Environment Agency Permitting decisions

We have decided to grant the minor technical variation to Novartis Vaccines and Diagnostics Ltd for Speke Vaccines.

The permit number is EPR/BS5401IK/V003.

The operator is Novartis Vaccines and Diagnostics Ltd

The facility is located at Gaskill Road, Speke, Liverpool, L24 8GR.

The decision was effective from 09/04/2010.

Summary of the decision

We have decided to grant a variation to the permit, subject to the conditions in the permit. The changes include atmospheric emission point additions and deletions, minor changes to process operations leading to beneficial environmental improvements and a more detailed review of odour impact and controls for the new emission point A37 (Site 4 Effluent Treatment Area odour abatement).

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 environment protection is provided.

This permit relates to a single installation that is made up of four sites: Evans Road (Site 1), Gaskill Road (Site 2), Speke Boulevard (Site 3) and Renaissance Way (Site 4).

The applicant manufactures influenza and this represents the principal listed activity falling under Section 4.5 A (1) (a) of the EPR Regulations. Production of seasonal and pandemic influenza vaccines is based on primary seeds obtained from external public health bodies. The process involves inoculating eggs with virus from the seed laboratory and, after incubation, harvesting the allantoic fluid. Following a series of concentration and purification stages the material is stored prior to blending and filling into syringes / vials. Each product is manufactured to the strict standards specified in the product licences issued by the pharmaceutical regulatory authorities.

Purpose of this document

This decision document:

- explains how the applicant's application has been determined;
- provides a record of the decision-making process;
- shows how all relevant factors have been taken into account; and
- justifies the specific conditions in the permit.

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

Structure of this document

- Key Issues of the decision;
- Annex 1 the decision check list;

Key Issues of the decision

Operator

There are no changes in respect of the operator or operator competence associated with this variation.

Commercial and industrial confidentiality

The applicant has not made a claim for commercial confidentiality. We have not received any information in relation to this application that appears to be confidential in relation to any party.

Summary of Changes within this Variation

The operator has applied to vary the permit in the following ways:

a) Inclusion of an additional site 4 boiler installed for the Effluent Treatment Area with associated additional atmospheric emission point. Clarification on temporary boiler for site 3 and longer terms plans for boiler capacity relative to details included within permit variation YP3531UV (EPR/BS5401IK/V003)
b) Addition of emission point for odour scrubber for the Effluent Treatment Area (A37) and optimisation of this odour control.
c) Optimisation of dewatering of the solid waste stream within the Effluent Treatment Area.
d) Optimisation of process technology for removal of chemical contaminants from one of the Effluent Treatment Area liquid streams.
e) Optimisation of process technology for the operational steps of transferring and cooling the dried waste.
f) Removal of pigging system to treat perceived potential for blockages in waste transfer pipeline.
g) Additional chiller unit and associated compressor air addition for upgrade to site 4 operations.
h) Removal of an emission point for BPL vent header.
i) Improvement to Site 4 downstream manufacturing effluent drainage infrastructure.
j) Removal of an emission point for the Effluent Treatment Area contaminated storage tank for egg waste.

Within this decision document each of these changes is outlined in more detail and the environmental impact assessed. There are two major changes and eight minor changes.

Major changes

a) Inclusion of an additional site 4 boiler installed for the Effluent Treatment Area, with associated additional atmospheric emission point

Due to the expansion of site 4 to include an Effluent Treatment Area (ETA) Waste Treatment Facility additional boiler capacity was required. This was first proposed within the variation YP3531UV but the emission point was not added to the varied permit. In addition, table S1.1 was not updated to include this new boiler as a directly associated activity for site 4.

In brief a summary of the boiler system is as follows:

- 1 x Gas Boiler.
- Output 7,000 kg/hr steam or 4.4 MW thermal output.

This information is detailed in section 2.7 of the Technical submission with the application for previous variation YP3531UV. In order to get a full understanding of the impact of this addition it is important to understand that the installation is composed of four sites. Sites 1 and 2 are subject to closure in the medium term. The total capacity of the boilers for this installation including the latest addition is 30.1 MW.

In the original permit BS5401IK the following conclusions were reached. The Operator's H1 assessment for Sites 1, 2 & 3 indicates that the emissions from the boilers are likely to result in significant breaches of the EALs for NO_2, SO_2 and CO. Additional assessment by the Agency suggests that although the Operator's H1 assessment is likely to significantly overestimate the impact of emissions, breaches of Air Quality Objectives/Standards may take place.

In practice, the Agency considers that this is unlikely for the following reasons:

- The area is not designated as an Air Quality Management Area for these substances;
- Sites 1, 2 & 3 are existing and therefore already contribute to the background air quality; and
- The boilers at Sites 1, 2 & 3 are relatively small, equating in size to the continuous operation of a 4MW combustion unit running at maximum load. The boilers at Sites 1, 2 & 3 are also located some distance apart.

However, given the potential impact of combustion emissions, a specific improvement programme was included in the Permit BS5401IK to verify this (IP4). It required an assessment of the combined impact of emissions from Sites 1-4 (worst case scenario) and the modelling of the combined emissions from Sites 3 & 4 assuming the transfer of activities from Sites 1& 2 (representing the impact following the closure of Sites 1 & 2). The improvement condition also requested a timetable for the implementation of any improvements identified.

Emission Limit Values of 150mg/m^3 for NOx were included in the original Permit for the boilers at Site 4 as these are new, although regular monitoring has not been specified and ELVs have not been included for the Site 1-3 boilers, though monitoring "as requested by the Agency" has been specified.

The following scenarios were investigated in the IP4 improvement programme response dated October 2007:

- Scenario 1 – Sites 1-4 boilers (as built without new Site 4 boiler)
- Scenario 2 – Sites 3-4 boilers (as built without new Site 4 boiler)
- Scenario 3 – Sites 1-4 boilers (as built, plus new Site 4 boiler)
- Scenario 4 – Sites 3-4 boilers (as built , plus a new Site 4 boiler)
- Scenario 5 - As scenario 1 but including all standby generators

For the H1 assessment in IP4 where the short-term process contribution exceeded 10 % of Air Quality Standard (AQS) the results were deemed "not insignificant" and where long term process contribution exceeded 1 % of the results of the long term Environment Assessment levels (EAL) were deemed "not insignificant".

The following table included in the response to improvement programme IP4 summarised the findings of this updated H1 assessment:

Emission	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
LT NO_2	Not insignificant	Insignificant	Not Insignificant	Insignificant	Not assessed
ST NO_2	Not insignificant	Insignificant	Not insignificant	Insignificant	Not significant
LT SO2 (Human)	Not insignificant	Insignificant	Not insignificant	Insignificant	Not assessed
ST SO_2	Not insignificant	Insignificant	Not insignificant	Insignificant	Not insignificant
LT CO	Insignificant	Insignificant	Insignificant	Insignificant	Not assessed
ST CO	Insignificant	Insignificant	Insignificant	Insignificant	Not insignificant
LT NOX	Insignificant	Insignificant	Insignificant	Insignificant	Not assessed
LT SO2 (Ecological)	Insignificant	Insignificant	Insignificant	Insignificant	Not assessed

LT = Long Term and ST=Short Term

The current site situation is scenario **3** with the addition of new Site 4 boiler. This is in the medium term to be replaced with scenario **4** when Sites 1 and 2 close.
The following terms are used in the discussion below:
PC= Process Contribution. PEC = Predicted Environmental Concentration (PC +Background
For scenario 3 the carbon monoxide (CO) process contribution (PC) is insignificant. The short term sulphur dioxide ($S0_2$) short term and long term (human) process contributions are not insignificant. However the percentages are only just exceeded with the long term $S0_2$ process contribution being less than 10 % of long term EAL and the short term $S0_2$ process contribution being less than 20 % of the AQS.
Long term NO_2 PC at the nearest human receptor cannot be deemed insignificant as it is greater than 1 % of the AQS. However when combined with background concentrations, the AQS is comfortably satisfied at all receptors with maximum PECs being less than 60 % of the AQS. With the exception of one of the modelled receptors, all short term PCs are less than 10 % of the AQS and can be deemed insignificant. The maximum PC is still less than 20 % of the AQS. There are no predicted exceedances of the AQS at any of the receptors when PECs are considered.

Conclusion
In brief there are only minor exceedances of the process contributions for SO_2 and NO_2 resulting in emissions being not insignificant.

Given the reality of the imminent change to scenario 4 where all the process contributions are insignificant we are satisfied with this assessment without the requirement for further actions. This is further justified by the following comments and actions:

a) The operator is already registered with the Climate Change Agreement and the Euopean Union Emission Trading Scheme. Both schemes require the implementation of an energy efficiency plan to challenge and reduce energy consumption within the entire installation. Novartis Vaccines adopts energy reduction targets and this is actively managed through a monthly Energy Forum.
b) The emission limit value for NOX for the exact same specification boiler of 137 mg/Nm^3 submitted with this application and previous application

YP3531UV (EPR/BS401IK/V002) is within the guidance for Speciality Organics Chemicals Sector (EPR4.02) being below 200 mg/Nm^3.

In order to have a consistent approach an Emission Limit Value (ELV) of 150 mg/Nm^3 for NO_X is to be set for this new Site 4 boiler emission point A38. This is in line with the other 2 boilers for site 4. The ELV was set as Site 4 is a new site at the time of the original permit application BS5401IK. The original application and subsequent variation displayed data showing compliance with this limit and a monitoring frequency only as requested by the Agency was set for the two original Site 4 boilers (combined boiler 1 / 2 emission point A23).This condition is to be repeated for A38 with the purpose of the allowing for monitoring only for specific concerns or incidents.

The applicant has volunteered emission data for A38 NO_X emissions to confirm compliance with 150 mg/Nm^3 ELV. The data received on 05-03-10 showed levels less than 100 ppm but this is based on monitoring not to MCERTS accreditation and not aligned to standard oxygen and ambient conditions.

A formal commitment has been received from the applicant to perform a one off MCERTS accredited NO_X monitoring within 12 months of the issuing of this variation to comply with the ELV.

In the process of this variation determination the current ISO 10849 NO_X monitoring technique was checked to determine whether it is in line with our MCERTS M2 guidance. It was then discovered that this technique has now been superseded and the new monitoring technique has been integrated into this variation (BS EN 14792). Tables S4.1 a), b), c) and d) point source emissions to air have been modified accordingly.

In the previous variation YP3531UV the usage of a temporary boiler was introduced. Clarification was received in this new variation application that the temporary boiler will continue indefinitely as a contingency. Its purpose is breakdown back up and not for additional capacity. Thermal output of this boiler is 0.68MW. This new variation application clarifies further that the potential for a new permanent boiler for site 3, mentioned in variation YP3531UV is now not to be progressed.

b) Addition of odour abatement system for Effluent Treatment Area

Introduction

In brief the Effluent Treatment Area (ETA) within Site 4 of the installation was introduced via the variation YP3531UV. Within the three streams being processed there is an egg waste stream. The stream is what is called Virus+ (V+) i.e. the virus has not been de-activated within this stream, but there is no chemical composition within this stream which has to be treated (C -). This process involves storage, initial de-watering of the stream, and thermal de-activation via the usage of one or two driers followed by cooling and egg waste storage for disposal. Within the variation YP3531UV the application referenced an atmospheric odour scrubber linked to abatement of odours from the feed tanks, dryers and egg storage facilities. However there was no detail given of this scrubber and no Odour Management Plan (currently no specific condition is in place for the requirement for such an Odour Management Plan). In turn we did not request any additional information to clarify the odour control measures in place during the determination phase for this previous variation. To compound this situation the scrubber was not listed as an atmospheric emission point in the varied permit.

The purpose of this element of the variation is to add this missing emission point, clarify the details of the original odour abatement system , provide a history of the odour complaints and odour issues beyond the installation perimeter and summarise the short and longer term improvements to ensure compliance for odour control. This includes the addition of the new odour condition within the permit requiring an Odour Management Plan (OMP) to be submitted.

The emission point is added as point A37 to table S4.1d (Site 4) Point source emissions to air.

Within sections 3.1, 3.2, 3.3 and 3.4 of the document reference 11.12.2009 supplied with this new variation the current abatement system is described in much more l detail than in the previous variation. In brief the abatement consists of a fluidised bed scrubber tower and 26.5 metre stack being 4.5 metres above the main building. The scrubber tower is designed to collect all potentially odourous contaminated air from the ETA and treat it to remove Hydrogen Sulphide and Mercaptans using a 15 % w/w Sodium Hypochlorite and 5 % w/w Sodium Hydroxide Solution. The system was designed from generic data for egg waste facilities and not from specific data from Novartis egg waste facilities elsewhere eg. their Italian operation.

Of the approximately 17,000 m^3/hr total air flow to the scrubber, the main odour impact is from the two dryers which make of 1300 m^3/hr of this total air flow. The scrubber is designed to operate at pH 13. A pH probe monitors the scrubber medium and there is a feedback loop to the control system to maintain the pH by additional dosage. The control system also alarms if the pH falls below 13. This pH control loop was not present at the time of the original variation application but has been recently added.

Both chemical dosing systems have duty and stand-by pumps to maintain continuous effective odour abatement.

The following process deviations have automatic responses to rectify the problem:

- Loss of power
- Loss of fresh scrubbing media
- Loss of Process Control System (PCS).

During operator checks the following failures have back up steps which are manually activated:

- Extraction Fan Failure
- Scrubber media circulation failure
- Loss of water to the Scrubber.
-

No odour modelling was carried out during initial variation determination.

Commissioning

- The variation YP3531UV was determined in December 2007 and yet it was only in Q2 2009 that the egg waste stream equipment complete with scrubber was commissioned. In July 2009 the first report of any problems was that the site inspector received a complaint from the Knowsley Council Environmental Health Officer. The complaint originated from a company next to Novartis Site 4. After a tour of the area the odour was identified as originating from Novartis ETA site. This was accepted by Novartis. In total during July and August 2009 there were six odour complaints (first complaint to the council and remainder

to the Agency). These all originated from three local manufacturing plants which are all within a kilometre of the installation boundary.

There were no odour complaints from domestic houses in the local area. The smell was characterised as highly offensive and various descriptions of the smell include a bad egg and fish meal type smell. Novartis took a pro-active attitude to rectify the problems once these issues were raised.

Immediate Response
The operator took the action after discussion with local businesses to operate the ETA egg waste treatment only on nights to minimise odour nuisance during day time operations of these sites. Further the operator actioned a plan to understand the scrubber system performance and limitations plus the odour source and strength to allow odour modelling. In addition a commitment was made by the operator to review short term improvements and research longer term options to establish what was the Best Available Technique (BAT) for this operation.

Within Section 4 of the document 11.12.09 within this new variation application short term improvements implemented up to the date of the application in December 2009 were summarised. These actions are summarised into the following headings below:

a) Moisture Eliminator to reduce entrained liquid in dryer condenser vents improving scrubber performance.
b) Site Boundary Odour Checks and Wind Direction Reporting.
c) Sampling of air in and out of odour scrubber followed by initial modelling Individual chemical component sampling and odour unit monitoring was completed.

During September and October 2009 odour complaints were received from some of the receptors mentioned above. However none of these complaints could be confirmed as originating from Novartis. The assessment at this stage from the experience of those operating the above local plants was that some improvements had been made but there were still offensive odours from Novartis.

Monitoring and Modelling
A summary of data sampled during August 2009 is as follows:
The results expressed in odour concentration ou_E/m^3

- 2,877,875 ou_E/m^3 (Condenser Out)
- 82,110 ou_E/m^3 (Scrubber In)
- 11,660 ou_E/m^3 (Scrubber Out) approx 60000 OU_e/s.

This confirms that the main source of odour is from the driers/ condensers and that the scrubber is successfully removing odour caused by H_2S and mercaptans. However other components such as aldehydes and ketones were not being removed and are potentially the source of the residual offensive odour beyond the installation boundary.

The sensitive receptors utilised were based on the industrial plants adjacent to the site. In line with H4 Environment Agency guidance the aim for reduction of odour at the site perimeter was based on 1.5 ou_E/m^3/ 98th percentile. Specifically within H4 this is detailed as follows:

"When the hourly average concentrations of odour are modelled over a year (8760 hours in a year), two per cent (175 hours) of those hourly average concentrations must not exceed 1.5 odour units for highly offensive odours."

At these receptors the initial modelling showed the need to reduce the odour unit levels from current 60,000 OUE/s to 29,000 OU/s at stack discharge.

New odour condition
In light of the obvious potential for odour outside the site boundary the new odour conditions in line with the latest draft H4 have been integrated into this variation.

The new odour conditions are listed below:

The condition 3.4.1 is amended to:

3.4.1 Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of the Agency, unless the operator has used appropriate measures, including, but not limited to, those specified in an approved odour management plan, to prevent or where that is not practicable to minimise the odour.

The condition 3.4.2 is added as follows:

3.4.2 (a) The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in Schedule 1, table S1.2 , unless otherwise agreed in writing by the Agency.

(b) If notified by the Agency that the activities are giving rise to pollution, the operator shall submit to the Agency for approval within the period specified, a revision of any plan specified in schedule 1, table S1.2 or otherwise required under this permit, and shall implement the approved revised plan in place of the original from the date of approval, unless otherwise agreed in writing by the Agency.

We have added specific wording to condition 3.4.2 because there is a real potential for odour at the site perimeter as evidenced by previous complaints. In addition this type of process (Mechanical Biological Treatment) is listed as one potentially with a risk of odour in our Getting the Basics Right Guidance Annex 2.

Interim Plan for Odour Control
An initial review of the best interim medium term options for better odour control was presented by the operator during September 09 and repeated in this variation application. This led to the choice of the addition of acid scrubbing and carbon absorption as abatement on the dryer vent stream along with dryer vent condenser optimisation. The options considered are summarised below with option 1 being chosen.

- Option 1: Sulphuric acid gas scrubbing post drier condenser followed by activated carbon adsorption. Relatively easy to install a portable unit and will treat main source of odour.
- Option 2: Routing of gases from driers to the existing boiler. Possible to engineer however residence time in boiler is low, emissions of NOx & SO_2 may be increased, but within limits. In addition boiler must operate continuously, this is not currently the case and burner temperature fluctuates on purge cycles further compromising abatement efficiency.
- Option-3: Sulphuric acid gas scrubbing post driers condenser followed by existing scrubber and carbon adsorption. This treats all potential sources of odour although tanks etc are not thought to be significant contributors. This abatement train would involve potential significant modification to current

abatement system operation and involve detailed engineering design studies. Consultants considered this an ideal theoretical option but with restrictively high economic cost and time delays.

Conclusions: The interim BAT solution is to install the portable acid scrubber downstream of the drier condenser and consider use of carbon adsorption if feasible, followed by use of the existing scrubber to improve abatement efficiency. This will provide time to conduct a more detailed review of BAT and undertake design and modification work as part of the Improvement Programme.

As an output from the interim BAT evaluation the operator installed a temporary abatement system in September 2009 and this is currently in operation. This system comprises a sulphuric acid scrubbing unit installed after the dryer condenser vent. The portable unit also has the facility for post acid scrubbing carbon adsorption abatement prior to the treated gas being sent to the existing bleach scrubber for final treatment.

The operator has been optimising the system within the last months to achieve the best odour control performance within the limitations of a system not specifically designed for this application.

Current consumption rates of materials during the trials are:

- Sulphuric acid/25 litres per day
- Carbon 250 Kg replaced approximately every 15 batches.

The subjective feedback from both Novartis and the surrounding receptors is that there have been no incidents of offensive odours beyond the installation boundary since the system commenced full operation in October 2009.

Interim Odour Management Plan (OMP)

The operator has volunteered a commitment to an interim odour management plan based on the usage of the portable abatement system and other process improvements including dryer vent condenser optimisation and dryer operation optimisation. This summary report including new odour monitoring and modelling was committed to be supplied within the determination phase. This was received on the 26th February 2010.The commitment to an OMP is in line with our approach of utilising this variation to add the new odour condition as stated in our H4 guidance.

This document has two big overall aims:

- BAT selection review for A37 odour abatement in line with our guidance H1 and H4.
- Interim Odour Management Plan for current medium term abatement solution and process improvements in advance of final abatement system and associated new update Odour Management Plan.

After a review of the Odour Management Plan and a meeting with the operator two further sets of OMP updates were sent dated 05/03/10 and 23/03/10.

The following is a summary of the review of the OMP submission and two addenda:

Odour assessment including monitoring and modelling
In line with our H4 guidance the aim for reduction of odour at the site perimeter was based on1.5 $ou_{E/}m^3$ 98th percentile. Specifically within H4 this is detailed as follows: "When the hourly average concentrations of odour are modelled over a year (8760 hours in a year), two per cent (175 hours) of those hourly average concentrations must not exceed 1.5 odour units for highly offensive odours"

Two receptors were identified based on previous odour complaint history:
- Inner Road (opposite Novartis Sites 3 / 4 along Renaissance way).
- Maximum location (close to Effluent Treatment Area within site boundary).

The dispersion modelling utilised as the baseline for the current A37 stack discharge conditions is as follows:
- Stack height 26.5 metres.
- Efflux Velocity 10 m/s.

Based on above H4 reference level of 1.5 $ou_{E/}m^3$ 98th percentile for the two receptors the maximum allowable odour concentration per cubic metre (OuE/m3) was modelled .The results are as follows:

Receptor	Inner Road	Maximum location
Target odour exposure criterion	1.5 oue/m3	1.5 oue/m3
Maximum permitted odour. oue/m3 .Concentration Based on stack/height data as above	18086	5251

Stack height and efflux velocity were also varied to establish impact on maximum permitted odour concentration. However this approach as BAT was discounted for the following reasons:
a) Effluent Treatment Area introduced as new plant after original permit (variation YP3531UV) and dubious justification for enhanced dispersion only as BAT.
b) With the complaints already received from local businesses, as listed above, malfunction of this system would cause both further complaints and unpleasant impact on workers at these businesses and related potential negative production impact at these businesses.
c) No odour abatement of amines, aldehydes, ketones and alcohols.

Options considered for abatement techniques within the 26th February 2010 submission include:
- Multi-stage chemical scrubbing technology
- Thermal incineration
- Bio filtration
- Adsorption using carbon filtration
- Ultraviolet/ozone systems.

Each technique has been reviewed for this A37 application with advantages and disadvantages under section 4 of the report. The operator has compared capital and operating costs in line with our H1 guidance part 2 and the section on economic considerations.

A summary of this analysis is provided below:

Multistage chemical scrubbing technology
In brief with the existence already of a caustic bleach scrubber this option provides economic and project simplicity advantages. Also the addition of an acid scrubber would provide effective removal of amines currently not abated by caustic bleach scrubber. The stated abatement efficiency of > 95 % is given with this report. The current approved H4 Part 2 guidance (dated 2002) states wet scrubbing technology efficiency in general to be as follows:

"90 % with water, but can be greater with appropriate chemical reagents in one or more stages"

Hence the > 95 % efficiency for chemical absorption relates satisfactorily with guidance analysis.

The other major advantage of this system is relatively low incremental running costs (£6,000 per annum sulphuric acid usage). In contrast the disadvantages include the disposal of spent liquor and the environmental issue of containment of sulphuric acid to prevent emissions to water. A commitment has already been made by the operator to ensure current bunding to cover this environmental issue. In summary the usage of combined acid and bleach scrubbing as part of a multi-stage abatement is a well documented odour abatement technique. It is listed in the above H4 Part 2 2002 guidance. The capital costs for such systems are described as "Medium".

Thermal incineration
A correctly designed thermal incinerator has potential for > 99 % odour abatement efficiency. This figure listed in the operator report is corroborated by our H4 guidance part 2 (2002) stating:

"Can be > 99 % but there is often a residual combustion odour. "

There are many advantages including the performance being independent of incoming odour concentrations and correctly deigned system can guarantee consistent performance. However in the Novartis situation there are many disadvantages. With high flow of > 10,000 m^3/hr and low volatile organic carbon (VOC) concentration the capital costs can be extremely high. There would be an additional high project cost for the removal of the existing caustic bleach abatement system. Further disadvantages include:

- Carbon foot print increase as a result of the combustion of additional fuel; and
- There may be an increase of oxides of nitrogen.

The potential usage of the current on site boilers was reviewed. However this is fraught with potential problems of inconsistent performance including:

- Consistent boiler temperature for correct incineration (> 850 ^{o}C consistently)
- Existing boiler residence time of 1 second (as opposed to custom designed thermal oxidisers of 2-3 seconds)
- Boiler not operational when dryer not running and during pre and post purge cycles the boiler temperature is further reduced.

The main concern is that the boilers' temperatures modulate and the time they spend at high temperature will not be adequate to provide effective abatement. Hence the usage of existing boilers for incineration was discarded by the operator as not technically consistently effective.

In contrast the new incinerator option is feasible but with economic and operational draw backs.

Bio filtration
Odour abatement efficiency in the operator report for a well designed and maintained bio filter is > 95 %. Our H4 guidance confirms this stating efficiencies of peat/heather systems of 95 %.

Bio filters based on our H4 guidance are not appropriate for high flow applications as here (> 10,000 m^3/hr). The performance of a bio filter is dependent on the gas residence time and for low water soluble odorous components a residence time of 60 seconds is stated by the operator. This relates to a volume of filter material for this application of 283m^3. This backs up our guidance for this application that bio filters are not practicable with the required area being not available within limited area around the Site 4 Effluent Treatment Area facility.

Adsorption systems and combined adsorption /absorption options.
Carbon adsorption has been assessed for three operating scenarios

- Stand alone abatement system for full 17,000 m^3/hr flow fully replacing existing caustic bleach scrubber.
- Adsorption as a polishing step after re-usage of the existing scrubber for complete 17,000 m^3h/flow.
- Simple initial abatement after an acid scrubber on dryer vent stream (lower flow rate of 1,050 m^3/h).

The potential odour abatement efficiency of 95-98 % is stated in the report. This however drops over time and can be as low as 80 %. The H4 guidance lists an efficiency of > 90 % but can be higher with systems in series to allow carbon re-generation. Capital costs are not exceptionally high for low or high flow rates options. However the carbon costs alone for the higher flow rate options are excessive (potentially £100,000 to £200,000 per year). This is backed up by our guidance not even considering carbon adsorption for high flow rate odour abatement applications.

In brief the usage of carbon adsorption post an acid scrubber on the dryer vent line appears to be more economically attractive with low capital costs and more reasonable carbon usage annual operating costs (approximately £30,000). In addition the operator has provided monitoring data based on the existing pilot acid scrubber / carbon adsorption system on dryer vent combined with existing caustic bleach scrubber to prove effectiveness of this scenario.

In summary this three fold stage abatement has odour abatement efficiency based on odour emission rates (oue/s) of between 80.7 and 99.2%. Once the system was stabilised after the first two pieces of monitoring the efficiency then ranged between 91.0 and 99.2 %. This excludes the further optimisation of the dryer system which would be common to all abatement techniques.

UV/Ozone based systems
In this case odorants in the air to be treated are mixed with air containing the treatment agent. The process depends mainly on turbulence, oxidant concentration and residence time (minimum 1 second). The abatement efficiency for hydrogen sulphide claimed to be > 90 % but for larger molecules little information is available and no guarantee can be made more than 50 %. Hence the removal of the complex

amines present in A37 gas stream is questionable. For this reason this method is not deemed appropriate here especially for the following additional reasons:

- Reaction time within ductwork is usually too short to achieve full oxidation of more complex odorants.
- Control of ozone/radical relative to treatment needs can be problematic.
- Emissions of unused ozone may pose a problem as a toxic gas.

Process optimisation steps

In addition to the abatement options listed above the following process improvements have been implemented since September 09.

Egg waste Hold Tank

- Reduce transfer line blocking by better operation of the line
- Waste filtering and de-watering options evaluation to reduce times and temperatures
- Better management of pH and maximum age of material stored

Dryers Improvement

- Better controls of the temperature profile and ensuring that the operation temperature never exceeds 165 ^{o}C. This minimises disruptions and reduces feed storage time.
- Pre-heating sweep gas to improve energy efficiency and increased concentration of gases amenable for abatement reduction in gas flow to abatement systems from dryers.

Dryer Condenser optimisation

- Minimising the carry over of condensate droplet to the active abatement system by installing a vane separator to demist the exhaust gas.
- Use chilled water to cool water pumps, valves etc.

These improvements have been completed and monitoring carried out for the odour unit reduction at the condenser vent without inclusion of abatement systems. The overall average odour concentration (oue/m3) reduction is 85 % and hence a significant improvement.

Odour Monitoring review in more detail

Between August 2009 and January 2010 a considerable quantity of monitoring was performed on existing abatement including:

- Gas Chromatography-Mass Spectrometry (GC-MS) analysis before/after scrubber for original abatement system without improvement. This showed that the amines, alcohols and ketones are not removed by the caustic scrubber.
- Odour concentration oue/m3 data exceeds 5251 $ou_{E/}m^3$ for compliance with H4 guidance relating to stack emission of 5251 $ou_{E/}m^3$ as discussed above in this decision document. Levels as high as 53,480 $ou_{E/}m^3$ were measured.

Current pilot system with acid scrubber and carbon adsorption on dryer vent plus final existing caustic scrubber monitoring results summarised below:

- Odour concentration oue/m3 monitoring at each stage across the system.
    - ✓ Between dryer vent and carbon adsorption outlet average odour removal efficiency is 94.4 % with carbon adsorption being responsible for majority.
    - ✓ Total system odour removal dryer vent to existing caustic scrubber outlet is 99 % approximately with pilot system in place.
    - ✓ Actual odour concentration monitoring data at final scrubber outlet was less than 5,251 $ou_{E/}m^3$ for all five results. Data ranged

between 3,966 and 488 ou_E/m^3 with lower data resulting after system optimisation.

- GCMS analysis of specific odour components
  - ✓ Excellent amine removal with < 1ppm for 6 monitoring results (see Table 5.9 of original OMP report, dated February 2010).
  - ✓ Complex sulphur and aldehyde component removal > 98 % at all points with final outlet data never higher than 0.1 mg/m^3 with make up air process improvement included.

In summary the data shows the odour concentration at the stack has been reduced below target level to ensure no odour nuisance at two receptors stated at the beginning of this review. In addition, the problem of minimal ketone, alcohol and amine removal via caustic scrubber alone has now been rectified by the addition of the acid scrubber and carbon adsorption system on the dryer vent.

BAT option selection and Conclusion

Out of the five options for odour removal only three were even potentially practical (multiple stage wet scrubbing, thermal incineration and carbon adsorption/combined with wet scrubbing).

The lack of consistent performance of existing boilers on Site 4 to act as a thermal incinerator removed this option. Furthermore whilst potentially feasible the high capital costs and operating costs of a new thermal incinerator for such a high air flow application ruled this out when combined with additional fuel usage environmental issues.

The above monitoring and modelling data underline our agreement with the operator's view that BAT for this application is:

- Process optimisation of the dryer and associated feed tank systems to minimise odour emissions at source (steps as listed above).
- A37 abatement upgrade with the introduction of a combined acid scrubber and carbon adsorption system on dryer vent combined with optimisation of the existing caustic scrubber system.

In addition to this, the inclusion of the new odour conditions (as stated above) in the permit as a result of this variation ensures the operation of the plant in line with an approved Odour Management Plan and this further ensures that the management and controls are in place to provide an installation with BAT facilities for odour control.

In discussion with the operator it was highlighted that BAT emphasises best available odour control as opposed to minimum criteria to ensure no significant impact at critical receptors. After review the operator volunteered the level of 4000 ou_E/m^3 odour concentration as performance criteria for interim BAT to be utilised in stack monitoring discussed below. This is based on above monitoring data of interim BAT performance. Data ranged between 3,966 and 488 ou_E/m^3 with lower data resulting after system optimisation.

The fuller process flow for this interim solution provided in the response dated 23-03-10 confirmed that there is a heater between acid scrubber and carbon bed. This will ensure the relative humidity runs sufficiently low with a relative humidity maximum set at 60 %. Also to prevent fires there is a maximum air inlet temperature set at 60 degrees C.

Sulphuric acid /carbon usage and handling for the interim BAT abatement system

The sulphuric acid is delivered in the form of 5 litre drums. These drums are housed in a contained area. The application gave only limited information on the sulphuric acid handling systems and hence a request for further information resulted in a response dated 23/03/10 within OMP addendum II Part1. A process flow was supplied as a useful overview.

The following additional useful information was clarified:

- 25 % sulphuric acid utilised.
- Acid scrubber and associated carbon bed are located in a self contained bund.
- The 5 litre containers are received on site and stored in a bunded area remote from the scrubber.
- After usage the spent acid is directed from scrubber by dedicated pipeline.
- Spent acid stored in a bunded IBC prior to off site disposal by a licensed disposal outlet.

Hence in summary spillage risk is minimised with no drainage without bunds. The respective bunds are capable of containing 110 % of the inventories of fresh and waste acid. The operator has confirmed that in the improbable event that the acid did reach the drainage system all waste water passes to the ETA waste water treatment system that has pH adjustment capability.

The carbon adsorption follow on abatement post the acid scrubber utilises approximately 250 kg and is changed approximately after 15 batches. The coconut derived carbon has been found to be the optimum choice for abatement efficiency. In terms of system effectiveness this change frequency builds in a safety factor to ensure consistent abatement efficiency and in addition a daily check is observed to alert premature break through. Waste carbon is collected, placed in sealed drums and disposed of by a licensed disposal outlet. A standard operating procedure (SOP) for the acid scrubber /carbon adsorbtion system refers to the number of operating cycles that the carbon can be used for before replacement.

A clarification was received in the 23/03/10 responses that this SOP is already in place and not in preparation as incorrectly described in the original OMP response. The operator has committed to optimise the carbon usage level balancing system effectiveness versus raw material usage. This will be an on-going point of review with the site inspector.

However the current hired acid scrubber and carbon adsorption skid is not optimised to the precise application. Hence the longer term BAT proposal as discussed below is a new acid scrubber/carbon adsorption system specifically designed for this application.

Controls for current system

- Dryer emissions. Control of steam pressure/dryer temperature and air flow through it ensures process control and odour minimisation. The dryer has a dedicated Standard Operating Procedure (SOP) in addition to a separate overall SOP for the ETA facility. As discussed above recent improvement to prevent temperature exceeding 165 ^{o}C has contributed to odour minimisation.
- Acid Scrubber – Control parameters for this system include pH (1.2 and 4) with a set point of 2 (manual control), acid recirculation flow rate 6000

litres/hour, pressure in the recirculation line and scrubber sump liquor level (sight glass manual check). A standard operating procedure
- Carbon adsorption system controls include air inlet temperature and humidity with maximum limits for each.
- Caustic scrubber controls includes pH set point automated control with set point at 12.5 and an alarm at pH10, Redox set point and alarm plus scrubber liquor recirculation flow rate with flow switch.
- Local exhaust system for the scrubber – flow rate control within acceptable system performance levels measured equivalent to pressure drop across the exhaust fans of 3000 - 6,000 Pascals.
- Effluent feed tanks to the drier, product skips and skip handling area – local exhaust ventilation capture of odorous components exists for these facilities. Running and differential pressures are monitored by the process control system and alarm sound if no restoration in flow.

The procedure in event of parameter failure mode detection is as follows:
The addendum II part 2 submission on 23/03/10 has clarified in flow chart form the critical process parameters, critical failure modes and the point at which the contingencies measures are enacted.
This document clarifies actions for various process equipment and abatement systems with impact on odour control:
- Egg waste storage and drying chart with links to contingency decision matrix.
- Abatement systems (acid scrubber/carbon bed and bleach scrubber with associated local exhaust ventilation fan) with links to contingency decision matrix.
- Steam and boiler processes to ensure optimum dryer performance and hence odour control with links to contingency decision matrix.

Contingencies
A contingency decision matrix within addendum II part 2 submission on 23/03/10 then further clarifies what steps would then be actioned. Specifically all the potential equipment failures which lead to egg waste feed holding time exceeding 48 hours will lead to the contingency plan been implemented.

In all events except a total loss of power to site in excess of 48 hours, the feed will be transferred to a dedicated IBC fill station and disposed off site by a licensed waste carrier. The material will be pre-treated on site for virus kill before removal from site. This is in line with the facilities and procedures already approved within the Site1 part of the installation. Once sealed the IBC's will be housed to minimise stored in a bunded area at site 4 before despatch for treatment. There is the beneficial effect of using a more local treatment facility with the associated material travel reduction.

In the event of an extreme power failure the continuity plan will lead to procurement of a temporary generator which would provide power to transfer egg waste from the storage tanks to the IBC filling station and ensure material removal as described above.

A commitment has been received in the additional information document dated 05-03-10 regarding plant operation that is as follows:
"If for any reason the abatement systems cannot be operated effectively the egg waste driers will not be operated."

In addition, clarification was sought from the operator on the odour abatement of egg waste feed in relevant storage tanks and final product skips when the dryers are not

operating. The operator confirmed in addendum II part 1 response that the complete interim abatement system (acid scrubber/carbon adsorption and final caustic bleach scrubber) will be in operation 24/7 independent of whether the dryers are running or not.

Management controls
In addition to standard operating procedures the following management and training controls are in place:

- Clear Management structure for the ETA plant has been provided with this report (section 7.1 of original OMP submission) with a specific ETA Manager and shift supervisors.
- Commitment to review this Odour Management Plan automatically when changes occur and otherwise at least annually.
- Training – operating procedures and environmental management training with awareness of the EPR permit plus all emergency procedures is in place.

Monitoring
The optimisation odour concentration and individual odour component GCMS monitoring has confirmed with the environmental modelling that odour levels will not cause nuisance at the two designated receptors.

The monitoring for the interim system will consist of three elements:

- Process control monitoring to alert when abatement systems are operating outside acceptable levels to ensure odour control.
- Installation daily checks.
- Annual stack monitoring of A37 emission point.

In more detail these involve:

- Indirect monitoring of process control parameters as listed in controls section above to ensure optimum abatement system control.
- Continuous performance to ensure odour control.
- Installation daily checks. A request was made for clarification of what exactly such checks included. This led to confirmation of list as follows:
  - During egg waste drying ETA personnel perform periodic subjective odor monitoring at key off site locations every 2 to 3 hours. The atmosphere at the same points identified in the dispersion model is sense checked for odour. If odour were to be detected immediate investigation/remedial action is undertaken in line with the contents of the monitoring standard operating procedure.
  - When egg waste drying is not being undertaken (note abatement systems are still operational) the same key off site locations are monitored every 4 to 6 hours.
  - For this monitoring, if odour is detected, the odour identification and strength are recorded in an odour monitoring log. The log also includes weather conditions (air pressure, wind speed and direction).
  - Once per shift, the operators do a sense check for odour at the ETA stack.
  - A perimeter tour of the site 4 building is done regularly to monitor any potential ‘on site’ odour.

- Annual A37 olfactometry monitoring to reconfirm the odour concentration is less than 4000 ou_E/m^3 as discussed in above review as BAT for selected abatement system. The target level of 4000 ou_E/m^3 has been confirmed with a level of 5000 ou_E/m^3 as a maximum trigger level for a review of the OMP. The odour monitoring will be taken from collecting odour samples from the stack

and odour concentration of the samples will be determined using dynamic olfactometry carried out in accordance with BS:EN13725:2003 " Air Quality-determination of Odour Concentration by Dynamic Olfactometry." This method is in line with our guidance M2 where it is confirmed as an acceptable MCERTS approved technique and this guidance confirms the following: "Method (BS EN13725) may be used to measure the emission rate of odorous emissions from stacks".

The operator has confirmed that the sampling period is approximately 5 to 15 minutes. This will be in the final OMP that is an amalgamation of the original OMP and the two addenda. The variation notice confirms this and the relevant revised table S4.1 d) is reproduced below:

Table S4.1d) Point source emissions to air as referenced in condition 3.6.1 is amended as follows:

Table S4.1d (Site 4) Point source emissions to air – emission limits and monitoring requirements

Emission point ref. & location	Parameter	Source	Limit (including unit)	Reference Period	Monitoring frequency	Monitoring standard or method[1]
A19, A28 (Points A1 & A10 on Figure 3, received 03/11/05)	No parameters set	zone 1, zone 2 (including vacuum system exhaust)	No limit set	-	-	-
A20 (Point A2 Figure 3, received 03/11/05)	No parameter set	β-propiolactone vent header: zone 1	No limit set	-	-	-
A21 (Point A3 on Figure 3, received 03/11/05)	No parameter set	Brine tank	No limit set	-	-	-
A22 (Point A4 on Figure 3, received 03/11/05)	No parameter set	Hotwell stack	No limit set	-	-	-
A23 (Point A5 on Figure 3, received 03/11/05)	Oxides of Nitrogen (expressed as NO_2)	Boiler 1, 2	150 mg/m^3	Hourly average	As requested by the Agency	BS EN 14792
A24, A25 (Points A6 & A7 on Figure 3, received 03/11/05)	No parameter set	Bulk waste tanks (TK417004 & TK417005)	No limit set	-	-	-
A27 (Point A9 on Figure 3 received 03/11/05)	No parameter set	Egg waste tank	No limit set			
A29, A31, A32, A34, A35 (Points A11, A13, A14, A15 & A16 on Figure 3, received 03/11/05)	No parameter set	Zone 1, 3, 4, 5, and 6 Heating Ventilation and Cooling (HVAC) systems.	No limit set	-	-	-
A37 (Point A37 on Fig 3-1 2007 received 10/09/07)	Odour unit per cubic metre (oue/m^3)	Odour scrubber (Effluent Treatment Area)	Note 2	Note 3	Annual	BS EN 13725

Table S4.1d (Site 4) Point source emissions to air – emission limits and monitoring requirements						
Emission point ref. & location	**Parameter**	**Source**	**Limit (including unit)**	**Reference Period**	**Monitoring frequency**	**Monitoring standard or method[1]**
A38 (Original point A36 on Fig 3-1-2007 as received 10/09/07)	Oxides of Nitrogen (expressed as NO_2)	Boiler 3	150 mg/m^3	Hourly average	As requested by the Agency	BS EN 14792

Note 1: Permanent sampling access not required.
Note 2: Limit as stated in approved Odour Management Plan.

Note 3: Sampling reference as stated in approved Odour Management Plan.

Odour complaints system
The information within the original OMP submission did not clarify what OMP review procedures would be triggered by a substantiated compliant. In addition clarity what was required on reporting incidents related to odour control equipment to comply with the permit requirements for Environment Agency notification (BS5401IK permit condition 4.3.1).

The addendum II part 3 received 23-03-10 provides the following extra commitments: The operator has committed that an OMP review process will be activated on the receipt of a justified and verified odour complaint. The review will:

- Investigate the cause of the complaint and instigate remedial action immediately.
- Adjust the process or activity to minimise those emissions.
- Promptly record the events and actions taken using established SOP.
- Revise the OMP to ensure that such events do not reoccur.

Novartis will notify the Environment Agency without delay following the detection of

(a) Any malfunction, breakdown or failure of equipment or techniques or accidents related to odour control equipment.
(b) Fugitive emissions which has caused or is causing or may cause significant odour pollution
(c) Any significant adverse odour impact attributed to the site 4 operation.

Conclusion on Interim BAT solution Odour Management Plan
We have accepted the adequacy of the Odour Management Plan based on

- Original 26/02/10 OMP submission
- First addendum dated 05/03/10
- Second addendum dated 2303/10.

The operator has committed to formalise these multiple documents into a single OMP which will act as an overriding procedure for odour management on site referencing more detailed procedures, in time for permit issue date.

New abatement system proposal
The operator understands that the current dryer vent abatement system is an interim solution and a project has already started for the introduction of a new carbon adsorption/acid scrubber system linking to reuse of the existing caustic bleach scrubber with the following advantages over the current pilot acid scrubber /carbon adsorption system:

- Specific design more focused on exact air flow rate, odour concentrations and components.
- The design will ensure optimum contact time in both acid scrubber and carbon adsorption steps ensuring optimum odour control.

- Automated system with PLC control.
- Optimisation of sulphuric acid usage.
- More robust sulphuric acid containment system.
- HAZOP risk assessment to underpin design.

In addition the proposal outlined in the report received 26th February 2010 confirms that there will be two acid scrubbers in series followed by two carbon beds in series for production reliability and environmental continuous performance. A schematic for the proposed system has been provided (Figure 5.2 within the original OMP report).

Control Measures
These will be in line with the interim solution discussed above but with PLC automated control to ensure less dependence on manual operator intervention in the event of system malfunction.

Commissioning
The commissioning is to be carried out in compliance with the site operating philosophy entitled "Environmental Treatment Area Procedure-Inspection and Functional Test Plan."
Inspection Testing is structured into 5 phases:

- Risk assessment
- P and ID Walk Down
- Drawing check
- Documentation Check
- Snagging Close Out.

Functional Testing is structured into 3 phases:
-Setting to work
-Regulation and Adjustment
-Testing and Performance Testing.

This commissioning overview needs more detailed clarification and specifically what performance testing is to be included and clarification of the monitoring procedures. In light of this, two Improvement Programmes have been included (see below IP 11 commissioning protocol and IP 12 commissioning report).

Monitoring
The on-going monitoring actions will be in line with actions listed above for interim solution.

Timing and Follow on

- Finalised design 31st May 2010
- Commissioning 31st January 2011.

Summary
The new abatement system design is still in the process of being finalised (deadline as above 31st May 2010). Consequently an improvement programme IP 10 has been included in this variation notice. This has as its aim the clarification of the new BAT abatement system design details and procedures for odour control (see below for details). Also the clarification is required within this condition of what constitutes system failure relevant to odour nuisance beyond the installation boundary plus details of corrective and contingency actions to ensure robust odour control.

Improvement Programmes
In summary the above review has led to the inclusion within the variation notice. These dates have been reviewed and accepted by the operator. All three relate to odour control and are discussed in the above odour risk assessment review section.

Table S1.3 Improvement programme requirements

Reference	Requirement	Date
IP10	The Operator shall, having regard to Agency Guidance Note IPPC H4 Odour Part 2 – Assessment and Control provide a written report outlining the features of the new odour abatement system for Site 4 emission Point A37 to minimise potentially odorous emissions from the Permitted Installation. A written summary shall be submitted to the Agency which shall include, but not be limited to, the following: • Overall description of the final abatement system design; • Process parameters and their control for effective odour abatement; • Abatement system solid and liquor annual usages, liquor containment, waste handling and waste minimisation; • Actions in the event of system failure and corrective actions to ensure odour control; • Contingency facilities and procedures in the event of complete system abatement failure (including having regarded to permit condition 4.3.1).	30/06/10
IP11	The Operator shall, having regard to Agency Guidance Note IPPC H4 Odour Part 2 – Assessment and Control, outline the commissioning protocol for the new A37 odour abatement system. A written summary shall be submitted to the Agency which shall include, but not be limited to, the following: • Inspection Testing – provision of details of actions under this phase; • Functional Testing – provision of actions under this phase ; • Performance Monitoring – provision of actions to undergo odour monitoring for confirmation that targets for minimisation of potentially odorous emissions from the Permitted Installation have been achieved. Monitoring shall have regard to Agency Guidance Note M2: Monitoring of Stack Emissions to Air; and • Procedures for corrective action completion to ensure optimum design for odour control. The Environment Agency is to provide written approval on receipt of this report to allow actioning of this protocol.	31/07/10
IP 12	The Operator shall undertake the approved commissioning protocol for A37 new odour abatement system as detailed in improvement condition IP11. A report summarising the results with monitoring data, including details of the methodology used and interpretation of the results plus any remedial actions, shall be submitted to the Agency.	Within 3 months of the commencement of the operation of new A37 emission point odour abatement system at Site 4

Minor changes

c) Optimisation of dewatering of solid waste stream within Effluent Treatment Area

A change is proposed surrounding the operation of the egg waste stream fed to the Effluent Treatment Area. The design as set out in the original permit application involves the usage of “edge filters” to dewater the solid waste. The purpose of this step is to remove excess water from the waste stream prior to drying the waste for thermal inactivation. The environmental benefit of an operational dewatering step prior to feed into the drier unit is to reduce waste volume with corresponding reduction in steam and energy demands to dry the waste. It has the additional benefit of allowing optimisation of the dryer temperature with potential for reduction in

gaseous decomposition products. This latter benefit has the potential to reduce the loading to the A37 abatement system and contributing to odour control beyond the installation boundary.

The particular edge filters chosen for this operation have not been fully effective. Trials are ongoing to optimise an improvement via alternative centrifugation technology. Installing this option could marginally increase the electricity demand for the ETA but only an insignificant marginal increase from 0.001 MW to 0.01 MW. The original design assumed operation of the edge filters in order to meet the quoted gas consumption of 39.4MWh for the dryers. It is believed the change will have a positive impact on gas consumption with less energy required to dry with reduced water composition.

Conclusion
The change and optimisation of the de-watering technology will have an overall beneficial environmental impact and as such we accept this change.

d) Optimisation of process technology for removal of chemical contaminants from one of the Effluent Treatment Area liquid streams.
The original permit application proposed the usage of a combination of Reverse Osmosis and Ultra filtration for removal of Thiomersal (Mercury) and Nonylphenol-ethoxylates (NPE) from the contaminated waste stream fed to the Site 4 Effluent Treatment Area. However laboratory trials with the contaminated waste highlighted the preferred solution for optimum chemical removal to be a single step Nano-Filtration membrane. This design was selected as BAT and installed. The expected Thiomersal removal rate for the membrane is 99.2 % (based on an input concentration of 0.01g/l) and 100 % for NPE (based on an input concentration of 0.03 g/l).

The nanofiltration system is described in section 2 of the application supplementary document 11.12.2009. The ancillary equipment linked to this treatment step remains the same as detailed in the previous variation application (i.e. secondary spill containment, leak detection and tank overfill protection and over-flow pathways). The system has been commissioned but is only entering full production operation in Q1 2010. The operator has made a voluntary commitment to provide a report on the system performance detailing the actual treatment efficiency of the equipment relative to Mercury and NPE removal.

Conclusion
The change will provide a beneficial improvement to NPE and Mercury removal from site waste and therefore is accepted.

e) Optimisation of process technology for the operational steps of transferring and cooling the dried waste
The previous variation application describes a pneumatic transfer system for transferring and cooling the dried waste from the two site 4 egg waste dryers within the Effluent Treatment Area. The system has proven not to be as energy effective as initially believed. A change is proposed to utilise a motor driven elevator to transfer dried waste and cooling for odour reduction via introduction of cooling water.

In broad terms the energy loss from the previous compressed air system is greater than the cooling water system. The advantage of the cooling water is that the energy previously used to air cool the waste is fully liberated from the system. In contrast the water cooled system is cooled and subsequently loses much less energy. No changes have been required to the existing cooling water tower system. The egg

waste conveyors use 5 X 1.1 K W motors and the cooling water flow rate through them is 80 m3/hr.

Conclusion
The change will provide a robust system with less energy losses and as such is accepted.

f) Removal of pigging system to treat perceived potential for blockages in waste transfer pipeline
This "pigging system" was detailed in the previous variation application. The purpose of this system was to allow the cleaning of potential blockages in the line between the upstream manufacturing and the Effluent Treatment Area feed waste storage tanks. The pigging system was both ineffective and unnecessary so is to be removed. A reduction in water usage of 5 m3/day is linked to the termination of the usage of this system.

Conclusion
This change is accepted as we agree that the system is unnecessary and a knock-on water usage reduction.

g) Additional chiller unit and associated compressor air addition for upgrade to site 4 operations. Clarification of previously listed temporary chillers
This element of the current variation includes the installation of additional waste chiller capacity for Site 4 operation during the commissioning phase. An engineering review led to a recommendation for additional chiller capacity. The chiller would ensure that the installed capacity met the theoretical maximum load for summertime maximum temperatures.

In terms of cooling capacity there is a total increase of cooling water of 700 Kw (delivered). In terms of actual figures this translates into an increase from 3500 to 4200KW i.e. a 20 % increase in electricity consumption. The chillers are sequenced to come on line only as load requires and as such optimise electrical consumption. The unit is currently isolated and was not actually run in 2009. The load may increase by approximately 600 KW (maximum delivered capacity 700 KW) with the addition of chilled rather than ambient temperature water on vent condensers from two egg waste driers in the Site 4 Effluent Treatment Area. This is an odour control improvement by reducing the odour at source and minimising the load on final "end of pipe" abatement.

In the variation application YP3531UV three diesel fuelled chiller units were listed to allow temporary chiller capacity. These units each had a capacity of 25.7 KW. However they were never installed.

Conclusion
The increase is accepted on the basis of the automatic system to bring the unit on line only when required and isolate when not needed. In addition the impetus for future usage is a critical environmental improvement to prevent offensive odours beyond the installation boundary.

h) Removal of an emission point A30 Zone 2 vent header (previously designated as emitting β-propiolactone (BPL))
This emission point was included in the original permit application. BPL is utilised in the inactivation of the virus. However this point is within Zone 2 of Site 4 and in the downstream area where there is no BPL or other Volatile Organic Compound (VOC) usage. As such this vent header does not emit BPL. A clarification letter dated 22nd

January 2010 confirmed no emission of any VOC or other hazardous chemical from this emission point A30 whatsoever.

Conclusion
We agree that this emission point A30 can be removed from the permit table S4.1d (Site 4) point source emissions to air.

i) Improvement to Site 4 downstream manufacturing effluent drainage infrastructure
The down stream manufacturing on Site 4 has two wastewater streams. These consist of a stream for contaminant-free water and a system to carry water with chemical contaminants (including Thiomersal containing mercury and caustic cleaning agents). Each stream is handled in a separate manner for environmental benefits and compliance. The water with chemical contaminant stream has been upgraded with a pipe-in pipe system within the drainage to reduce any potential for fugitive effluent releases from Site 4.

Conclusion
We agree to this change as it has a beneficial environmental impact.

j) Removal of an emission point for Effluent Treatment Area contaminated storage tank for egg waste.
This relates to the removal of emission point A26 as an egg waste storage tank listed in variation YP3531UV which was never built. Hence the emission point needs to be deleted.

The related A27 egg storage tank has been taken out of commission. It will be utilised in an emergency only as a standby egg waste storage tank. The tanks have been physically isolated with the removal of feed pipework. There are carbon and HEPA filters installed on the vent to abate potential VOC, odorous or particulate emissions. In agreement with the operator it was decided that this emission point should remain listed in the permit but the description changed to Egg Waste Emergency Storage.

Conclusion
A26 is to be deleted and A27 description changed as detailed above. These emissions are listed in Table S4.1d) point source emissions to air.

Conservation
The following European site is approximately 2.5 km from the installation:
Mersey Estuary (SPA/RAMSAR site).

The combustion process at the installation is not considered relevant for assessment under the Agency's procedures which cover the Conservation (Natural Habitats) Regulations 1994 (Habitats Regulations). This was determined by referring to the Agency's guidance 'AQTAG14: Guidance on identifying ' relevance ' for assessment under the Habitats Regulations for installations with combustion processes'. This was accepted within the original determination for permit application BS5401IK.

Even with the addition of a 4.4 MW boiler as a result of this application the total installation combustion power capacity is 30.1 MW. The above guidance states that for combustion sites with total power capacity between 20-50 MW detailed habitat assessment needs to be made only for SPA/RMSAR sites that are less than 2 km from the installation.

Hence here no further detailed assessment is required. The original determination justification of no further action required is still valid.

Groundwater

The installation does not permit the direct discharge of substances to groundwater. In addition the necessary measures within the original permit BS5401IK were determined as acceptable to prevent an indirect discharge. There are no changes within the subsequent variation YP3531UV and this variation application that affect this assessment.

Air quality

The site is located within Liverpool City Council boundary. The Council has identified an Air Quality Management Area for Nitrogen Dioxide. This area covers the city centre and South Liverpool. However there are no area emission limit values. The variation has no significant impact on atmospheric emissions as discussed in more detail under review of both major and minor changes above. Even the addition of the extra boiler to Site 4 has still been assessed as leading to an insignificant process contribution of NOX when the imminent closure of Sites 1 and 2 takes place.

Operational techniques

We have amended table S1.2 of the permit by adding reference to the revised operating techniques, as provided in the variation application. Specifically additional information was provided under question 2a and 2b of the application form. In addition more details of operating technique changes were given in separate technical document appendix and improved operating procedures for odour control for emission point A37 in interim Odour Management Plan (OMP) and two supplementary OMP submissions.

Monitoring and compliance

As a result of the changes listed in the application there are two specific additional monitoring requirements related to emission point A37 for ETA odour scrubber and A38 Boiler 3 for Site 4. The table S4.1d) for Site 4 atmospheric emission monitoring has been modified accordingly. In addition the the emission point A30 is deleted from the permit table S4.1d (Site 4) point source emissions to air, as BPL is not discharged from this emission point.

We have amended the monitoring standard for NOX emission monitoring for each of the sites 1 , 2, 3 and 4 in each of the respective tables S4.1a) , 4.1b) , 4.1 c) and 4.1 d) to BS EN 14792. As detailed in section a) within this determination for A38 boiler addition the NOX Emission Limit Value is set at 150 Nmg/m3 and the sampling frequency is as requested by the Agency, inline with other NOx monitoring across this installation. These amendments have been made in the new variation notice.

OPRA Score

The OPRA score for the installation before the variation is 166.

Whilst the NOx and SOx levels have increased the operator has confirmed that the existing annual air emissions data has taken this into account. Therefore there is no Opra Score increase as a result of this variation.

Annex 1: decision checklist

Activity	Justification / Detail	Determination criteria met	
		No	Yes
Receipt of submission			
Application fee	The application fee is correct for a minor variation.		✓
Commercial confidentiality	The operator has not made a claim for commercial confidentiality. We have not received any information in relation to this application that appears to be confidential in relation to any party.		✓
Consultation			
Scope of consultation	For a minor variation there are no consultation requirements.		✓
Consultation responses	Not applicable.		✓
Operator			
Control of the facility	There are no changes to the operator as a result of this variation.		✓
The facility			
The regulated facility	There are no changes to the regulated facility as a result of this variation.		✓
European Directives			
Applicable Directives	The European Directives that apply are as follows: • IPPC Directive • Groundwater Directive • Air Quality Framework Directive • Air Quality Framework Directive and Daughter Directives • Dangerous Substances Directive • Waste Framework Directive		✓
The site			
Extent of the site of the facility	We are satisfied that there are no changes proposed to the extent of the site of the facility resulting from this variation application and the operator will carry on the permitted activities within the site boundary.		✓
Planning permission	We are not required to consider the planning permission for variation applications.		✓
Site condition report	We are not required to review the site condition report as there are no changes to the installation site area.		✓
Environmental Risk Assessment and operating techniques			
EIA	Not applicable to a minor variation		✓
Environmental risk	We have reviewed the operator's assessment of the environmental risk from the facility. This variation provides a beneficial environmental impact of prevention of offensive odours beyond the installation boundary.		✓
Operating techniques	We have reviewed the techniques used by the operator and compared these with the relevant guidance notes. The operating techniques have changed via the introduction of this variation and are in line with the guidance notes. Operating procedures have been introduced to optimise odour control and energy usage efficiency		✓
The permit conditions			
Use of conditions other than those from the template	There are no non-standard conditions added to this template.		✓
Odour	We consider that the Applicant's proposals represent the appropriate measures to prevent/minimise odour in the interim.		✓

Activity	Justification / Detail	Determination criteria met	
		No	Yes
alternative conditions	Three improvement programmes have been added on the subject of odour control improvement as follows: • IP10 – Detailing of A37 BAT selection. • IP11- A37 Abatement system commissioning protocol. • IP12- A37 Abatement system commissioning results report.		
Emission limits	One new emission point is included for: • A38 Boiler 3 Site 4. For A38 an Emission Limit Value of 150 Nmg/m3 for oxides of Nitrogen has been set in line with the other boilers on this site.		✓
Monitoring	We have decided to state the monitoring frequency as only at the request of the Environment Agency for monitoring of oxides of nitrogen from emission point A38. This is in line with similar monitoring requirement for boilers 1 and 2 on site 4 (emission point A23) For A37 emission point olfactometry measurement has been added to measure odour concentration oue/m3. There is no emission limit set for this monitoring. The monitoring frequency is annual		✓
Reporting	We have specified reporting as specified in Schedule 5 for the following reasons. The addition of A37 and A38 atmospheric emission monitoring are added to reporting requirements.		✓
Operator Competence			
Technical competence	There is no known reason to consider that the operator will not have the management systems to enable it to comply with the permit conditions. The decision was taken in accordance with RGN 5 on Operator Competence		✓
Relevant Convictions	The National Enforcement Database has been checked to ensure that all relevant convictions have been declared. The operator satisfies the criteria in RGN 5 on Operator Competence No relevant convictions		✓
Financial provision	There is no known reason to consider that the operator will not be financially able to comply with the permit conditions. The decision was taken in accordance with RGN 5 on Operator Competence.		✓
OPRA			
Opra Score	The Opra score is 166 The Opra score has not changed from that set out in the application.		