have agreed alternative values. 3. Identify the main chemical constituents of the emissions, including VOC speciation where practicable. 4. Assess vent and chimney heights for dispersion capability and assess the fate of the substances emitted to the environment. 	<p>Emissions benchmarks listed in sector guidance have been considered and are referenced and discussed within the PTZ variation submission document.</p> <p>Emissions from the calcination stage will be extracted under negative pressure and treated in a caustic scrubbing system prior to point source emission. No VOCs are emitted. A dispersion model has been completed as a part of this submission.</p>
<p>3.4 Fugitive emissions - Fugitive emissions to air</p>	<p>You should where appropriate:</p> <ol style="list-style-type: none"> 1. Identify all potential sources and develop and maintain procedures for monitoring and eliminating or minimising leaks. 2. Choose vent systems to minimise breathing emissions (for example pressure/ vacuum valves) and, where relevant, should be fitted with knock-out pots and appropriate abatement equipment. 3. Use the following techniques (together or in any combination) to reduce losses from storage tanks at atmospheric pressure: <ul style="list-style-type: none"> • maintenance of bulk storage temperatures as low as practicable, taking into account changes due to solar heating etc. • tank paint with low solar absorbency • temperature control • tank insulation • inventory management 	<p>The drying and calcination oven operates under a drafted abatement system with a draft extract fan. Oven pressure is monitored, and this will be fed back to a PLC with alarms in the event of a fault including high pressure. The oven will be subject to routine preventative maintenance.</p>

	<ul style="list-style-type: none"> • floating roof tanks • bladder roof tanks • pressure/vacuum valves, where tanks are designed to withstand pressure fluctuations • specific release treatment (such as adsorption condensation) 	
3.7 Monitoring - Monitoring and reporting of emissions to air	<p>You should where appropriate:</p> <ol style="list-style-type: none"> 1. Carry out an analysis covering a broad spectrum of substances to establish that all relevant substances have been taken into account when setting the release limits. The need to repeat such a test will depend upon the potential variability in the process and, for example, the potential for contamination of raw materials. Where there is such potential, tests may be appropriate. 2. Monitor more regularly any substances found to be of concern, or any other individual substances to which the local environment may be susceptible and upon which the operations may impact. This would particularly apply to the common pesticides and heavy metals. Using composite samples is the technique most likely to be appropriate where the concentration does not vary excessively. 3. If there are releases of substances that are more difficult to measure and whose capacity for harm is uncertain, particularly when combined with other substances, then "whole effluent toxicity" monitoring techniques can be appropriate to provide direct measurements of harm, for example, direct toxicity assessment. 	<p>The emissions from process are defined in the PTZ variation document. The monitoring requirements are also defined in this document as per sector guidance. This includes the techniques to be used and the frequency of monitoring. In addition, JM will undertake emission monitoring of initial batches processed and report to the local EA inspector as a part of the commissioning process.</p>
Process variables	<p>You should where appropriate:</p> <ol style="list-style-type: none"> 1. Identify those process variables that may affect the environment and monitor as appropriate. 	<p>Temperature and pressure are monitored in the calcination stages</p>

Submit, using H1 risk methodology or otherwise, a detailed assessment of the aqueous discharge from PTZ production to demonstrate it cannot impact adversely on receiving waters.

This is a mistake in the Platinum on Zeolite variation document, the document should state there is no increase in caustic scrub liquor effluent rather than a negligible increase.

The emissions from the Platinum on Zeolite process do not represent any change in scale or inventory when compared to the emissions from existing coating and drying operations undertaken in Procat 1 and therefore will not generate any additional volumes of scrub liquor.

This is because production within the area is completed on a campaign basis and when the platinum on zeolite process is in production, the production campaigns of other products with similar emissions inventories will stop.

Submit a summary of the site environmental management system that includes the operation of the Procat1 plant in which the PTZ production will occur (often this can be in the form of a copy of the index of the environmental management system manual).

The Refining and Chemicals Europe (R&CE) Environmental Management System manual (JMC 700 001) gives an overview of how the R&CE EMS works and outlines key requirements including roles and responsibilities from a general perspective but doesn't really show the specific operations fit within the EMS.

The EMS Scope document (JMC 700 000) defines the activities and the boundaries of scope, including the specific reference to Procat processes to produce supported catalysts in the Royston

site section of the scope on page 2 "The development and manufacture of chemicals, supported catalysts, ..."

Both the Manual and the Scope documents are included as accompanying attachments, please note that the R&CE EMS system encompasses refining operations at the Brimsdown permitted installation in addition to operations at the Royston site.

Further responses to queries about the site dispersion model;

I have discussed the required changes to the existing dispersion model with our dispersion modelling consultants. They are confident that they can provide an updated dispersion model which meets all the discussed requirements by 15 July 2020 (-modelling of 7 LNR/LWS, -modelling impacts of N₂O, -modelling impacts of Ammonium Chloride, - modelling just the impacts of PTZ against baseline) provided we can confirm that the changes proposed below are acceptable and if we could get further detail, ideally including a map, regarding the locations of the local wildlife sites.

i) additional modelling of impacts to 7 local nature reserves and local wildlife sites within 2 km of site

The dispersion modelling consultancy was unable to locate the 7 sites provided in the list and have asked if more detail including a map could be provided such that they can assess the impacts at the boundaries of these locations. Once this information is available, assessing the impacts to these sites is a straightforward activity.

ii) requirement to re-assess derivation of EAL for Nitrous Oxide (N₂O). The Environment Agency now proposes that the applicant use a substance on the currently published EAL list that most closely represents the substance of interest and use that EAL in the screening process. If a suitable candidate parameter cannot be used, a hierarchy of source information should be considered which includes UK Expert Air Quality Standards (EPAQS) standards and guidelines and WHO Air Quality Guidelines for Europe.

We have followed the hierarchy of source information outlined in the question above and were not able to identify a suitable EAL using these information sources. Either no suitable levels were found or the source information lead proposed EALs which were far too lenient (eg use of WEL under reach hierarchy leading to a EAL of 183 mg/m³). We therefore propose to use the WEL of 183ug/m³ derived from the withdrawn guidance as this is far more stringent than any other that could be identified. Further details on the review are given below:

- Review of other substance on the current EAL list.

We have reviewed all substances on the current list and check for criteria including, chemical/molecular similarity, physical properties similarity and lastly for similarity of health or Environmental effects. Following this review most substances were screened out either for being dissimilar in chemical nature or for having a differing effect. Of the substances which were similar in chemical nature (containing nitrogen; ammonia, nitrogen dioxide, nitric acid) all were ruled out for having very different impacts to health and environment.

When comparing effects nitrous oxide does have an analgesic effect, of the other gaseous substances on the lists which may have similar effects Chloroform was ruled out as the effects of this substance have a much more severe impact than those of Nitrous oxide. Lastly Ethyl ether was mooted as a potential alternative. Although this substance is very different as it is an organic in nature, it does have anaesthetic effects and therefore could be considered similar from an impact's perspective. As both the long and short term EALs for this substance are less stringent than those derived from the WELs and used in the dispersion model, we would not proposed using this substance as an alternative; instead if no other substances could be found using the source hierarchy above we would propose to use the more stringent standards derived from the WELs.

- UK Expert Air Quality Standards

A search of literature from EPAQS was conducted on the national archives. The front pages of the EPAQS information showed links to information for PM_{2.5}, halogens, 1,3 butadiene, particulates, poly aromatic hydrocarbons, lead, nitrogen dioxide, carbon monoxide, ozone, and benzene. None of these substances have similar impacts to those of Nitrous oxide and are therefore discounted. A further search of the National Archives for nitrous oxide EPAQSI highlighted several links to the archives' glossary for nitrous oxide, however this was in reference to being a greenhouse gas; these impacts are assessed elsewhere in the application and H1 assessment. This search did also highlight a link to an EPAQS meeting minutes in 2003 where nitrous oxide is mentioned as a priority substance in the other category, however no mention of air quality targets or Environmental assessment levels is made, nor is any comparison suggested to other similar gases. Therefore, no assessment levels are proposed following the review of EPAQS information.

- WHO Air Quality Guidelines for Europe

A review of WHO Air quality guidelines gives brief reference to nitrous oxide during a discussion of the impacts of nitrogen dioxides and ammonia on vegetation. No specific information regarding nitrous oxide impacts or critical levels is made, instead more focus is given to nitrogen dioxide and ammonia.

- Lastly, we also considered the value discussed in our teleconference on 18 May 2020, source from the Reach no effect concentration.

A review of the information in the paper Derived No-effect Levels (DNELs) under the European Chemicals Regulation REACH—An Analysis of Long-term Inhalation Worker-DNELs Presented by Industry from The Annals of Occupational Hygiene, Volume 59, Issue 4, May 2015, Pages 416–438, the paper suggests a worker Derived No-Effect Level (wDNEL) of 183 mg/m³.

This is the same value as listed in the current EH40, and which was used in the derivation of the EAL for nitrous oxide in the JM Royston dispersion model (1830 µg/m³ for long term EAL and 54,900 for short term EAL) which followed the withdrawn guidance.

In terms of use as an EAL it does not appear appropriate to use 183 mg/m³ as it is significantly higher the values previously used as an EAL. We therefore propose to continue using the more stringent values of 1830 µg/m³ for long term EAL and 54,900 for short term EAL.

iii) requirement to review and propose EAL for Ammonium Chloride (NH₄Cl).

- Following the hierarchy of source information, we were able to identify a suitable alternate substance on the current EAL list for impacts to health.

Ammonium Chloride is a non-harmful particulate therefore we propose to assess the health impacts of this substance as an additional particulate emission from the site.

CERC have also confirmed that the model can be set up to include the nitrogen deposition impacts to the local receptors.

It should be noted that there are no emissions of Ammonium Chloride from the platinum on zeolite process, instead this substance is included in the dispersion model as the emissions from the entire permitted installation. Therefore, this variation proposal will not alter the emissions or impacts or ammonium chloride from the installation.

Clarification needed on how the consultant has derived the emission rates used in the model, including relevant data, such as pollutant concentrations, normalised volume flows, actual oxygen and moisture levels used to adjust volumetric flows.

The dispersion model is split into 3 scenarios. Following ongoing discussions with the Environment Agency we understand that it is confusing to understand which scenario is relevant to the new Platinum on Zeolite process. Furthermore, none of the scenarios model the impacts of Platinum on Zeolite process alone upon the installation.

This is an oversight as scenario 2 captures the impacts of Platinum Zeolite along with the impacts of several other proposed minor changes. The rationale for this being that this would act as a worst-case scenario against which the H1 assessment could be made, particularly as the main concern was the addition of a new emission substance, Nitrous Oxide, and the Platinum on zeolite process is the only one which would emit this substance.

To correct this, we will ensure the dispersion model is revised with a new scenario which captures just the impact of the platinum on zeolite process, so this can be assessed against the base case. CERC have confirmed that this revision to the dispersion model can be completed by the target date listed above, 15 July 2020.

Further explanation of the model scenarios is provided below, but in addition I include a supporting data file which describes the stack reference conditions, used to derive the mass emissions, and the actual stack flow rates, used to calculate the efflux velocities. This file also references the source data used to compile the report.

Further explanation:

Scenario 1 represents a baseline of the current emissions inventory from the permitted installation.

Scenario 2 represents the current emissions inventory plus the additional emissions from the proposed platinum on zeolite process and from a proposed new precious metals refinery

Scenario 3 represents a future situation with the existing refinery decommissioned.

For the purposes of the impacts modelling for the platinum on zeolite process, the impacts from scenario 2 represent the impacts to air from the installation, for this variation.

The data from scenario comes from historical emissions monitoring results for existing emissions points, and from process design data for proposed new processes like the platinum on zeolite process.

The dispersion model uses mass emission rates and stack efflux velocities to predict concentrations of substances at local receptors.

For mass emissions rates, the data is taken directly from the measured rates, if the data is presented in the report in this format (for Exova Catalyst Ltd emission monitoring reports) or calculated from the pollutant concentration and flows at the standard reporting conditions (for RPS Ltd). The concentrations and flows at the standard reporting conditions are used to ensure there is no multiplication errors between standardised and non-standardised concentrations and flows.

For efflux velocities the actual stack volume flows are used without any correction for moisture, temperature or oxygen to ensure the actual efflux velocity is reported.

The only exception to this requirement is for 8 stacks (A230, A231, A8a, A8b, A13, A15, A16, A3) which have emissions temperatures significantly above ambient temperature. As the temperature measurement for these stacks takes place in the stack monitoring location, usually at the base of the stack, and not the point of efflux, a correction for temperature had been made whereby it is assumed that half of the temperature above the ambient temperature is lost. This is to ensure that the worst-case temperatures and flows are used when modelling the efflux velocities. Please note

this correction does not impact upon the mass emission rates as the flows and concentrations at standardised conditions are used. Furthermore, none of these emission points are relevant to the Platinum Zeolite process to the contribution from these stacks is not impacted or changed by this variation.



Ben Halliday
Environmental Engineer
Johnson Matthey
Orchard Road
Royston
SG8 5HE
T +44(0)1763 253161
M +44(0)7967 278458
hallib@matthey.com