

# Permitting decisions

## Variation

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We have decided to grant the variation for Royston Site operated by Johnson Matthey plc.

The variation number is EPR/BT7086IJ/V015.

We consider in reaching that decision we have taken into account all relevant considerations and legal requirements and that the permit will ensure that the appropriate level of environmental protection is provided.

### Purpose of this document

This decision document provides a record of the decision making process. It:

- highlights key issues in the determination
- summarises the decision making process in the decision checklist to show how all relevant factors have been taken into account
- shows how we have considered the consultation responses.

Unless the decision document specifies otherwise we have accepted the applicant's proposals.

Read the permitting decisions in conjunction with the environmental permit and the variation notice. The introductory note summarises what the variation covers.

### Key issues of the decision

#### Process Description.

This permit authorises a new process to be carried out on the Johnson Matthey plc Royston site which will be located in its existing Procat 1 building. The plant will produce a platinum on zeolite (PTZ) support using processing techniques which are similar to existing processes undertaken in the Procat 1 building and elsewhere on site.

The process will involve impregnation of platinum (from platinum nitrate solution) onto an inert carrier using similar technology to that already used in Procat 1. Following the impregnation step a drying and calcination step will reduce and fix the platinum onto the inert carrier.

The specific chemical reactions associated with the impregnation and drying/calcination steps are outlined in the following section, "Chemical Reactions".

These products will be used in the manufacture of light duty diesel vehicle auto catalyst technologies elsewhere onsite. The key benefit of PTZ will be that it will reduce vehicle nitrous oxide (N<sub>2</sub>O) emissions and remove ammonia (NH<sub>3</sub>) emissions in the ammonia slip catalyst. The overall system has an increased conversion of exhaust gas to nitrogen and water.

The air emissions from the drying and calcination step of the new process will be controlled with existing abatement systems including caustic scrubbing and bag filtration. The main process emissions will be directed to the existing Procat stack, A11. During drying and calcination steps the process will emit:

- Oxides of nitrogen ( $\text{NO}_x$ ), which stack A11 is already authorised to release. There will be no increase in the permitted emission limit value for  $\text{NO}_x$  releases from A11 as a result of this variation;
- Nitric acid ( $\text{HNO}_3$ ) which, because of its low volatility, current operation and monitoring indicate is completely removed in the existing scrubbing abatement plant and demister;
- Nitrous oxide ( $\text{N}_2\text{O}$ ), which will be a new permitted release from stack A11.

Acetic acid which is also released from stack A11 is not affected or changing as a result of this new process and its emission limit value remains as  $50 \text{ mg/m}^3$  following this permit variation.

### **Process Operation and Control.**

The PTZ process is an operation that uses relatively small amounts of reagents – 4 tonnes of zeolite and 1.85 tonnes of platinum nitrate per annum. Although the amount of material that can be lost to the environment is low, the operation has controls in place to ensure any risk of loss is minimised. This is especially required as platinum nitrate is very toxic to aquatic life with long lasting effects

All raw materials used in the PTZ process are on the existing Royston Installation raw materials list for the Procat 1 building.

Dispensing of platinum nitrate solution into a transport vessel will take place in a fume cupboard within a bunded area inside the dispensing building with quantities of platinum nitrate limited to approximately 10 litres at any one time. All effluent gulleys within this dispensing area root to the onsite Johnson Matthey trade effluent treatment plant, via trade effluent drains, for processing prior to discharge to sewer

The platinum nitrate solution is transported to the Procat building from the existing dispensing building on a pallet on a fork lift truck and travels approximately 200m on the site roadways. These roadways are tarmac or concrete and there is no unmade ground present in the vicinity of the transit route. Local spillage kits are also available and staff are trained in their use.

Once in the Procat building, the platinum nitrate (maximum 10 litres) is transferred into a dilution flask with capacity of at least 100 litres under vacuum in a bunded area. A pre-measured volume of water is added to the dilution vessel. A visible mark on the outside of the glass vessel indicates the level of dilution water to use.

The zeolite material is brought into the Procat building from its existing storage location in 75 kg capacity plastic drums on pallets by forklift truck and travels around 5-10 metres. The contents of the drums are transferred into polythene bags in a dedicated decanting booth. The zeolite is then transferred into the impregnator vessel from the polythene bags. The impregnator has a new mobile extraction system which loads zeolite to a small hopper (with approximately 2kg zeolite capacity). The transfer system exhausts through a new barrier filter and new High Efficiency Particulate Arrestance (HEPA) filter. The transfer system ensures transfer of zeolite to the hopper under negative pressure to prevent diffuse emissions of particulates into the Procat 1 workplace during loading operations.

The diluted platinum nitrate solution will be transferred into the impregnator vessel via a vacuum flask which represents no change for existing liquid transfer processes within the Procat 1 building. The nominal capacity of the vacuum flask is approximately ten times larger the volume of platinum nitrate used which is weighed out in advance so over filling of the vacuum flask is not envisaged. The vacuum system is protected by a new local catch pot and also an existing vacuum catch-pot with high level protection to shut off the vacuum system. The capacity of the impregnator is approximately twice the capacity of the vacuum flask so over filling the impregnator with dilute platinum nitrate solution from the vacuum flask and causing a loss of containment is not expected.

Following impregnation of platinum onto zeolite, the wet zeolite will be loaded into trays for drying and calcination within an existing local exhaust ventilation dust booth served by a bag filter. There will be no change to the existing material handling operation within the Procat building.

Where there is a change in operation of the Procat building is in the use of the new calcination oven which is connected to the existing scrubbed draught system and operated under negative pressure to prevent fugitive emissions. The calcination oven is fitted with control instrumentation to monitor process temperatures utilising ten thermocouples – seven of which are used to monitor and control oven internal temperatures. The thermocouples detect when conditions have moved outside set limits to give audio and visual alarms when appropriate. As an additional precaution the remaining three thermocouples are used to raise an extra high temperature alarm and initiate automatic power isolation of the oven where necessary, to safeguard against high temperature events.

### **Permitted Activities:**

During the application process, it was agreed with the applicant that there were errors in both the permitted activities being requested by this permit variation and the existing activities permitted within Table S1.1 of the permit.

In the application, the operator had proposed the PTZ process should be permitted as an S6.4 B (a) process relating to a coating activity. Upon further detailed review of the nature of the PTZ process, it was agreed that it should be permitted under an S4.2 A (1) (c) activity as it was essentially a manufacturing activity involving the use of compounds of platinum.

The chemical reactions involved in the process stages of impregnation sand drying/calcination are included in the following section, “Chemical Reactions”.

Although a manufacturing activity involving platinum compounds would be classified as S4.2 A (1) (c) (viii), the permit variation lists the specific scheduled activity as S4.2 A (1) (c) as other permitted processes carried out by Johnson Matthey on the Royston site already use compounds of other metals listed in S4.2 A (1) (c) (i)-(xi).

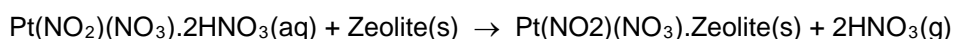
This permit variation also requested the correction of an error in Table S1.1. Existing calcination activities carried out in the Fastcat and Zeocat plants were described as S4.2 A (1) (d) activities - recovering any compound of cadmium or mercury. This was incorrect as the nomenclature in activity S4.2 changed with implementation of The Environmental Permitting (England and Wales) Regulations 2016 and the permit had not been updated to reflect this change. The operations authorised in the permit as S4.2 A (1) (d) activities are actually S4.2 A (1) (c) activities and Table S1.1 should have been updated in 2016 to reflect this change. This has been done in this variation. Although the activity reference has been changed, the nature of the operations have not.

In changing the activity from S4.2 A (1) (d) to S4.2 A (1) (c) there is a risk that existing permitted operations involving the other platinum group metals (and in particular rhodium nitrate) would now become unpermitted as rhodium compounds are not explicitly listed in S4.2 A (1) (c) (i-xi).

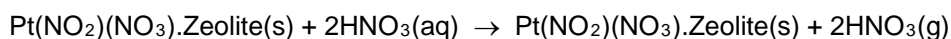
To address this, these operations involving the other platinum group metals are now permitted under activity, S4.2 A (1) (f) – an activity likely to result in the release into air of any acid-forming oxide of nitrogen. No operation has changed nor no new operation added to the permitted operations as a result of this change.

### **Chemical Reactions.**

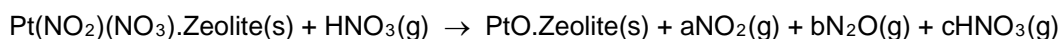
#### **Step 1. Impregnation:**



#### **Step 2. Drying and Calcination:**



The operator states that the stoichiometry of the decomposition during calcination is not yet fully understood, however, from development trials the proportion of N<sub>2</sub>O and N<sub>2</sub>O in the off-gases is given in the equation below



aq. = aqueous solution; s = solid; g = gas

Gas mass fractions:

a = 87% NO<sub>2</sub>; b = 3% N<sub>2</sub>O; c = 10% HNO<sub>3</sub>

### **Best Available Techniques (BAT) Assessment.**

The operator has carried out a number of BAT assessments against the applicable guidance. As the raw materials storage and handling, impregnation processes and drying processes are already permitted, the only significant change appropriate to the PTZ process is the addition of a new calcination stage. The operator carried out a BAT Assessment of this new calcination stage against the requirements of guidance document, "How to comply with your environmental permit. Additional guidance for the Inorganic Chemicals Sector (EPR 4.03)".

- 1.1 (Environmental performance indicators):
  - The contribution of the PTZ process will be included in the Johnson Matthey (JM) Process Catalysts environmental KPIs; including addition of throughput to area UoP,(units of production) and addition of calcination energy use to overall site annual energy use.
- 1.3 (Energy efficiency):
  - JM ascertained there are no credible alternate options for the calcination stage. The electrical energy provided for all processes on Royston site comes from either CHP or is imported from certified renewable sources via the national grid.
- 2.1 (Design of a new process):
  - JM have designed the process following the 6-stage hazard study process including the HAZOP study stage.
- 2.3 (Plant systems and equipment):
  - JM have considered emissions from plant during process design stages and HAZOP study.
- 2.4 (Reaction Stage):
  - JM considered alternative processes at the design stage of the calcination process. JM evaluated it was not possible to achieve the fixing of the platinum onto the zeolite substrate via a wet chemical process. The use of a semi-continuous calcination process (such as a rotary calciner) was ruled out as the material morphology did not allow for processing in that manner. JM therefore selected a batch calcination process.
- 2.7 (Chemical process controls):
  - Temperatures in the calcination oven are measured and linked to a programmable logic controller (PLC).
- 3.1 (Point source emissions to air):
  - JM considered emissions benchmarks listed in sector guidance. 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.
- 3.4 (Fugitive emissions to air):
  - 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 is subject to routine preventative maintenance.

- 3.7 (Monitoring and reporting of emissions to air):
  - Process chemistry calculations have been carried out to define the expected emissions from the calcination process. The monitoring requirements are based on sector guidance including the techniques to be used and the frequency of monitoring. In addition, JM have committed to undertaking emission monitoring of initial batches processed and to report results as a part of the commissioning process.
  - Temperature and pressure are monitored in the calcination stages

We are satisfied that the calcination process to fix impregnated platinum onto zeolite represents BAT.

The emission limit values (ELVs) for releases from A11 proposed by the operator are the higher concentration limit of those that are listed as Emission Benchmarks in Annex 1 (Emissions to air associated with the use of BAT) of “How to comply with your environmental permit. Additional guidance for the Inorganic Chemicals Sector (EPR 4.03)”.

These are:

- Nitrogen oxides (acid-forming as NO<sub>2</sub>)
  - Emission benchmark (Annex 1) 50\* – 200^ mg/Nm<sup>3</sup>
  - Emission Limit Value proposed 200 mg/Nm<sup>3</sup>
    - \* = selective catalytic reduction (SCR).
    - ^ = wet scrubbing.
- Nitrous oxide (N<sub>2</sub>O)
  - Emission benchmark (Annex 1) 200# mg/Nm<sup>3</sup>
  - Emission Limit Value proposed 200 mg/Nm<sup>3</sup>
    - # = selective non catalytic reduction (SNCR).

The existing ELVs for release point A11 are:

- 200 mg/m<sup>3</sup> for oxides of nitrogen (expressed as NO<sub>2</sub>)
  - The new proposed ELV would not result in a less prohibitive limit;
- 50 mg/m<sup>3</sup> for acetic acid
  - There is no new ELV proposed as acetic acid is not an emission from the PTZ process and this limit would therefore remain.

From the application documentation, it appeared that the operator had chosen to exhaust gaseous emissions from the PTZ process through the existing wet scrubber abatement as it would achieve existing ELVs and air dispersion modelling indicated no impact on receptors at those concentrations rather than because it was BAT for gaseous treatment.

During the determination, the matter of whether it was BAT to use existing wet scrubbing abatement was considered further.

### **Abatement of Nitrogen Oxides (NO and NO<sub>2</sub>):**

The operator referenced the Best Available Techniques (BAT) Reference Document for Common Waste Water and Waste Gas Treatment/Management Systems in the Chemical Sector (CWW) 2016. This BREF document notes that the advantages of wet scrubbing include high abatement efficiencies for pollutant removal (Table 3.173) with typical efficiencies of >95% for many pollutants (Table 3.170). Wet scrubbing towers maintain these levels of efficiency when at low concentration ranges of pollutants, where other technologies (e.g., SCR) perform much better with consistently higher input concentrations.

The caustic scrubbing system which serves Procat 1 building is an existing system which achieves the emissions limits that are within the benchmark figures for NO<sub>x</sub> as stated in the Annex 1 of the inorganic chemicals sector guidance (EPR 4.03). In addition to the PTZ process, this scrubber also serves several

other existing permitted processes in Procat 1 and the Fine Chemicals Plant. The scrubbing tower is subject to existing preventative maintenance programmes.

The operator proposes that wet scrubbing is an effective means of capturing oxides of nitrogen as both NO and NO<sub>2</sub> are soluble in water and are neutralised in a caustic scrubbing media to form dissolved salts.

The operator notes that SCR is used elsewhere on their Royston site, within the Clean Air Sector, and is applied to large-scale production line areas which have been built as new processes. The typical cost allowed for the implementation of a new SCR abatement system is estimated at £2 million.

Table 3.290 in CWW 2016 outlines the economic costs associated with the selective reduction of NO<sub>x</sub>.

Investment costs, in euros, for SNCR are proposed to be 2,500 – 10,000 (per 1,000 Nm<sup>3</sup>/hour) and for SCR are 10,000 – 83,000 (also per 1,000 Nm<sup>3</sup>/hour).

The flowrate through the Procat 1 abatement plant is approximately 21,000 m<sup>3</sup>/hour.

The indicative costs of selective reduction of NO<sub>x</sub> applied to the abatement of gases from Procat 1 building would be:

- SNCR: 52,500 – 210,000 euros;
- SCR: 210,000 – 1,750,000 euros.

The upper value of the range for implementation of SCR in this Table is of the same financial order of magnitude that Johnson Matthey would allow for implementation of a new SCR abatement system.

The CWW 2016 further states in 3.5.1.5.3 that “A key cost-effectiveness parameter in the case of SNCR is the consumption of ammonia or urea; in the case of SCR, it is the catalyst as well as ammonia or urea. The retrofitting of SNCR is relatively easy because there is no equipment to install other than the injection items and the storage tank for the reagent. Retrofitting of SCR units can require radical modifications of the existing installation and thus demand high investment costs.”

For the operator to install and operate SNCR or SCR on the abatement of emissions from the Procat 1 building would have potentially significant costs impacting on the viability of a relatively small-scale process such as PTZ casting doubts on whether the material could viably be produced.

SCR has considerable space requirements, as outlined within the disadvantages of SCR in Table 3.289 of CWW2016. The operator has discussed this with their Clean Air Sector and believes that the typical footprint of an SCR unit installed is 500 m<sup>2</sup> (10 metres by 50 metres). The operator proposes that there is insufficient space existing within the Procat 1 building in which to install an SCR unit.

For reasons of required expenditure and required footprint, the operator has discounted SCR as a viable abatement option for the PTZ process.

In the air dispersion modelling report submitted, the operator screened out the release of NO<sub>x</sub> as not significant. We have reviewed their report and conclusions and we note that, although the human and ecological impacts from the plant as a whole are not insignificant and our worse-case predictions are higher than the operator's, the incremental increase for the addition of the proposed platinum/zeolite process is negligible compared to existing impacts.

The operator noted that the mass release of NO<sub>x</sub> from stack A11 increased from a current baseline of 0.136 g/s to 0.144 g/s with implementation of the PTZ process. As this gave no perceptible difference in the PCs/PECs for the two scenarios, they presented only the one set of results to cover both scenarios.

This is shown in the table below.

Year	Standard	Measurement	Objective Value	PC (NOx)	PC (NO <sub>2</sub> ) <sup>(A)</sup>	PC (% of EAL)	Background NO <sub>2</sub> <sup>(B)</sup>	PEC NO <sub>2</sub>	PEC % of objective	x location	y location
2014	Short-term AQO	99.79th percentile of hourly averages	200	271	95	48	32.8	128	64	534920	241290
	Long term AQO	Annual average	40	6.8	4.8	12	16.4	21.2	53	534920	241320
2015	Short-term AQO	99.79th percentile of hourly averages	200	270	95	48	32.8	128	64	534920	241290
	Long term AQO	Annual average	40	6.8	4.8	12	16.4	21.2	53	534920	241320
2016	Short-term AQO	99.79th percentile of hourly averages	200	303	106	53	32.8	139	70	534920	241290
	Long term AQO	Annual average	40	7.6	5.3	13	16.4	21.7	54	534920	241320
2017	Short-term AQO	99.79th percentile of hourly averages	200	263	92	46	32.8	125	63	534920	241290
	Long term AQO	Annual average	40	9.5	6.7	17	16.4	23.1	58	534920	241320
2018	Short-term AQO	99.79th percentile of hourly averages	200	270	95	48	32.8	128	64	534680	241320
	Long term AQO	Annual average	40	7.5	5.3	13	16.4	21.7	54	534860	241290

(A) 35% of short-term NOx PC and 70% of long term NOx PC

(B) Adding double the annual average background concentration to the 99.79th percentile of hourly averages

The dispersion model shows that emissions of NO<sub>x</sub> are within long and short term air quality objectives (AQOs).

We agree with the operator that as the emission of NO<sub>x</sub> from the PTZ process has a negligible impact compared with existing NO<sub>x</sub> emissions and there is no requirement to install additional abatement for NO<sub>x</sub> releases at this time. The oxides of nitrogen emission limit for emission point A11 has been set at the benchmark level of 200 mg/m<sup>3</sup>.

#### **Abatement of Nitrous Oxide (N<sub>2</sub>O):**

The operator notes that nitrous oxide (N<sub>2</sub>O) is not abated by caustic wet scrubbing. However they confirm that the PTZ process does not emit significant quantities of nitrous oxide. Monitoring of the emissions during process trials has shown that there is a small peak in nitrous oxide, less than 5 mg/m<sup>3</sup>, in the exhaust from the PTZ oven, at the start of the calcination stage which lasts for less than half an hour. When averaged over an hourly period, this equates to less than 1mg/m<sup>3</sup> discharged from release point, A11.

The operator stated this value was considerably lower than BAT emissions benchmarks in literature such as:

- In the inorganic chemicals sector guidance EPR 4.03, the nitrous oxide emissions benchmark, defined in Annex 1 is 200 mg/m<sup>3</sup>;
- In the CWW 2016, it is stated that 100 mg/m<sup>3</sup> nitrous oxide emissions can be achieved with the use SNCR with a 95% efficiency (Table 3.291).

The operator concludes that, although nitrous oxide is not abated by wet scrubbing with caustic media, the emissions concentrations observed by the process are very low and therefore use of SNCR specifically to further reduce emissions from the PTZ process is not justified as the emissions are already below the emissions to air associated with the use of BAT from EPR 4.03 (Annex 1).

In addition, the operator notes that SNCR requires a very high operating temperature with a very precise optimal reaction temperature (CWW 2016, Table 3.289, Disadvantages of SNCR) which is significantly higher than the off gas temperature from the PTZ process.

The operator contended that use of SNCR was not justified for further reduction of nitrous oxide emissions.

The operator has demonstrated in their air dispersion modelling report that emissions of nitrous oxide screen out as insignificant. In their assessment, the release of nitrous oxide is considered as a new release. There is no current baseline scenario as nitrous oxide is not currently released through stack, A11. Originally, in the absence of an environmental assessment level (EAL) standard for nitrous oxide, the operator derived such a standard from work place exposure limits (WELs). This methodology was rescinded in 2016 and now, in the absence of an EAL, we ask the applicant to use the following hierarchy in determining an appropriate assessment level for the emission in question:

- Use of a suitable alternative substance on the current EAL list;
- UK Expert Air Quality Standards (EPAQS) standards and guidelines 1;
- WHO Air Quality Guidelines for Europe;
- Tolerable concentrations in air (TCA) derived according to the Environment Agency hazard characterisation method to derive tolerable concentrations in air;
- Environment Agency health criteria values for inhalation 2;
- Derived no effect levels using risk assessment guidance to support REACH;
- Tolerable concentrations in air derived using the Calabrese & Kenyon approach to deriving ambient air level goals.

The operator reviewed the potential EALs for nitrous oxide against this list.

- They reviewed all substances on the current list using criteria such as chemical/molecular similarity, physical properties similarity and similarity of health or environmental effects. Following this review, they screened out most substances 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, they noted nitrous oxide does have an analgesic effect and, 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. They considered ethyl ether 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 limits previously derived from the WELs and used in the dispersion model, the operator did not propose using it as an alternative. If no other substances could be found using the source hierarchy, they would propose to use the more stringent standards previously derived from the WELs.

- They searched literature from EPAQS and reviewed information on PM2.5, halogens, 1,3 butadiene, particulates, poly aromatic hydrocarbons, lead, nitrogen dioxide, carbon monoxide, ozone, and benzene. None of these substances had similar impacts to those of nitrous oxide and were discounted. Information that could be found on nitrous oxide related solely to it being a greenhouse gas. This search did also highlight a link to an EPAQS meeting minutes in 2003 where nitrous oxide was mentioned as a priority substance. However no mention of air quality targets or environmental assessment levels is made, nor is any comparison suggested to other similar gases. Therefore, the operator proposed no assessment levels following the review of EPAQS information.
- They reviewed WHO Air quality guidelines and found 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.
- They reviewed 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. This paper suggests a worker Derived No-Effect Level (wDNEL) of 183 mg/m<sup>3</sup>.

This is the same value as listed in the current EH40 document (Workplace Exposure Limits) which the operator used in their derivation of the EAL for nitrous oxide in the dispersion model (1830 µg/m<sup>3</sup> for long term EAL and 54,900 for short term EAL). In terms of its use as an EAL, the operator believed it was not appropriate to use 183 mg/m<sup>3</sup> as it was significantly higher than values they previously used as an EAL. They proposed to continue using the more stringent values of 1830 µg/m<sup>3</sup> for long term EAL and 54,900 for short term EAL. We accepted these levels as the most appropriate they could derive for nitrous oxide. Using these EALs, the emissions of nitrous oxide screened out as insignificant (maximum impact). The process emissions of N<sub>2</sub>O are not significant when compared to derived targets for both long and short term emissions scenarios.

Year	Standard	Measurement	EAL	PC	PC (% of EAL)	Significant	x location	y location
2014	Short-term EAL	Max hourly average	54,900	293	0.5	No	534680	241650
	Long term EAL	Annual average	1,830	0.03	<0.1	No	534860	241680
2015	Short-term EAL	Max hourly average	54,900	304	0.6	No	534680	241650
	Long term EAL	Annual average	1,830	0.03	<0.1	No	534860	241680
2016	Short-term EAL	Max hourly average	54,900	200	0.4	No	534680	241650
	Long term EAL	Annual average	1,830	0.03	<0.1	No	534950	241620
2017	Short-term EAL	Max hourly average	54,900	209	0.4	No	534680	241320
	Long term EAL	Annual average	1,830	0.03	<0.1	No	534950	241620

Year	Standard	Measurement	EAL	PC	PC (% of EAL)	Significant	x location	y location
2018	Short-term EAL	Max hourly average	54,900	282	0.5	No	534650	241620
	Long term EAL	Annual average	1,830	0.02	<0.1	No	534950	241620

As releases of nitrous oxide screen out as insignificant and as the monitored concentrations of nitrous oxide are significantly less than those detailed as benchmark limits in EPR 4.03, it is not appropriate that the operator be required to install further abatement for nitrous oxide releases. The nitrous oxide emission limit for emission point A11 has been set at the benchmark level of 200 mg/m<sup>3</sup>.

We have included an Improvement Condition (IC18) requiring the operator to report the results of their commissioning on the PTZ process, including monitoring results of nitrous oxide and nitrogen dioxide, along with a plan of additional appropriate measures to be taken should commissioning trials indicate that emissions from and operation of the PTZ process is not that outlined in the application and used as the basis of screening out environmental impact.

### **Aqueous Discharges:**

In the application, the operator contended that there would be no change in the aqueous emissions from the site due to the new PTZ process. This was because, being a batch process, the aqueous releases from the PTZ process would replace those from other existing processes within the Procat 1 building that will not take place when the PTZ process is on line. However this would only be strictly true if the aqueous emissions from the PTZ process were exactly the same as those from the replaced processes. The operator agreed this could not be guaranteed and carried out an assessment of aqueous releases.

The emissions from PTZ will result in a slight increase in volume and add a small amount of sodium nitrite and sodium nitrate to the trade effluent. The caustic scrubbing of the nitrogen dioxide and nitric acid will create sodium nitrate and sodium nitrite in the scrub liquor effluent as per the reactions shown below:

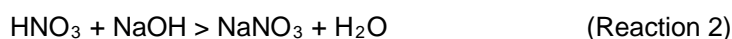
The operator carried out chemical engineering calculations to predict the volume of effluent created from the PTZ process. They assumed a scrubbing efficiency of 95% for NO<sub>2</sub> and 100% for HNO<sub>3</sub> has been assumed to act as a worst-case estimate of pollutants captured by the scrubber and ultimately being sent to site trade effluent.

For each batch of PTZ produced, the operator noted that development trials predict 5.32 kg of NO<sub>2</sub> and 0.39 kg of HNO<sub>3</sub> would be emitted to the scrubbed draught. These figures were converted to molar quantities and using the scrubbing efficiencies and the reactions described below were then converted to molar quantities of reaction products created during scrubbing process. The same information was used to calculate a molar quantity of sodium hydroxide consumed by the scrubber per batch.

Nitrogen dioxide (NO<sub>2</sub>):



Nitric Acid (HNO<sub>3</sub>):



The resulting molar quantities were then converted back to mass quantities to allow a concentration in the final effluent to be calculated.

On an annual basis the operator calculated that the PTZ process will increase the trade effluent discharge volumes by 6.012m<sup>3</sup> per year to 46,325.012 m<sup>3</sup> representing an increase in volume of 0.01%.

The average concentrations of pollutants from the PTZ process in trade effluent would then be 2.946 mg/l nitrite and 4.418 mg/l nitrate. In the discharge from the Royston sewage treatment works after treatment (to

which effluent from the Johnson Matthey Royston site is discharged), this would be equivalent to 0.085 mg/l nitrite & 0.127 mg/l nitrate.

There are no thresholds currently for nitrate or nitrite in relation to protection of aquatic life under the Water Framework Directive. The operator reviewed information on nitrates and nitrites in water courses from the Environment Agency, DEFRA and World Health Organisation. This indicated that most thresholds for these substances have been derived in relation to drinking water protection and human health. Although these are only really relevant if they relate to a watercourse that may be of concern in relation to abstraction for potable supply, they might be the most appropriate way to assess the potential impact of nitrate and nitrite in this case.

The operator proposed assessing potential impact of nitrate and nitrite against WHO guidelines for nitrate and nitrite in drinking water of 50mg/l and 3mg/l respectively.

In the case of nitrate releases, the operator demonstrated that, using the WHO guidelines as a threshold, its impact on receiving waters would not be significant as for both the annual average environmental quality standard and the maximum allowable concentration environmental quality standard, the release concentration was less than 10% of the relevant standard.

In the case of nitrite releases however, these did not immediately screen out as insignificant against WHO drinking water standards and further assessment using background nitrite levels in the receiving water would be required. Neither the operator nor ourselves were able to access any background nitrite levels in literature for the receiving waters in question. In the absence of this information, it is proposed to use 50% of the WHO drinking water standard as the background – 1.5mg/l. using this value, the discharge of nitrite screens out in our H1 risk assessment tool under Tests 3, 4a and 4b, indicating that detailed modelling is not required.

The operator did propose two potential alternative background levels of nitrite that could be used in the assessment:

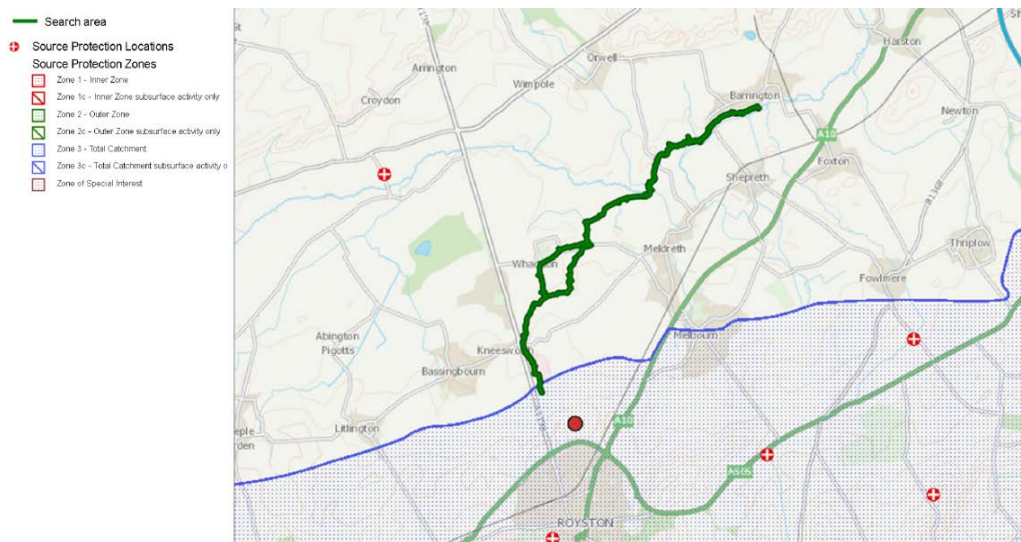
- A WHO document (Nitrate and nitrite in drinking water. Background document for development of WHO guidelines for drinking water quality) which stated that typical nitrite concentrations are <0.1mg/l with a maximum value of 0.21mg/l detected in the Netherlands;
- Document "Macronutrient status of UK groundwater: nitrogen, phosphorus and organic carbon" by M.E. Stuart and D.J. Lapworth that made specific mention of levels in the Great Ouse catchment area which is near to the North Hertfordshire/South Cambridgeshire area. In this document the maximum background nitrite concentration of groundwater was listed as 0.101 mg/m<sup>3</sup>.

Using both these maximum values as a nitrite background concentration, the release of nitrite from Johnson Matthey also screens out at Tests 3, 4a and 4b of the H1 risk assessment tool.

There is one other standard against which the operator could have assessed their nitrate and nitrite releases and that is the EU Drinking Water Directive which has a standard of 50 mg/l for nitrate (equivalent to the WHO standard) and 0.5 mg/l nitrite (lower than the WHO standard). In this case, the nitrite would not have screened out and further modelling would have been required.

However, as these standards and thresholds apply to water at the point of consumption (household tap for example) they are not directly relevant to the protection of aquatic life.

There is no direct discharge of Johnson Matthey effluent to groundwater and no potential for that discharge to impact on any potable water abstraction boreholes. We have reviewed the discharge location of the receiving waters for the Johnson Matthey effluent and are satisfied that the water course is not used for potable water abstraction.



We agree with the operator's conclusions that the aqueous discharge of nitrate and nitrite will not impact on receiving waters.

We have included an improvement condition (IC19) requiring the operator to sample and monitor for nitrate and nitrite both the aqueous discharge released from their site and the receiving waters downstream from Royston waste water treatment works to confirm the estimates of nitrate and nitrite proposed in the permit application from mass balance calculations. Should the nitrate and nitrite results obtained from sampling and analyses not confirm those from the mass balance calculations used in the application, the operator must assess the impact on receiving waters of the monitored levels of nitrate and nitrite and propose, if required, appropriate measures to reduce these emissions or reduce their impact.

## **Habitats Assessment.**

Within the statutory consultation distances from the Johnson Matthey plc Royston site are the following protected habitats sites:

Sites of Special Scientific Interest (SSSI):

- Therfield Heath (800 m approx.);
- Holland Hall (Melbourn) Railway Cutting (1700 m).

Local Nature Reserves (LNR):

- Therfield Heath (800 m).

Local Wildlife Sites (LWS):

- Therfield, south of tumulus (1500 m);
- Royston chalk pit (1600 m);
- Green Lane south of Royston (1600 m);
- Shaftesbury Green (1600 m);
- Icknield Way, A5905 north of Gallows Hill (1800 m);
- Therfield Green Lane (1900 m).

The two SSSIs have the following features:

(i) **Therfield Heath:**

Therfield Heath is a very good example of the East Anglian type of chalk grassland. This plant community has suffered severe losses throughout its range during the post-war period, mainly as a result of agricultural intensification or the cessation of sheep grazing, so the remaining examples are of high conservation value. The site contains some of the richest chalk grassland in England. Since the turn of

the century the traditional use of the Heath for sheep grazing has gradually given way to a variety of recreational uses, of which golfing has had the greatest impact. Parts of the site were ploughed during the Second World War but have since reverted to grassland.

The remaining unimproved pasture is dominated by upright brome *Bromus erectus* and red fescue *Festuca rubra*. There is a rich assemblage of herbs including such rarities as pasque flower *Pulsatilla vulgaris* which occurs in abundance at Church Hill, spotted cat's ear *Hypochoeris maculata*, wild candytuft *Iberis amara*, bastard toadflax *Thesium humifusum*, and lesser meadowrue *Thalictrum minus*.

The plant communities of the partially improved areas have a lesser, though increasing, diversity of species, including purple milk-vetch *Astragalus danicus* and horseshoe vetch *Hippocrepis comosa*. The site also includes mixed scrub communities at various stages of development, and two areas of mature beech woodland. The latter is best developed at Fox Covert, where the ground flora includes abundant white helleborine *Cephalanthera damasonium*. The grassland supports a diverse insect fauna, including the chalk hill blue butterfly *Lysandra coridon*. The habitats within this site are highly sensitive to inorganic fertilisers and pesticides, applications of which should be avoided both within the site itself and in adjacent surrounding areas.

The site area is 146.5 hectares with 2.3 hectares (1.5%) designated as "favourable" and 144.2 hectares (98.5%) designated as "unfavourable – recovering".

The features which may be affected by this activity are:

- Butterflies which have experienced substantial declines (such as *Lysandra coridon*);
- *Bromus erectus* lowland calcareous grassland;
- Invertebrate assemblage;
- Vascular plant assemblage;
- *Fagus sylvatica* – *mercurialis perennis* woodland.

(ii) Holland Hall (Melbourn) Railway Cutting.

Holland Hall (Melbourn) Railway Cutting is located approximately one kilometre north-east of Royston. It is a steep railway cutting through chalk, the slopes of which have been colonised by a wide range of plants characteristic of chalk grassland in eastern England, including some species which are uncommon in Britain. This type of grassland was once widespread on the Cambridgeshire downland, but it is now confined to only a very few examples. The grassland is largely of the upright brome *Bromus erectus* type but sheep's-fescue *Festuca ovina*, quaking-grass *Briza media* and yellow oat-grass *Trisetum flavescens* all assume local dominance.

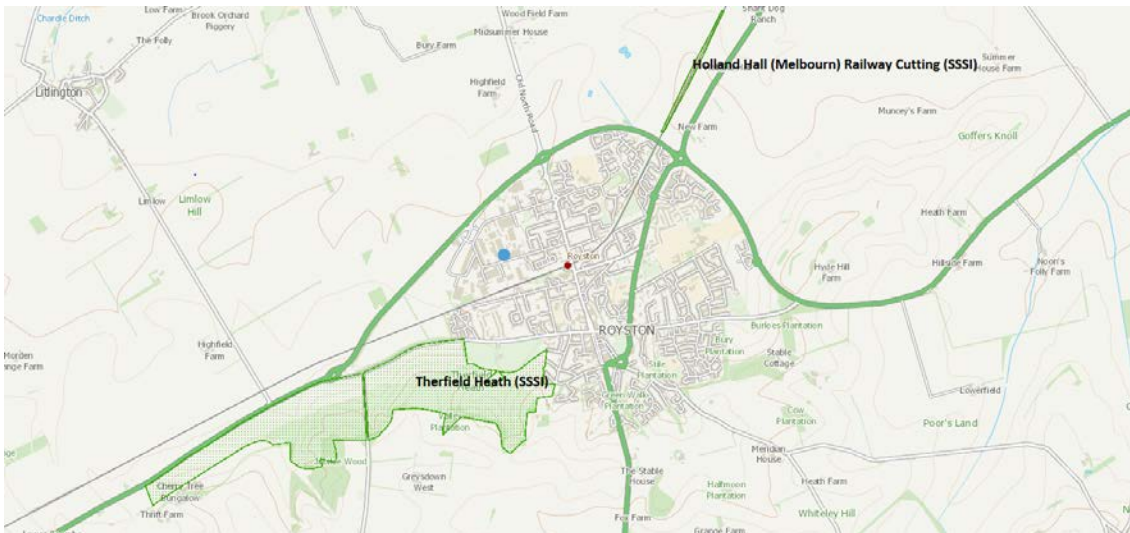
Many parts of the cutting are unstable and the raw, shallow, highly calcareous soils which result, carry an open growth of calcicolous plants apparently unique in Cambridgeshire. Characteristic plants of this community include the nationally uncommon wild candytuft *Iberis amara*, with wild carrot *Daucus carota*, greater knapweed *Centaurea scabiosa*, mouse-ear hawkweed *Pilosella officinarum*, basil thyme *Acinos arvensis*, kidney vetch *Anthyllis vulneraria*, sainfoin *Onobrychis viciifolia* and small scabious *Scabiosa columbaria*. Of particular interest is the presence of greater pignut *Bunium bulbocastanum*, a plant species which is nationally rare.

This site is very valuable for its chalkland flora, and there is evidence that it may also be of value for its invertebrate fauna. Some scrub is present and this may require control if it is not to invade the grassland communities.

The site is 3.3 hectares in area – all of which is categorised as "unfavourable – recovering".

The features which may be affected by this activity are:

- *Bromus erectus* lowland calcareous grassland.



The operator modelled air dispersion for four scenarios:

- Current scenario without PTZ process (variation, EPR/BT7086IJ/V015) or 3CR process (variation, EPR/BT7086IJ/V016) [scenario 1];
- Scenario with existing process (including PGMR stacks) and 3CR process in place [scenario 2];
- Scenario without PGMR stacks but with 3CR project in place [scenario 3];
- Current scenario without the addition of PTZ process [scenario 4].

The only scenarios relevant to variation, EPR/BT7086IJ/V015, are scenarios 1 and 4.

The remaining scenarios [scenarios 2 and 3] relate to the operation of the site following the next significant process change which is the subject of permit variation, EPR/BT7086IJH/V016 (received October 2020).

#### Nitrogen Oxides:

There is only a very slight increase in the typical emission rate of NO<sub>x</sub> between Scenario 1 and Scenario 4 with the NO<sub>x</sub> emission rate for stack A11 increasing from 0.136 g/s to 0.144 g/s. There is no perceptible difference between results for these two scenarios, so the dispersion modelling grouped the results together.

The operator modelled air dispersions using meteorological data from the Met. Office Andrewsfield site for the years 2014 – 2018. This is located approximately 40km to the south east of the Johnson Matthey Royston site and was considered to give good representation of meteorological conditions at the site location.

The daily average process contributions (PCs) were not screened out for any of the designated conservation areas but the annual average PCs were screened out for the six LWSs assessed.

When site-specific background concentration data were added, the maximum predicted environmental concentrations (PECs) were below the critical levels for both annual and daily average NO<sub>x</sub> concentrations at all designated conservation sites.

(1) Daily Average NOx:

Site Name	Critical Level	Year	PC	%PC of critical level	Significant Release	Background	PEC	%PEC of Critical Level
Therfield Heath SSSI	75	2014	24	32	Yes	14.2	38	51
		2015	28	37	Yes		42	56
		2016	22	29	Yes		36	48
		2017	22	29	Yes		36	48
		2018	21	28	Yes		35	47
Holland Hall (SSSI)	75	2014	13	17	Yes	15.3	28	38
		2015	14	19	Yes		29	39
		2016	11	15	Yes		26	35
		2017	12	16	Yes		27	36
		2018	11	15	Yes		26	35
Therfield south of tumulus LWS	75	2014	10	13	Yes	14.3	24	32
		2015	11	15	Yes		25	34
		2016	9	12	Yes		23	31
		2017	7	9	No		21	28
		2018	12	16	Yes		26	35
Royston Chalk Pit LWS	75	2014	12	16	Yes	14.8	27	36
		2015	10	13	Yes		25	33
		2016	11	15	Yes		26	34
		2017	14	19	Yes		29	38
		2018	9	12	Yes		24	32
Shaftesbury Green LWS	75	2014	12	16	Yes	14.8	27	36
		2015	10	13	Yes		25	33
		2016	11	15	Yes		26	34
		2017	14	19	Yes		29	38
		2018	9	12	Yes		24	32
Icknield Way A505, north of Gallows Hill LWS	75	2014	10	13	Yes	14.2	24	32
		2015	7	9	No		21	28
		2016	12	16	Yes		26	35
		2017	13	17	Yes		27	36
		2018	8	11	Yes		22	30
Green Lane south of Royston LWS	75	2014	9	12	Yes	12.6	22	29
		2015	12	16	Yes		25	33
		2016	13	17	Yes		26	34
		2017	10	13	Yes		23	30
		2018	10	13	Yes		23	30
Therfield Green Lane LWS	75	2014	8	11	Yes	11.7	20	26
		2015	11	15	Yes		23	30
		2016	10	13	Yes		22	29
		2017	5	7	No		17	22
		2018	8	11	Yes		20	26

(2) Annual Average NOx:

Site Name	Critical Level	Year	PC	%PC of critical level	Significant Release	Background	PEC	%PEC of Critical Level
Therfield Heath SSSI	30	2014	0.5	1.7	Yes	14.2	15	49
		2015	0.4	1.3	Yes		15	49
		2016	0.5	1.7	Yes		15	49
		2017	0.4	1.3	Yes		15	49
		2018	0.6	2.0	Yes		15	49
Holland Hall (SSSI)	30	2014	0.4	1.3	Yes	15.3	16	52
		2015	0.4	1.3	Yes		16	52
		2016	0.4	1.3	Yes		16	52
		2017	0.5	1.7	Yes		16	53
		2018	0.4	1.3	Yes		16	52
Therfield south of tumulus LWS	30	2014	0.2	0.7	No			
		2015	0.2	0.7	No			
		2016	0.2	0.7	No			
		2017	0.1	0.3	No			
		2018	0.2	0.7	No			
Royston Chalk Pit LWS	30	2014	0.2	0.7	No			
		2015	0.2	0.7	No			
		2016	0.2	0.7	No			
		2017	0.3	1.0	No			
		2018	0.2	0.7	No			
Shaftesbury Green LWS	30	2014	0.2	0.7	No			
		2015	0.2	0.7	No			
		2016	0.2	0.7	No			
		2017	0.3	1.0	No			
		2018	0.2	0.7	No			
Icknield Way A505, north of Gallows Hill LWS	30	2014	0.2	0.7	No			
		2015	0.2	0.7	No			
		2016	0.2	0.7	No			
		2017	0.1	0.3	No			
		2018	0.2	0.7	No			
Green Lane south of Royston LWS	30	2014	0.2	0.7	No			
		2015	0.2	0.7	No			
		2016	0.2	0.7	No			
		2017	0.2	0.7	No			
		2018	0.2	0.7	No			
Therfield Green Lane LWS	30	2014	0.1	0.3	No			
		2015	0.1	0.3	No			
		2016	0.2	0.7	No			
		2017	0.1	0.3	No			
		2018	0.2	0.7	No			



(3) Ammonia:Annual Average Ammonia:

Site Name	Critical Level	Year	PC	%PC of critical level	Significant Release
Therfield Heath SSSI	3	2014	0.003	0.1	No
		2015	0.003	0.1	
		2016	0.003	0.1	
		2017	0.002	0.1	
		2018	0.004	0.1	
Holland Hall (SSSI)	3	2014	0.002	0.1	No
		2015	0.003	0.1	
		2016	0.003	0.1	
		2017	0.003	0.1	
		2018	0.002	0.1	
Therfield south of tumulus LWS	3	2014	0.001	<0.1	No
		2015	0.001	<0.1	
		2016	0.001	<0.1	
		2017	0.001	<0.1	
		2018	0.001	<0.1	
Royston Chalk Pit LWS	3	2014	0.001	<0.1	No
		2015	0.001	<0.1	
		2016	0.001	<0.1	
		2017	0.002	0.1	
		2018	0.001	<0.1	
Shaftesbury Green LWS	3	2014	0.001	<0.1	No
		2015	0.001	<0.1	
		2016	0.001	<0.1	
		2017	0.002	0.1	
		2018	0.001	<0.1	
Icknield Way A505, north of Gallows Hill LWS	3	2014	0.001	<0.1	No
		2015	0.001	<0.1	
		2016	0.001	<0.1	
		2017	0.001	<0.1	
		2018	0.001	<0.1	
Green Lane south of Royston LWS	3	2014	0.001	<0.1	No
		2015	0.001	<0.1	
		2016	0.001	<0.1	
		2017	0.001	<0.1	
		2018	0.001	<0.1	
Therfield Green Lane LWS	3	2014	0.001	<0.1	No
		2015	0.001	<0.1	
		2016	0.001	<0.1	
		2017	<0.001	<0.1	
		2018	0.001	<0.1	

For above tables the figures in green show those results that are insignificant (i.e. for PC then <1 % long term and <10 % short-term and for PEC <70 %) and those in red show those that are significant and required further assessment.

For the scenario reflecting operation of the PTZ process, at all years considered (2014 – 2018), the maximum annual average ammonia concentrations are screened out as insignificant at all designated conservation sites. The applicant compared predicted concentrations against the critical levels for higher plants. The citations for the protected ecological sites gave no indication that sensitive lichen and bryophyte communities were present but the applicant noted the concentrations would also be insignificant if the lower critical level for those species had been used.

#### Nitrogen Deposition:

The applicant considered the deposition of nitrogen from concentrations of NO<sub>2</sub> (assumed as a worst case to be 100% of NO<sub>x</sub>), NH<sub>3</sub> and NH<sub>4</sub>Cl. Dry deposition velocities of 0.0015 m/s for NO<sub>x</sub> and 0.02 m/s for NH<sub>3</sub> were used for grassland. Values of 0.003 m/s and 0.03 m/s for NH<sub>3</sub> were used for forest. Wet deposition for these pollutants was not included.

Deposition of NH<sub>4</sub>Cl was modelled assuming a particulate with density 1530 kg/m<sup>3</sup> and diameter 10 µm, which is likely to be a worst case (overestimating) assumption. Wet deposition of NH<sub>4</sub>Cl was included based on default ADMS parameters.

For scenario 4, the operator outlined the maximum predicted annual PC to deposition rates of nitrogen at each designated conservation area, proposed sources, together with the PC as a percentage of the most stringent Critical Load applicable to each designated conservation area. The maximum PCs to nitrogen deposition were screened out for grassland habitats within the designated conservation areas. The maximum PC to nitrogen deposition for the woodland habitat within the Therfield Heath SSSI was greater than 1% of the lower value of the Critical Load range.

However, when the locations of specific habitat types within Therfield Heath were considered, the PC to nitrogen deposition at Therfield Heath was screened out as insignificant, as it was less than 1% of the Critical Load range relevant to specific locations.

The figures tabled below for PC as % of critical load for scenario 4 (PTZ process) are not different from the existing situation of emissions from the Johnson Matthey Royston site without the PTZ process (scenario 1). The addition of the PTZ process does not cause an increase in the PC as % of critical load at any of the protected ecological sites assessed.

Site Name	Critical Load Class	Critical Load	Year	PC (from NOx)	PC (from NH <sub>3</sub> )	PC (from NH <sub>4</sub> Cl)	PC (total)	PC as % of critical load	Significant Release
Therfield Heath SSSI	Fagus Woodland	10-20	2014	0.117	0.013	0.0006	0.131	0.6 - 1.6	Yes
			2015	0.113	0.013	0.0006	0.126		
			2016	0.121	0.014	0.0006	0.136		
			2017	0.104	0.012	0.0006	0.117		
			2018	0.146	0.017	0.0006	0.164		
	Calcareous Grassland	15-25	2014	0.062	0.010	0.0006	0.072	0.3 - 0.6	No
			2015	0.059	0.009	0.0006	0.069		
			2016	0.065	0.010	0.0006	0.075		
			2017	0.055	0.009	0.0007	0.064		
			2018	0.077	0.012	0.0008	0.090		
Holland Hall (SSSI)	Calcareous Grassland	15-25	2014	0.050	0.008	0.0009	0.059	0.2 - 0.5	No
			2015	0.059	0.010	0.0012	0.070		
			2016	0.060	0.010	0.0010	0.071		
			2017	0.062	0.010	0.0010	0.074		
			2018	0.051	0.008	0.0007	0.060		
Therfield south of tumulus LWS	Calcareous Grassland	15-25	2014	0.019	0.003	0.0002	0.021	0.0 - 0.2	No
			2015	0.016	0.002	0.0001	0.018		
			2016	0.023	0.003	0.0002	0.026		
			2017	0.010	0.002	0.0001	0.012		
			2018	0.021	0.003	0.0002	0.025		
Royston Chalk Pit LWS	Calcareous Grassland	15-25	2014	0.025	0.003	0.0002	0.029	0.1 - 0.3	No
			2015	0.025	0.004	0.0003	0.029		
			2016	0.031	0.004	0.0003	0.035		
			2017	0.038	0.005	0.0004	0.044		
			2018	0.025	0.004	0.0003	0.029		
Shaftesbury Green LWS	Calcareous Grassland	15-25	2014	0.025	0.003	0.0002	0.029	0.1 - 0.3	No
			2015	0.025	0.004	0.0003	0.029		
			2016	0.031	0.004	0.0003	0.035		
			2017	0.038	0.005	0.0004	0.044		
			2018	0.025	0.004	0.0003	0.029		
Icknield Way A505, north of Gallows Hill LWS	Calcareous Grassland	15-25	2014	0.021	0.003	0.0002	0.025	0.1 - 0.2	No
			2015	0.021	0.003	0.0002	0.024		
			2016	0.025	0.004	0.0002	0.029		
			2017	0.013	0.002	0.0001	0.015		
			2018	0.021	0.003	0.0002	0.025		
Green Lane south of Royston LWS	Calcareous Grassland	15-25	2014	0.022	0.003	0.0002	0.025	0.1 - 0.2	No
			2015	0.021	0.003	0.0002	0.024		
			2016	0.026	0.004	0.0003	0.030		
			2017	0.029	0.004	0.0003	0.034		
			2018	0.023	0.003	0.0002	0.026		
Therfield Green Lane LWS	Calcareous Grassland	15-25	2014	0.019	0.003	0.0002	0.021	0.0 - 0.2	No
			2015	0.016	0.002	0.0001	0.018		
			2016	0.023	0.003	0.0002	0.026		
			2017	0.010	0.002	0.0001	0.012		
			2018	0.021	0.003	0.0002	0.025		

Acid Deposition:

Site Name	Habitat Type	Acidity Critical Load Class	PC as % of critical load function	Significant
Therfield Heath SSSI	Broadleaved, mixed and yew woodland	Unmanaged broadleaved/ coniferous woodland	0.2	No
	Calcareous Grassland	Calcareous grassland (using base function)	0.2	No
Holland Hall (SSSI)	Calcareous Grassland	Calcareous grassland (using base function)	0.2	No
Royston Chalk Pit LWS	Calcareous Grassland	Calcareous grassland (using base function)	0.0	No
Shaftesbury Green LWS	Calcareous Grassland	Calcareous grassland (using base function)	0.0	No
Icknield Way A505, north of Gallows Hill LWS	Calcareous Grassland	Calcareous grassland (using base function)	0.0	No
Green Lane south of Royston LWS	Calcareous Grassland	Calcareous grassland (using base function)	0.0	No
Therfield south of tumulus LWS	Calcareous Grassland	Calcareous grassland (using base function)	0.0	No
Therfield Green Lane LWS	Calcareous Grassland	Calcareous grassland (using base function)	0.0	No

For above tables the figures in green show those results that are insignificant (i.e. for PC then <1 % long term and <10 % short-term and for PEC <70 %) and those in red show those that are significant and required further assessment.

The operator obtained critical load values for specific SSSIs from the APIS website and used locations to determine the applicable critical load values for other sites such as Local Wildlife Sites. The critical load function was defined by three quantities to account for the contribution of different species to total acid deposition – CLmaxS is the maximum critical load for acidity expressed in terms of sulphur; CLmaxN is the maximum critical load for acidity expressed in terms of nitrogen and CLminN defines a nitrogen deposition level below which additional nitrogen will not acidify the system due to long-term nitrogen losses in the soil

The operator calculated the rate of acid deposition based on the PC from nitrogen plus the additional contribution from HCl. The APIS Critical Load Function Tool26 was used to assess the combined impact of the nitrogen and HCl contributions to acid deposition at each of the designated conservation areas

According to the Critical Load Function Tool, the maximum PCs for acid deposition for Scenario 4 (PTZ process) were screened out at all designated conservation areas.

The figures tabled below for PC as % of critical load for scenario 4 (PTZ process) are not different from the existing situation of emissions from the Johnson Matthey Royston site without the PTZ process (scenario 1). The addition of the PTZ process does not cause an increase in the PC as % of critical load at any of the protected ecological sites assessed.

### **Habitats Conclusion:**

We have audited the operator's air dispersion modelling provided and the conclusions on impacts on protected ecological sites derived from that report.

Although the ecological impacts are not insignificant and our worse-case predictions are higher than those proposed by the operator, the incremental increase for the addition of the proposed PTZ process is negligible compared to the existing impacts from the site.

### **Environmental Management System.**

The Refining & Chemicals Europe (R&CE) Business Unit, of which the Platinum Group Metals Refinery (PGMR), Fine Chemicals and Supported Metal Catalysts (Procat 1 and Zeocat Plants) are constituent parts, operates management systems accredited to the International Standards of ISO 14001 (Environmental Management Systems) with certification held since 1998. The R&CE Business Unit is also covered by ISO 9001 (Business Management System with certification held since 1995) and BS OHSAS 18001 (Occupational Health and Safety Management Systems with certification held since 2007). These systems have been extended to cover the operation of the new PTZ plant from start-up. New documented procedures have been introduced and, where relevant, are included in Table S1.2 (Operating Techniques) in the varied permit. Full training in operation of the PTZ process has been provided for operators.

### **Environmental Risk Assessment.**

Johnson Matthey have assessed the process design of the PTZ operation using a structured hazard study methodology in line with their Group EHS Risk Matrix. Risks have been assessed after controls and mitigation to ensure residual risks are as low as reasonably practicable.

### **Environment Agency Initiated Variation**

We have also made changes as part of an Environment Agency initiated variation.

- We have varied Schedule 5 (Notification) to add a new notification template for a breach of permit conditions not related to limits. This reflects the current permit template and the requirement in

condition 4.3.2 to report any information provided under condition 4.3.1 by sending to the Environment Agency the information listed in schedule 5;

- We have varied Schedule 6 (Interpretation) to include an amended definition of “Industrial Emissions Directive” to reflect the ending of the United Kingdom’s EU Exit transition period;
- We have varied Table S1.3 to include an updated Improvement Condition 16 (IC16) to reflect the fact that the 3-D printer permitted via variation notice, EPR/BT7086IJ/V014, has never been commissioned and there is currently no date specified for commencing commissioning. We have therefore removed the completion date for submission of a report on commissioning to the Environment Agency. There is now a requirement for the operator to notify the Environment Agency and submit a commissioning plan at least one month before starting commissioning of the 3-D printer plant. There is also a requirement for the operator to submit the report on commissioning within two months of completion of commissioning.

Should the operator have to commence commissioning quickly due to customer demand and not be able to provide one month’s notice, there is the ability in condition 2.4.1 for the operator to agree an alternative date in writing with the Environment Agency.

## Decision checklist

Aspect considered	Decision
<b>Receipt of application</b>	
Confidential information	A claim for commercial or industrial confidentiality has not been made.
Identifying confidential information	We have not identified information provided as part of the application that we consider to be confidential.
<b>Consultation</b>	
Consultation	<p>The consultation requirements were identified in accordance with the Environmental Permitting Regulations and our public participation statement.</p> <p>The application was publicised on the GOV.UK website.</p> <p>We consulted the following organisations:</p> <p>North Hertfordshire District Council, Environmental Protection</p> <p>North Hertfordshire District Council, Planning Control</p> <p>Director of Public Health, Hertfordshire Council</p> <p>Public Health England</p> <p>Health &amp; Safety Executive.</p> <p>The comments and our responses are summarised in the <a href="#">consultation section</a>.</p>
<b>The facility</b>	
The regulated facility	We considered the extent and nature of the facility at the site in accordance with RGN2 ‘Understanding the meaning of regulated facility’, Appendix 2 of RGN 2 ‘Defining the scope of the installation’, Appendix 1 of RGN 2

Aspect considered	Decision
	<p>'Interpretation of Schedule 1', guidance on waste recovery plans and permits.</p> <p>The extent of the facility is defined in the site plan and in the permit. The activities are defined in table S1.1 of the permit.</p>
<p>Biodiversity, heritage, landscape and nature conservation</p>	<p>The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat.</p> <p>We have assessed the application and its potential to affect all known sites of nature conservation, landscape and heritage and/or protected species or habitats identified in the nature conservation screening report as part of the permitting process.</p> <p>We consider that the application will not affect any sites of nature conservation, landscape and heritage, and/or protected species or habitats identified.</p> <p>We have not consulted Natural England on the application. The decision was taken in accordance with our guidance.</p>
<b>Environmental risk assessment</b>	
<p>Environmental risk</p>	<p>We have reviewed the operator's assessment of the environmental risk from the facility.</p> <p>The operator's risk assessment is satisfactory.</p>
<b>Operating techniques</b>	
<p>General operating techniques</p>	<p>We have reviewed the techniques used by the operator and compared these with the relevant guidance notes and we consider them to represent appropriate techniques for the facility.</p> <p>The operating techniques that the applicant must use are specified in table S1.2 in the environmental permit.</p>
<p>Operating techniques for emissions that screen out as insignificant</p>	<p>Emissions of oxides of nitrogen (expressed as NO<sub>2</sub>) and nitrous oxide (N<sub>2</sub>O) have been screened out as insignificant, and so we agree that the applicant's proposed techniques are BAT for the installation.</p> <p>We consider that the emission limits included in the installation permit reflect the BAT for the sector.</p>
<b>Permit conditions</b>	
<p>Improvement programme</p>	<p>Based on the information on the application, we consider that we need to impose an improvement programme.</p> <p>We have included two new improvement conditions (IC18 and IC19) requiring the operator to:</p> <ul style="list-style-type: none"> <li>- submit a written report to the Environment Agency for approval that outlines the results of a commissioning trial on the PTZ process including analyses of gaseous and aqueous emissions and assessments of dust control, noise and odour (IC18);</li> <li>- carry out sampling and monitoring for nitrate and nitrite on effluent discharged from the Johnson Matthey Royston site and on the</li> </ul>

Aspect considered	Decision
	<p>receiving waters after treatment at Royston sewage treatment works. The operator must compare the values of nitrate and nitrite obtained from monitoring with those predicted in the application using mass balance calculations. If the monitored data do not confirm the calculated data, the operator must demonstrate that discharges at the monitored concentrations of nitrate and nitrite do not cause any adverse impact on receiving waters.</p> <p>We have also amended improvement condition 16 (IC16) to reflect the fact that the 3-D printer which was the subject of variation, EPR/BT7086IJ/V014, has not yet been commissioned. We now require the operator to inform us of the start of commissioning, the content of commissioning and the criteria that will be used to determine the end of the commissioning period.</p>
Emission limits	<p>Emission limits have been added for the following parameter from the following emission point:</p> <ul style="list-style-type: none"> <li>- Nitrous oxide (N<sub>2</sub>O), 200mg/m<sup>3</sup>, A11.</li> </ul>
Monitoring	<p>Monitoring has been added for the following parameter from the following emission point at the stated frequency:</p> <ul style="list-style-type: none"> <li>- Nitrous oxide (N<sub>2</sub>O), A11, Annually.</li> </ul>
Reporting	<p>We have added reporting in the permit for the following parameters:</p> <ul style="list-style-type: none"> <li>• Nitrous oxide (N<sub>2</sub>O), A11, Annually.</li> </ul>
<b>Operator competence</b>	
Management system	<p>There is no known reason to consider that the operator will not have the management system to enable it to comply with the permit conditions.</p>
<b>Growth Duty</b>	
Section 108 Deregulation Act 2015 – Growth duty	<p>We have considered our duty to have regard to the desirability of promoting economic growth set out in section 108(1) of the Deregulation Act 2015 and the guidance issued under section 110 of that Act in deciding whether to grant this permit.</p> <p>Paragraph 1.3 of the guidance says:</p> <p>“The primary role of regulators, in delivering regulation, is to achieve the regulatory outcomes for which they are responsible. For a number of regulators, these regulatory outcomes include an explicit reference to development or growth. The growth duty establishes economic growth as a factor that all specified regulators should have regard to, alongside the delivery of the protections set out in the relevant legislation.”</p> <p>We have addressed the legislative requirements and environmental standards to be set for this operation in the body of the decision document above. The guidance is clear at paragraph 1.5 that the growth duty does not legitimise non-compliance and its purpose is not to achieve or pursue economic growth at the expense of necessary protections.</p>



Aspect considered	Decision
	We consider the requirements and standards we have set in this permit are reasonable and necessary to avoid a risk of an unacceptable level of pollution. This also promotes growth amongst legitimate operators because the standards applied to the operator are consistent across businesses in this sector and have been set to achieve the required legislative standards.

## Consultation

The following summarises the responses to consultation with other organisations, our notice on GOV.UK for the public and the way in which we have considered these in the determination process.

### Responses from organisations listed in the consultation section

<b>Response received from</b>
North Hertfordshire District Council, Environmental Protection (NHDC)
<b>Brief summary of issues raised</b>
<p>The consultee noted that the applicant had submitted a dispersion modelling report on emissions to air to support the permit variation (for the PTZ process, EPR/BT7086IJ/V015, and the 3CR process, EPR/BT7086IJ/V016).</p> <p>They noted that the assessment appeared to indicate there should not be any issues when Johnson Matthey switched over to their new operational system. They noted that the PTZ process would produce elevated levels of oxides of nitrogen (NO<sub>x</sub>) and a new emission of nitrous oxide (N<sub>2</sub>O). They pointed out that that the supplied reports made it clear that the stoichiometry of the decomposition during calcination was not fully known so that the proportion of N<sub>2</sub>O in the off-gases was not certain.</p> <p>However they noted there was a six-month period when existing and upgraded systems may be operating together which did appear to have the potential to give rise to elevated levels of chlorine and volatile organic compounds (VOCs). This scenario related solely to the forthcoming 3CR project (EPR/BT7086IJ/V016) and not the PTZ process which is the subject of this current variation, EPR/BT7086IJ/V015.</p> <p>They asked that :</p> <ul style="list-style-type: none"> <li>- the Environment Agency provide them with details of the variation to the environmental permit required to operate the new plant;</li> <li>- the new permit should provide details of changes to, or any additional, monitoring required;</li> <li>- they be made aware of when the six-month changeover period was to take place so they could be alert for any odour complaints arising in the area at that time;</li> <li>- the operation of the LEV dust booth bag plant should be scrutinised in relation to accommodating the increased dust emissions from the process;</li> <li>- appropriate monitoring be carried out to verify that the increased levels of NO<sub>x</sub> and N<sub>2</sub>O emissions from stack, A11, are within authorised limits;</li> </ul>

- appropriate monitoring be carried out for chlorine and VOCs when both plants are operating together (3CR project) and that
- they be provided with results of confirmatory monitoring to establish that the new plant meets authorised emission levels for all emissions to air and water.

**Summary of actions taken or show how this has been covered**

1. Copy of permit variation, EPR/BT7086IJ/V015, is provided to NHDC with details on the limit of activities authorised by that permit variation;
2. Further information sought from applicant at Schedule 5 stage over the products of decomposition at calcination;
3. Improvement programme condition included in permit variation, EPR/BT7086IJ/V015, requiring applicant to report on the performance of the LEV dust booth bag plant and emissions from A11 stack after commissioning;
4. Information to be made available to permitting officer determining application, EPR/BT7086IJ/BV016, to ensure they are aware of the requirements from NHDC relating to that variation (3CR project).

**Response received from**

Public Health England

**Brief summary of issues raised**

The consultee noted that the applicant was applying for a permit variation to allow the operation of a platinum on zeolite (PTZ) process, replacement of one building and the addition/replacement of emissions stacks for current processes. Although the PTZ process is the only aspect of variation, EPR/BT7086IJ/V015, the air dispersion modelling report sent to the consultees included the scenarios resulting from both variations, EPR/BT7086IJ/V015 and 016.

They noted that the nearest residential receptors were located approximately 200 m east and 300 m west of the Johnson Matthey Royston site.

They stated that the main emissions of potential concern would be nitrous oxide (N<sub>2</sub>O) from the PTZ process and oxides of nitrogen (NO<sub>x</sub>), particulate matter and volatile organic compounds (VOCs) from the other processes to change as a result of variation, EPR/BT7086IJ/V016.

They noted that the applicant had provided a detailed dispersion modelling assessment that suitably assessed that the emissions would not significantly impact public health.

Based on the information contained in the application supplied to them, Public Health England had no significant concerns regarding risk to the health of the local population from the installation.

**Summary of actions taken or show how this has been covered**

PTZ process will be managed and operated in the manner set out in the application. Operating techniques proposed in the application are included within Table S1.2 of the permit variation.

**No consultation comments were received from:**

North Hertfordshire District Council, Planning Control

Director of Public Health, Hertfordshire Council

Health & Safety Executive.