Technical Note

Project:	SWIP, Stopgate Lane		
Subject:	Review of AQA & HHRA		
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Document history

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Rev 1.0	Draft for comment	SH, SM	ML	VLS	PB	16/05/22

1. Introduction

A planning application has been submitted by Culzean W2E Ltd (the Applicant) to Lancashire County Council (LCC) as Waste Planning Authority, for the development of a medical waste incineration plant at Tower House, Stopgate Lane, Simonswood Industrial Park, Simonswood, (planning application reference LCC/2022/0003).

Atkins has been commissioned by LCC as the waste planning authority, to review the Applicant's Environmental Statement (ES) that was submitted with the planning application in December 2021. Atkins' review considers whether the air quality assessment and associated human health risk assessment are robust and have been carried out in accordance with relevant guidance and legislation, using suitable methods and applying appropriate criteria for evaluation. A review is also provided of relevant statutory consultee comments. Recommendations are made for additional work to address any identified shortcomings or clarifications, and thus verify the validity of the conclusions.

The review comprises the following:

- Review of relevant sections of the ES (Version 1.2, 13 December 2021) focussing on:
  - Chapter 10 – Air Quality and Climate (with reference to the generic information in other chapters as appropriate);
  - Appendix VI – Emissions Modelling Assessment (Version 1.3, 6 October 2021)
  - Appendix VII - Human Health Risk Assessment (Version 1.1, 2 November 2021);
- Review of statutory consultee comments as relating to air quality.

This report presents and summarises the findings of Atkins' review. The air quality specialist leading the review has over 20 years' experience in air quality assessment, is a full member of the Institution of Environmental Sciences (IES) and Institute of Air Quality Management (IAQM) and is a Chartered Scientist and Chartered Environmentalist.

2. Outline of proposals

The proposals are for a high temperature treatment facility for management of medical wastes. This will include acceptance of up to 3,650 tonnes/annum of hazardous wastes for treatment, which will form the majority of wastes accepted, in addition to smaller quantities of non-hazardous waste with wastes predominantly arising from medical sites. The waste will be treated (thermally destroyed) in a pyrolysis unit, and flue gases to air will be treated prior to discharge to atmosphere via a 14 m high stack. The pyrolysis unit will process, on average, 400 kg of waste per hour and will be operational 24/7.

As the plant will have a capacity less than or equal to 10 tonnes per day for hazardous waste, it is classified as a "small waste incineration plant" and will require an Environmental Permit (EP) to operate under Schedule 13 of the Environmental Permitting (England and Wales) Regulations 2016. The permit, which will include limits on pollutant emissions to air set out in the EU Industrial Emissions Directive (IED) (2010/75/EU), will be issued by West Lancashire Borough Council (WLBC), the local authority area within which the facility is sited.

The proposed abatement of air emissions is comprised of:

- Removal of solids/dust with a trace heated cyclone prior to the oxidiser;
- Selective Non-Catalytic Reduction (SNCR) for nitrogen oxides (NOx) control;
- Ceramic filtration for particulate matter removal;
- Sodium bicarbonate to treat acid gases (SO_2, HCl, HF);
- Powdered Activated Carbon (PAC) to control volatile heavy metals and dioxins and furans

The assessment of best available techniques (BAT) for the proposed facility will be undertaken by the regulator as part of the permit application process and it is not discussed as part of this review.

3. Review of information

Atkins' review of the air quality chapter, emissions modelling, human health risk assessment (HHRA), supporting documentation and relevant statutory consultee responses provided by the Applicant is summarised below.

Item	Reference	Topic	Atkins comment	Action
Air quality assessment – Legislation and Policy				
1	ES Chapter 10	General	Appropriate references are made to EU Directives 2008/50/EC and UK regulations, policy and guidance documents for air quality (inter alia, those published by Department for Environment, Food & Rural Affairs (DEFRA), Institute of Air Quality Management (IAQM) and Environment Agency (EA)). However, some references are missing: Environmental Act 1995, Clean Air Strategy 2019, LAQM.TG(16), Industrial Emissions Directive (IED) (Directive 2010/75/EU) 2013 and Waste Incineration BREF by European Integrated Pollution Prevention and Control (IPPC) Bureau 2019	If a revised version of report is issued, these should be added.
2	ES Chapter 10	General	Reference should be made to the EU (Withdrawal Agreement) Act 2020, which sets out arrangements for implementing the air quality limit values that are included in the EU Directive on ambient air quality and cleaner air for Europe (2008/50/EC) included in air quality regulations (SI 2010 No.1001) and as amended (SI 2016 No.1184).	If a revised version of report is issued, this should be added
3	ES Chapter 2, Section 2.1	EIA regulations	Schedule 4 to the EIA Regulations sets out the information to be included in an ES. Compliance with these requirements is considered to be appropriate as summarised in Table 2.1 of the ES. Specifically, Regulation 18(5) requires that assessment is completed by competent experts. For air quality, appropriate evidence (Member of IAQM) is presented at Table 2.2 of the ES. Regulation 18(4)(a) of the EIA Regulations requires an ES to be based on the direction of the Scoping Opinion. In relation to air quality, this is referenced at paragraph 2.4.2 of the ES.	N/A

Item	Reference	Topic	Atkins comment	Action
Air quality assessment – Methodology				
4	ES Chapter 10, Section 10.3	General	The air quality assessment methodology is set out in Section 10.3 of the ES. The assessment addresses construction phase dust emissions, operational stack emissions (with associated Human Health Risk Assessment (HHRA)) and operational dust and odour fugitive emissions. The Applicant has used an appropriate selection of guidance covering: • Construction dust assessment (IAQM, 2014) • Odour assessment for planning (IAQM, 2018) • Construction and operational traffic (IAQM, 2017) • Stack emissions (Environment Agency online guidance for permitting, HMIP methodology for dioxins, USEPA human health risk assessment protocol) • Ecological impacts (Environment Agency online guidance, IAQM 2019)	See further comments below in relation to Appendix VI
Air quality assessment – Baseline				
5	ES Chapter 10, Section 10.4	General	A range of baseline data sources has been used, which is appropriate given the wide variety of pollutants under consideration. Relevant pollutants have been included in line with the IED. The choice of site and year is questionable in some cases and lacks a clear and coherent rationale. However, based on the results it is not likely to have a material impact on the assessment conclusions.	See later comments.
6	10.4.2 (3.1 of Appendix VI)	LAQM	The Applicant has focused only on the local authority within which the facility is situated (WLBC), and therefore has not identified the closest AQMA to the site, Liverpool City AQMA located 3.7 km south-west of the site. The Liverpool City AQMA is unlikely to be affected but a comment ruling out any potential impacts, for which the IAQM has set more stringent traffic change criteria, is missing.	Applicant to check all nearby authorities and confirm whether other AQMAs could be affected.
7	10.4.1 (3.2 of Appendix VI)	Air quality monitoring	The closest AURN monitoring site is correctly identified to be St Helens Linkway which is 10km to the south east of the proposed site. St Helens Linkway AURN data is excluded on the basis of being located in an	AURN sites and adjoining local authority reports should be reviewed to identify if more

Item	Reference	Topic	Atkins comment	Action
			urban traffic location, which is appropriate. It would however be useful to identify the closest representative (background or suburban) AURN monitoring site. WLBC monitoring data and that undertaken by adjacent authorities has not been considered. WLBC data is excluded on the basis of being located within the WLBC AQMA, which is appropriate. However, there are potentially other relevant sites in neighbouring authorities that would represent receptors in the study area.	suitable background monitoring data are available to verify the suitability of the DEFRA mapped background data used in the assessment.
8	10.4.2 (3.3 of Appendix VI)	DEFRA Background Mapping	DEFRA 2020 mapped data were used in the assessment rather than measured data for NO_2, PM_{10} and $PM_{2.5}$. DEFRA 2001 mapped values (with appropriate adjustment to 2020) were used rather than measured for CO and SO_2.	See item 7
9	N/A	PCM links	The Applicant has not identified DEFRA PCM road links which could present a constraint and compliance risk. The nearest PCM links are located 2km away from the site and do not exceed the criteria.	Applicant to comment on any potential impacts.
Air quality assessment – Impacts				
10	10.5.1	Construction Dust	The assessment has been completed in accordance with the appropriate IAQM methodology. A detailed review of the construction dust assessment is not within the scope of this review however, the assessment appears to be adequate, with final determination of dust risk impacts given in Table 10.22 considered to be appropriate.	N/A
11	10.5.2	Construction Traffic	Screening criteria for assessment of vehicle emissions reference those within the IAQM Planning Guidance (2017) as appropriate. A review of the construction traffic assessment is not within the scope of this review.	N/A
12	10.6.1	Operational Traffic	Screening criteria for assessment of vehicle emissions reference those within the IAQM Planning Guidance (2017) as appropriate. A review of the operational traffic assessment is not within the scope of this review.	N/A
13	10.6.2	Odour	A review of the odour assessment is not within the scope of this review.	N/A
14	10.6.3	Stack Emissions	See sections below relating to the emissions modelling assessment (Appendix VI)	N/A
15	10.6.3	HHRA	See sections below relating to the HHRA assessment (Appendix VII)	N/A

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16	10.6.4	Climate	The impact on climate is not within the scope of this review	N/A
Air quality assessment – Mitigation, Residual & Cumulative Impacts				
17	10.7.1	Construction phase mitigation	Proposed construction phase mitigation is considered to be appropriate. Specific measures will be identified by the appointed contractor and agreed in advance with the Local Authority.	N/A
18	10.7.2	Operational phase mitigation	Operational mitigation is inherent in the facility design, recognising that operational emissions will be subject to control under the EP. The stack height of 14 m and emission abatement is an integral part of facility design to meet BAT and is not strictly mitigation.	N/A
19	10.8	Residual impacts	Consideration of residual impacts is appropriate	N/A
20	10.9	Cumulative impacts	Consideration of cumulative impacts is appropriate	N/A
Emissions modelling assessment – ES Appendix VI				
21	ES Appendix VI	General	Appendix VI describes the detailed dispersion modelling study that has been undertaken to determine how ground level concentrations at sensitive receptors have been derived. The Applicant has used an appropriate model (AERMOD, although not the latest version) and reasonable conservative assumptions have been applied throughout the assessment in line with common practice for such assessments: • Continuous operation every day, 24/7 through the year; • Worst case modelled concentrations across 5 years of meteorological data; • Total particulate matter assessed both as PM_{10} and $PM_{2.5}$; • Total organic carbon (TOC) emission assessed as consisting entirely of benzene; • Use of 30 minute IED emission limit values (ELVs) to assess against hourly short-term air quality criteria; • Consideration of nearest sensitive receptors; • Conversion of NO_x to NO_2 using EA's recommended "worse case" [sic] 70/35% ratios;	N/A

Item	Reference	Topic	Atkins comment	Action
			• Future ambient pollutant concentrations held at existing levels, generally considered a conservative approach given current policy.	
22	ES Appendix VI, Chapter 2	Air quality, legislation and policy	See items 1 and 2	N/A
23	3.2.1 & 3.2.2	Baseline position	See item 5 to item 9	N/A
24	3.2.3	Heavy metals	The closest DEFRA Heavy Metals monitoring site is correctly identified as Runcorn Weston Point (note: distance from the proposed site stated incorrectly as 20km rather than 50km). This monitoring site closed in March 2019, however the data presented in Table 3.1 is considered appropriate for use in the assessment. Table 3.1 appears to be incorrectly labelled as the maximum calculated annual mean metal concentrations across **urban industrial monitoring locations** between 2015 and 2019 whereas the data is stated in the text as for the Runcorn site only. Data presented in Table 3.1 also appears to contain inconsistencies for example: for arsenic the maximum should be 0.733 ng/m^3 (2019) rather than 0.708 ng/m^3 (2016); for cadmium the maximum should be 0.118 ng/m^3 (2016) rather than 0.128 ng/m^3 , and for chromium the maximum should be 1.70 ng/m^3 (2018) rather than 1.729 ng/m^3. The methodology for estimating Cr(VI) from chromium is stated to be as per the reference cited (Metals and Metalloids, Expert Panel on Air Quality Standards, 2009) and is in line with the EA document *"Releases from municipal waste incinerators - Guidance to applicants on impact assessment for group 3 metals stack emissions from incinerators"* (https://www.gov.uk/government/publications/waste-incinerators-guidance-on-impact-assessment-for-group-3-metals-stack). However, the background Cr(VI) concentration of 0.785 ng/m^3 presented in Table 3.1 appears to be not 20% but rather 45% of the maximum annual mean chromium concentration of 1.729 ng/m^3. Data provided for the background Cr(VI) concentration in Table 3.5 and as used in the assessment is however correct (0.35 ng/m^3). See Item 84 under consultee responses below for further discussion and suggested actions.	Data provided in Table 3.1 appears to be inconsistent with published data. Data should be checked and corrected as appropriate. Also, see item 84

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25	3.2.4	Benzene	The closest DEFRA non-automatic hydrocarbon monitoring site is correctly identified as Liverpool Speke. Data presented in the Table 3.2 appears to contain slight inconsistencies with published data, however the maximum annual mean data used in the assessment (for 2017, as provided in Table 3.5) is correct and therefore the assessment results are unaffected.	N/A
26	3.2.5	Dioxin and Furan Monitoring	The closest Toxic Organic Micropollutants (TOMPs) monitoring site is correctly identified as Manchester Law Courts. Data for all six TOMPs sites across the UK is presented in Table 3.3 (incorrectly titled as data for the Manchester Law Courts site only). An average of all annual mean concentrations across all six sites between 2012 and 2016 (latest 5 years of available data) has been used to represent the background dioxin and furan concentration at the proposed site. Data presented in the Table 3.3 appears to contain slight inconsistencies with published data. The range in the annual mean data presented in Table 3.3 implies the use of an average across all sites is not conservative. However this is unlikely to materially impact the results as the assessment of dioxin is focused on ingestion not inhalation.	Applicant to justify the suitability of background data used.
27	3.2.6	Acid gas monitoring	The closest acid gas and aerosol monitoring station is identified as Plas Y Brenin which is 82km to the south west of the proposed site. Ladybower is located closer, 76km south east of the proposed site. Both sites stopped monitoring HCL in 2016. Data for the sites has not been provided. The background HCL and HF data used in the assessment has been taken from the EPAQS report, *Guidelines for Halogens and Hydrogen Halides in Ambient Air for Protecting Human Health Against Acute Irritancy Effects, Expert Panel on Air Quality Standards, 2005*. For HCl, this has been taken as the maximum annual mean concentration across 12 monitoring locations in 2002. More recent data are available and have not been used. For example, the maximum concentration measured in the UK 2011 to 2015 was 0.71 µg/m^3. For HF, there are very limited data available. The annual mean has been taken from the maximum monthly concentrations measured in the	Applicant to justify suitability of the background data used and consider using more recent HCl monitoring data from the UK Acid Gases and Aerosols Monitoring Network where available. Also, see item 84.

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			vicinity of three industrial plants. Therefore the background used in the assessment is deemed to be highly conservative. See Item 84 under consultee responses below for further discussion and suggested actions.	
28	Table 3.5	Background data used in the assessment	Table 3.5 presents the specific background data used in the assessment. EA guidance *"Air Emissions Risk Assessment for your Environmental Permit"* states that for short term averaging periods (hourly, daily, 8-hourly, 15-minute) the background concentrations should be assumed to be twice the long term concentration (annual mean). The Applicant has applied this rule to the 1-hour mean background data only, while backgrounds for averaging periods of 24 hour mean, 8 hour mean and 15 min mean have been calculated by applying conversion factors, which in our view are only to be applied to the modelled pollutant concentration. Table 3.5 does not provide a background concentration for daily benzene, for comparison with the latest air quality criterion in EA guidance.	Applicant to amend Table 3.5 and update results accordingly.
29	3.5.1	Sensitive receptors	The precise location of the listed receptors in the receptor figure (see Appendix II to the emissions assessment) is unclear, but by cross comparison to OS mapping (see inset) it appears a suitable selection of existing receptors, including those closest to the source, has been included in the study. There is, however, no mention of future developments that could introduce new sensitive receptors. No short term receptors have been specifically selected for assessment, such as footpaths or amenity space, however, the maximum short term ground level concentrations suggest this is not an issue.	Applicant to confirm local plans have been reviewed to identify locations of future sensitive development

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			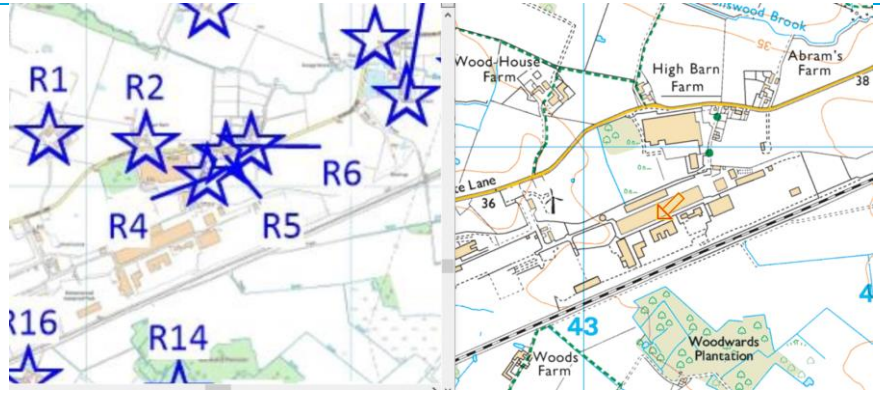	
30	4.1.1 (3.3.1.1 of Appendix VII)	Dispersion modelling software	The use of the AERMOD dispersion modelling software is appropriate and common industry practice. The ES states that modelling was undertaken using the 2019 executable v19191. The latest AERMOD executable is v21112 which was released 22/4/2021. A reason is not provided for not using the most up to date version but it is considered unlikely that minor recent upgrades would materially impact the results.	N/A
31	4.2, Table 4.1	Model inputs	Atkins' calculation of normalised flow is slightly higher at 1.46 Nm^3/s but likely due to rounded values used as presented in the table. A lower flow rate will give lower mass emissions and thus lower modelled ground level concentrations. The moisture content of 4% appears low for medical waste with biological material content; a value of 10% would instead give a normalised flow rate closer to that presented in the table.	Applicant to clarify flow rate calculation and moisture content
32	4.2.2	Pollutant emissions	The calculations of emissions appear to have been undertaken correctly. See points above re. possible underestimation of the flow rate presented in Table 4.1.	N/A
33	4.2.2.3 – 4.2.2.5	Pollutant emissions – group 3 metals	The use of data for Municipal [solid] Waste Incinerators (MSW) and Waste Wood Incinerators is only accepted if it can be shown that the data are representative. Given the fact that medical waste to be incinerated at the proposed site, is likely to have a different elemental composition to MSW/wood, supporting evidence should be provided.	See item 84

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			See Item 84 under consultee responses below for further discussion and suggested actions.	
34	4.2.2.7	TOCs	The benzene short-term EAL was updated in EA guidance in September 2021 to a 24 hour mean of 30 µg/m^3.	Applicant to update reference in 4.2.2.7
35	4.2.3 (and 3.3.6 of Appendix VII)	Buildings	Structure B is a relatively large building to the north of the proposed facility (see Table 4.4 of Appendix VII which states 12m high). The proposed stack height of 14 m does not therefore meet standard practice of 3 m clearance above nearby structures. Aerial photography also shows another structure north of Structure B which appears not to have been modelled. If lower than Structure B it would not be the dominant structure and results should not be affected. The results of a stack height calculation or sensitivity analysis are not provided, to demonstrate that 14 m is an appropriate height for the stack discharges. The results for annual mean dioxin concentrations (Table 4.1, Appendix VII) show the field wide maximum concentrations are 25 times higher than at the closest receptor (R4). This suggests poor dispersion possibly as a result of building downwash due to Structure B. See also Item 43 (assessment of percentiles not maxima is not appropriate for a stack height study).	Applicant to clarify how 14 m stack was derived and the buildings included in that calculation; or present a stack height study to support their choice.
36	4.2.4 (and 3.3.3.1 of Appendix VII)	Met data	Five years of meteorological data from 2013-2017 for Liverpool John Lennon Airport were used. Five years is in line with EA permitting guidance, which does not specify that the most recent years must be used. A slightly closer site, Crosby, is available, but wind patterns appear to be reasonably similar thus it is not a significant concern. Data were provided by an experienced supplier (ADM Ltd), who apply quality assurance to the data prior to issue. Although the most recent data have not been used, modelling five years typically covers the potential for inter-annual variation. A comparison of windroses held by Atkins suggests, for instance, that the pattern seen in 2014 data for Liverpool is similar to that in 2018.	N/A
37	Table 4.4 (Table 3.3, Appendix VII)	Surface parameters	It is not possible to check from the information presented what land use categories were assigned to arrive at the stated values.	Applicant to clarify land use

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38	4.2.5 (3.3.4.1 of Appendix VII)	Receptor grid	The modelling covers an area 3 x 3km at 20 m spacing, which is suitably detailed for the relatively low stack and location of nearest receptors.	N/A
39	4.2.6 (3.3.5.1 of Appendix VII)	Terrain	The Applicant has applied standard good practice in the incorporation of Ordnance Survey terrain data. Terrain has been included at a resolution of 5 m intervals, which is adequate	N/A
40	4.2.7	NOx to NO2 conversion	Appropriate conversion of NOx to NO2 using EA's recommended "worse case" [sic] 70/35% ratios.	N/A
41	4.3	In-combination assessment	Other significant processes with point source emissions within 1km of the proposed site were searched by the Applicant. This search radius may not be sufficient should a large combustion plant to be proposed, as the plume may travel further to cause a cumulative impact at the proposed site. It is unclear if such a possibility has been ruled out.	Statement as to whether there are any proposed large combustion plants likely to impact the proposed site to be added.
42	4.4 & 4.5	Methodology for assessment of potential impacts	The Applicant refers to the screening criteria in EA guidance that are intended for users of the screening methodology to determine firstly if detailed modelling is required. In this case, as detailed modelling has been undertaken, the key determining factor is whether the total predicted environmental concentration (PEC) exceeds relevant ambient air criteria. Nevertheless it is common practice to consider long term process contributions (PCs) equal to <1% of the relevant criterion, and short term PCs of <10% of the relevant criterion, as "not significant".	The criteria in 4.4.3 should not have been used in the assessment of results in section 5.1.
Emissions modelling assessment (ES Appendix VI) – human health results				
43	5.1	Modelled pollutant concentrations	The Applicant mentions that the maximum modelled concentrations from five years' modelling have been used in the assessment. However, the assessment of short term impacts e.g. for NO_2, PM_{10} and SO_2, presents the modelled percentile equivalent to the objective. This excludes the top 18/35 etc. results and masks the highest results, which are particularly important when determining whether a stack height is sufficiently high to exclude downwash effects.	Applicant to provide maximum modelled short term concentrations for all relevant pollutants in table format. Applicant to present stack height study using maxima (see item 35).
44	5.2.1	Nitrogen dioxide	Annual mean NO_2 results indicate that the PC is less than 1% of the AQS objective at the majority of receptors. Where it is above 1% (R1,	Applicant to provide maximum annual mean and maximum hourly mean contour plots for NO_2.

Item	Reference	Topic	Atkins comment	Action
			R2 and R4-R6), the PEC is well below (<30%) of the objective at all receptors. Hourly mean 99.8th percentile NO_2 results indicate that the PC is less than the short term 10% criterion at all receptors. However this table does not present the *maximum* hourly concentration and this may mask some high results at the maximum point of impact (where the PC as the 99.8th percentile equates to 53% of the criterion). Contour plots are stated to be in Appendix IV to the emissions assessment (Appendix VI), but have not been identified; they should be found after the windroses in Appendix III.	
45	5.2.2	Particulate matter	Both the short and long term PM_{10} and $PM_{2.5}$ results show the PC to be less than the EA screening criteria at all receptors and the maximum point of impact. Again the Applicant has presented a 90.4th percentile rather than the maximum daily mean and the PC at maximum point of impact is a large proportion of the criterion. The assessment would also be impacted by the correction of the background concentration used for daily mean PM_{10}. See item 28.	Applicant to provide maximum daily PM_{10} concentrations and check impact of a corrected background concentration (using EA approach)
46	5.2.3	Sulphur dioxide	Both the daily and hourly mean SO_2 results show the PC to be less than the EA screening criteria at all receptors. The maximum point of impact PC equates to 14% and 33% of the daily and hourly criteria respectively. It is therefore agreed that further consideration of the PEC is not required, and the impact can be considered to be not significant. The assessment would therefore not be materially affected by the correction of the background concentration used for daily mean SO_2. See item 28. The 15 min SO_2 results indicate that the PC is less than the EA screening criteria at all but four receptors. The PEC presented in Table 5.12 remains below 20% of the criterion at all receptors. The assessment would not be materially affected by the correction of the background concentration used for 15-mean SO_2. See item 28.	N/A
47	5.2.4	Benzene	Table 5.9 is incorrectly titled as hourly mean rather than daily mean. Twice the annual mean background has been correctly applied to calculate the PEC.	Table 5.9 heading to be amended if a revised report is issued

Item	Reference	Topic	Atkins comment	Action
			Both the annual and daily mean benzene results demonstrate the PC to be less than 1% and 10% of assessment criteria at all receptors. The maximum point of impact daily PEC equates to 30% of the criterion. It is therefore agreed that further consideration of the PEC is therefore not required, and the impact can be considered to be insignificant.	
48	5.2.5	Carbon Monoxide	Tabulated results for maximum hourly carbon monoxide concentrations are not provided.	Applicant to include a table for modelled carbon monoxide results
49	5.2.6	Hydrogen Chloride	The short term HCl results demonstrate the PC to be less than 10% of the assessment criterion at all receptors and the maximum point of impact. It is therefore agreed that further consideration of the PEC is therefore not required, and the impact can be considered to be insignificant.	N/A
50	5.2.7	Hydrogen Fluoride	The short term HF results demonstrate the PC to be less than 10% of the assessment criterion at all receptors and the maximum point of impact. It is therefore agreed that further consideration of the PEC is therefore not required, and the impact can be considered to be insignificant. The assessment would therefore not be materially affected by the correction of the background concentration used for monthly HF. See item 28	Background data used for monthly mean PEC calculation should be amended.
51	5.2.8	Mercury and Cadmium	Both the long and short term mercury results demonstrate the PC to be less than 1% and 10% of the assessment criteria at all receptors and the maximum point of impact. It is therefore agreed that the impact can be considered to be insignificant.	
52	5.2.9	Group 3 metals	Both the short and long term results for all group 3 metals with the exception of Cr (VI) demonstrate the PEC to be less than the EAL at all receptors and the maximum point of impact. It is therefore agreed that the impact can be considered to be insignificant. For commentary on Cr(VI) results refer to item 84.	See item 84 of the consultee response review.
53	5.2.10	Dioxins and Furans	There are no ambient air quality standards for dioxins/furan, hence the requirement for the HHRA. The Applicant has nevertheless compared the PC to the selected annual mean background concentration, the percentage of which would be lower still with the use of a more conservative background (see item 28).	N/A

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Emissions modelling assessment (ES Appendix VI) – ecological results				
54	5.3.1	Critical levels	The results for relevant pollutants and averaging periods demonstrate the PC to be less than the EA assessment criteria for local nature sites at all receptors. EA guidance does not require the PEC to be calculated for local nature sites. It is therefore agreed that further consideration is therefore not required. For commentary on HF results refer to item 84 of the consultee response review.	See item 84 of the consultee response review.
55	5.3.2	Nitrogen deposition	A detailed review of the assessment of ecological receptors is not within the scope of this review.	N/A
Emissions modelling assessment (ES Appendix VI) – In-combination assessment results				
56	5.4	In-combination results	Annual mean NO_2 results table is missing a title. Results indicate that the PC and PEC are below relevant EA screening criteria. It is therefore agreed that further consideration is therefore not required, and the potential for in-combination impacts is not considered to be significant.	Update title if a revised report is issued.
Human health risk assessment (ES Appendix VII)				
57	Para 1.1-1.3	Scope	The reference to H1 methodology is out of date – the Applicant should refer to the online source Air emissions risk assessment for your environmental permit - GOV.UK (www.gov.uk) (as correctly referenced in footnote 5 to paragraph 10.2.2.1 of the ES AQ chapter).	Confirm latest guidance has been applied
58	Para 1.3	Pollutants of concern	The Applicant has considered dioxins/furans only, not PCBs or heavy metals. The EALs for metals in the above referenced guidance are considered by the EA to be sufficiently protective of human exposure via routes other than inhalation so it is common now not to see metals included in the HHRA. Conversely, there are no ambient air quality standards for dioxins/furans and these pollutants can accumulate in the environment with 90% of exposure through the diet (see also para 2.2.1), hence the requirement for the HHRA.	Provide supporting evidence for exclusion of PCBs

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			Regarding dioxin-like PCBs, it is unclear if these were excluded because there are no PCB sources in the incoming medical waste stream or if it is an omission from the assessment.	
59	Table 2.3	Emissions	The 17 dioxin/furan congeners that have been selected are in line with HMIP guidance.	N/A
60	Table 2.3	Emissions	The Applicant has applied a dioxin profile for municipal waste incineration plant in absence of site specific information. It does not appear to align with the profiles found in other Waste to Energy applications. No supporting information has been provided as to why or to what extent the applied municipal waste emissions profile (taken from data for US incinerators in 2000) is deemed representative of the proposed hazardous medical waste incinerator emissions in 2022, other than it being described as a "large dataset". A medical waste incinerator may well be expected to have a different profile.	Applicant to provide evidence of applicability to emissions from medical waste, or adjust modelled emission profile accordingly.
61	Table 2.1	TEQ factors	The TEQ factors appear generally reasonable but with some discrepancies against other MSW applications published online, which have been based on the international toxic equivalence factors as given in the IED (2010/75/EU) Annex VI Part 2. Instead the factors appear to have been taken from the US EPA recommendations in https://rais.ornl.gov/documents/dioxin_tef.pdf.	Provide comment on likely impact on results or amend assessment. Consider sensitivity test assuming all 2,3,7,8-TCDD in light of uncertainty.
62	Para 2.1.2	Emission limits	An emission concentration of 0.1 ng/Nm^3 i-TEQ is used in the modelling, based on the IED emission limit value for dioxins/furans. The EU BREF for waste incineration (Waste Incineration | Eippcb (europa.eu)) suggests a value of 0.04 ng/Nm^3 or combined 0.06 ng/Nm^3 for dioxins and dioxin-like PCBs can be achieved by new plant. The EU BREF Section 3.2.2.4 presents data on periodically monitored PCDD/F emissions concentrations including a figure of 0.02 ng i-TEQ/Nm^3 for two small (2 tph) clinical waste incinerators in the UK (Knostrop, Leeds; twin-line stepped hearth design; flue gas cleaning with bag filter, dry scrubber mixing unit, dry sorbent injection). Therefore the value used in the assessment may be considered conservative.	Provide clarification or supporting information

Item	Reference	Topic	Atkins comment	Action
63	Para 2.3.2	Exposure criteria	A Tolerable Weekly Intake (TWI) for dioxins, furans and dioxin like PCBs of 2 picograms (pg) I-TEQ/kg body weight (bw), equivalent to approximately 0.29 pg I-TEQ/kg bw/day, has been adopted by the Applicant for this assessment. However, the UK Committee on Toxicity (COT, March 2021) draft interim position paper[1] suggests that the European Food Safety Authority (EFSA) proposal for a TWI of 2 pg/kg bw/day is not supported and that a tolerable daily intake (TDI) of 2 pg/kg bw per day is deemed protective for effects on the developing male foetus. Therefore we consider the WHO and UK COT recommended value is a TDI of 2 pg I-TEQ/kg bw/day. The implication is that by using the TWI, the Applicant has compared results to a much more stringent criterion than is typically applied for other waste plant in UK planning and permitting applications.	Applicant to explain why this limit was adopted or amend assessment to use TDI.
64	Para 2.3.3	Breast milk exposure	Exposure via breast milk has not been compared to the TDI of 2 pg I-TEQ/kg bw/day. Instead, background exposure of 1.8 pg I-TEQ/kg bw/day (representing an average consumer) was used as the baseline for a breastfeeding infant. This is not representative for an infant whose exposure is assumed to be via breastmilk only. The COT states in 1997 the 97.5 percentile intake of dioxin (TEQ) was 7.2 pg/kg bw/day for toddlers. Therefore the use of 1.8 pg/kg bw/day for an average consumer gives a higher result when expressed as a percentage of "background" than if the figure for toddlers had been used. The value for toddlers is likely to underestimate breastfed infants' intake, as dioxins tend to concentrate in the milk therefore intake may be substantially higher (possibly by an order of magnitude). The COT states, (para 85) "*although intakes of dioxins and dioxin-like PCBs by breast-fed babies are higher than is desirable, encouragement of breast-feeding should continue on the basis of convincing evidence of the [*overall*] benefits*". Overall, the maximum PC of 1 pg/kg bw/day (note, this is the maximum field wide impact not the result at a receptor) is unlikely a material contribution to the baseline intake for a breastfed infant.	N/A

[1] (https://cot.food.gov.uk/sites/default/files/2021-03/Dioxin%20interim%20position%20statement_0.pdf

Item	Reference	Topic	Atkins comment	Action
65	Table 3.1	Model inputs	Model input parameters are consistent with the information provided in Appendix VI Emissions Modelling. See item 31 under Appendix VI Emissions Modelling review.	
66	Table 3.2	Emission rates	The calculations of emissions appear to have been undertaken correctly. See points above re. a) discrepancies in the TEQs applied vs those in the EU Directive and b) possible underestimation of the flow rate presented in Table 3.1.	N/A
67		HHRAP software	The use of IRAP-h software for the human health risk assessment is appropriate and common industry practice.	N/A
68	Para 3.3.2.1-2	Deposition	All dioxins have been modelled as particle phase / bound and selection of Method 2 is appropriate as is a mean particle diameter of 0.1 microns. However, the most volatile e.g. 2,3,7,8-TCDD/F could be modelled in the gaseous phase. (Ref. US EPA HHRAP companion database in Appendix A of HHRAP). It is unclear if dioxins were modelled as particle phase or particle bound and what impact this choice would have on the results.	Applicant to clarify approach and comment on likely effect of this on results
69	Para 3.4.1-2	Exposure scenarios	An appropriate selection has been made for a conservative approach using maximum field wide impact as well as the maximum result for a receptor (R4). Both were assessed as farmer/farmer child (which assumes consumption of locally grown veg/fruit, that animals are reared at those locations and eat locally produced feed), so this will tend to overestimate exposure of a typical resident. Excluded pathways are appropriate: dermal exposure; drinking water; ground water; surface water; soil ingestion for infants (all breast milk). No justification has been provided for exclusion of intake via fish, which given the proximity of Newbridge Fishing Lakes less than 1 km to the north east would be expected. However, Atkins consider this is unlikely to be a substantial source of dioxin intake from the diet and a conservative approach for dietary intake has already been assumed for the farmer.	N/A
70	3.6.1.1	Rainfall	The time period for average annual rainfall is not stated, e.g. if it is for a recent year or a 30 year historical average. The flood assessment uses a	Applicant to clarify potential impact of underestimating rainfall

Item	Reference	Topic	Atkins comment	Action
			higher figure of 873 mm and rainfall in future years may be higher as a result of climate change. Liverpool John Lennon Airport data was used for wind data, and it is unclear if the values differ substantially between this site and Crosby.	
71	3.6.2.1	Evapo-rate	70% of total precipitation is a standard assumption taken from IRAP-h and is accepted	N/A
72	3.6.3.1	Irrigation	0 mm irrigation is a standard assumption taken from IRAP-h and is accepted	N/A
73	3.6.4.1	Runoff	10% of total precipitation is a standard assumption taken from IRAP-h and is accepted	N/A
74	3.6.5.1	Wind speed	Wind speed is taken from Liverpool John Lennon Airport data which is appropriate given the use of data for the modelling, although inconsistent with source of rainfall data from Crosby.	Applicant to comment on choice
75	3.6.6.1	Soil mixing zone	2 cm is a standard assumption taken from IRAP-h and is accepted	N/A
76	3.6.7.1	Exposure duration	40 years applied for farmer adult, 6 years for child. In the UK we would typically see 30 years applied for an adult, to be consistent with the anticipated lifetime of the facility. This approach is conservative as it assumes a longer lifetime exposure.	N/A
77	3.7.2.2	Inhalation rate	The HHRAP rate of 0.83 m^3/h for an adult corresponds to 20 m^3/day which is appropriate. We suspect the rationale for choosing the child value from HMIP is because it gives a more conservative value for a child (we have seen 0.3 m^3/h applied in other assessments)	N/A
78		Body weight	The IRAP/HHRAP default value of 70 kg for an adult and 15 kg for a child were applied, whereas in the UK a value of 20 kg is typically applied for a child. This is inconsistent with the approach taken for inhalation where a UK value was selected for a child, presumably because the choice of a lower body weight is conservative.	Applicant to comment on rationale for selection
79	4.1.1	Table 4.1	There is a substantial difference (x 25 or more) between the maximum point of exposure and receptor R4 which suggests dispersion may not	Applicant to clarify how stack height was determined

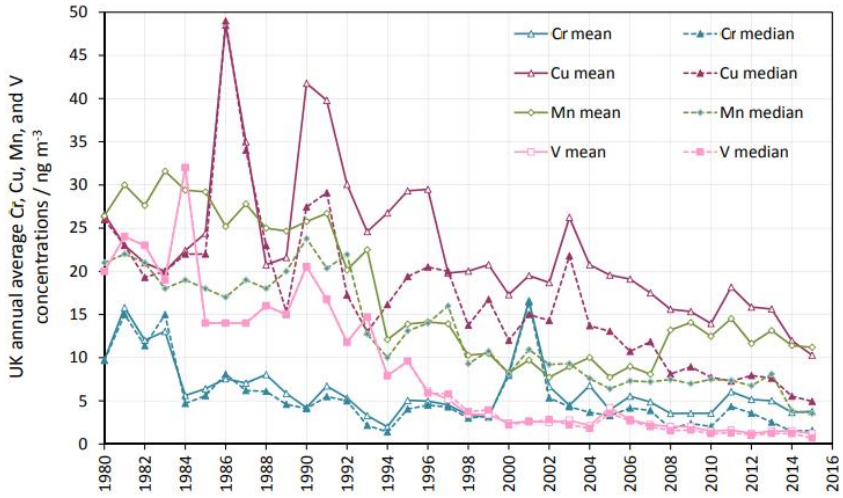
Item	Reference	Topic	Atkins comment	Action
			have been optimised through stack height. See comments under 3.4 above.	
80		Table 4.2	Unitised deposition rates provide lower values than may typically be expected. i.e. for a concentration of 50 µg/m^3 we would expect a deposition rate in g/m^2/year of the same order of magnitude or 2 to 3 times higher for a deposition velocity of 0.01 m/s (suitable for fine particles). It is the case that the AERMOD calculation of wet deposition tends to give negligible results, whereas ADMS can give much higher deposition rates.	Applicant to review and confirm relationship between concentration and dry/wet deposition is as expected
81		Table 4.4	Results at the closest receptor, R4, are a small fraction of the TDI (1%) despite a number of conservative assumptions made in the assessment. This allows for a large margin for error in aspects like deposition, intake rates, exposure assumptions etc without affecting the conclusion.	N/A

Atkins' review of relevant consultee responses is summarised below.

Item	Reference	Topic	Atkins comment	Action
Consultee responses				
82	WLBC Case Officer Report	Permitting	The WLBC EHO does not specifically comment on air quality but notes that under NPPF, the Local Planning Authority must assume that this control regime will operate effectively, be properly applied and enforced. The WLBC case officer notes a concern about the business' ability to adhere to the permit in order to safeguard the amenities of local residents and the local environment. The assessment has shown that in terms of human health, the assessment has been undertaken in line with appropriate guidance and the results imply there should be no significant effects on the local population.	LCC could consider the requirement for post-commissioning emissions testing and annual testing thereafter to confirm ELVs are met.
83	Environment Agency	Permitting	The EA note that it is the type of plant and maximum throughput that determines the permitting regime rather than the actual throughout or how it is operated.	LCC to ensure application does not exceed waste throughput threshold. Consider requirement for annual reporting of waste handled.

Item	Reference	Topic	Atkins comment	Action
84	Knowsley Council (KBC) (Environmental Health & Consumer Protection)	Air emissions	KBC raise concerns regarding the results for HF and Cr(VI). For HF, their concern is that the PEC exceeds the EAL at ecological receptors, and for Cr(VI) that the PEC exceeds the EAL for human health. There is a lack of available background data for HF in recent years. The EAPQs study refers to a concentration rate of 0.5 to 3 µg/m^3, the upper range relating to sites in proximity to coal fired power stations, aluminium production, brick and coke production, none of which apply to the Application site. Therefore the use of a background of 2.35 µg/m^3 is deemed to be highly conservative. The HF EAL of concern is for a weekly average and is not a statutory air quality standard or objective. The EA approach to assessment against non-statutory critical levels is to ensure that the PC does not exceed 100% of the EAL which is considered to demonstrate BAT. This is the case, as stated in paragraph 5.3.1.1. Indeed, the maximum PC is less than 10% of the EAL and just 1.7% of the selected background concentration. It is deemed to be not significant. The National Atmospheric Emissions inventory shows the HF emissions have declined over the last 50 years (Pollutant information - NAEI, UK (beis.gov.uk)) The assessment of Cr(VI) follows EA guidance for the assessment of Group 3 metals which uses data for MSW and waste wood co-incinerators to allocate the percentage of each metal to the total Group 3 metal emission rate (Table 4.2 of ES Appendix VI). There is no supporting discussion as to how this distribution may also be considered representative for a medical waste facility. Table 3.1 of Appendix VI provides maximum annual mean metal concentrations. For Chromium the value of 1.7 ng/m^3 appears low compared to the UK mean in the NPL heavy metals monitoring network report (2016) but in line with the median. The comment in para 3.2.3.2 regarding 20% being assumed to be Cr(VI) does align with the EA screening approach for Cr(VI) but the value presented of 0.785 ng/m^3 is not consistent with this. Table 3.5 of Appendix VI however provides the correct Cr(VI) value of 0.35 ng/m^3 and it is this value that has been used in the assessment.	Applicant to provide evidence that the EA metals fraction for MSW is suitable. Alternatively, LCC to consider a post-commissioning emissions test requirement. Applicant to demonstrate that use of older monitoring data is conservative.

Item	Reference	Topic	Atkins comment	Action
			For Cr(VI) the modelled PC is less than 0.2% of the EAL at the most affected receptor (R4). Therefore, whether or not the background site used is representative of local conditions or a conservative value, assuming the metal distribution is appropriate the contribution from the proposed facility can be regarded as not significant without the need to consider total concentrations. The suggestion for real time monitoring of ambient levels of HF and Cr(VI) is not considered to be proportionate to the risk presented by the emissions for either compound. KBC have queried the use of data for the years 2013 to 2017. The Environment Agency permitting guidance does not specify that meteorological data must be the most recent years, the key point is that the data cover a five year period to capture a range of dispersion conditions. With regard to background data, most pollutants exhibit a downward trend over time so monitoring results from an older period would typically be conservative. The NPL monitoring network report 2016 show generally downward trends for heavy metals in recent years.	

Item	Reference	Topic	Atkins comment	Action
			 **Figure 14.** The mean and median of station annual average concentrations of Cr, Cu, Mn and V measured on the UK Heavy Metals Monitoring Network over the last 35 years. Heavy Metals Annual Report 2015 (defra.gov.uk)	

4. Conclusion

Atkins has reviewed the Applicant's ES air quality chapter, emissions modelling and HHRA, plus supporting documentation and relevant statutory consultee responses. The review has focused on the human health impacts of stack emissions.

Despite some aspects of the data review such as the lack of a clear and consistent rationale for background data, the Applicant's assessment of stack emissions was generally found to have been conducted in line with appropriate guidance, using reasonable assumptions to give confidence in the conclusions drawn. The results have been compared to relevant health criteria in the ES and the results of dispersion modelling indicate that the facility stack contributions and resultant environmental concentrations of all pollutants considered are not significant. This is largely because of relatively small size of the proposed facility.

Some areas are identified for clarification, including the calculation of stack parameters, whether emission rates are suitably representative of medical waste, and the calculation of deposition. For instance, pollutant data have generally been taken from studies of municipal waste incinerators without supporting evidence as to why this is considered to be representative of medical waste. The suitability of certain background data used in the air quality assessment needs to be clarified and corrected where relevant. However, we do not expect the conclusions of the assessment to change as a result of the clarifications and corrections requested from the Applicant.

The results of the dispersion modelling suggest that the stack height may not be fully optimised for the most effective dispersion and it is unclear if the Applicant has used the maximum modelled short term concentrations for relevant pollutants such as nitrogen dioxide.

The HHRA has shown that dioxin intake as a percentage of the TDI allows for a substantial margin of error to account for the some of the queries raised, not least because the study has applied a much more stringent criterion than is typically the case for UK permitting applications. Therefore we also do not expect the conclusions of the HHRA assessment to change as a result of the clarifications requested of the Applicant.

On the basis of the air quality assessment and HHRA review, it is suggested that the Applicant provides the following clarifications and amendments:

- Provide the findings of the stack height study, demonstrating how the 14 m stack height is appropriate based on maximum hourly mean concentrations;
- Clarify the rationale for and suitability of certain background concentrations;
- Correct background concentrations for 15-min, 8 hourly, daily averaging periods;
- Clarify the flow rate calculation and moisture content of the stack parameters;
- Provide maximum modelled short term concentrations for relevant pollutants (in table format) rather than the percentile equivalent and provide annual mean and hourly mean contour plots for NO_2;
- Perform a sensitivity test for dioxin emissions for the HHRAP using an assumption that all 2,3,7,8-TCDD, but using a more realistic background concentration at the location of maximum impact;
- Provide supporting evidence for the exclusion of PCBs from the HHRA;
- Provide supporting evidence that the dioxin and Group 3 metals emissions profile taken from MSW are also suitable for the medical waste that will be treated.

We would note that in the ES there is no proposal for monitoring of emissions and facility performance once operational but this would be expected for the permit application. LCC may wish to discuss with the Applicant their proposals for in-stack emissions monitoring as well as other more pragmatic measures such as to ensure odours and dust are kept under control. Abatement equipment such as filters and scrubbers should be regularly maintained at such a frequency so as to avoid cases of malfunctioning which could cause ELVs to be exceeded.