Environment Agency Permitting decisions

We have decided to issue the substantial variation for Davyhulme Wastewater Treatment Works operated by United Utilities Water Plc.

The variation number is EPR/HP3931LJ/V005

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:

- explains how the application has been determined
- provides a record of the decision-making process
- shows how all relevant factors have been taken into account
- justifies the specific conditions in the permit other than those in our generic permit template.

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

Structure of this document

Annex 1	The decision checklist
Annex 2	Key issues in the determination
Annex 3	The consultation, web publicising and newspaper responses.
Annex 4	AQMAU report Davyhulme WwTW

Annex 1: The decision checklist

Aspect considered	Justification / Detail	Criteria met Yes
Consultation		
Scope of consultation	The consultation requirements were identified and implemented. The decision was taken in accordance with RGN 6 High Profile Sites, our Public Participation Statement and our Working Together Agreements. The application was sent for consultation to HSE Environmental Health Food Standards Agency Trafford Metropolitan Borough Council Director of Public Health In line with the Environment Agency operating procedure this application was advertised on the Environment Agency website and the local press	✓
Responses to consultation, web publicising and newspaper advertising	The web publicising, consultation and newspaper advertising responses (Annex 2) were taken into account in the decision. The decision was taken in accordance with our guidance.	✓
Operator		
Control of the facility	We are satisfied that the applicant (now the operator) is the person who will have control over the operation of the facility after the grant of the permit. The decision was taken in accordance with EPR RGN 1 Understanding the meaning of operator.	✓
European Directives		
Applicable Directives	All applicable European Directives have been considered in the determination of the application. • IPPC Directive • Groundwater Directive • Air Quality Framework Directive • Waste Framework Directive	✓
The site		
Extent of the site of the facility	The operator has provided a plan which we consider is satisfactory, showing the extent of the site of the facility A plan is included in the permit and the operator is required to carry on the permitted activities within the site boundary.	✓

Aspect considered	Justification / Detail	Criteria met Yes
Biodiversity, Heritage, Landscape and Nature Conservation	The application is within the relevant distance criteria of a site of heritage, landscape or nature conservation, and/or protected species or habitat . a) No Sites of Special Scientific Interest (SSSI) within 2 km b) No Ramsar sites within 10 km c) No Specific Area of Conservation (SAC) within 10 km. d) One Local Nature Reserve within 2 km – Davyhulme Millennium Nature Reserve. We have not formally consulted specifically on this aspect of the application as the only relevent site is Davyhulme Millenium nature reserve and the impact here has been concluded as insignificant. The decision was taken in accordance with our guidance OI 124_02 and OI 196_07.	✓
Environmental Risk Assessment and operating techniques		
Environmental risk	We have reviewed the operator's assessment of the environmental risk from the facility. We have reviewed the operators environmental risk assessment . There is a potential of a risk of odour from this facility beyond the site boundaries. An odour risk assessment has been provided and an improvement condition has been inserted into the permit for a review of the adequacy of the odour control plan. Further information given in Key Issues section.	✓
Operating techniques	We have reviewed the techniques used by the operator and compared these with the relevant guidance notes. The proposed techniques/ emission levels for priorities for control depart from the benchmark levels contained in the TGN EPR 1.01 for combustion activities. We have considered the operators justification for departure from the guidance and accept it in the case of emission levels of carbon monoxide (CO) and oxides of nitrogen (NO_x) from spark ignition engines, as the emission limits for NO_x specified in the TGN cannot be attained without increased CO emissions, and there is limited experience of such engines in the UK. We have therefore imposed emission limit values (ELVs) for NO_x and CO at levels the operator can achieve based on Agency Guidance for Monitoring Landfill Gas Engines LFTGN 08 which have been demonstrated not to cause a significant adverse effect on the environment.	✓

Aspect considered	Justification / Detail	Criteria met Yes
	Further information given in Key Issues section.	
The permit conditions		
Waste types	We have specified the permitted waste types, descriptions and quantities, which can be accepted at the regulated facility. We are satisfied that the operator can accept these wastes for the following reasons, There has been no change in the waste types at this facility.	✓
Improvement conditions	Based on the information on the application, we consider that we need to impose improvement conditions. We have imposed improvement conditions to ensure that: ➢ We receive a commissioning report on the Thermal Hydrolysis Plant ➢ We receive a review and modelling report with an assessment of the significance of impacts using H1 significance criteria. ➢ The Operator reviews its options for the reduction on air emissions ➢ All sub-surface pipework around the new installations is reviewed. ➢ We receive a report of the implementation and effectiveness of odour control measures	✓
Emission limits	We have decided that emission limits should be set for the parameters listed in the permit. • Oxides of Nitrogen • Carbon Monoxide • Silicon Oxide • NMVOC • Total VOC These limits be set on the CHP Plant exhaust flues are set in accordance with Agency guidance LFGN 08. It is considered that the ELVs described above will ensure that significant pollution of the environment is prevented and a high level of protection for the environment secured. Further information given in Key Issues section.	✓
Monitoring	We have decided that monitoring should be carried out for the parameters listed in the permit, using the methods detailed and to the frequencies specified. These monitoring requirements have been imposed in order to ensure emissions are within ELV's. We made these decisions in accordance with The Monitoring of Landfill Gas Engines LFTGN 08. [reference the relevant TGN]	✓

Aspect considered	Justification / Detail	Criteria met Yes
	Based on the information in the application we are satisfied that the operator's techniques, personnel and equipment have either MCERTS certification or MCERTS accreditation as appropriate. Further information given in Key Issues section.	
Reporting	We have specified reporting in the permit in schedule 5 of the variation notice in order to ensure emissions are within ELV's and that the installation is being operated in an efficient manner.. We made these decisions in accordance with Monitoring Landfill Gas Engines LFTGN 08.	✓
Operator Competence		
Environment Management System	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.	✓
Technical competence	Technical competency is required for activities permitted. The operator is a member of an agreed scheme. WAMITAB	✓
Relevant Convictions	The National Enforcement Database has been checked to ensure that all relevant convictions have been declared. One relevant conviction were found. We did not consider it necessary in this instance to require the submission of a post conviction plan. This decision was based on the nature of the offences which were primarily water quality. The site inspector has not raised any issues with respect to these matters. The operator satisfies the criteria in RGN 5 on Operator Competence.	✓
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.	✓

Annex 2: Key issues in the determination

1. Introduction

United Utilities Water (UUW) plc operates a non-hazardous urban waste sludge treatment facility at the Davyhulme Wastewater Treatment Works (WwTW). The treatment process consists of storage, screening and dewatering of sewerage sludge, followed by anaerobic digestion in enclosed digester vessels. The anaerobic digestion process involves the biological breakdown of the sludge under oxygen deprived conditions. During this process a 'biogas', comprising predominantly of methane is generated. On-site combustion of the biogas in boilers and combined heat and power (CPH) plant generates heat to drive the anaerobic digestion process with the excess heat being used to generate electricity, which is used in the WwTW.

UUW are currently upgrading certain areas of the WwTW as part of their strategic Sludge Balanced Asset Project (SBAP). The SBAP includes improvements to the existing combustion plant, principally by installing new plant items to increase the rated thermal input of the combustion plant hence maximising the beneficial use of biogas. As part of these changes, the main CHP plant will also be re-located from its current location in the south-east of the WwTW to a new location near to the existing boiler house. Once the new combustion plant is operational the remainder of the existing plant will have been moved or decommissioned and the pollutant emissions from the existing release points will then cease.

This is a substantial variation which brings about a number of changes including an extension to the permitted area. The applicant has included in the application a site condition report for this extended area.. The extended site is to undergo a significant upgrade which includes:

- Addition of a new built multi-stream thermal hydrolysis (TH) digestion pre-treatment plant and associated infrastructure
- Addition of a second new-build Siloxane Removal System (SRS) and the relocation of the existing SRS including fitment of a vent air burner (VAB).
- Relocation of the Combustion Area. This is to include:
    - the relocation of 3 existing Jenbacher Combined Heat and Power engines (CHP);
    - removal of other existing CHPs;
    - the removal of existing boiler plant;
    - the addition of 2 new CHP engines;
    - and the addition of 3 new composite boilers for the purpose of steam generation.
- Addition of a new built cake import and handling facility
- Addition of a new built cake export and handling facility
- Addition of two new built gasholders and the demolition of the existing gasholder. .
- Construction of new secondary fuel storage tank
- Removal of existing flare stack and replace with new TGN compliant unit

- Re-designation of existing sludge storage assets and equipment

In addition, the variation corrects a number of minor errors in the current permit.

These changes will allow United Utilities Water to meet increasing demand for sludge treatment as part of their statutory obligations.

2. Environmental Risk Assessment

2.1 Emissions to Air

The applicant submitted an Air Dispersion (document ref: May 2010 UU ID 90020547) modelling results for the installation of the 5 CHP engines, 3 boilers, siloxane plant and regen flair. The air quality modelling document (ref: UU ID 90020547) was sent to AQMAU (Air Quality Modelling Assessment Unit) for appraisal.

The conclusion of AQMAU was that this report assumed 5 new engines and 3 boilers and was modelled on this as opposed to just the actual increase in pollution from 1 new engine and 1 new boiler. A revised report was submitted to the Agency. A further air modelling report was forwarded to the Agency for assessment by AQMAU and their report is summarised below.

The conclusions were as follows:

1) Both the applicant and AQMAU are in agreement that the combined effects of the relocation of the combustion plant to the new location and increase in operational capability will result in a rise in annual mean NO_2 concentrations of between 1 – 2 % of the environmental standard in a residential area within an Air Quality Management Area (AQMA) that has been declared because of persistent, high annual mean concentrations of NO_2.

2) Environmental standards pertaining to short term NO_2 levels and other pollutants should not be exceeded as a result of plant operations.

These conclusions were based on an assessment scenario in the model of an operational profile of four gas engines and one supplementary fired boiler.

On the basis of the background values used and estimated process contributions (PCs) the applicant predicted that the plant emissions will result in no exceedences of the listed pollutants (NO_2, SO_2, CO and VOCs) for relevant short term and long term environmental standards at local human receptors with the exception of the annual mean NO_2 in certain areas.

The applicant predicts that the proposed change will result in an increase in the process contribution to long term NO_2 concentration equal to or greater than 1% of the environmental standard (40 $\mu g/m^3$) over that residential area within the AQMA that lies to the west of the M60/ A57 junction and extends for approximately 1 km west of the junction. The maximum increase in this area is predicted to be approximately 2 %.

In the AQMAU audit of the earlier assessment, where the proposal was for an operational scenario of five gas engines and three boilers the process contribution to long term NO_2 at human receptors in the A57/ M60 junction area of the AQMA was found to be up to 4% of the EUEQS.

On the basis of the modelling, the long term process contribution of NO_2 is greater than 1% and so cannot be screened out as insignificant. However, because air modelling uses conservative assumptions and is likely therefore to over predict the level of impact, a process contribution which only just exceeds this 1% threshold cannot necessarily be considered to be significant. In particular, the model assumes that the plant emits continuously at the emission limit value. The emission limit value for gas engines is based on periodic monitoring, i.e. short term measurements rather than the long term average. The AQMA has been declared because of persistent, high annual mean concentrations of NO_2. Modelling showed the short term impact to be acceptable.

The Agency has therefore taken the following approach:

1) Limit the Operator to the assessment scenario of 4 gas engines and one boiler (or the equivalent thereof)
2) More frequent (quarterly) monitoring of NO_x emissions and monitoring over an extended period of operation (minimum of 4 hours) to build up data on actual emissions.
3) Reassessment of the impact of NO_x emissions on the AQMA based on monitored data.

Additionally we have paid particular attention to the Applicant's BAT assessment to ensure the CHP gas engines are performing at their optimum level as follows:

<u>Engines</u>

In this variation there are 2 new engines (CHP) to be installed and three of the four (one of the original engines removed) original engines are to be relocated to the new extended area. The 2 new engines are proposed to be identical to the existing engines. All engines will be subject to the monitoring regime as indicated below. As there is no specific Agency guidance for the monitoring of these engines the monitoring parameters have been taken from the 'Guidance for monitoring landfill gas engines emissions' LFTGN08 with monitoring times and frequencies amended in light of the air dispersion modelling results. The landfill gas guidance for the three existing engines A2, A3 and A4 states that emission limits should be based on Table B within guidance document LFTGN08 'emission testing for landfill gas spark ignition engines commissioned after 31st December 2005'. Engines A2, A3 and A4 were manufactured in 2000 and commissioned in 2006 but because of their age recent monitoring results confirm they cannot currently meet the emission limit values (ELVs) contained in table B of the guidance.
We have concluded that, since we cannot set limits that an Operator cannot meet with current equipment configuration, we shall set ELVs consistent with table A in the guidance.
Following re-location and re-tuning etc of these old machines, the Operator is required (via improvement conditions) to carry out appropriate monitoring to determine actual, achievable ELVs. This data is to be re-entered into the air dispersion model to assess the likely impact in the worst case scenario. A

report of an options appraisal to reduce ELVs and hence environmental impact is required following the monitoring exercise.

Table S4.1 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 (see Note 1)**
A2 CHP Engine exhaust stack	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	Bio-gas engine	6500mg/m³	Hourly average over a minimum of 4 hours*	Quarterly	BS EN 14792
A2 CHP Engine exhaust stack	CO	Bio-gas engine	1,500mg/m³	Hourly average	Annually	BS EN 15058
A2 CHP Engine exhaust stack	Total VOC's	Bio-gas engine	1,750mg/m³	Hourly average	Annually	BS EN 12619 or BS EN 13526 dependant upon concentration
A2 CHP Engine exhaust stack	NMVOC	Bio-gas engine	150mg/m³	Hourly average	Annually	BS EN 13649:2002
A3 CHP Engine exhaust stack	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	Bio-gas engine	650mg/m³	Hourly average over a minimum of 4 hours*	Quarterly	BS EN 14792
A3 CHP Engine exhaust stack	CO	Bio-gas engine	1,500mg/m³	Hourly average	Annually	BS EN 15058
A3 CHP Engine exhaust stack	Total VOC's	Bio-gas engine	1,750mg/m³	Hourly average	Annually	BS EN 12619 or BS EN 13526 dependant upon concentration
A3 CHP Engine exhaust stack	NMVOC	Bio-gas engine	150mg/m³	Hourly average	Annually	BS EN 13649:2002
A4 CHP Engine exhaust stack	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	Bio-gas engine	650mg/m³	Hourly average over a minimum of 4 hours*	Quarterly	BS EN 14792
A4 CHP Engine exhaust stack	CO	Bio-gas engine	1,500mg/m³	Hourly average	Annually	BS EN 15058
A4 CHP Engine exhaust stack	Total VOC's	Bio-gas engine	1,750mg/m³	Hourly average	Annually	BS EN 12619 or BS EN 13526 dependant upon concentration
A4 CHP Engine exhaust stack	NMVOC	Bio-gas engine	150mg/m³	Hourly average	Annually	BS EN 13649:2002
A21 CHP Engine exhaust stack	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	Bio-gas engine	500mg/m³	Hourly average over a minimum of 4 hours*	Quarterly	BS EN 14792
A21 CHP Engine exhaust stack	CO	Bio-gas engine	1,400mg/m³	Hourly average	Annually	BS EN 15058

A21 CHP Engine exhaust stack	Total VOC's	Bio-gas engine	1,000mg/m³	Hourly average	Annually	BS EN 12619 or BS EN 13526 dependant upon concentration
A21 CHP Engine exhaust stack	NMVOC	Bio-gas engine	75mg/m³	Hourly average	Annually	BS EN 13649:2002
A22 CHP Engine exhaust stack	Oxides of Nitrogen (NO and NO_2 expressed as NO_2)	Bio-gas engine	500mg/m³	Hourly average over a minimum of 4 hours*	Quarterly	BS EN 14792
A22 CHP Engine exhaust stack	CO	Bio-gas engine	1,400mg/m³	Hourly average	Annually	BS EN 15058
A22 CHP Engine exhaust stack	Total VOC's	Bio-gas engine	1,000mg/m³	Hourly average	Annually	BS EN 12619 or BS EN 13526 dependant upon concentration
A22 CHP Engine exhaust stack	NMVOC	Bio-gas engine	75mg/m³	Hourly average	Annually	BS EN 13649:2002

* Unless otherwise agreed in writing by the Environment Agency

The applicant has given details of the BAT compliance of the Janbacher engine which is summarised below:

The primary reduction methods of NO_x

Lean burn operation: Janbacher engines are already lean burn.

Engine tuning: For gas engines, one of the key criteria is the ignition timing angle. Engines are generally tuned to produce the highest efficiency possible as this has the greatest impact in respect of carbon dioxide reductions. However, this is at the expense of higher NOx concentrations.

In general decreasing the timing angle reduces NOx emissions, however decreasing the timing angle also reduces efficiency and increases the concentrations of carbon monoxide and unburnt hydrocarbons in the exhaust gas. In addition it can cause engine operational issues and may invalidate the engine manufacturers warranty.

The reduction in efficiency following de-tuning of the engines to reduce NOx concentrations in the exhaust gas is manifested as an increase in fuel consumption. Typically, for every 250 mg Nm^{-3} (@ 5% O_2 content) reduction in NOx concentration, a 1-2% increase in fuel consumption results. However, for some engines this may be as high as 2-3% (Environment Agency, 2005) Given the reduction in efficiency, and potential for increased CO emissions, it is not considered practical to de-tune the engines to achieve lower NOx emission concentrations.

Engine Management System: Modern gas engines usually come equipped with electronic engine management systems (EMS) to continually control and balance the consumption process. Continuous computer controlled adjustments of parameters such as ignition timing and airflow from the

turbocharger is achieved by the installation of analogue or digital transducers at key locations within the engine and sampling of key parameters typically takes place every 50 microseconds (ms). The EMS operator interface is typically driven by a touch screen graphical interface where the operator can adjust the EMS to produce specific operation conditions. The operating conditions chosen through an EMS must achieve the balance between greater efficiency and NOx production. EMS on modern spark ignition engines will be set to operate at optimum efficiency. The Janbacher engines forming the Combined Heat & Power (CHP) plant are modern variants with sophisticated controls for managing engine performance (fuel/air ratio, ignition, timing etc).

Exhaust Gas Recirculation: Exhaust gas recirculation is an effective method of controlling NO_x emissions. However this also reduces engine output and combustion efficiency. This method of NO_x control is not recommended for lean burn engines.

Water injection: Injection of de-ionised water before the main combustion chamber is a proven technique to control NO_x emissions in large industrial and marine diesel engines. However, for this method a specialised water purification plant would be needed to be factored in to the economic justification.

Replacement engines: The new Janbacher engines have a manufacturer guarantee NO_x emission of 500mg Nm^{-3} at 5% O_2. Replacing all engines with newer models capable of operating with NOx emissions of 500 mg NM^{-3} at 5% O_2 would, therefore reduce the installation-wide NOx emission rate by approximately 14%, with a corresponding reduction in Process Control (PC). This would result in the PC increasing by only 0.8 % of the AQS at Wilfred Close. However, given the estimated cost to produce three new engines is some £5.5 million, the modest environmental benefit gained is likely to be disproportionate to the financial cost and, by definition, against the BAT principle and the benefit gained would not be cost effective.

Selected Catalytic Reduction (SCR): This is a process where NO_x is removed from the exhaust gases following combustion. The cost to operate this system is in the region of £1.5m which is likely to preclude this option as BAT.

Non-Selective Catalytic Reduction (NSCR): This system uses a precious metal catalyst without injecting regents to reduce NOx emissions in a exhaust gas stream. This process is also highly effective at reducing HC and CO emissions. NCSR is commonly referred to as a three way converter and is similar to catalytic converters found on motor vehicles. NSCR removal is only effective under stoichiometric or fuel-rich combustion conditions where the combustion gas is nearly depleted of oxygen. This factor makes NSCR unsuitable for lean burn applications.

Lean NO_x Trap (LNT) Catalysis::_To overcome the limitations of NSCR in lean burn conditions, lean NO_x trap (LNT) catalysis has been successfully applied to diesel reciprocating and natural gas turbines. However, this is a still an emerging technique and few suppliers offer this technology in the UK.

We consider that the use of the CHP engines represents BAT for the combustion of biogas. The process involves the use of fuel derived from the processing of sewerage sludge to produce heat and power. The plant is designed so that emissions meet the Landfill Technical Guidance Note. However, biogas from an anaerobic digestion plant should be of a more consistent composition than that drawn from a landfill site and so it should be feasible to operate gas engines to better environmental standards.

An improvement condition has therefore been imposed to review the levels of NO_x, SO_2, CO, total VOC and non–methane VOC emissions following completion of the monitoring exercise to determine the actual values for the releases to air and their impact on the environment. In particular, the impact of NO_x emissions on the AQMA should be re-assessed based on actual NO_x emission data.

In the event that the impact of NOx on the AQMA still shows a process contribution >1%, a further review will be required to look at all options for further reducing the emissions to air.

The benchmark for point source emissions to air from spark ignition engines commissioned after 31 December 2005 is currently 500 mg/Nm^3 for NO_x and 1,400 mg/Nm^3 for CO at 5% O_2 which are monitored on a hourly average .

2.2 Composite Boiler monitoring

A composite boiler is a boiler unit that has one section which has two combustion sections, a fired section and a waste heat section. The boiler takes hot exhaust gases from the engine to utilise for the production of steam. Biogas from the digestion process is used to supplement this process when required and a diesel oil burner may be used as a back up if there is insufficient biogas but this will need to meet particulate limitations.

There is no Agency guidance regarding the monitoring of these boilers. However, these units will be monitored for NO_x, CO, SO_2, NMVOC and Total VOC.

2.3 Flares

During periods when the volume of biogas exceeds the storage capacity of the gasholders and the requirements of the engine/boilers it will be necessary to flare this excess gas. Two new flare stacks are to replace the existing stack. The flare stacks will be operated in accordance with Agency guidance ‘Guidance for the Monitoring of Enclosed Landfill Flares’ LFGTGN05. As these are standby flares, monitoring will not be required providing the flares are not operational for greater than 10% of the time in one year. The hours the flares are operational and the amount of gas flared will be recorded.

2.4 Odour Control

The odour potential at this facility is recognised as significant and as such this has to be managed effectively. The type of odour control operated at this facility are:

- Dry Chemical Scrubber – five stage strain press
- Wet Chemical Scrubber – general odour abatement from sludge area

- Air Ionisation

Odour control in this decision document will only look at those new additions included in this variation.

The Thermal Hydrolysis vessels and associated infrastructure plus the secondary digesters do not require odour control as these are sealed units operating under pressure. The storage tanks contain digestate which is unlikely to be odorous. Odour control for the remaining units are described below in Table 2.1.5

Table 2.1.5 Asset	Odour Control
Raw sludge holing tank	Tanks are covered and any emissions treated in the wet scrubber.
Primary sludge screen screening skips (2)	Skips are stored within housing and covered. Odorous emissions collected by wet scrubber treatment plant
Screened sludge buffer tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant
Secondary sludge screening skips	Skips are stored within housing and covered. Odour emissions are collected and treated in a separate designated odour treatment plant supplemented by air ionisation plant.
Screened sludge tanks (4)	Tanks are covered. Odorous emissions collected by wet scrubber treatment plant
Raw sludge centrifuge feed storage tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant
Centrifuges (4)	Assets are within a building which is under negative pressure with any odorous emissions collected by wet scrubber treatment plant
Centrate Tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant
Thickened sludge storage tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant
TH buffer silos (4)	Tanks are covered. Odorous emissions collected by wet scrubber treatment plant
Cake silos (2)	Tanks are covered. Odorous emissions collected by wet scrubber treatment plant
Cake import bunkers (2)	Tanks are covered. Odorous emissions collected by wet scrubber treatment plant. Conveyers transferring sludge between the cake import bunkers and the cake silos are enclosed and air extracted to the wet scrubber odour treatment plant.
Degassing tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant
Centrifuges (2)	Assets are within a building which is under negative pressure with odorous emissions collected by wet scrubber treatment plant
Centrate collection tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant
Centrate buffer tank	Tank is covered. Odorous emissions collected by wet scrubber treatment plant

A revised odour risk assessment has been carried out to include the new infrastructure and these sections are reproduced below:

Odour Risk Assessment						
Hazard	Receptor	Pathway	Risk management	Probability of exposure	consequences	What is overall risk
Imported sludge cake silo	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
TH buffer silo	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
Screened sludge buffer tank	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
Screened sludge tanks (4)	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
Raw sludge centrifuge feed storage tank	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
Centrate tank	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
MVSP & centrate feed tank	Local residents	Air	This site operates an odour management plan	Very low	Localised odour annoyance	Not significant
Centrate collection tank	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
Centrate buffer tank	Local residents	Air	Served by a wet scrubber odour treatment plant	Very low	Localised odour annoyance	Not significant
Centrifuges (6)	Local residents	Air	Served by a wet scrubber odour treatment plant. The building	Very low	Localised odour annoyance	Not significant

			which they are located will be served by either Air-Ionisation or odour treatment plant			
Odour related nuisance from loss of containment of biogas	Local residents	Air	Robust design Accident management plan	Very low	Localised odour annoyance	Not significant

As part of the companies operating procedures an odour management plan is employed. The plan covers a number of issues including:

- A summary of the site, odour sources.
- Details of site management responsibilities
- Odour critical plant operation and management procedures
- Operative training
- Maintenance and inspection
- Record keeping
- Spillage management procedures
- Emergency breakdown and incident response

This is a living document and will be regularly reviewed and updated.

An improvement condition has been included in the permit for the operator to provide a report of the effectiveness of the odour control measures which are currently in place.

3. Other Changes

3.1 Siloxane Removal System

There is a siloxane removal plant at this facility which is currently undergoing a commissioning stage and is monitored subject to the conditions of the installations existing permit.

The result of an accident with this system has stalled the commissioning stage and the introduction of the new siloxane removal system. Whilst an investigation is being carried out regarding this incident this permit variation has introduced pre-operational measures for future development for recommencement of this system. These measures are detailed in section 5 below.

3.2 Thermal Hydrolysis Plant

The thermal hydrolysis plant will break down the cell matter into components that are easier to digest. The thermal hydrolysis process will also provide pasteurisation of the sludge feed to the digestion process.

Thermal hydrolysis processes are batch systems that will use direct medium pressure steam as the principle heating medium. The steam shall be provided from a combination of CHP engine waste heat and fired steam boilers using biogas from the anaerobic digestion process as fuel.

The main purpose of the thermal hydrolysis plant is to prepare the sludge for the digestion process. During the hydrolysis process, cells and cell clusters are broken open and solubilised and therefore more easily accessible for digestion. The main concept of the thermal hydrolysis process is a step wise heating and cooling of sludge through pressure and temperature control. The process consists of the following main steps:

- Sludge heating in the pulper/pre-heater tank
- Thermal hydrolysis in the reactor
- Pressure let down in the flash tank

The reactor operation will be a batch process. The reactors operate on a staggered basis creating the effect of a continuous flow. When the hydrolysis process is complete, a valve at the top of each reactor will open gradually and the pressure will be reduced. The resultant steam will be redirected back to the pulper for use in the pre-heating process. The thermal hydrolysis system is sealed and under pressure and there are no releases of liquids or gas. An improvement condition (1) has been added to this permit to ensure a revised assessment of any environmental impact is carried out.

3.3 Cake Import Handling Facility

Sludge cake is to be imported by covered vehicle to one of two import reception bays. Each reception bay will serve a cake import bunker. Both the reception bays and import bunkers are covered and have a odour extraction system. From the import bunker the cake is transferred via conveyer belt to the cake silo's which are located above ground. From the cake silos, cake is pumped to one of four Thermal Hydrolysis buffer silos using a dedicated cake transfer pump for each cake silo. Each pump shall be capable of feeding all the THP silos and are variable speed operating as duty/duty. Reliquification will be carried out using heated final effluent which will be added at the cake transfer pump. The cake silos will then feed the Thermal Hydrolysis Plant. There has been a trial carried out regarding the cake import handling facility which has restricted the storage of the cake to 50m^3. Pre operational measures (4 & 5) have been added to this permit to ensure dust minimisation and an odour air dispersion assessment is to be carried out.

3.5 Energy Efficiency

Based on the information supplied by the operator we are satisfied that appropriate measures are in place to ensure that energy is used efficiently.

This installation is a net energy provider. Table 2.7.2a of the variation application details the energy operating and maintenance measures. Table 2.7.2b contains the basic energy efficient building service measures.

There are a limited number of materials used by and stored within the installation. Effluents from the odour control units and condensates from biogas combustion processes are returned to the on-site, off installation WwTW for treatment.

Water should be recycled within the process from which it issues, by treating it first if necessary.

There are also to be two new flares installed so if there is to be too much gas produced at the site for the combustion plant to utilise this has to be flared.

3.6 Conservation

A summary of the Easimap screening results are as follows:

e) No Sites of Special Scientific Interest (SSSI) within 2 km
f) No Ramsar sites within 10 km
g) No Specific Area of Conservation (SAC) within 10 km.
h) One Local Nature Reserve within 2 km – Davyhulme Millenium Nature Reserve.

This variation does not add any significant environmental impact for air emissions and therefore there is no additional risk to these conservation sites via the introduction of this variation.

3.7 Groundwater

The changes introduced via this Application do not impact groundwater. The risk of fugitive emissions to groundwater related to the re-liquidification trial are to be prevented via the constant supervision of the operation and no overnight sludge cake storage on site, unless in the event of equipment breakdowns, and the limitation of sludge cake on site to no greater than 50 m^3.

3.8 Emissions to Surface Water and Sewer

There are no point source emissions to surface water or sewer introduced via this variation. Fugitive emissions are minimised via the usage of operating procedures and spill kit usage. For the mobile steam generator, drain isolation and shutoff procedures further minimise the risk of fugitive emissions. During the trial fugitive emissions will be minimised via supervision at all times and minimisation of the on site volume of sludge cake as detailed in the groundwater section above.

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3.9 Site condition report

The site condition report covers the extended area as shown on drawing No 7530/90020547/03/96/1001 in the document Davyhulme WwTW STF Volume II.

The site condition report covers the permit application stage in line with our H5 Site Condition Report Guide for Applicants as follows:

- Section 1 Summary
- Section 2 Introduction and details
- Section 3 Sensitive Receptors
- Section 4 Permitted Activities
- Appendix A – Figures
- Appendix B – Envirocheck Report
- Appendix C – Photolog
- Appendix D – Site Reference Data

The operator has listed the potential sensitive receptors' within a 10km radius of the centre point of the installation. These results are shown in Table 1.2 Davyhulme WwTW STF Volume II.

- Physical settings geology and hydrogeology have been provided.
- The envirocheck report for the area shows the site to be located on Ladinian – Permian geological strata.
- Historic pollution incidents
- There have been six historic pollution incidents to controlled waters to within a kilometre of the midpoint of the instillation. None of these incidents occurred on the installation itself.
- Evidence of historical contamination

The site has been identified as being a sewage treatment works since 1894. Remote ground investigations directly underlying the extended installation were undertaken by AEG in 2008.

Results of soil samples were compared to soil guidelines values (SGV's) or CIEH/LQM 2006 derived guideline values. This analysis showed exceedence of soil guideline values for the following compounds contained within UUW plc Environmental Permitting Reference data list: lead and TPH.

The results for the chemical testing of groundwater samples were compared to UK/WHO Drinking Water Quality Standards, Environmental and Water Quality Standards. These analysis showed exceedence of these values for the following compounds contained within the UUW plc Environmental Permitting Reference data list: nitrate and THP (C10-C40)

It is noted that some of these materials analysed by the historic site investigation will be excavated and removed from site and replaced with recycled aggregate as part of construction operations.
Conclusion

We have reviewed the site condition report and associated documents and we have accepted them as satisfactory with the following comments:

- Adequate site investigation has been undertaken to provide sufficient information as to baseline conditions.
- Improvement programme Reference 4 requires following the building of the new phase a review of all sub-surface pipe-work and drainage survey in relation to their potential risk to cause fugitive emissions to surface and groundwater's having regards to the requirements of section 2.2.5 of the Agency Guidance note IPPC S5.06 dated December 2004.
- Location of the new installation covered by the variation application is within the existing site.

3.10 Increase in tonnage

There is to be an increase in tonnage for the treatment of waste only, from 1,243,350 to 4,635,865 tonnes per year. The amount of waste material stored on site remains the same. Due to this variation the speed of processing this waste will increase and therefore this will also increase the throughput of waste which requires a rise in annual tonnage.

4. Improvement Conditions

There are a number of issues with the introduction of new plant that need to be incorporated into the permit such as monitoring results, infrastructure integrity etc but the results of these cannot be demonstrated prior to the permit issue (plant not yet installed) therefore improvement conditions or pre-operational measures are included in the permit to ensure these issues are accommodated. Some of these conditions will already have been reproduced above.

The reasoning behind the date these conditions are set, February 2014 is because the project has a period after commissioning, of optimisation and performance testing. This is where the performance of the plant is fine tuned and consolidated for operations and ongoing use. This performance testing lasts for 12 months in order to ensure that the operator can capture summer and winter conditions which can affect the nature of the sludge and the performance of the equipment and this will obviously have the potential to impact on the emissions. In addition the data collection and evaluation exercise for emissions to air may not gather typical and representative data if it is taken before February 2014 and may lead to erroneous conclusions or the need to repeat the work.

There have been a number of improvement conditions included in this variation and these are reproduced below:

Table S1.3 Improvement programme requirements

Reference	Requirement	Date
1	Following final commissioning of the Thermal Hydrolysis plant, the operator shall submit to the Environment Agency a report detailing the outcome of the commissioning programme. The report shall include but not necessarily be limited to the following: • A revised assessment of the potential impact on the environment (using the Environment Agency H1 methodology or equivalent) based on monitoring data acquired during commissioning and optimisation; • Confirmation of the efficiency data provided in the application and supporting information; • Identification of any changes to the operating techniques provided in the application.	28th February 2014 or one year post completion of commissioning (whichever is the later)
2	Following final commission of the proposed new engines, the operator shall review the level of NOx, SO2, CO, Total VOC and non methane VOC emissions following completion of the monitoring exercise to determine actual values for the releases to air required by condition 3.6.1. The operator shall use this detailed release data to establish the impact on air quality through the use of an appropriate air dispersion model. The results of the review and modelling should be submitted to the Agency in a written report with an assessment of the significance of the impacts using H1 significance criteria.	28th February 2014 or six months post completion of commissioning (whichever is sooner)

Table S1.3 Improvement programme requirements		
Reference	**Requirement**	**Date**
3	The operator shall undertake to review all options for reducing the emissions to air to at least the benchmark standards in the Agency Technical Guidance Note for combustion and the guidance for monitoring landfill gas engine emissions (LFTGN 08), and to ensure that the releases to air do not result in a significant contribution to an exceedence of an air quality standard, objective or European Union Limit Value. Where an exceedence of a European Union is predicted and the operations would provide a significant contribution to the exceedence then the review shall assess whether it is necessary to implement measures in order to ensure that the contribution is minimised.	28th February 2014 or one year post completion of commissioning (whichever is sooner)
4	Following final commissioning of the plant the operator shall review the condition of all sub-surface pipe-work by conducting a drainage survey in order to demonstrate integrity of the drainage system in relation to their potential risk to cause fugitive emissions to surface and groundwaters having regards to the requirements of section 2.2.5 of the Agency guidance note IPPC S5.06 dated December 2004.	28th February 2014 or one year post completion of commissioning (whichever is the later)
5	The Operator shall provide a report of the effectiveness of odour control measures which are currently in place, having regard to Part III of Defra's Code of Practice on Odour Nuisance from Sewage Treatment Plants dated 2006 and the Environment Agency Sector Guidance S5.06. This is with specific reference to the new raw cake reception, dilution and sludge transfer. A written summary of the assessment shall be submitted to the Environment Agency in writing for approval, which shall include, but not be limited to: • A review of the adequacy of the installation Odour Management Plan in the light of the above assessment; A timetable for the implementation of any improvements identified.	28th February 2014 or one year post completion of commissioning (whichever is the later)

5. Pre-Operational Measures

Table S1.4A Pre-operational measures shall be amended to include:

Table S1.4A Pre-operational measures	
Reference	**Pre-operational measures**
1	Prior to the operation of each individual new activity included in this variation the operator shall update the accident management plan having regard to the requirements set out in Section 1 of Environment Agency Guidance - How to comply with your environmental permit. The documents and procedures shall be made available for inspection at the installation.
2	Prior to the operation of each individual new activity included in this variation the operator shall extend the Environment Management System (EMS) protocols to include the above units, having regard to the requirements set out in Section 1 of Environment Agency Guidance - How to comply with your environmental permit. The documents and procedures shall be made available for inspection at the installation.
3	At least 30 days before commissioning commences of these facilities the operator shall submit an amendment to the existing Odour Management Plan (OMP) to cover each new activity included within this variation. The Operator shall have regard to Part III of Defra's Code of Practice on Odour Nuisance from Sewage Treatment Plants dated 2006 and the Environment Agency Sector Guidance S5.06 Guidance for the disposal and recovery of hazardous and non-hazardous waste The documents and procedures shall be made available for inspection at the installation.
4	At least 30 days before commissioning commences of these facilities the operator shall submit a report demonstrating that the necessary infrastructure and operating procedures are in place as detailed in operator application EPR/HP3931LJ/V005 for the Installation to allow environmental compliance with the permit EPR/HP3931LJ. This report shall include but not be limited to: • Cake silo discharge dust minimisation measures in place during off-loading to lorries. No operations shall commence until this report has been approved by the Agency.
5	Prior to the operation of the proposed new raw sludge thickening and cake import facility the operator shall carry out an odour air dispersion assessment taking into account the requirement of section 2.2.6 in the Agency guidance document IPPC S5.06.

Table S1.4B Pre-operational measures for future development.

Table S1.4B Pre-operational measures for future development		
Reference	**Operation**	**Pre-operational measures**
1	Addition of a new build Siloxane Removal System	30 days prior to comissioning of the siloxane removal system the Agency will be provided with a detailed plan regarding the type of plant, equipment and design parameters (e.g. maximum daily treatment capacity). This plan must contain, but not be limited to: • Details of chemical reactions and their reaction kinetics/energy balance • The control system as relevant to the minimisation of emissions, in particular the main reactions and their control. • Comparison with indicative BAT standards in the sector guidance note including a comparison of candidate techniques (H1). • Typical reactor conditions e.g. volume, temperature, pressures, exotherms. • Details of condensate collection and removal • Temperature of the exhaust gas from the condensate stack This plan must contain dates for the implementation of individual measures.
2		A commissioning report for the siloxane removal plant shall be provided to the Agency to demonstrate it's performance within the first three months of it's operation. The report should be submitted within 6 months of it's operation. This will include: • Appropriate sampling of the emissions from the Vent Air Burner (A26) shall be undertaken (the suite of analysis should include those determinants supplied in Appendix E (dated 22nd November 2007)of the variation (EPR/HP3931LJ/V002) application as a minimum) to allow the operator to carry out an environmental impact assessment of the releases to air from A26. The impact assessment shall use representative release data, obtained through the monitoring exercises, and the H1 tool, or other appropriate assessment method. • Temperature results from the exhaust gas from the siloxane condensate stack. • Any complaints, incidents or releases. • Any breakdown, operational problems and remedial action. • Monitor condition of the engine oil to highlight contamination trends, in particular to examine concentration of siloxanes within the oil. **It is likely that once the Agency have reviewed this report, we will set emission limits for A26 and a monitoring frequency.**
3		14 days prior to the installation of the siloxane removal system the operator shall provide to the Agency O&M documentation showing: • Routine monitoring procedures • Procedures for start up & shut down • Emergency procedures • Hazardous operations plan • Management of change procedure • Hazardous area classification

Annex 2: Consultation, web publicising and newspaper advertising responses

Response received from
Trafford Primary Care Trust (PCT)
Brief summary of issues raised
Assumed will comply with the relevant European Regulations Emissions to air, we recommend that the regulator is satisfied with the use of landfill gas engine limits The Agency is satisfied with the monitoring levels for the boilers. The Agency is satisfied that there is no monitoring of the emergency flares. The Agency is satisfied with the proposed monitoring of the siloxane unit. Are the Agency satisfied that there are no monitoring requirements for the Pressure release valves (PRV's) Confirm that site monitoring will be updated with respect to planned changes Ensure that the Agency is satisfied with the air modelling report These sites occasionally cause odour and noise issues, the regulator is required to ensure that any recent complaints are taken into account
Summary of actions taken or show how this has been covered
The above concerns have been taken into account. All relevant Europeon Regulations are taken into account The gas engine limits are in line with the landfill Directive LFTGN08 which is in use as no other guidance is available The monitoring levels for the boilers is set at previous monitoring levels, there is no Agency guidance on emissions from these types of boilers.. There is no requirement for the flares to be monitored as they are used for emergancy only The siloxane monitoring levels will be set once the trail is complete There is no requirement to monitor the pressure relief valves as used in emergency only The air modelling report has been completed to the satisfaction of the Agency. Odour is controlled by the odour management plan as are noise issues.

Response received from
Environmental Health did not respond
Brief summary of issues raised
Summary of actions taken or show how this has been covered

Response received from
Food Standards Agency did not respond
Brief summary of issues raised
Summary of actions taken or show how this has been covered

Response received from
Health and Safety Executive did not respond
Brief summary of issues raised

Summary of actions taken or show how this has been covered

Response received from
Trafford Metropolitan Borough Council Local Planning Authority did not respond
Brief summary of issues raised
Summary of actions taken or show how this has been covered

Annex 3 AQMAU report Davyhulme WwTW

1. Summary of Work Request

The National Permitting Service (NPS) asked the Air Quality Modelling and Assessment Unit (AQMAU) to audit an air quality impact assessment (air quality and habitats) submitted by United Utilities in support of proposed combustion plant at Davyhulme Wastewater Treatment Works (WwTW), Salford.

The Operator proposes to shut down the following combustion units:

- One Jenbacher engine
- Two composite boilers

The Operator proposes to relocate following combustion units:

- Three Janbacher engines

The Operator proposes to add the following new combustion units:

- Two new Janbacher engines
- Three new composite boilers

This will add a total number of one Janbcher engine and one composite boiler to the original total of four Janbacher engines and two composite boilers.

The overall impact of these changes is to increase the thermal imput of the installation from ~37 MW to ~45 MW.

The Applicant has modelled both the overall impact of emissions to air from these proposed changes and the increased impact when compared against current operations.

This model has been audited by the Environment Agency's air quality modelling experts, who conclude:

Applicants submission is as follows:

The revised report states that the future operation will house five Jenbacher gas engines and three boilers. The assessment scenario is for an operational profile of four gas engines and one supplementary fired boiler.

The applicant has obtained background levels of NO_2, SO_2, CO and NMVOCs (as benzene) from the National Air Quality database[3] which provides average values for 1 km x 1 km squares and from local council NO_2 diffusion tube data.

The applicant has calculated the air quality impacts resulting from the existing and proposed future scenarios.

The applicant has examined the plant's impact on 39 human receptor locations (residential and non-residential) and 9 ecological locations. In addition, process contribution annual mean NO_2 concentration isopleths have been presented in an appendix for the surrounding local area (5 x 5 km square).

The applicant has used ADMS, V4.2 to model the air pollutant dispersal and assumed a surface roughness of 0.5 m for the dispersion site.

The applicant has used five years of meteorological data from Manchester International Airport (2006 - 2010) which is approximately 13 km to the SE of the proposed installation.

The applicant has used emission limit values appropriate to gas engines commissioned since 2005.

Conversion factors of 0.7 x and 0.35 x for long term and short term NOx conversion to NO_2 respectively have been used.

The local terrain is relatively flat and the applicant has stated that terrain data was not used in their modelling.

Numerous site buildings were included in the modelling with the CHP buildings in both scenarios (height 20 m) selected as the main building affecting the dispersion.

On the basis of the background values used and estimated process contributions (PCs) the applicant has predicted that the plant emissions will result in no exceedences of the listed pollutants for relevant short term and long term environmental standards at local human receptors with the exception of annual mean NO_2 in certain areas.

The applicant predicts that the proposed change will result in an increase in the process contribution to long term NO_2 concentration equal to or greater than 1% of the environmental standard (40 µg m^{-3}) over that residential area within the AQMA that lies to the west of the M60/ A57 junction and extends for approximately 1 km west of the junction[6]. The maximum increase in this area is predicted to be approximately 2 %.

The applicant has examined the impact of plant emissions on the following habitat sites: Foxhill Glen, Davyhulme Millennium Nature Reserve and Bridgwater Canal (all LWS), Manchester Mosses (3 positions, all SACs) and Rixton Clay Pits (SAC).

The applicant has found that environmental standards for critical levels and loads for some habitat sites are already exceeded by background. The process contributions to NO_x and SO_2 levels as a result of the proposed change are predicted to be less than 100% of the environmental standard (annual mean and maximum daily mean) at the LWS habitat sites and less than 1% at the SACs. Acid and nutrient nitrogen deposition loads are already exceeded by background at the sites. The contributions arising from the proposed plant change are predicted to be insignificant.

AQMAU Audit

In the AQMAU audit of the previous application where the proposal was for an operational scenario of five gas engines and three boilers the main issue was found to be the process contribution to long term NO_2 at human receptors in the A57/ M60 junction area of the AQMA. This contribution was found to be up to 4% of the relevant environmental standard. This assessment therefore

concentrates on the revised estimates for the process contribution to long term NO_2 at human receptors in the A57/ M60 junction area of the AQMA.

There are discrepancies between the data provided in the previous report for the stack emissions and that in the present report, these discrepancies are to be found in both present and future scenarios and include the number of engines and boilers, the stack locations, flow and stack parameters and emission rates. Following an e-mail exchange with the applicant it was decided to carry out check calculations on the basis of emission rates of 1.35 g s^{-1} of NO_x per gas engine using the emission data in the most recent report.

Our check modelling used ADMS v. 4.2 with meteorological data from Manchester Ringway Airport (2003), NWP predictions (2004) and Woodford Airfield (2004 – 2007). A dispersion site surface roughness value of 0.3 m was used for most of the model runs. Sensitivity to a higher value (0.5 m) was tested. The results did not affect the main audit conclusions. No terrain data was used.

Stacks with identical grid references and discharge conditions were combined.

Background data for 1 km x 1 km squares was obtained from the National Air Quality database[2] and local diffusion tube results for annual mean NO_2 levels at the A57 /M 60 junction from Salford District Council. As before, we have taken the view that there is no headroom for annual mean NO_2 levels within the AQMA in the vicinity of the A57/ M60 junction. Consequently, the magnitude of the process contribution with respect to the environmental standard (40 µg m^{-3}) is considered by us to be important for assessing the environmental impact of the plant at residential receptors within the AQMA.

The impact of the proposed plant has been assessed by subtracting the predicted ground level concentrations from those arising from the existing site. Our predictions are in general agreement with those of the applicant in so much as we both find that the incremental increase in annual mean NO_2 levels in that part of the AQMA adjacent to the A57/ M60 junction that results from operation of the proposed site relative to the existing one will be between 1 – 2 %.

We have noted previously that there are several local future additional sources of NOx under consideration - increased traffic associated with the new Port Salford facilities, the Carrington I and II power stations, Partington Paper Mill and the Barton Renewable Energy Plant.