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GENT FAIRHEAD

RIVENHALL IWMF

ENVIRONMENTAL PERMIT VARIATION - SUPPORTING INFORMATION

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NON-TECHNICAL SUMMARY

An Environmental Permit (EP) (Ref: EPR/FP3335YU) was granted to Gent Fairhead (the Applicant) for the Rivenhall Integrated Waste Management Facility (the Facility) on 11 September 2017.

The Facility includes three scheduled activities (a paper pulp plant, an anaerobic digestion facility and a waste incineration plant utilising CHP) and three directly associated activities (an MBT facility, a Materials Recycling Facility and a waste water treatment plant). The direct emissions to atmosphere from the three scheduled activities would be released to atmosphere via a single windshield with a height of 58m above surrounding ground level.

The planning consent for the Facility includes a stack height of 35m above surrounding ground level. The Applicant has submitted planning applications in July 2017 for a modification to the existing planning consent for a taller stack, to be consistent with the approved EP. However, these planning applications are yet to be determined by the local authority.

The Applicant wishes to apply for a variation to the EP to reduce the stack height to 35m above surrounding ground level and to reduce a number of emission limits in order to ensure that the change to environmental impacts is insignificant. This would be achieved by using an advanced abatement system for oxides of nitrogen.

The air quality assessment has been repeated from the original application. The change in impact is considered to be insignificant.

(1) All pollutants which could be screened out as insignificant for the approved EP can still be screened out as insignificant.

(2) For pollutants which could not be screened out as insignificant as before, the conclusions of the assessment are unchanged:
   a) For short term concentrations of nitrogen dioxide and Sulphur dioxide and long term concentration of cadmium, the impact of the Facility has been reduced.
   b) For long term concentrations of nitrogen dioxide, the area where the impact cannot be screened out as insignificant is barely changed and only covers five receptors, and the overall impact remains less than all other large EfW plants which have been granted permits in England.
   c) For long term concentrations of VOCs, it is still unlikely that these will give rise to significant pollution.

(3) The impacts on ecological receptors are still not significant.

For completeness, a BAT assessment has been carried out to compare the proposed variation with the permitted plant. This shows that the proposed variation would increase annualised costs slightly while reducing annual emissions of NOx.

Hence, the applicant considers that the proposed changes are an alternative method of achieving the environmental impacts associated with Best Available Techniques.

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1 INTRODUCTION

1.1 Background

An Environmental Permit (EP) (Ref: EPR/FP3335YU) was granted to Gent Fairhead (the Applicant) for the Rivenhall Integrated Waste Management Facility (the Facility) on 11 September 2017.

The Facility includes three scheduled activities (a paper pulp plant, an anaerobic digestion facility and a waste incineration plant utilising CHP) and three directly associated activities (an MBT facility, a Materials Recycling Facility and a waste water treatment plant). The direct emissions to atmosphere from the three scheduled activities would be released to atmosphere via a single windshield with a height of 58m above the surrounding ground level.[1]

The planning consent for the Facility includes a stack height of 35m above surrounding ground level. The Applicant submitted planning applications in July 2017 for a modification to the existing planning consent for a taller stack, to enable the designs to be consistent with the approved EP. However, these planning applications are yet to be determined by the local authority.

The Applicant has not commenced construction of the Facility.

1.2 Type of Variation

Under the Environment Agency's (EA's) charging regime, a "substantial variation" is defined as "an application to vary a permit which the Agency considers is likely to involve significant assessment." During the pre-application meeting the EA indicated that this will apply to this variation. Therefore, this application is being submitted as a substantial variation.

[1] As the CHP plant would be located below the surrounding ground level, the height of the stack from its base would be 78m. However, throughout this application, any references to stack height will relate to the height above the surrounding ground level unless otherwise stated.

2 Proposed Changes

2.1 Summary

This application is requesting the following changes to the EP.

(1) Reduce the stack height from 58m above surrounding ground level to 35m above surrounding ground level.

(2) Reduce the daily emission limit for emission points A1 and A2 (the CHP plant) for oxides of nitrogen (NO_x) from 150 mg/Nm^3 to 100 mg/Nm^3.

(3) Reduce the half-hourly emission limit for emission points A1 and A2 for oxides of nitrogen (NO_x) from 400 mg/Nm^3 to 200 mg/Nm^3.

(4) Reduce the half-hourly emission limit for emission points A1 and A2 for sulphur dioxide from 200 mg/Nm^3 to 90 mg/Nm^3.

(5) Reduce the emission limit for emission points A1 and A2 for cadmium and thallium from 0.05 mg/Nm^3 to 0.02 mg/Nm^3.

As explained above, the reduction in stack height would make the EP consistent with the existing planning consent. The reduction in emission limits are to ensure that the environmental impact of the Facility does not change significantly, as discussed in section 3. The methods for achieving the reductions in the proposed emission limits are explained below.

For the avoidance of doubt, no changes are proposed to the quantities or types of waste being stored and processed. Therefore, no changes are required to the fire prevention plan.

2.2 Nitrogen oxides

The reduced emission limits for nitrogen oxides would be achieved using an advanced version of the currently permitted SNCR system. The enhancements are as follows:

(1) The installation of injection lances at multiple levels (five or more) in the boiler, with the ability to control the delivery of ammonia to the lances individually or in groups.

(2) Improved measurement of furnace temperature with acoustic or IR pyranometers. This enables the distribution of temperatures across the furnace to be measured.

(3) Improved control system which uses the furnace temperature measurement as well as the measurement of ammonia and NOx to select which lances are most appropriate to use and to adjust the dosing rate of ammonia.

These methods are mentioned in section 4.5.4.3 of the draft Waste Incineration BREF.

It is anticipated that the ammonia consumption of the plant would increase by 35 kg/hr/line. This would increase annual consumption from around 1,500 tonnes to 2,071 tonnes. There would be no change to the storage arrangements.

2.3 Sulphur dioxide

The long term (daily) emission limit for sulphur dioxide would remain at 50 mg/Nm^3 and the emission concentration will be controlled below this level by the controls within the acid gas abatement system. The sulphur dioxide concentration before abatement and in the flue gases will be measured and the lime injection rate will be varied to control the emission concentration.

The Applicant is confident that the control system will be able to control peak concentration of sulphur dioxide to ensure that the half-hourly concentration remains below 90 mg/Nm^3.

2.4 Cadmium and Thallium

The abatement methods for cadmium and thallium would be unchanged.

The draft Waste Incineration BREF includes a BAT-AEL range of 0.005-0.02 mg/Nm^3, compared to the current emission limit of 0.05 mg/Nm^3. The Applicant is happy to commit to achieving this BAT-AEL from the commencement of operations and prior to implementation of the requirements of the BREF.

3 ENVIRONMENTAL IMPACT

The only environmental impacts which would change as a result of the proposed variation are the air quality impacts. Therefore, the air quality impacts have been assessed using the same methodology as set out in the original application. The only changes made to the air quality assessment are to the emission concentrations and the stack height. Therefore, full details of the assessment have not been set out below. For reference, the air quality assessment (ref S1552-0700-0011RSF Dispersion Modelling Assessment_v8.pdf) (herein referred to as the original air quality assessment) used to determine the original application as submitted on 30 May 2017, is included in Appendix D.

3.1 Revised Inputs

The following changes have been made to the input values:

(1) Throughout, the stack height has been changed to 35m, or 85m AOD.

(2) In Table 6.2 (Emissions Data – CHP (per stream) – Daily Emission Limit Values), the emission rate for oxides of nitrogen has been changed from 7.734 g/s (150 mg/Nm^3) to 5.156 g/s (100 mg/Nm^3) and the emission rate for cadmium and thallium has been changed from 2.578 mg/s (0.05 mg/Nm^3) to 1.031 mg/s (0.02 mg/Nm^3).

(3) In Table 6.3 (Emissions Data – CHP (per stream) – Half-Hourly Emission Limit Values), the emission rate for oxides of nitrogen has been changed from 20.623 g/s (400 mg/Nm^3) to 10.312 g/s (200 mg/Nm^3) and the emission rate for Sulphur dioxide has been changed from 10.312 g/s (200 mg/Nm^3) to 4.640 g/s (90 mg/Nm^3).

3.2 Results

The results of the dispersion modelling are shown in Table 3.1 below, which is an update of Table 7.1 in the original dispersion modelling assessment. The impacts which cannot be screened out as insignificant are highlighted. These are:

- Annual mean nitrogen dioxide process contributions;
- Annual mean VOCs (as benzene) process contributions; and
- Annual mean VOCs (as 1,3-butadiene) process contributions; and
- Annual mean cadmium process emissions.

Table 3.2 shows the results for these pollutants and compares them to the original air quality assessment. The table also shows the results for short term nitrogen dioxide and sulphur dioxide, because it is proposed that the short term emission limits be reduced for these pollutants.

For all other pollutants, the impacts could be screened out as insignificant in the original air quality assessment and can still be screened out as insignificant. Therefore, they have not been considered further as, by definition, there would not be a significant change in environmental impact associated with the impact of these emissions.

Table 3.1: Dispersion Modelling Results – All Sources

Pollutant	Quantity	Units	AQAL	Bg Conc.	Process Contribution (PC) at Point of Greatest Impact						Max as % of AQO /EAL	PEC (PC +Bg)	PEC as % of AQO /EAL
					2009	2010	2011	2012	2013	Max			
Nitrogen dioxide	Annual mean	µg/m³	40	18.60	0.92	0.66	1.31	0.99	0.90	1.31	3.27%	19.91	49.77%
	99.79th%ile of hourly means(1)	µg/m³	200	37.20	15.76	14.76	16.38	15.58	16.33	16.38	8.19%	53.58	26.79%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	12.40	6.00	5.24	7.81	6.26	6.13	7.81	6.24%	20.21	16.16%
	99.73rd%ile of hourly means(1)	µg/m³	350	12.40	19.96	18.88	20.83	19.98	20.44	20.83	5.95%	33.23	9.49%
	99.9th%ile of 15 min. means(1)	µg/m³	266	12.40	22.72	21.60	23.48	22.71	23.00	23.48	8.83%	35.88	13.49%
PM_{10}s	Annual mean	µg/m³	40	20.20	0.13	0.09	0.18	0.14	0.12	0.18	0.45%	20.38	50.95%
	90.41th%ile of daily means	µg/m³	50	40.40	0.45	0.37	0.64	0.51	0.50	0.64	1.28%	41.04	82.08%
$PM_{2.5}$s	Annual mean	µg/m³	25	13.80	0.13	0.09	0.18	0.14	0.12	0.18	0.72%	13.98	55.92%
Carbon monoxide	8 hour running mean(1)	µg/m³	10,000	602.00	24.43	24.76	24.84	24.45	32.17	32.17	0.32%	634.17	6.34%
Hydrogen chloride	Hourly mean(1)	µg/m³	750	1.44	16.46	15.73	16.31	17.19	17.30	17.30	2.31%	18.74	2.50%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.02	0.01	0.01	0.02	0.11%	2.37	14.80%
	Hourly mean(1)	µg/m³	160	4.70	1.10	1.05	1.09	1.15	1.15	1.15	0.72%	5.85	3.66%
Ammonia	Annual mean	µg/m³	180	1.80	0.13	0.09	0.18	0.14	0.12	0.18	0.10%	1.98	1.10%
	Hourly mean	µg/m³	2,500	3.60	2.75	2.63	2.72	2.87	2.89	2.89	0.12%	6.49	0.26%
VOCs (as benzene)	Annual mean	µg/m³	5	0.40	0.23	0.16	0.33	0.25	0.23	0.33	6.56%	0.73	14.56%

Table 3.1: Dispersion Modelling Results – All Sources

Pollutant	Quantity	Units	AQAL	Bg Conc.	Process Contribution (PC) at Point of Greatest Impact						Max as % of AQO /EAL	PEC (PC +Bg)	PEC as % of AQO /EAL
					2009	2010	2011	2012	2013	Max			
VOCs (as benzene)	Hourly mean(1)	µg/m³	195	0.80	7.70	7.36	7.63	8.04	8.09	8.09	4.15%	8.89	4.56%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.20	0.23	0.16	0.33	0.25	0.23	0.33	14.57%	0.53	23.46%
Mercury	Annual mean	ng/m³	250	1.51	0.63	0.45	0.90	0.68	0.62	0.90	0.36%	2.41	0.96%
	Hourly mean	ng/m³	7,500	3.02	13.73	13.13	13.60	14.34	14.43	14.43	0.19%	17.45	0.23%
Cadmium	Annual mean	ng/m³	5	0.15	0.25	0.18	0.36	0.27	0.25	0.36	7.19%	0.51	10.19%
	Hourly mean	ng/m³	-	0.30	5.49	5.25	5.44	5.74	5.77	5.77	-	6.08	-
Thallium	Annual mean	ng/m³	-	-	0.25	0.18	0.36	0.27	0.25	0.36	-	-	-
	Hourly mean	ng/m³	-	-	5.49	5.25	5.44	5.74	5.77	5.77	-	-	-
Dioxins	Annual mean	fg/m³	-	22.82	1.26	0.90	1.80	1.36	1.23	1.80	-	24.62	-
PCBs	Annual mean	ng/m³	200	0.14	0.06	0.05	0.09	0.07	0.06	0.09	0.04%	0.23	0.12%
	Hourly mean	ng/m³	6,000	0.28	1.37	1.31	1.36	1.43	1.44	1.44	0.02%	1.73	0.03%
PAHs	Annual mean	pg/m³	250	140.00	1.32	0.95	1.89	1.43	1.30	1.89	0.76%	141.89	56.76%
Other metals	Annual mean	ng/m³	-	-	0.92	0.66	1.31	0.99	0.90	1.31	See metals assessment		
	Hourly mean	ng/m³	-	-	8.04	7.53	8.36	7.95	8.33	8.36			

Notes:

(1) Based on operation of all items of plant at the ST ELV

(2) Based on operation of the EfW at the long term ELV and the AD gas engines at the daily ELV

Table 3.2: Comparison of Dispersion Modelling Results – All Sources							
Pollutant	Quantity	Units	AQAL	Consented		Proposed	
				Max	Max as % of the AQAL	Max	Max as % of the AQAL
Nitrogen dioxide	Annual mean	µg/m³	40	0.88	2.19%	1.31	3.27%
	99.79th%ile of hourly means(1)	µg/m³	200	16.21	8.11%	16.38	8.19%
Sulphur dioxide	99.73rd%ile of hourly means(1)	µg/m³	350	22.69	6.48%	20.83	5.95%
	99.9th%ile of 15 min. means(1)	µg/m³	266	26.37	9.9%	23.48	8.83%
VOCs (as benzene)	Annual mean	µg/m³	5	0.15	2.97%	0.33	6.56%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.15	6.60%	0.33	14.57%
Cadmium	Annual mean	ng/m³	5	0.41	8.14%	0.36	7.19%

Note:
(1) Based on operation of all items of plant at the ST ELV

It can be seen that the process contribution at the point of maximum impact for most of the pollutants considered in Table 3.2 would reduce with the proposed variation. This applies to

- Short term concentrations of nitrogen dioxide;
- Short term concentrations of sulphur dioxide; and
- Long term concentrations of cadmium.

The other pollutants are considered below.

3.2.1 Long Term Nitrogen Dioxide

The long term impact of nitrogen dioxide was not screened out as insignificant in the original application as the process contribution was 2.2% of the AQAL. However, as identified on page 99 of the EA's decision document for the EP, dated 11 September 2017, this impact (and a stack height of 58m) was considered to be acceptable for the following reasons.

(1) The peak process contribution of 2.2% of the AQAL is lower than all but two of the thirteen other large incineration plants which have been permitted.

(2) The Predicted Environmental Concentration (PEC) is well below the AQAL (at 48.7%) and lower than all of the thirteen other large incineration plants.

(3) There are only three residential properties at which the impact is not screened out as insignificant, compared to 111 with a 35m stack and an emission limit of 150 mg/Nm³.

(4) The modelling is conservative.

(5) There is an improvement condition to require emissions of NOx to be minimised by optimising the SNCR system.

By reducing the stack height to 35m and reducing the daily emission limit to 100 mg/Nm^3, all of these reasons remain essentially valid.

(1) The peak process contribution increases to 3.3% of the AQAL, but this is still lower than all but three of the thirteen large incineration plants which have been permitted.

(2) The PEC remains well below the AQAL (at 50%) and lower than all of the thirteen other large incineration plants.

(3) There are only five residential properties at which the impact is not screened out as insignificant. The concentrations at those receptors are shown below and it can be seen that the changes are insignificant. In addition, the area where the impact is not screened out as insignificant is barely changed, as shown in Figure 1 below, and has actually moved away from the main residential areas in Coggeshall.

For completeness, the results at all sensitive receptors are shown in Table A.1 in Appendix A. This shows, for example, that the concentration in the centre of Coggeshall reduces by 0.07% of the AQAL.

Table 3.3: Annual Mean Nitrogen Dioxide Concentration

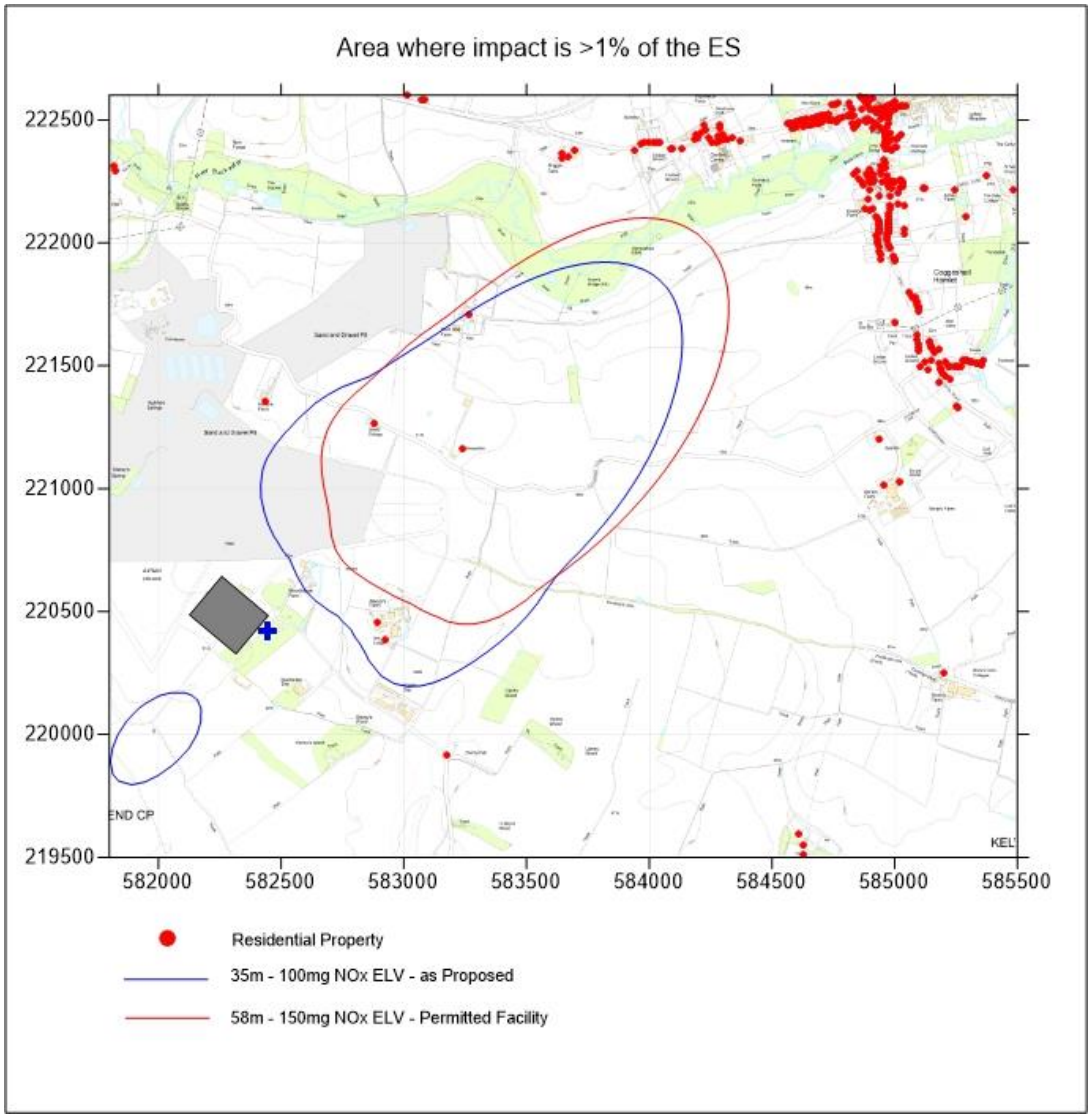
Property	Consented		Proposed		Change as &AQAL
	Max	Max as %AQAL	Max	Max as %AQAL	
Allshots Farm/The Lodge	0.24	0.60%	0.56	1.40%	0.80%
Haywards	0.81	2.02%	0.86	2.15%	0.13%
Curd Hall Farm	0.44	1.10%	0.40	1.00%	0.10%
Deeks Cottage	0.50	1.25%	0.56	1.40%	0.15%

(4) The modelling remains conservative.

(5) There is no change to improvement condition 5 in Table S1.3, which implements the requirement to optimise the SNCR system.

Therefore, the change in impact associated with the proposed changes to the design of the Facility can be descried as '*insignificant*.

Figure 1 – Change in area where impacts cannot be screened out as insignificant



3.2.2 Long Term VOCs

The long term impact of VOCs could not be screened out as insignificant in the original air quality assessment. If all of the VOCs are assumed to be 1,3-butadiene, the process contribution was predicted to be 6.7% of the AQAL. However, as the PEC was only 15.5% of the AQAL, and assuming that all of the VOCs are 1,3-butadiene is very conservative, it was concluded in the decision document that emissions of VOCs were unlikely to give rise to significant pollution.

With a stack height of 35m above surrounding ground level, if it is assumed that all of the VOCs are 1,3-butadiene, the process contribution is 14.6% of the ES and the PEC is 23.5% of the AQAL. As the PEC is still well below the AQAL, it is considered that the same conclusions can be drawn.

For completeness, the impacts at sensitive receptors can be found in Appendix A.

3.2.3 Heavy metals

The original air quality assessment included a more detailed assessment of the impact of metal emissions, using the screening methodology outlined in the Environment Agency guidance document "Guidance on assessing group 3 metals stack emissions from incinerators – v4". This assessment has been repeated below.

The first stage (worst-case screening) is to assume that each metal is emitted at 100% of the emission level. Where the PC of any metals exceeds 1% of a long term or 10% of a short term AQAL the Environment Agency consider this a potential for significant pollution. Under these circumstances the PEC should be compared to the AQAL. If the PEC is greater than 100% of the AQAL the assessment should proceed to stage 2.

Stage 2 (case specific screening) is to use the maximum emissions data listed in Appendix A of the guidance to revise the predictions. Again, where the PC of any metals exceeds 1% of a long term or 10% of a short term AQAL the PEC should be compared to the AQAL. This can be screened out where the PEC is less than the AQAL.

Table 3.4 (Long term results) and Table 3.5 (Short term results) outline the PC and PEC for each metal assuming the worst-case screening and case specific screening. The "case specific screening" assumes the emissions are no worse than a currently operating plant. The results presented in the tables are subsequently discussed in more detail in sections 3.2.3.1 and 3.2.3.2.

Table 3.4: Long-Term Metals Results

Metal	AQAL (ng/m³)	Background conc. (ng/m³)	Metals emitted at combined metal limit		Metal as % of ELV (2)	Metals emitted no worse than a currently permitted Facility		
			PC as % AQAL (1)	PEC as % AQAL		PC (ng/m³)	PC as % AQAL	PEC as % AQAL
Annual mean								
Arsenic	3	0.47	299.61%	315.27%	5.00%	0.45	14.98%	30.65%
Antimony	5,000	0.83	0.18%	0.20%	2.30%	0.21	0.004%	0.02%
Chromium	5,000	3.43	0.18%	0.25%	18.40%	1.65	0.03%	0.10%
Chromium (VI)	0.2	0.69	4494.10%	4837.10%	0.026%	0.0023	1.17%	344.17%
Cobalt	-	0.08	-	-	1.12%	0.10	-	-
Copper	10,000	2.57	0.09%	0.12%	5.80%	0.52	0.0052%	0.03%
Lead	250	4.40	3.60%	5.36%	10.06%	0.90	0.36%	2.12%
Manganese	150	2.25	5.99%	7.49%	12.00%	1.08	0.72%	2.22%
Nickel	20	1.37	44.94%	51.79%	44.00%	3.95	19.77%	26.62%
Vanadium	5,000	1.11	0.18%	0.20%	1.20%	0.11	0.0022%	0.02%

Note:

(1) The long-term process contribution is 4.45 ng/m³ for each metal.

(2) Metal as maximum percentage of the IED group 3 ELV, as detailed in Environment Agency metals guidance document (V.4) Table A1.

(3) Chromium (VI) concentrations are based on stack measurements of total chromium and measurements of the proportion of chromium (VI) to total chromium in Air Pollution Control (APC) residuals collected at the same plant.

(4) Nickel concentration is greater than 11% is due to one single measurement outlier. The average is around 4% of the Group ELV.

Table 3.5: Short-Term Metals Results

Metal	AQAL (ng/m³)	Background conc. (ng/m³)	Metals emitted at combined metal limit		Metal as % of ELV (2)	Metals emitted no worse than a currently permitted Facility		
			PC as % AQAL (1)	PEC as % AQAL		PC (ng/m³)	PC as % AQAL	PEC as % AQAL
Annual mean								
Arsenic	-	0.94	-	-	5.00%	7.22	-	-
Antimony	150000	1.66	0.10%	0.10%	2.30%	3.32	0.0022%	0.003%
Chromium	150000	6.86	0.10%	0.10%	18.40%	26.56	0.018%	0.022%
Chromium (VI)	-	1.37	-	-	0.03%	0.04	-	-
Cobalt	-	0.16	-	-	1.12%	1.62	-	-
Copper	200000	5.14	0.07%	0.07%	5.80%	8.37	0.004%	0.007%
Lead	-	8.80	-	-	10.06%	14.52	-	-
Manganese	1500000	4.50	0.01%	0.01%	12.00%	17.32	0.0012%	0.001%
Nickel	-	2.74	-	-	44.00%	63.51	-	-
Vanadium	1000	2.22	14.43%	14.66%	1.20%	1.73	0.17%	0.40%

Note:

(1) The long-term process contribution is 78.53 ng/m³ for each metal.

(2) Metal as maximum percentage of the IED group 3 ELV, as detailed in Environment Agency metals guidance document (V.4) Table A1.

(3) Chromium (VI) concentrations are based on stack measurements of total chromium and measurements of the proportion of chromium (VI) to total chromium in Air Pollution Control (APC) residuals collected at the same plant.

3.2.3.1 Long-term results

As shown in Table 3.4, if it is assumed that the entire emissions of metals consist of only one metal, the annual process contributions of arsenic, chromium (VI), lead, manganese and nickel are predicted to be greater than 1% of the long-term AQAL. However, only the PECs for arsenic and chromium (VI) are predicted to be greater than 100% of the AQAL under this worst-case screening assumption.

If it is assumed that the Facility will perform no worse than a currently permitted Facility, the predicted process contribution is below 1% of the AQAL for all pollutants with the exception of arsenic and nickel. The PECs for arsenic and nickel under this assumption are less than the AQAL, and so the impacts can be screened out. Therefore, under the EA guidance criteria, it can be concluded that there is no risk of exceeding the long-term AQAL for any metals and there is no potential for significant pollution. This is consistent with the conclusions reached in the original air quality assessment.

3.2.3.2 Short-term results

As shown in Table 3.5, if it is assumed that the entire emissions of metals consist of only one metal, the maximum 1-hour process contribution of all metals except vanadium is predicted to be less than 10% of the short-term AQAL.

If it is assumed that the Facility will perform no worse than a currently permitted Facility, the predicted process contribution is well below 10% of the AQAL for vanadium, because very little vanadium is released from EfW plants.

Therefore, it can be concluded that there is no risk of exceeding the short-term AQAL for any metal and there is no potential for significant pollution. Again, this is consistent with the conclusions reached in the original air quality assessment.

3.2.4 Ecological receptors

There were and still are no statutory designated sites within the 10km screening criteria. Therefore, the original air quality assessment only considered the impact on non-statutory designated ecological sites within 2 km of the Installation. The assessment of ecological impacts has been repeated in Appendix B. The highest predicted process contributions to ground level concentrations at the identified ecological receptors are presented in Table B.1 and the highest predicted levels of nitrogen and acid deposition are presented in Table B.2 and Table B.3.

As stated in the original air quality assessment, the EA's Operational Instruction 67_12 "Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation" states that if the process contribution is less than the Critical Level and Load at locally-designated sites, then emissions from the application are not significant.

- The PC is not predicted to exceed the Critical Level at any of the locally-designated sites. The highest contribution to ground level concentrations is 16.7% of the daily average of oxides of nitrogen at Storey's Wood.
- The maximum nitrogen deposition PC at a non-statutory designated site is predicted to be 5.21% of the relevant Lower Critical Load (at Storey's Wood) and the maximum acid deposition is predicted to be 4.88% of the relevant Lower Critical Load (at the River Blackwater) of the respective Lower Critical Loads.

Hence, the process contributions are well below the Critical Levels and Loads. Therefore, emissions from the Facility at locally designated sites are not significant. This is consistent with the conclusions reached in the original air quality assessment.

3.3 Human Health Risk Assessment

A human health risk assessment was submitted with the original application. This considered the potential for accumulation of heavy metals and dioxins through the environment. However, the EA stated (in the AQMAU review of the modelling) that this type of assessment is not necessary for heavy metals and so this has not been repeated.

The maximum predicted contribution to dioxin intake at any receptor in the original assessment was 0.0116 pg I-TEQ/kg-bw/day, which is only 0.58% of the Tolerable Daily Intake (TDI) of 2 pg I-TEQ/kg-bw/day. We have shown the dioxin ground level concentrations at all receptors considered in the human health risk assessment in Table A.4 in Appendix A. This shows that the maximum concentration at a receptor increases by 56%, which means that the maximum predicted contribution to dioxin intake at any receptor would be, at most, 0.58% x 156% = 0.90% of the TDI. Therefore, the assessment has not been repeated as it is clear that the conclusion would be unchanged.

3.4 Abnormal Emissions Assessment

An abnormal emissions assessment was included in the original application. This has been revised to allow for the 35m stack and is presented in Appendix C. The conclusions of the assessment are consistent with the previous assessment.

3.5 Summary

The environmental impact of the proposed variation is not considered to have changed significantly, for the following reasons:

(1) All pollutants which could be screened out as insignificant for the approved EP can still be screened out as insignificant.

(2) For pollutants which could not be screened out as insignificant in the original air quality assessment, the conclusions of the assessment are unchanged:

   a) For short term concentrations of nitrogen dioxide and Sulphur dioxide and long term concentration of cadmium, the impact of the Facility has been reduced.

   b) For long term concentrations of nitrogen dioxide, the area where the impact cannot be screened out as insignificant is barely changed and only covers five receptors, and the overall impact remains less than all other large EfW plants which have been granted an EP in England.

   c) For long term concentrations of VOCs, it is still unlikely that these will give rise to significant pollution.

(3) The impacts on ecological receptors are still not significant.

4 BEST AVAILABLE TECHNIQUES

4.1 Nitrogen oxides abatement

In the original application, it was concluded that the use of SNCR was BAT.

This variation includes an advanced SNCR system which is described in the draft BAT Reference document and which will lead to reduced emissions of nitrogen oxides. This is considered to go beyond BAT.

4.2 Stack Height

As explained in the decision document, the EA previously concluded that a 58m stack would be BAT. This means that the environmental impacts associated with the previous application are considered to be consistent with BAT.

In reducing the stack height, the Applicant will ensure that the environmental impacts will not change significantly from those associated with BAT. This has been demonstrated in section 3. Therefore, the Applicant considers that this variation is an alternative approach to achieving the environmental impacts associated with BAT and, hence, is also BAT.

4.3 Overall Assessment

The combination of SNCR, with a NO_2 emission limit of 150 mg/Nm^3, and a 58m stack, was accepted as BAT in the previous application. This variation is for an advanced SNCR system, with a NO_2 emission limit of 100 mg/Nm^3, and a 35m stack. For completeness, the applicant has compared these two options using the same method as was used in the original application for quantitative BAT assessments, and using the same assumptions for costs. This assessment follows the structure of Technical Guidance Note EPR-H1 and includes comments on all of the environmental parameters mentioned in EPR-H1.

4.3.1 Environmental Performance

4.3.1.1 Emissions to Air

The emission performance for nitrogen oxides is shown in Table 4.1.

The tonnages of nitrogen oxides removed by the current and proposed abatement systems are also shown.

Table 4.1– Air Emissions

Parameter	Units	Permit	Variation
NO_x, unabated conc. (with FGR)	mg/Nm^3	315	315
NO_x, unabated release rate	tpa	950	950
NO_x, abated conc.	mg/Nm^3	150	100
NO_x releases after abatement	tpa	450	300
NO_x emissions removed by abatement	tpa	500	650

The impact of emissions to air is considered in section 3.2 above. The following table shows the predicted ground level concentrations.

Table 4.2 – Air Emissions - Impacts			
Abatement System		**Permit**	**Variation**
Long Term			
Process Contribution (PC)	µg/m^3	0.88	1.31
Background	µg/m^3	18.60	18.60
Predicted Environmental Contribution (PEC)	µg/m^3	19.48	19.91
Air Quality Objective (AQO)	µg/m^3	40	40
PC as % of AQO	%	2.20	3.28
PEC as % of AQO	%	48.70	49.78
Short Term			
Process Contribution (PC)	µg/m^3	16.12	16.38
Background	µg/m^3	37.20	37.20
Predicted Environmental Contribution (PEC)	µg/m^3	53.41	53.58
Air Quality Objective (AQO)	µg/m^3	200	200
PC as % of AQO	%	8.11	8.19
PEC as % of AQO	%	26.71	26.79

As discussed in section 3, there is no change in the significance of the environmental impact between the permitted plant and the proposed variation.

4.3.1.2 Emissions to Water

There are no emissions to water from NOx abatement.

4.3.1.3 Photochemical Ozone Creation Potential

Nitrogen dioxide has a photochemical ozone creation potential (POCP) value relative to Ethylene of 2.8 and nitrogen oxide has a POCP value relative to Ethylene of -42.7. Assuming that 10% of NOx is released as NO2 and the rest as NO, the POCP is -17,200 for the permitted plant and -11,400 for the variation, meaning that the variation is less favourable. This is because nitrogen oxide converts to nitrogen dioxide in the atmosphere by reacting with ozone, this removing ozone from the atmosphere. Hence, the abatement of NO actually has a negative impact on POCP.

4.3.1.4 Global Warming Potential

There is no change in global warming potential.

4.3.1.5 Raw Materials

The estimated consumption of raw materials for each option is shown below.

Table 4.3 – Raw Materials			
Parameter	**Units**	**Permit**	**Variation**
Water	tpa	3,700	5,100
Ammonia solution	tpa	1,500	2,071

4.3.1.6 Waste Streams

There are no waste streams associated with NOx abatement.

4.3.2 Costs

The estimated costs associated with each option are presented below. In order for direct comparisons to be made, the costs are presented as annualised costs, with the capital investment and financing costs spread over a 30 year lifetime with a rate of return of 3.5% consistent with Treasury Green Book guidance.

Table 4.4 – Costs			
Parameter	**Unit**	**Permit**	**Variation**
Capital Cost, NOx Abatement	£	£3,000,000	£3,870,000
Capital Cost, stack	£	£3,944,000	£2,440,000
Total Capital Cost	£	£6,944,000	£6,310,000
Annualised Capital Cost	£ p.a.	£676,000	£614,000
Maintenance	£ p.a.	£106,000	£77,000
Reagents	£ p.a.	£308,000	£425,000
Total Annualised Cost	**£ p.a.**	**£1,090,000**	**£1,116,000**

4.3.3 Conclusions

The table below compares the two options.

Table 4-5 – Comparison Table			
Parameter	**Units**	**Permit**	**Variation**
NO_x emissions removed by abatement	tpa	500	650
POCP		-17,200	-11,400
Ammonia solution	tpa	1,500	2,071
Total Annualised Cost	£ p.a.	£1,090,000	£1,116,000

As can be seen from information presented in Table 4-5, the proposed variation:

(1) increases the annualised costs by approximately £26,000;

(2) abates an additional 150 tonnes of NOx per annum; and

(3) increases ammonia consumption by approximately 471 tonnes per annum.

Considering the variation as a whole, it would not lead to a significant change in the environmental impact, but it would reduce emissions of NOx by 150 tonnes at an effective additional cost of £173 per tonne.

Appendix A – Detailed Results at Sensitive Receptors

Table A.1: Annual Mean Nitrogen Dioxide Impact at Sensitive Receptors

Receptor	Consented		Proposed		Changes as % AQAL
	µg/m³	As % of AQAL	µg/m³	As % of AQAL	
Sheepcotes Farm (Hanger No.1)	0.18	0.45%	0.21	0.54%	0.09%
Wayfarers Site	0.03	0.08%	0.16	0.41%	0.33%
Allshot's Farm (Scrap Yard)	0.24	0.60%	0.56	1.40%	0.80%
Haywards	0.81	2.03%	0.86	2.15%	0.12%
Herons Farm	0.28	0.70%	0.33	0.82%	0.12%
Gosling's Farm	0.17	0.43%	0.17	0.42%	0.00%
Curd Hall Farm	0.44	1.10%	0.40	1.01%	-0.09%
Church (adjacent to Bradwell Hall)	0.14	0.35%	0.13	0.33%	-0.02%
Bradwell Hall	0.13	0.33%	0.12	0.31%	-0.02%
Rolphs Farmhouse	0.11	0.28%	0.10	0.24%	-0.03%
Silver End / Bower Hall / Fossil Hall	0.23	0.58%	0.22	0.55%	-0.03%
Rivenhall Pl/Hall	0.20	0.50%	0.19	0.48%	-0.02%
Parkgate Farm / Watchpall Cottages	0.23	0.58%	0.23	0.57%	0.00%
Ford Farm / Rivenhall Cottage	0.16	0.40%	0.15	0.38%	-0.02%
Porter's Farm	0.21	0.53%	0.20	0.50%	-0.03%
Unknown Building 1	0.25	0.63%	0.26	0.66%	0.03%
Bumby Hall / The Lodge / Polish Site	0.24	0.60%	0.36	0.90%	0.30%
Elephant House (Street Sweepings)	0.02	0.05%	0.13	0.33%	0.28%
Green Pastures Bungalow	0.18	0.45%	0.18	0.46%	0.01%
Deeks Cottage	0.50	1.25%	0.56	1.41%	0.16%
Gosling Cottage / Barn	0.18	0.45%	0.18	0.46%	0.01%
Felix Hall / The Clock House / Park Farm	0.14	0.35%	0.12	0.31%	-0.04%
Glazenwood House	0.10	0.25%	0.10	0.24%	-0.01%
Bradwell Hall	0.08	0.20%	0.08	0.20%	0.00%
Perry Green Farm	0.11	0.28%	0.11	0.27%	0.00%
The Granary / Porter Farm / Rook Hall	0.14	0.35%	0.13	0.32%	-0.03%
Grange Farm	0.31	0.78%	0.27	0.69%	-0.09%
Coggeshall	0.27	0.68%	0.24	0.60%	-0.07%

NOTES:

Assumes 100% operation of all items of plant at the daily ELVs.

Receptors which are not occupied (e.g. footpaths) are not included in this table as they are not relevant receptors for long term AQALs.

Table A.2: Annual Mean VOCs (as Benzene) Impact at Sensitive Receptors

Receptor	Consented		Proposed		Changes as % AQAL
	µg/m³	As % of AQAL	µg/m³	As % of AQAL	
Sheepcotes Farm (Hanger No.1)	0.031	0.62%	0.054	1.08%	0.45%
Wayfarers Site	0.006	0.11%	0.041	0.81%	0.70%
Allshot's Farm (Scrap Yard)	0.041	0.81%	0.140	2.80%	1.98%
Haywards	0.138	2.75%	0.215	4.30%	1.55%
Herons Farm	0.048	0.96%	0.083	1.65%	0.69%
Gosling's Farm	0.029	0.57%	0.042	0.85%	0.27%
Curd Hall Farm	0.074	1.48%	0.101	2.03%	0.55%
Church (adjacent to Bradwell Hall)	0.023	0.46%	0.033	0.65%	0.20%
Bradwell Hall	0.022	0.43%	0.031	0.61%	0.18%
Rolphs Farmhouse	0.018	0.36%	0.024	0.48%	0.12%
Silver End / Bower Hall / Fossil Hall	0.039	0.78%	0.055	1.10%	0.32%
Rivenhall Pl/Hall	0.035	0.69%	0.049	0.97%	0.28%
Parkgate Farm / Watchpall Cottages	0.038	0.77%	0.057	1.15%	0.38%
Ford Farm / Rivenhall Cottage	0.027	0.53%	0.038	0.75%	0.22%
Porter's Farm	0.035	0.70%	0.050	0.99%	0.29%
Unknown Building 1	0.043	0.85%	0.066	1.31%	0.46%
Bumby Hall / The Lodge / Polish Site	0.041	0.81%	0.090	1.80%	0.99%
Elephant House (Street Sweepings)	0.003	0.07%	0.033	0.66%	0.60%
Green Pastures Bungalow	0.031	0.62%	0.046	0.92%	0.30%
Deeks Cottage	0.085	1.70%	0.141	2.82%	1.12%
Gosling Cottage / Barn	0.030	0.61%	0.046	0.92%	0.31%
Felix Hall / The Clock House / Park Farm	0.024	0.49%	0.031	0.62%	0.13%
Glazenwood House	0.017	0.34%	0.024	0.48%	0.15%
Bradwell Hall	0.014	0.27%	0.020	0.40%	0.13%
Perry Green Farm	0.019	0.38%	0.027	0.54%	0.16%
The Granary / Porter Farm / Rook Hall	0.023	0.46%	0.032	0.63%	0.17%
Grange Farm	0.052	1.04%	0.069	1.38%	0.33%
Coggeshall	0.046	0.92%	0.060	1.21%	0.28%

NOTES:

Assumes 100% operation of all items of plant at the daily ELVs.

Assumes all VOCs consist only of benzene.

Receptors which are not occupied (e.g. footpaths) are not included in this table as they are not relevant receptors for long term AQALs.

Table A.3: Annual Mean VOCs (as 1,3-butadiene) Impact at Sensitive Receptors

Receptor	Consented		Proposed		Changes as % AQAL
	µg/m³	As % of AQAL	µg/m³	As % of AQAL	
Sheepcotes Farm (Hanger No.1)	0.031	1.39%	0.054	2.39%	1.00%
Wayfarers Site	0.006	0.25%	0.041	1.81%	1.56%
Allshot's Farm (Scrap Yard)	0.041	1.81%	0.140	6.22%	4.41%
Haywards	0.138	6.12%	0.215	9.56%	3.44%
Herons Farm	0.048	2.14%	0.083	3.67%	1.53%
Gosling's Farm	0.029	1.27%	0.042	1.88%	0.61%
Curd Hall Farm	0.074	3.28%	0.101	4.50%	1.22%
Church (adjacent to Bradwell Hall)	0.023	1.02%	0.033	1.45%	0.44%
Bradwell Hall	0.022	0.96%	0.031	1.36%	0.40%
Rolphs Farmhouse	0.018	0.81%	0.024	1.07%	0.27%
Silver End / Bower Hall / Fossil Hall	0.039	1.73%	0.055	2.44%	0.71%
Rivenhall Pl/Hall	0.035	1.53%	0.049	2.16%	0.62%
Parkgate Farm / Watchpall Cottages	0.038	1.70%	0.057	2.55%	0.85%
Ford Farm / Rivenhall Cottage	0.027	1.18%	0.038	1.67%	0.49%
Porter's Farm	0.035	1.55%	0.050	2.21%	0.65%
Unknown Building 1	0.043	1.90%	0.066	2.92%	1.02%
Bumby Hall / The Lodge / Polish Site	0.041	1.81%	0.090	4.01%	2.20%
Elephant House (Street Sweepings)	0.003	0.15%	0.033	1.47%	1.33%
Green Pastures Bungalow	0.031	1.39%	0.046	2.05%	0.66%
Deeks Cottage	0.085	3.77%	0.141	6.26%	2.49%
Gosling Cottage / Barn	0.030	1.35%	0.046	2.04%	0.69%
Felix Hall / The Clock House / Park Farm	0.024	1.09%	0.031	1.38%	0.29%
Glazenwood House	0.017	0.75%	0.024	1.08%	0.33%
Bradwell Hall	0.014	0.61%	0.020	0.89%	0.29%
Perry Green Farm	0.019	0.84%	0.027	1.20%	0.36%
The Granary / Porter Farm / Rook Hall	0.023	1.02%	0.032	1.40%	0.38%
Grange Farm	0.052	2.32%	0.069	3.06%	0.74%
Coggeshall	0.046	2.05%	0.060	2.68%	0.63%

NOTES:

Assumes 100% operation of all items of plant at the daily ELVs.

Assumes all VOCs consist only of 1,3-butadiene.

Receptors which are not occupied (e.g. footpaths) are not included in this table as they are not relevant receptors for long term AQALs.

Table A.4: Annual Mean Dioxin Impact at Sensitive Receptors			
Receptor	**Consented**	**Proposed**	**Changes as % of Consented**
	ng ITEQ/m³	**ng ITEQ/m³**	
Sheepcotes Farm (Hanger No.1)	0.171	0.295	72.37%
Allshot's Farm (Scrap Yard)	0.223	0.767	243.61%
Haywards	0.755	1.179	56.26%
Herons Farm	0.264	0.453	71.39%
Gosling's Farm	0.157	0.232	47.68%
Curd Hall Farm	0.405	0.555	37.19%
Church (adjacent to Bradwell Hall)	0.125	0.179	43.10%
Bradwell Hall	0.118	0.168	42.15%
Rolphs Farmhouse	0.099	0.132	33.06%
Silver End / Bower Hall / Fossil Hall	0.213	0.301	41.32%
Rivenhall Pl/Hall	0.189	0.266	40.69%
Parkgate Farm / Watchpall Cottages	0.210	0.315	49.64%
Ford Farm / Rivenhall Cottage	0.146	0.206	41.63%
Porter's Farm	0.192	0.272	41.99%
Unknown Building 1	0.234	0.361	53.87%
Bumby Hall / The Lodge / Polish Site	0.223	0.495	121.63%
Green Pastures Bungalow	0.171	0.253	47.46%
Deeks Cottage	0.465	0.772	66.03%
Gosling Cottage / Barn	0.167	0.252	51.20%
Felix Hall / The Clock House / Park Farm	0.134	0.170	26.79%
Glazenwood House	0.092	0.133	43.98%
Bradwell Hall	0.075	0.110	47.14%
Perry Green Farm	0.104	0.148	43.24%
The Granary / Porter Farm / Rook Hall	0.126	0.173	37.70%
Grange Farm	0.286	0.377	32.08%
Coggeshall	0.253	0.331	30.85%
MAX AT A RECEPTOR	**0.755**	**1.179**	**56.26%**

NOTES:
Assumes 100% operation of all items of plant at the daily ELVs.
Includes all receptors considered in the original human health risk assessment.

Appendix B - Ecological Impacts

Table B.1: Impact of Emissions at Non-Statutory Designated Sensitive Ecological Receptors

Site	Oxides of Nitrogen				Sulphur Dioxide		Hydrogen Fluoride				Ammonia	
	Daily		Annual		Annual		Daily		Weekly		Annual	
	Conc. µg/m³	As % of CL	Conc. µg/m³	As % of CL	Conc. µg/m³	As % of CL	Conc. ng/m³	As % of CL	Conc. ng/m³	As % of CL	Conc. ng/m³	As % of CL
Critical Level	**75**	**-**	**30**	**-**	**20**	**-**	**5**	**-**	**0.5**	**-**	**3**	**-**
Non-statutory designated sites (within 2km)												
Blackwater Plantation	3.93	5.2%	0.29	1.0%	0.15	0.7%	37.78	0.8%	13.45	2.7%	27.87	0.9%
Storeys Wood	12.54	16.7%	0.55	1.8%	0.28	1.4%	120.56	2.4%	30.67	6.1%	52.69	1.8%
Maxey's Spring	8.83	11.8%	0.38	1.3%	0.19	1.0%	84.86	1.7%	23.60	4.7%	36.70	1.2%
Upney Wood	5.82	7.8%	0.49	1.6%	0.25	1.3%	55.95	1.1%	15.89	3.2%	47.52	1.6%
Link’s Wood	3.75	5.0%	0.14	0.5%	0.07	0.3%	36.09	0.7%	11.59	2.3%	13.16	0.4%
Park House Meadow	2.37	3.2%	0.13	0.4%	0.07	0.3%	22.78	0.5%	6.73	1.3%	12.69	0.4%
Screening Criteria	-	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**	**-**	**100%**

Table B.2: Detailed Results – Nitrogen Deposition - Maximum								
Site	Habitat	Deposition Velocity	Process Contribution			Predicted Environmental Concentration		
			PC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL	PEC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL
Non-statutory designated sites								
Blackwater Plantation	Broadleaved, mixed and yew woodland	Woodland	0.276	2.76%	1.38%	30.376	303.76%	151.88%
Storeys Wood	Broadleaved, mixed and yew woodland	Woodland	0.521	5.21%	2.61%	27.961	279.61%	139.81%
Maxey's Spring	Calcareous grassland	Grassland	0.229	1.53%	0.92%	18.149	120.99%	72.60%
	Neutral grassland	Grassland	0.229	1.15%	0.76%	18.149	90.75%	60.50%
Upney Wood	Broadleaved, mixed and yew woodland	Woodland	0.470	4.70%	2.35%	30.570	305.70%	152.85%
Link’s Wood	Broadleaved, mixed and yew woodland	Woodland	0.130	1.30%	0.65%	30.230	302.30%	151.15%
Park House Meadow	Calcareous grassland	Grassland	0.079	0.53%	0.32%	17.999	119.99%	72.00%
	Neutral grassland	Grassland	0.079	0.40%	0.26%	17.999	90.00%	60.00%

Table B.3 Detailed Results – Acid Deposition								
Site	Habitat	Deposition Velocity	Process Contribution			Predicted Environmental Concentration		
			N (keq/ha /yr)	S (keq/ha /yr)	% of Min CL Function	N (keq/ha /yr)	S (keq/ha /yr)	% of CL Function
Non-statutory designated sites								
Blackwater Plantation	Broadleaved, mixed and yew woodland	Woodland	0.020	0.064	4.88%	2.170	0.364	148.15%
Storeys Wood	Broadleaved, mixed and yew woodland	Woodland	0.037	0.120	1.83%	1.997	0.430	28.16%
Maxey's Spring	Calcareous grassland	Grassland	0.016	0.039	1.16%	1.296	0.299	33.58%
	Neutral grassland	Grassland	0.016	0.039	1.16%	1.296	0.299	33.58%
Upney Wood	Broadleaved, mixed and yew woodland	Woodland	0.034	0.109	1.30%	2.184	0.409	23.72%
Link’s Wood	Broadleaved, mixed and yew woodland	Woodland	0.009	0.030	0.46%	2.159	0.330	28.78%
Park House Meadow	Calcareous grassland	Grassland	0.006	0.013	0.40%	1.286	0.273	32.82%
	Neutral grassland	Grassland	0.006	0.013	0.40%	1.286	0.273	32.82%

Appendix C - Abnormal Emissions Assessment

Appendix D – Original Air Quality Assessment

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