RPS

Proposed modification of Condition 3 of Planning Application Reference 01/10135/FUL

Sheffield Energy Recovery Facility, Bernard Road, Sheffield.

Veolia ES Sheffield Ltd



Supporting Note - Carbon Analysis

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1. Sheffield CHP Condition 3 Variation Impact on Carbon

1.1 Introduction

1.1.1 This note assesses the carbon effects associated with the proposed variation in planning permission 01/10135//FUL. The proposed change to Condition 3 of the planning permission would allow the delivery of waste to the ERF operated by Veolia Environmental Services (VES) from a wider geographical area.

1.1.2 In summary the changes will result in the displacement of some of the C&I waste with a higher proportion of domestic waste gathered over a wider area.

1.1.3 This note summarises the carbon implications of the proposed changes to the waste stream at the Sheffield CHP facility. The scope of work covers the collection and treatment of the waste and has been completed based on the parameters and assumptions contained herein.

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1.2 Assessment Methodology

Scope

1.2.1 The CHP facility is already operational and the purpose of this note is not to consider the carbon balance for the facility as a whole. The focus is to extract the elements that are anticipated to change and assess the potential impacts of such changes on emissions of climate related gases. The climate gases have been restricted to carbon dioxide (CO_2) and methane (CH_4) for the purposes of this assessment as changes in nitrous oxide (N_2O) and other greenhouse gases are not anticipated.

1.2.2 The assessment focuses on transport and the potential emissions from the waste disposal excluding emissions avoided or recovered/sequestered. The transport emissions have been assessed and reported in the air quality section with the methodology set out therein.

1.2.3 The scenarios analysed are:

- Existing scenario – current situation where the annual waste throughput is assumed to comprise of 140,000 tonnes domestic waste and 85,000 tonnes of non-domestic (C&I) waste
- Variation to Condition 3 scenario – proposed situation where annual waste throughput for the purposes of this assessment are assumed to comprise 215,000 tonnes domestic waste and 10,000 tonnes of C&I waste.

Transport

1.2.4 The transport emissions have been assessed and reported in the air quality section with the results from that assessment utilised below.

Emissions from waste treatment

1.2.5 The focus of the emissions assessment from waste treatment is on the potential change in waste stream constituents and what this may mean for potential emissions from the CHP plant and current alternative disposal route, landfill. This assessment is achieved by considering the theoretical emissions potential from the waste streams based on assumptions of the constituents and their greenhouse gas releasing potential.

1.2.6 The results of the analysis are provided below. The following assumptions have been utilised in the completion of the work.

Table 1.1: Assume composition of waste						
Materials Composition	**Proportion of the waste stream (%)**		**Total carbon content % dry waste [c]**	**Fossil carbon fraction % of total carbon (%)[d]**	**Proportion of total carbon degradable (%)[d]**	**Dissimilable Degradable Organic Carbon, DDOC (%)[e]**
	C & I [a]	**Domestic [b]**				
Paper & card	18.0	21.0	39.1	1	100	14
Plastic film	2.0	2.8	47.8	100	0	0
Dense plastics	1.9	4.5	54.8	100	0	0
Textiles	0.6	1.8	39.8	50	50	6
Miscellaneous non-combustibles (including soil)	10.1	10.8	n/a	n/a	n/a	n/a
Glass	2.2	5.8	n/a	n/a	0	n/a
Putrescibles (including garden and kitchen waste)	14.1	30.5	18.7	0	100	12
Ferrous metal	9.1	4.7	n/a	n/a	0	n/a
Non-ferrous metals (cans)	5.6	0.8	n/a	n/a	0	n/a
Miscellaneous combustibles (including furniture, nappies and fines)	36.6	17.3	38.4	50	75	10

a Source: Adapted from Defra 2006[1]
b Source: Adapted from EA Wrate 2006
c Source: Adapted from Environment Agency 1994 and Defra 2006[2]
d Source: Adapted from IPCC 2006[3]
e Source: Calculated

Significance Criteria for Assessment of Operational Effects

1.2.7 Assigning significance to emissions of greenhouse gases is not a simple process due to the global nature of effects , the small size of contributions to global emissions, the difficulty in linking emissions from one project to atmospheric concentrations and the difficulty predicting with certainty the links between atmospheric concentrations and climatic changes. Any project based significance assessment is therefore likely to be based on expert judgement, as is the case here. For the purposes of this assessment **Table 1.2** sets out the magnitude descriptors that can be expressed as both positive (reducing the carbon emissions) and negative (increasing the carbon emissions) impacts.

[1] Defra 2007, Carbon balances and energy impacts of the management of UK wastes, R&D project completed for Defra by ERM and Golder Associates

[2] Environment Agency 1994, National Household Waste Analysis Project

[3] IPCC 2006, Intergovernmental Panel on Climate Change, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Waste.

Table 1.2: Magnitude Descriptors for carbon impacts	
Descriptor	**Carbon equivalent emissions**
Very Large	Increase/decrease > 25%
Large	Increase/decrease 15 - 25%
Medium	Increase/decrease 10 - 15%
Small	Increase/decrease 5 - 10%
Very Small	Increase/decrease 1 - 5%
Extremely Small	Increase/decrease < 1%

1.3 Operational Effects

Transport

1.3.1 As detailed in the air quality section carbon dioxide emissions (expressed as carbon) associated with existing traffic flows and traffic flows under the proposed variation to Condition 3 in 2008 have been calculated using the Regional Air Quality module within the DMRB model and are presented in **Table 1.3**. The change in total C emissions is 42.81 tonnes.

Table 1.3: Carbon Emissions in Tonnes Per Annum in 2008		
Existing	**Variation of Condition 3**	**Change Associated with Variation of Condition 3**
99.95	142.76	42.81

1.3.2 The estimated increase in road related C emissions in 2008, due to the variation of Condition 3 is 42.81 tonnes equivalent to 0.03% of the road related C emissions for the Sheffield City area. It is therefore considered an extremely small negative impact.

Waste treatment

1.3.3 The assumptions detailed in **Table 1.1** have been used to estimate the carbon content of the waste streams, the potential impact this has on the theoretical biogenic and non-biogenic carbon (see Appendix 1.1) and theoretical emissions of greenhouse gas from landfill. In order to complete the calculations composite waste streams have been derived by combining the masses and contents of the different waste streams.

1.3.4 **Table 1.4** summarises the theoretical emissions production potential from landfill of the waste for the two scenarios distinguishing between the biogenic and non-biogenic (including methane) fractions and expressed as tonnes of carbon equivalent. The results show that if the current domestic waste is continued to be landfilled then this has the potential to give rise to more methane than the variation scenario; equivalent to 1,988 tonnes carbon per annum. Please note these figures do not account for methane capture and oxidisation through biological conversion and assume the instantaneous release of methane in the year of disposal. Such an impact may reduce the size of the figures but is not likely to alter the nature of the conclusions.

Table 1.4: Theoretical carbon emissions from 1 years waste disposal in landfill				
Scenario	**Non-biogenic (including methane)**	**Biogenic**	**Total**	**Contributing to global warming**
Existing	92,340	7,364	99,704	92,340
Variation	94,328	7,517	101,845	94,328
Difference	1,988	153	2,142	1,988

1.3.5 **Table 1.5** summarises the theoretical emissions production (CO_2 only) from combustion of the waste streams in the CHP facility. The results for the two scenarios are also divided between the biogenic and non-biogenic (including methane) fractions and expressed as tonnes of carbon equivalent.

Table 1.5: Theoretical carbon emissions from 1 years waste disposal in the CHP[1]				
Scenario	**Non-biogenic (including methane)**	**Biogenic**	**Total**	**Contributing to global warming**
Existing	18,409	38,720	57,130	18,409
Variation	17,182	39,334	56,516	17,182
Difference	-1,227	614	-614	-1,227

[a] Note that combustion also releases emissions of N_2O although these are assumed to be similar between the scenarios and have therefore not been included in calculations.

1.3.6 The results in **Table 1.5** indicate that, based on the assumptions set out in this assessment, the changes in waste stream constituents may reduce the proportion of non-biogenic carbon emissions per tonne of waste disposed. In addition to the emissions from combustion and the alternative of landfill there are emissions avoided through the recycling of waste and the recovery of energy (in the form of both heat and electricity). These are assumed to be similar between the two options and have therefore been excluded from this assessment.

1.3.7 These calculations indicate that due to the differences in constituents between domestic and C&I waste some impacts on the greenhouse gas emissions potential are likely. Based on the variation scenario where more domestic waste is recovered and treated in the CHP the results indicate that this could avoid the emission of a theoretical 1,988 tonnes of carbon equivalent per year (assuming the release of emissions from the life of this waste in the landfill are instantaneous). This is due to the potential higher biogenic fraction within the domestic waste stream per tonne of waste. The same factor also contributes to the results in **Table 1.5** that suggest a reduction in fossil emissions per tonne although given the complexities associated with energy yield and the quantities of waste this effect has not been included. The inclusion of such influences is estimated to have the effect of reducing the difference in **Table 1.5** but potentially increasing the difference in **Table 1.4**.

1.3.8 The conservative position of considering only the theoretical differences from avoiding landfilling more domestic waste results in a potentially very small positive impact on climate emissions (approximately 2% potential emissions reductions per annum equivalent when compared to the existing situation).

Waste treatment

1.3.9 Overall results indicate an extremely small negative transport impact on carbon of less than 50 tonnes carbon annually which is more than offset by a very small potentially positive impact on the theoretical methane production potential of approximately 2,000 tonnes carbon equivalent per annum. On balance it could therefore be concluded that the changes may result in a very small positive impact on greenhouse gas emissions although given the uncertainties associated with the assessment this could be represented as a negligible to extremely small positive change overall.

1.4 Mitigation Measures

Operational Effects

1.4.1 Mitigation measures are not required for the operational phase, as traffic effects are predicted to be of negligible to minor significance, according to the criteria adopted for this assessment, and are more than offset by the potential reduction in emissions from the domestic waste being landfilled.

1.5 Conclusions

1.5.1 This assessment has been undertaken as part of the EIA accompanying the planning application for a revised Condition 3 to planning application for ERF facility in Sheffield and its associated waste supply traffic.

1.5.2 There is a predicted extremely small negative impact on carbon emissions from transport more than offset by a potential very small positive impact on the methane production potential of the waste treated under the variation scenario.

1.5.3 Overall the variation changes are anticipated to have at least no impact but potentially a positive impact on greenhouse gas emissions from the Sheffield CHP.

Appendices

Appendix 1.1 Biogenic and non-biogenic carbon

1.5.4 Essentially there are two types of carbon that are considered within greenhouse gas footprint assessments. The so-called biogenic (short-cycle) carbon and the non-biogenic (fossil) carbon. The biogenic sources feed the short-term carbon cycle, which assumes such carbon was taken up recently by the biomass when it grew, and if such materials are grown sustainably an equilibrium is reached between carbon taken up from and that released to the atmosphere.

1.5.5 Conversely, non-biogenic (fossil) sources feed the long-term carbon cycle, which prior to combustion was stored underground for a long time and hence is regarded as a net addition to the atmosphere.

1.5.6 Intergovernmental Panel on Climate Change guidelines on greenhouse gas assessment and reporting stipulate that biogenic emissions of carbon should not be included in the assessment of emissions from waste. Biogenic emissions are considered to be from biomass sources and are therefore treated, like biomass renewables, as having a zero carbon emissions factor. In contrast methane emissions from the degradation of the biogenic waste fraction are considered anthropogenic (man-made) due to the increased strength of the warming impact from these molecules.

1.5.7 It is noted that the biogenic and non-biogenic differences in accounting do not impact materially on this assessment although the terms are used throughout the reporting.