CRITIQUE OF TRANSPORT CARBON ASSESSMENT FOR THE RUNCORN ENERGY FROM WASTE FACILITY

BACKGROUND

1 The Runcorn Energy from Waste (EfW) Facility has consent under s.36 of the Electricity Act 1989 for the combustion of 850 thousand tonnes per annum (ktpa) of refuse derived fuel (RDF). This consent is restricted by a planning condition (number 57) which limits the delivery of waste by road to 85 ktpa.

2 Ineos Chlor is seeking to amend this condition to allow a further 395 ktpa of RDF to be delivered to the Facility by road. Should this application be approved, the total quantity of RDF that could be delivered to the Facility by road would increase to 480 ktpa.

3 To support the planning condition variation application, Ineos Chlor commissioned consultants RPS to undertake a 'Carbon Assessment' study (December 2010). This study compares the greenhouse gas implications, or 'carbon impacts' of various rail and road fuel delivery scenarios. An Addendum to this assessment was produced in July 2011.

4 ERM has prepared this critique of both the Carbon Assessment and the Addendum ('the Assessments'). This note reports the key issues that we have identified in our review.

KEY POINTS ARISING

The Balance Between Local and Global Impacts

5 Both the Assessment and the Addendum consider the greenhouse gas emissions associated with the 'rail' and 'road' scenarios, albeit that the former also involve a significant amount of road transport. These emissions occur largely as a result of fuel combustion by bulk transport vehicles and diesel locomotives. This approach is a frequently-used proxy for environmental impacts in general, because climate change, to which greenhouse gas emissions contribute, is widely recognised as the most important sustainability issue that we face.

6 However, the reason stated for the condition limiting road transport to the Facility is to:"*… minimise road traffic movements in the locality.*" (1) The condition seeks to control the number of traffic movements on the local road network and thus local, as well as, and possibly to a greater extent than, global, environmental impacts. Such local impacts would include congestion,

(1) Delivery of Refuse Derived Fuel, Secretary of State's Letter to Ineos Chlor Ltd. BERR Ref 01.08.10.04/8c. 16th September 2008.

noise & vibration, local air pollution and road accidents, none of which are given adequate proxy via the assessment of greenhouse gas emissions alone.

7 The Assessment states that Ineos Chlor supports the Council's 'sustainability objectives'. However, these themselves are not considered in the Assessments.

Choice of Scenarios

8 A limited number of different road and rail scenarios have been defined and are appraised in the Assessments. The results of the Assessments are a direct artefact of the specific scenarios appraised by RPS. They are not more widely applicable.

9 The December 2010 Assessment focuses on RDF produced from municipal sources, whilst the Addendum focuses on commercial sources of fuel for the Facility. The latter is questionable in itself, as we understand that the terms of the Section 36 consent limit the development to the treatment of domestic waste. Therefore, we question the robustness of an analysis that models a waste mix that is not permitted.

10 Beyond this fairly fundamental point, the scenarios are not necessarily representative of the catchment area from which the Facility might source its waste in practice.

11 Whilst the Assessments employ a clear and simple approach, in terms of identifying scenarios, quantifying total vehicle km and applying greenhouse gas emissions factors to these, they fail to articulate clearly a justification for why these scenarios have been chosen to be assessed and, more critically, why other sources of fuel have not been appraised.

12 Whilst the Addendum adds to the scenarios appraised, they are still severely limited considering the potential road- and rail-served sources of waste that the Facility might access for its fuel.

December 2010 Assessment

13 In the December 2010 Assessment, only a very limited geographical catchment is considered. The Assessment examines only the movement of RDF from municipal waste management contracts being tendered in Warrington and North Wales.

14 The waste from these contracts is expected to be 60 ktpa and 150 ktpa respectively. In total, this equates to 43% of the total tonnage for which a variation for road transport is sought. In the Assessment, these arisings are scaled up proportionally to the total for the variation sought, ie 395 ktpa.

15 This would be a reasonable approach if Warrington and North Wales, and the logistics of movement of these wastes to the Facility, were characteristic of the

catchment area the Facility might serve. However, we understand that Ineos Chlor intends, although it is certainly not obliged, as there is no limitation on the consent to this effect, to source waste from the whole of the North West Region. Large parts of Region are not considered in the Assessment. (1)

16 Furthermore, in ERM's opinion, the nature of the scenarios is so extreme (to the extent of absurdity) that this extrapolation leads to an unjustifiable over-reporting of the potential greenhouse gas savings that might be made through road transport. It is tempting to conclude that the scenarios have been selected because they are advantageous to Ineos Chlor's case, rather than to present an objective analysis. This is explored further below.

17 It is difficult to be certain in relation to future waste sources, and the source of waste is seen in policy as a commercial matter for the operator. However, the assumed sources of waste is a key element of any transport impacts assessment.

18 All of the rail-based scenarios incorporate road transport, because bulked waste needs to be moved from the original transfer station to a rail waste transfer station (RWTS). However, in some parts of the country, notably London, waste is transferred directly to rail from Refuse Collection Vehicle (RCV), and there is no intermediate bulking stage and the 'double-handling' to which RPS refers.

19 All of the December 2010 Assessment scenarios involve a significant proportion of road transport, by comparison with rail, because of the relative location of source, RWTS and Facility. The road element of the scenario dominates the results. However, the split between road and rail transport has not been stated explicitly in the report, which is potentially misleading.

20 Scenarios B and C are particularly extreme. Waste is assumed to be transported by road to RWTS located further away from the source of the waste than is the Facility. Due to the scaling up of the North Wales and Warrington waste arisings, the assessment assumes that over 71% of the 395 ktpa of waste would be transported 70 km by road for delivery to the RWTS, for onward delivery to the Facility by rail, when direct delivery to the Facility by road would only be 40 km.

21 Under these assumptions, it should be no surprise that rail performs less well than road. But, whilst it is clearly correct that road transport would incur lower greenhouse gas emissions in these circumstances, it is not reasonable to extrapolate these findings to other sources of waste.

22 In Scenarios D and E, the Shotton rail transfer station is assumed to be used, and in these cases, the distance from waste source to RWTS is considerably less than to the Facility. This is logical, performs well in the Assessment, and

(1) NB: ERM notes that a separate table (Figure 2 for Appendix 1) has since been submitted to the Halton Borough Council providing updated information on municipal contracts. However, justification for deselecting authorities is still not clear.

demonstrates the greenhouse gas advantages of onward transport of bulked waste over relatively short distances.

23 However, these scenarios are later dismissed for financial reasons. No specific evidence is presented to justify this dismissal. The factor is included, prejudicially to the rail transport scenarios, whilst other issues that are unhelpful to the road transport scenarios are ignored. These might include increasing fuel costs, promotion of alternative transport policy and local congestion issues, for example.

July 2011 Addendum

24 In the Addendum, two further scenarios relating to potential commercial and industrial (C&I) waste sources are considered. The logic behind the development of these two scenarios is not presented in the report and, as noted above, based on the terms of the Section 36 consent, we understand the scenarios to be incapable of being met in practice.

25 The two scenarios incorporate transfer of C&I waste arisings from Merseyside and Warrington only. However, due to poor rail linkages between these authorities and the Facility, they require increased rail mileage and in the case of Warrington, transfer by road. As above, it is not surprising that these rail-based scenarios perform less well in the assessment. Indeed, they may have been selected because this was always likely to be the case.

26 The two administrative areas producing the most C&I waste in the Region, and from which the Facility might reasonably be likely to draw its fuel in practice, are Greater Manchester and Lancashire. Over 2500 ktpa of commercial waste [(1)] are produced in Greater Manchester. This area would be an obvious waste source, particularly because waste can be transferred directly by rail to the Facility. However, only 118 ktpa of this waste is assumed to be captured in the scenarios appraised, with no rationale presented for the choice of this figure. Nonetheless, transfer of waste by rail from Greater Manchester always performs better than the road alternatives in the scenarios examined.

27 Despite being the second largest source of commercial waste in the Region, waste arising in Lancashire is not assessed in the Addendum, with no justification presented for its exclusion.

Emission Factors Sensitivity Analysis

28 RPS has correctly employed DEFRA vehicle emission factors in its reports. There is a more up to date set of factors available, but these only raise emissions by an insignificant amount. The emissions factors are average data, and do not allow for vehicle movements in congested areas, where emissions will increase.

(1) North West of England Commercial and Industrial Waste Survey, Urban Mines, 2009.

29 ERM expects the local road network to the Ineos site to be severely congested at certain times of the day. Under such circumstances, it would be reasonable to employ an uplifted set of emissions factors, the result of which would be that road transport would be less favoured. This issue is not considered within the Assessments.

30 Two emissions factors for diesel locomotives are used in the Assessments. The 'high' assumption (49 gCO_2e tonne.km) is based on a report published in 2004. The 'low' assumption (31.59 gCO_2e tonne.km) is referenced to the 2010 Defra reporting tool. (1)

31 The emissions factor for diesel freight train transfer in the Environment Agency's LCA tool for waste management, WRATE, is 20gCO_2e tonne.km. This suggests that the factors that RPS have employed are at the 'high end' of the published data. We are surprised that RPS has not referenced the WRATE emissions factor itself.

32 Nonetheless, RPS acknowledges that data on emissions relating to rail are limited. In the circumstances, we support the use of a range of emissions factors. The assessments undertaken are very sensitive to the emissions factors used. This is most clearly demonstrated in Scenario 1 of the Addendum, in which the rail options perform 'best' if the low factor assumption is used and 'worst' if the higher is assumed.

33 Of the rail emissions factors RPS employed, the higher factor is said in the reference document itself to be representative of operations in the early 1990s, since which time, emissions have fallen due to introduction of more efficient locomotives and operational changes to reduce idle times. ERM does not consider this to be an appropriate emissions factor to rely upon for the Ineos transport carbon assessments. Properly read, the source is clear that this is the case.

34 The reference that RPS uses states a number of emissions factors from other sources, all of which are substantially lower than the worst case that it employs. In *Annex A*, ERM suggests an alternative range of emissions factors. Although these are not sufficiently significantly different to alter the conclusions for Scenario B and Scenario C (this would not be possible, since a greater road transport distance is assumed for the rail scenarios than the road scenarios in any case), for Scenario D and Scenario E the preference for rail becomes much clearer.

35 ERM has carried out a breakpoint analysis to demonstrate the point at which rail becomes preferable to road transport under various assumed emissions factors. This is reported in *Figure 1* to *Annex A*. This demonstrates that under most circumstances, rail becomes preferred to road at a 40 km transport

(1) NB the figure used in Defra's 2011 guidance is 36.94 gCO_2e/tonne.km. For consistency, RPS applied the same 2010 emission factor in both the Assessment and the Addendum.

distance. Under the RPS worst case assumption that we criticise above, the breakpoint is 110km.

36 ERM acknowledges the reasons presented relating to the choice of train and routes etc. However, the assumptions used are speculative, with limited evidence provided in justification.

Consideration of Alternative Scenarios

37 ERM considers the waste sources used by RPS in its assessments to be particularly favourable to the case that Ineos wishes to present in seeking a variation to its road transport constraint. The local sources considered are unsuitable to be served by rail transports because of the currently available rail transfer infrastructure. Capture of these sources may be unrealistic in a competitive market.

38 Furthermore, extrapolation from an examination of the carbon merits of moving waste from these sources to other sources of waste is not justifiable, since few, if any, other sources would enjoy the same circumstances that are so preferential to the road transport case.

39 ERM believes that it would have been appropriate to examine scenarios where a more significant proportion of the waste fuel for the Ineos facility was sourced from Greater Manchester and Lancashire, at a greater road distance than those sources RPS concentrated upon.

40 In *Annex B*, ERM presents the relative carbon impacts of waste transport by road and rail of a number of alternative scenarios of waste source, using rail emissions factors discussed by ERM in *Annex A*. These scenarios include Manchester, Lancashire and a combination of these areas with a proportion drawn from Merseyside and Warrington based on RPS' figures. For the most part, rail is shown to be preferable to road. Only in the case of a combination including waste from Merseyside and Warrington, and with a high rail emissions factor, does road (marginally) emerge preferred.

41 ERM concludes that, with a range of waste sources beyond those exhibiting circumstances exceptionally unfavourable to rail, and with more reasonable rail emissions factors, the carbon case presented in the RPS' reports is substantially undermined.

42 Where rail infrastructure is lacking, particularly for especially local waste sources, road deliveries will be more favourable. This is not surprising where waste must be transported further to the RWTS than to the facility. However, this would always have been the case as Ineos advanced its proposals.

ANNEX A

EMISSIONS FACTOR SENSITIVITY

1 ERM has investigated the sources and assumptions made in relation to the emission factors used by RPS in the '*Runcorn EfW Transport Carbon Assessment*' and '*Transport Carbon Assessment – Addendum*'. The most up to date DEFRA emissions factors are used for road transport. However, these are essentially average emissions for the vehicles concerned, and do not account for different types of driving and the impact of congestion on total emissions. Literature speculates that different types of driving result in varying fuel consumptions, and consequently in CO_2e emissions.

2 With regard to the scenarios chosen by RPS, which involve travel across built-up areas, it is likely that trucks will traverse what are at times severely congested areas. Driving in congestion leads to 'stop and start vehicle movement, which will raise fuel consumption. Therefore, it is reasonable to assume that an uplifted emissions factor would be more representative of emissions in practice.

3 With regard to rail, the higher emission factor used by RPS is out of date. The document from which it is sourced refers to it as representative of the train freight operation from the early 1990s. The report itself states that train freight operations have significantly changed since then and have seen a drastic reduction in its carbon emissions.

4 Reasons for this are two-fold: the widespread replacement of locomotives to more efficient machines; and significant changes to the way that trains are operated. For example, idle times have been reduced to a minimum, which reduced the fuel consumption of the locomotive. In short, the high end emission factor selected by RPS is not considered to be appropriate for use in this assessment.

5 The CIT report used by RPS refers to a number of other studies on train freight and reports their respective emission factors.

- Rail Emissions Model from AEA Technology (2001): 20 gCO_2e/tkm (UK Specific);
- TREMOVE from the University of Leuven, which is a model regularly updated: 33 g CO_2e/tkm (UK Specific);
- NTM (2005): 17 g CO_2e/tkm;
- WRI-WCSD (2003): 30 g CO_2e/tkm;
- INFRAS (2004): 30 g CO_2e/tkm;
- IFEU (2005): 18 g CO_2e/tkm (electric) and 35 gCO_2e/tkm (diesel); and
- DfT: 14.7 g CO_2e/tkm for diesel, in optimum conditions

6 CIT recommends using a factor of 20 g CO_2e/tkm to represent a typical situation. This factor corresponds to the rail freight factor used in the Environment Agency's WRATE life cycle assessment software tool for waste management/.

7 In this context, the DEFRA emission factor used by RPS to represent the low end of the spectrum is actually more representative of the higher end. The range of emission factors should be scaled back in order for them to be more up-to-date. A more appropriate range would be 20g CO_2e/tkm for the low range and 33 g CO_2e/tkm for the high range. This is the result of the TREMOVE study and is UK-specific.

8 The use of these alternative emissions factors would significantly affect the results reported by RPS. *Table A1* presents results using the same scenarios as presented in the RPS assessment, using alternative ERM emissions factors.

Table A1 Original Scenario Results with Alternative Emissions Factors for Rail Freight

	Rail high	**Rail low**	**Road**	**Difference high**	**Difference low**	**% high**	**% low**
	tCO_2eq	*tCO_2eq*	*tCO_2eq*	*tCO_2eq*	*tCO_2eq*	%	%
Scenario A	-		1308	-	-	-	-
Scenario B	3058	2744	-	-1750	-1436	43%	48%
Scenario C	2205	2051	-	-897	-743	59%	64%
Scenario D	1264	1014	-	44	294	103%	129%
Scenario E	1069	864	-	239	444	122%	151%

9 These alternative results show a significant difference, although the extreme Scenarios B and C still show higher emissions than Scenario A. This is due to the assumptions made in the different scenarios, rather than the choice of emissions factors. However, Scenarios D and E show a net benefit in terms of carbon emissions.

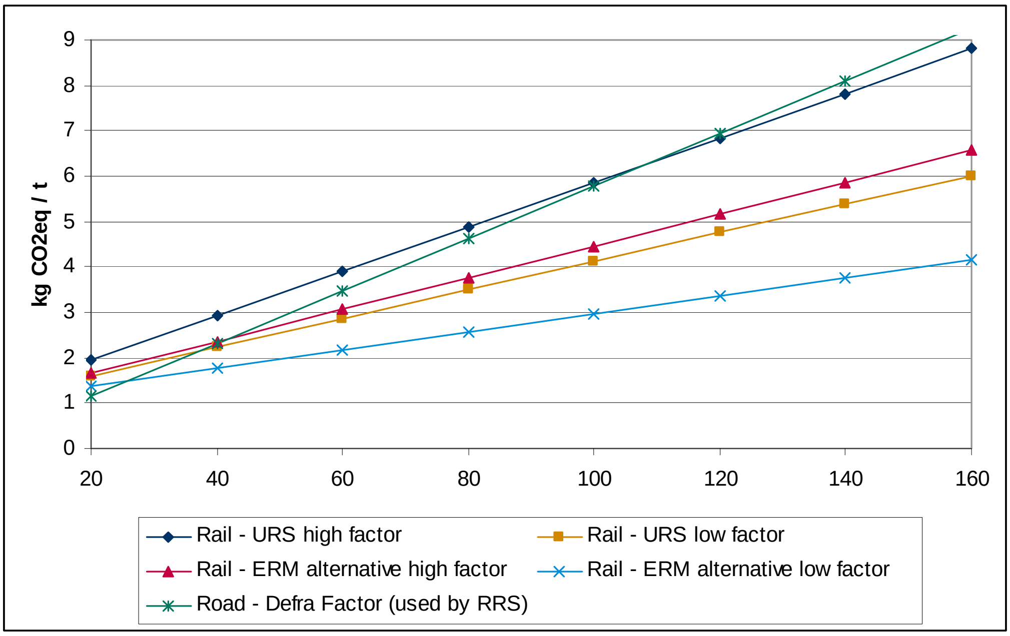
10 ERM has carried out a breakpoint analysis to demonstrate the point at which rail becomes preferable to road transport under various assumed emissions factors.

11 The CO_2e emissions per tonne of waste transported have been calculated for various distances, using the RPS emissions factors and the alternative ERM emissions factors. The distances modelled range between 20 km and 160 km for both rail and road. An additional road distance of 20 km was added to rail transport, in order to represent the potential transport of waste to the railheads. For purposes of simplicity, only the outward journey is considered, representing transport of waste to the Ineos Chlor facility in Runcorn.

12 The return journey has not been accounted for due to uncertainties in payload assumptions made by RPS. The exclusion of the return journey is likely to favour road transport slightly, as RPS assumes that the truck returns empty, which reduces the carbon emissions from vehicle operation. Alternatively,

trains will still need to transport the containers and so a 0% payload is never possible.

13 The results of this high-level assessment show a likely breakpoint at which rail transport would have less emissions, regardless of the emission factor chosen. Using the alternative ERM factors, the breakpoint when rail transport would have lower emissions is at 40 km. Using the RPS emissions factors, the breakpoint would be at 110 km. These results are shown in the figure below.



ANNEX B

CONSIDERATION OF ALTERNATIVE SCENARIOS

1 ERM has investigated the choice of scenarios set out by RPS in the '*Runcorn EfW Transport Carbon Assessment*' and '*Transport Carbon Assessment – Addendum*'. We consider that the RPS scenarios are severely limited in terms of intended geographical catchment and are likely to be unrepresentative of actual waste sources during operation.

2 According to Ineos, the intended geographical catchment for sourcing of waste for the Runcorn EfW facility is the North West region. However, the consent does not limit the catchment from which the waste will be sourced. The RPS scenarios consider only waste sources that are located within about 55 km of the site. Even if we take the North West region as a limit to the Facility's catchment (not in accordance with the permission) waste sources from other major urban areas in the region should also be considered.

3 The suggested proportions of waste from each geographical location are not adequately justified in the RPS assessment. In the '*Transport Carbon Assessment – Addendum*', the expected tonnages from Merseyside and Warrington are 132,750 tonnes and 44,250 tonnes, respectively. This accounts for 45% of the total tonnage for which a variation is sought. The expected tonnage from Manchester is 118,000 tonnes, which is not reflective of the likely availability of waste from this large urban area. The remainder of the expected tonnage is from North Wales, accounting for 100,000 tonnes. Waste sourced from Lancashire has not been included in the RPS scenarios. A larger proportion of waste sourced from Manchester should have been considered than is the case in the RPS assessment. Furthermore, waste from areas further afield should be considered as part of the scenarios, as these are viable waste sources that Ineos Chlor intends to make use of as a fuel.

4 The table below sets out the greenhouse gas emissions from the different transport routes per tonne of transported waste, using emissions factors used in the RPS Transport Carbon Assessment, as well as alternative emissions factors developed by ERM.

5 The table below demonstrates how rail transport is more efficient than road transport in carbon terms when considering longer transport distances. There are carbon savings from road transport when sourcing waste from Warrington only due to the need for a particularly long rail distance due to the rail infrastructure.

6 The proportion of waste sourced from different areas in the region requires further investigation. The RPS Addendum identifies Merseyside and Warrington as major sources of waste for the facility. Both Merseyside and Warrington are specific areas in the region for which there is a carbon benefit for transporting by road, rather than rail. Greater Manchester and Lancashire produce the greatest quantities of waste in the region and it can

therefore be reasonably expected that waste sourced from these areas would provide the major source for the Ineos Chlor facility.

7 ERM has identified alternative scenarios to those presented by RPS. These take into account the quantities of waste produced in the region and consequently the potential sources for the Ineos Chlor facility. We have considered arisings of commercial and industrial (C&I waste) because this is consistent with the RPS Assessments. However, we note that the terms of the Section 36 consent limit the development to the treatment of domestic waste. Calculations assessing the carbon impact from transport based on these facilities are presented in *Table B2* to *TableB5*. The calculations use the alternative rail transport emissions factors presented in *Annex A*, represented by 20 g CO_2e and 35 g CO_2e per tonne kilometre.

8 ***Alternative Scenario: Waste Sourced 50% from Manchester, 50% from Lancashire***. As two major producers of commercial and industrial (C&I) waste, these areas might reasonably be key waste sources for the Ineos Chlor facility. *Table 2* shows that rail transport is more efficient, resulting in 214-590 tonnes CO_2e less than for road transport.

9 ***Alternative Scenario: Waste Sourced 100% from Manchester***. Manchester produces the largest quantities of C&I waste in the region, making it a good choice as a consistent source for the Ineos Chlor facility. Furthermore, it is served by existing rail infrastructure leading directly to Runcorn. *Table 3* shows that rail transport is more efficient, resulting in 318 to 576 tonnes CO_2e less than for road transport.

10 ***Alternative Scenario: Waste Sourced 100% from Lancashire.*** Lancashire is the second highest producer of C&I waste in the region and provides a good alternative to waste sourced from Manchester. *Table 4* shows that rail transport is more efficient, resulting in 749 to 1,252 tonnes CO_2e less than for road transport.

11 **Alternative Scenario: Waste Sourced 30% from Manchester, 25% from Lancashire, 45% from 35% from Merseyside and 10% from Warrington**. Wastes sourced from Merseyside and Warrington are allocated based on the expected figures outlined in the RPS Transport Addendum (132,750 tonnes and 44,250 tonnes, respectively) which accounts for 45% of the total figure for which a variation is applied for. The remainder is allocated to Manchester and Lancashire, with Manchester taking the larger share. *Table 5* shows that rail transport is more efficient when using the 'low' rail emissions factor, resulting in 337 tonnes CO_2e less than for road transport. However, when using the 'high' rail transport emissions factor, road transport is more efficient, resulting in a saving of 58 tonnes CO_2e. This is due to the contribution from waste sourced from Merseyside and Warrington, which are located in areas for which rail transport requires substantial re-routing.

Table B1 Alternative Sources of Waste per Tonne of Waste

		RAIL					ROAD ONLY			
Waste Origin	WTS location	Rail head location	Road from source to railhead (km)	Rail from railhead to Ineos Chlor (km)	kg CO_2e per tonne of waste transported		Road from source to Ineos Chlor (km)	kg CO_2e per tonne of waste transported	Difference by using road only (kg CO_2e per tonne)	
					ERM high rail	ERM low rail			ERM high rail	ERM low rail
Warrington	Warrington	Widnes	12	81	3.41	2.20	15	0.87	-2.55	-1.33
Merseyside	Garston	Garston	0	91	3.19	1.82	16	0.93	-2.26	-0.89
Manchester	Manchester	Manchester	0	53	1.86	1.06	49	2.83	0.98	1.77
North Wales	Mold	Shotton	11	38	1.86	1.29	40	2.31	0.45	1.02
North Wales	Bangor	Shotton	93	38	5.81	5.24	123	7.11	1.31	1.88
North Wales	Llandudno	Shotton	65	38	4.46	3.89	95	5.49	1.03	1.60
Blackpool	Blackpool	Manchester	0	99	5.95	5.15	99	5.72	2.26	3.74
Lancaster	Lancaster	Manchester	0	103	6.19	5.39	103	5.96	2.35	3.90

Table B2 Waste Sourced 50% from Manchester, 50% from Lancashire (325,000 tonnes per annum)

Waste origin	% of total annual waste	tonnes of total annual waste	GHG Emissions from rail transport to Ineos Chlor (kg CO_2e)		GHG Emissions from direct road transport to Ineos Chlor (kg CO_2e)	Difference by using road only (kg CO_2e)	
			ERM high rail	ERM low rail		ERM high rail	ERM low rail
Manchester	50%	162500	301	172	141	-160	-31
Blackpool	25%	81250	282	161	465	184	304
Lancaster	25%	81250	293	167	484	191	317
Total			**876**	**501**	**1,090**	**214**	**590**

Table B3 Waste Sourced 100% from Manchester (325,000 tonnes per annum)

Waste origin	% of total annual waste	tonnes of total annual waste	GHG Emissions from rail transport to Ineos Chlor (kg CO_2e)		GHG Emissions from direct road transport to Ineos Chlor (kg CO_2e)	Difference by using road only (kg CO_2e)	
			ERM high rail	ERM low rail		ERM high rail	ERM low rail
Manchester	100%	325000	603	345	921	318	576

Table B4 Waste Sourced 100% from Lancashire (325,000 tonnes per annum)

Waste origin	**% of total annual waste**	**tonnes of total annual waste**	**GHG Emissions from rail transport to Ineos Chlor (kg CO_2e)**		**GHG Emissions from direct road transport to Ineos Chlor (kg CO_2e)**	**Difference by using road only (kg CO_2e)**	
			ERM high rail	ERM low rail		ERM high rail	ERM low rail
Blackpool	50%	162,500	563	322	930	367	609
Lancaster	50%	162,500	586	335	968	382	633
Total			**1,149**	**657**	**1,898**	**749**	**1,242**

Table B5 Waste Sourced 30% from Manchester, 25% from Lancashire, 45% from 35% from Merseyside and 10% from Warrington (325,000 tonnes per annum)

Waste origin	**% of total annual waste**	**tonnes of total annual waste**	**GHG Emissions from rail transport to Ineos Chlor (kg CO_2e)**		**GHG Emissions from direct road transport to Ineos Chlor (kg CO_2e)**	**Difference by using road only (kg CO_2e)**	
			ERM high rail	ERM low rail		ERM high rail	ERM low rail
Manchester	30%	97,500	181	103	276	95	173
Blackpool	13%	40,625	141	80	233	92	152
Lancaster	13%	40,625	146	84	242	96	158
Merseyside	34%	109,688	349	200	101	-248	-98
Warrington	11%	36,563	125	80	32	-93	-49
Total			**942**	**547**	**884**	**-58**	**337**