Response to Air Quality Consultants Ltd Review of Air Quality Assessment

Calder Valley Small Waste Incineration Plant

For Calder Valley Skip Hire Ltd

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Quality Management

Prepared by	Kathryn Barker MSc, BSc (Hons), MIAQM, AMIEnvSc	Principal Air Quality Consultant	15/03/2022	
Reviewed & checked by	Fiona Prismall MSc, BSc (Hons), CEnv, FIAQM, MIEnvSc	Technical Director	15/03/2022	
Authorised by	Fiona Prismall MSc, BSc (Hons), CEnv, FIAQM, MIEnvSc	Technical Director	15/03/2022	
Date of Issue	15/03/2022		**Revision Number**	Rev 3
Job Number	JAP10294			

Revision History

Rev	Date	Status	Reason for revision	Comments
0	28/01/2022	-	-	-
1	04/02/2022	-	-	-
2	01/03/2022	-	Legal comments	-
3	15/03/2022	-	-	-

Calculations or models file name, link and location

Prepared by	Kathryn Barker MSc, BSc (Hons), MIAQM, AMIEnvSc	Principal Air Quality Consultant	15/03/2022
Checked by	Fiona Prismall MSc, BSc (Hons), CEnv, FIAQM, MIEnvSc	Technical Director	15/03/2022

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1 Introduction

1.1 This report has been produced in response to the comments raised in the Air Quality Consultants Ltd (AQC) review of the Air Quality Assessment. The AQC review highlighted ten potential issues related to the air quality assessment within the context of the redetermination of an application for a Schedule 13 EPR environmental permit (the Permitting Application) for a small waste incineration plant (SWIP). Other potential issues related to the Permitting Application are addressed in a separate report.

1.2 Although AQC refer in passing to the fact that planning permission has already been granted, AQC make no reference to the Appeal Decisions dated 4 February 2020 or to the findings of the detailed assessment of the Inspector appointed by the Secretary of State as set forth in those Appeal Decisions. AQC list the documents which it has reviewed in compiling its report and the list of documents does not include the said Appeal Decisions. The reason for that omission is not known but the omission is considered to be very significant.

1.3 The planning regime and the environmental permitting regime are separate but complementary. Because that is so Central Government has consistently provided guidance on the different roles that each regime plays. It is provided in paragraph 188 of the National Planning Policy Framework (NPPF) 2021 that:

"*The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development the planning issues <u>should not be re-visited</u> through the permitting regimes operated by pollution control authorities.*" (our emphasis).

1.4 That approach has been consistent Government policy in every version of the NPPF since the first version was published in March 2012. As is apparent from the Appeal Decision air quality considerations were front and centre as planning issues for determination in the Appeal Decision made by the Planning Inspector in relation to the SWIP and related development. The Appeal Decision of the Secretary of State's appointed Inspector were issued only after an Environmental Impact Assessment which included air quality and after an extremely thorough Public Inquiry at which the Council was represented on matters that focussed primarily on air quality.

1.5 Where that is the case, it is the purpose of the planning decision to consider air quality impacts in order to determine whether the proposed development is an acceptable use of land. The air quality assessment within that context will assume that emissions to air will be effectively controlled by the environmental permit. Once the planning decision has been made, after consideration of air quality impacts, that the proposed development is an acceptable use of land the role of the regulator considering an environmental permit application is in the case of development of this kind to consider whether, having regard to the plant concerned and the relevant provisions of the Industrial Emissions Directive (IED) listed in Schedule 13 to the EPR, emissions will be effectively controlled by permit conditions so as, amongst other considerations, not to exceed any of the emission limit values in the IED, to impose those conditions which are necessary for that purpose and thereby to put in place the control of emissions upon which the planning decision has been based. It is because the role of the regulator in such circumstances is circumscribed in that manner that the guidance states that where a planning decision has been made on a particular development the planning issues (which in this case included air quality issues) should not be revisited through the environmental permitting regime.

1.6 In conformity with what is set out above Calderdale Metropolitan Borough Council and Calder Valley Skip Hire Ltd (CVSH) agreed in a Statement of Common Ground dated 26 September 2019 that:

"The appeal proposals are centred upon the treatment of residual waste in a small waste incineration plant (SWIP) (as defined in the Environmental Permitting (England and Wales) Regulations 2016). The SWIP together with associated plant will be required to meet all statutory industrial emissions standards and, under the environmental permit, such specific standards as applicable and in force from time to time in relation to incineration plants for the protection of human health and the environment. The control of emissions from the flue or stack associated with the SWIP would be regulated and enforced under the pollution control regime in accordance with such statutory and other regulatory standards and so as to ensure that there is no breach of any applicable emission limit values."

1.7 As is recorded in paragraph 28 of the Appeal Decisions the Council confirmed that the concerns upon which its reason for refusal of planning permission was based related to Nitrogen Dioxide and not to any of the other potential emissions to air from the scheme. After adding that the Environmental Statement Addendum confirmed that the predicted process contributions of other potential emissions, including PM_{10}, $PM_{2.5}$ and hexavalent chromium (Cr VI), would not be significant, the Inspector stated that he had not been provided with any compelling evidence to the contrary.

1.8 This report addresses four of the potential issues raised by AQC related to the air quality assessment. Issue number 7 relates to the Human Health Risk Assessment which has been considered in a separate report. The said four potential issues are identified in paragraph 1.9 below. If those instructing AQC wished to raise these issues they should have done so and presented evidence in relation to them at the above-mentioned Public Inquiry where they were given ample opportunity to do so. They did not. It would be open to CVSH to take the position that, for that reason, these four potential issues should not be raised in the context of the Permitting Application. Without prejudice to that, this report proceeds to address them for the sake of completeness and transparency. By contrast, issues numbers 1, 3, 5, 6 and 10 have not been considered in this report as they relate to issues which were specifically addressed in the Environmental Statements and the detailed evidence presented and tested at the above-mentioned Public Inquiry, resulting in the fully detailed and reasoned Appeal Decisions granting planning permission for the SWIP and related development, which are unchallenged.

1.9 The four potential issues this report addresses are reproduced below:

- *'Issue 2 – Benzo(a)pyrene - Within the 2019 additional air quality assessment, the applicant predicts a 'worst-case' Benzo(a)pyrene process contribution, i.e., that relating to emissions from the SWIP processes in isolation, of 9% of the Air Quality Standard, and predicted environmental concentration of 98.4%, i.e., the SWIP process contribution plus contributions from other emission sources. This level of impact is presented at the location of maximum impact anywhere on the modelled grid.*

  The applicant needs to provide more information to justify that the contribution is insignificant.

- *Issue 4 – Ecological Impacts - The applicant has not assessed the impacts at nearby ancient woodland and local nature reserve ecological sites within their ES addendum or their 2019 additional Air Quality Assessment. These sites are within the 2 km screening distance for assessment of ecological sites required by the Environment Agency.*

- *Issue 8 – Carbon Monoxide 1-hour EAL - The applicant has not undertaken an assessment against the Carbon Monoxide 1-hour Environmental Assessment Level (EAL) of 30,000 µg/m^3. In the experience of the reviewers, carbon monoxide emissions are generally insignificant compared to the environmental standards. As there are no predicted significant effects towards the 8-hour CO objective, lack of consideration of the 1-hour EAL is unlikely to alter the conclusion of the assessment.*

- *Issue 9 – TOC Emissions - The applicant has not undertaken an assessment of the likely emissions of total organic compounds (TOC). It is a requirement within chapter IV of IED that* *emissions to air from waste incineration plants shall not exceed the emission limit value of 10 mg/Nm^3 for TOC; therefore, any robust assessment should consider the sites impact from TOC'.*

1.10 In addressing those four potential issues this report does so entirely without prejudice to what we have set out above and without any intention to revisit in the course of this environmental permitting redetermination process the air quality issues which were determined by the Planning Inspector in the Appeal Decisions referred to above or the findings and detailed assessment of the Planning Inspector on air quality issues set forth in those Appeal Decisions. Further, in addressing those four potential issues in this report it is not the intention to detract from the entitlement of CVSH to rely upon the above-mentioned Statement of Common Ground agreed with Calderdale MBC including the common ground recorded in the Appeal Decisions. This includes, in particular, what is stated in paragraph 6.2 below of this report.

1.11 The additional assessment work undertaken to respond to the issues raised has followed the same methodology as the original assessment work. The policy and legislative context and the assessment methodology are reproduced from the Environmental Statement Addendum, July 2019 in Appendix A for ease of reference. In doing so, we do not place any of the content of Appendix A, particularly the assessment methodology, in issue in this Permitting Application. The methodology was found by the Secretary of State's appointed Inspector to be sound in the above-mentioned Appeal Decisions. The following sections of this report reproduce the relevant extract from the AQC review in italics, followed by the RPS response.

2 Issue 2 – Benzo(a)pyrene

AQC Ltd Comment

2.1 *Within the 2019 additional air quality assessment, the applicant predicts a 'worst-case' Benzo(a)pyrene (B(a)P) process contribution (PC), i.e., that relating to emissions from the SWIP processes in isolation, of 9% of the Air Quality Standard (AQS), and predicted environmental concentration (PEC) of 98.4%, i.e., the SWIP process contribution plus contributions from other emission sources. This level of impact is presented at the location of maximum impact anywhere on the modelled grid.*

2.2 *This prediction is based on an emission concentration of 1 µg/m^3 derived from typical emissions data of B(a)P in the 2006 Waste Incineration BAT Reference (BREF) document. In December 2019, an update to the 2006 BREF was introduced that confirmed B(a)P emissions from 48 reference lines incinerating predominantly municipal wastes ranged from 0.004 ng/Nm^3 to 1 µg/m^3. In that respect, the assumed emission concentration for B(a)P can be viewed as precautionary. However, in combination with the previous discussion on model uncertainty, as the PEC approaches 100% and no evidence is presented about level of significance of this level of impact, it is not considered possible to definitively conclude no significant effects based on the data presented. In particular, the average B(a)P concentration at the Leeds Millshaw monitoring site between 2014 and 2017 has been used to define baseline concentrations, rather than the maximum. The maximum annual mean concentration during this period exceeds the objective.*

2.3 *However, it is important to recognise that this prediction is made based on the maximum predicted value at any location in the model domain. AQS apply only where there is 'relevant exposure' and, for the purpose of assessing compliance with the B(a)P objective, which is expressed as an annual mean assessment metric, relevant exposure only occurs at e.g., residential properties and schools. It is expected that model predictions at the specific human receptors considered in the assessment would be lower than the maximum predicted value, and could possibly be at a level where no significant effect could be concluded. However, this should be confirmed by the applicant by providing tabulated data for each specified receptor location where there is relevant exposure.*

RPS response

2.4 An atmospheric dispersion model was used to predict the Process Contribution (PC) for the stack emission concentrations across a grid of receptors and at selected sensitive receptors. The PC was added to the background Ambient Concentration (AC) to calculate a Predicted Environmental Concentration (PEC). The PC and PEC were compared with the relevant Environmental Assessment Level (EAL).

2.5 The original assessments used an emission concentration for benzo(a)pyrene (B[a]P) of 0.001 $mg.Nm^{-3}$, which is equivalent to the 1 $\mu g.m^{-3}$ quoted by AQC Ltd.

2.6 As stated by AQC Ltd, the baseline concentration (the AC) for B[a]P was derived from the average of measured concentrations of polycyclic aromatic hydrocarbons (PAHs) at the Leeds Millshaw monitoring site. B[a]P is one of many PAHs that are potentially emitted from SWIPs.

2.7 The most recently monitored annual-mean PAHs concentrations considered in the assessment are summarised in Table 2.1.

Table 2.1 Annual-Mean PAHs Concentrations ($ng.m^{-3}$)

Monitoring Site	Concentration ($ng.m^{-3}$)				
	2014	2015	2016	2017	Average
Leeds Millshaw	0.26	0.20	0.25	0.19	0.22

2.8 The assessment compared the AC of PAHs added to the PC for B[a]P with the EAL of B[a]P. Therefore, the conclusion that the PEC is below the EAL was conservative.

2.9 Nevertheless, for the purposes of this response the maximum measured concentration of 0.26 $ng.m^{-3}$ (i.e. 2.6E-04 $\mu g.m^{-3}$) has been used as the baseline concentration instead of the average of 0.22 $ng.m^{-3}$ used in the original assessment.

2.10 The results using this higher baseline concentration are shown in Section 5.

3 Issue 8 – Carbon Monoxide 1-hour EAL

AQC Ltd Comment

3.1 *The applicant has not undertaken an assessment against the Carbon Monoxide (CO) 1-hour Environmental Assessment Level (EAL) of 30,000 µg/m3. In the experience of the reviewers, carbon monoxide emissions are generally insignificant compared to the environmental standards. As there are no predicted significant effects towards the 8-hour CO objective, lack of consideration of the 1-hour EAL is unlikely to alter the conclusion of the assessment.*

RPS response

3.2 The AQC comment concludes that consideration of the hourly-mean EAL for CO is unlikely to alter the conclusion of the assessment. Nevertheless, further analysis has been undertaken and the maximum hourly-mean carbon monoxide (CO) PC has been compared with the 1-hour EAL of 30,000 µg.m^{-3} in Section 5.

4 Issue 9 – TOC Emissions

AQC Ltd Comment

4.1 *The applicant has not undertaken an assessment of the likely emissions of total organic compounds (TOC). It is a requirement within chapter IV of IED that emissions to air from waste incineration plants shall not exceed the emission limit value of 10 mg/Nm^3 for TOC; therefore, any robust assessment should consider the sites impact from TOC.*

4.2 *As the exact speciation, or composition, of TOC cannot be known, best practice guidance by the Environment Agency suggests comparing TOC impacts against the benzene AQS. Such an assessment was undertaken within the original 2017 ES chapter in respect to the annual mean benzene AQS. The Environment Agency has recently introduced a 24-hour mean benzene environmental assessment level (EAL) of 30 µg/m^3 which should be assessed against for completeness. However, it is accepted that the air quality assessment was produced before the publication of this new EAL.*

RPS response

4.3 Total organic compounds (TOCs) have been assessed in Section 5.

5 B[a]P, CO and TOC Results

5.1 The plant is designed to meet the emission concentration limits set out in the Industrial Emissions Directive (IED). The emission rates used for TOCs and CO have been derived from the short and long-term emission concentration limits in the IED.

5.2 For B[a]P, the emission concentration was obtained from the IPPC Reference Document on the Best Available Techniques for Waste Incineration (August 2006). The emission concentration is the concentration at the point of release i.e. the top of the stack. These are used to derive an emission rate in $g.s^{-1}$ from the stack. This emission rate is an input to the model which predicts concentrations at receptors, taking into account the dispersion of pollutants after leaving the stack.

5.3 The emission rates for CO and B[a]P are the same as in the 2019 ES Addendum Additional Air Quality Assessment report and have been reproduced in Table 5.1 for ease of reference.

Table 5.1 Emission Rates

Pollutant	Parameter (unit)	Short-term Emission Limit Value – Scenario 1	Long-term Emission Limit Value – Scenario 2
TOCs	IED Emission Limit Value ($mg.Nm^{-3}$)	20*	10*
	Emission rate ($g.s^{-1}$)	0.026	0.012
CO	IED Emission Limit Value ($mg.Nm^{-3}$)	100*	50*
	Emission rate ($g.s^{-1}$)	0.13	0.06
B[a]P	Emission concentrations obtained from the IPPC Reference Document on the Best Available Techniques for Waste Incineration (August 2006) ($mg.Nm^{-3}$)	-	0.001
	Emission rate ($g.s^{-1}$)	-	1.28E-06

Note: $mg.Nm^{-3}$ refers to mg of pollutant per cubic metre at reference conditions (or normalised). The reference conditions are temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas

*As outlined in Appendix A, paragraph A.4, for the purposes of this assessment for those pollutants having only one IED emission limit (for a single averaging period), the facility has been assumed to operate at that limit (with the exception of arsenic and Chromium VI, as discussed later in the Appendix). Where more than one limit exists for a pollutant, the half-hourly mean emission limit value has been used to calculate short-term (≤ 24-hour average) peak ground-level concentrations (Scenario 1) (again, with the exception of arsenic and Chromium VI, as discussed later in the Appendix). The daily mean emission limit value has been used for these pollutants to calculate long-term (greater than 24-hour average) mean ground-level concentrations (Scenario 2).

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5.4 Table 5.2 and Table 5.3 show the maximum predicted Process Contributions across the modelled grid. The modelled grid is outlined in paragraph A.43 of Appendix A. As explained by AQC, the point of maximum impact may not necessarily be a location where there is relevant exposure.

The PCs at sensitive receptors will be lower than the maximum across the grid. These PCs are the predicted concentrations at a receptor and have been compared with the relevant EALs.

Table 5.2 Predicted Maximum Process Contributions (µg.m^{-3}) at Short-Term Emission Limit Values (Scenario 1) – Results Across the Modelled Grid

Pollutant	Averaging Period	EAL (µg.m^{-3})	Max PC (µg.m^{-3})	Max PC as % of EAL	Criteria (%)	AC (µg.m^{-3})	PEC (µg.m^{-3})	Is PC Potentially Significant?	Is PEC Potentially Significant?
CO	1 hour (maximum)	30,000	220.1	1	10	-	-	No	-
TOCs*	24 hour (maximum)	30	26.0	87	10	0.58	26.5	Yes	No

*Consistent with the Environment Agency's *'Air emissions risk assessment for your environmental permit'* guidance, as the substances in the TOCs are unknown, the TOCs are assumed to be 100% benzene. The EAL and AC are for benzene. This is a highly conservative approach.

Table 5.3 Predicted Maximum Process Contributions (µg.m^{-3}) at Long-Term Emission Limit Values (Scenario 2) – Results Across the Modelled Grid

Pollutant	Averaging Period	EAL (µg.m^{-3})	Max PC (µg.m^{-3})	Max PC as % of EAL	Criteria (%)	AC (µg.m^{-3})	PEC (µg.m^{-3})	Is PC Potentially Significant?	Is PEC Potentially Significant?
CO	1 hour (maximum)	30,000	110.0	0	10	-	-	No	-
TOCs*	24 hour (maximum)	30	13.0	43	10	0.58	13.6	Yes	No
	24 hour (annual mean)	5	0.22	4	1	0.29	0.51	Yes	No
B[a]P	1 hour (annual mean)	2.5E-04	2.2E-05	9	1	2.6E-04	2.8E-04	Yes	Yes

*Consistent with the Environment Agency's *'Air emissions risk assessment for your environmental permit'* guidance, as the substances in the TOCs are unknown, the TOCs are assumed to be 100% benzene. The EAL and AC are for benzene. This is a highly conservative approach.

5.5 The maximum hourly mean CO PC does not exceed 10% of the EAL of 30,000 µg.m^{-3} and the impacts can be scoped out as insignificant. This is consistent with AQC's comment that consideration of the hourly-mean EAL for CO would not alter the conclusion of the assessment.

5.6 On the highly conservative basis that all TOC is present in the form of benzene (which is not plausible) the daily mean TOC PC exceeds 10% of the benzene EAL of 30 µg.m^{-3} and the impacts are potentially significant. However, when the PC is added to the AC in both scenario 1 and scenario 2, the daily mean PEC is less than the benzene EAL and the impacts can be scoped out as insignificant.

5.7 The annual-mean TOC PC exceeds 1% of the benzene EAL of 5 µg.m^{-3} and the impacts are potentially significant. When the TOC PC is added to the AC, the PEC of 0.51 µg.m^{-3} is less than the benzene EAL and the impacts can be scoped out as insignificant.

5.8 For B[a]P, when the maximum across the modelled grid is considered, the PC exceeds 1% of the B[a]P EAL. The PEC exceeds the EAL and the impacts across the modelled grid are potentially significant if there is relevant exposure at the point of maximum impact. This is a conservative approach as the AC used is the maximum measured concentration of all PAHs, not just B[a]P, over a four-year period.

5.9 Further analysis has been undertaken for B[a]P to determine the predictions at locations where there is relevant exposure. For TOCs and CO, the predictions at locations with relevant exposure have not been considered further as the maximum PEC across the modelled grid is below the EAL and therefore predictions at relevant exposure will be lower. AQC make this point in issue 2 (reproduced at paragraph 2.3 above).

5.10 Table 5.4 presents the annual-mean B[a]P concentrations predicted at the façades of receptors i.e. locations where there is relevant human exposure.

Table 5.4 Maximum Predicted Annual-Mean B[a]P Impacts at Receptor Locations

Receptor ID	Receptor Name	Annual-Mean PC ($\mu g.m^{-3}$)	PC as % of the EAL*
1	28 Rochdale Road	1.20E-06	0
2	9 Breck Lea	5.92E-07	0
3	Sacred Heart Catholic Primary	5.80E-07	0
4	Haugh End House	7.18E-07	0
5	84 Rochdale Road	1.72E-06	1
6	Highfield Jerry Lane	1.44E-06	1
7	Spring Bank Industrial Estate**	2.27E-05	N/A
8	Mill West (AQMA)	1.32E-06	1
9	Ivy Cottage	1.61E-06	1
10	Cottage	1.15E-06	0
11	Black Sowerby Croft	1.25E-06	1
12	Prospect Terrace	2.48E-07	0
13	Hullen Edge	2.43E-07	0
14	Bank House	1.30E-06	1
15	Mill House Farm	1.65E-06	1
16	Mill House Lodge	1.24E-06	0

*The PC as a percentage of the EAL is rounded to the nearest whole number, in line with the EPUK/IAQM guidance. PCs of <0.5% round down to 0%.
**Annual-mean EALs do not apply at workplaces

5.11 The PC does not exceed 1% of the EAL at all relevant discrete receptors modelled and the resulting effects are not considered to be significant. At receptor 7 Spring Bank Industrial Estate the annual-mean EAL does not apply but the PC has been included for information.

6 Issue 4 – Ecological Impacts

AQC Ltd Comment

6.1 *The applicant has not assessed the impacts at nearby ancient woodland and local nature reserve ecological sites within their ES addendum or their 2019 additional Air Quality Assessment. These sites are within the 2 km screening distance for assessment of ecological sites required by the Environment Agency. This assessment has been undertaken for the original 2017 ES chapter; however, this assessment is not considered fully robust as it is not clear if ammonia and hydrogen fluoride emissions have been accounted for when considering the impacts of nutrient nitrogen and acid deposition.*

RPS response

6.2 Following the Planning Inquiry, the Inspector recorded in paragraph 94 of the Appeal Decisions that Calderdale Metropolitan Borough Council and CVSH agreed that the proposal would not have an adverse impact on sensitive ecological receptors including protected species, habitats and wildlife corridors and would not harm the adjacent woodland. The Inspector also noted in the same paragraph of his Appeal Decisions that he had not been provided with any compelling evidence to the contrary. In those circumstances, there is no justification for either Calderdale or objectors to take any different position in the context of environmental permitting.

6.3 As outlined in AQC's comment, the air quality impacts at ancient woodland and local nature reserves were assessed in the original 2017 ES chapter. In addition, the impacts at the South Pennine Moors were assessed in Appendix E of the 2019 ES Addendum that AQC reviewed.

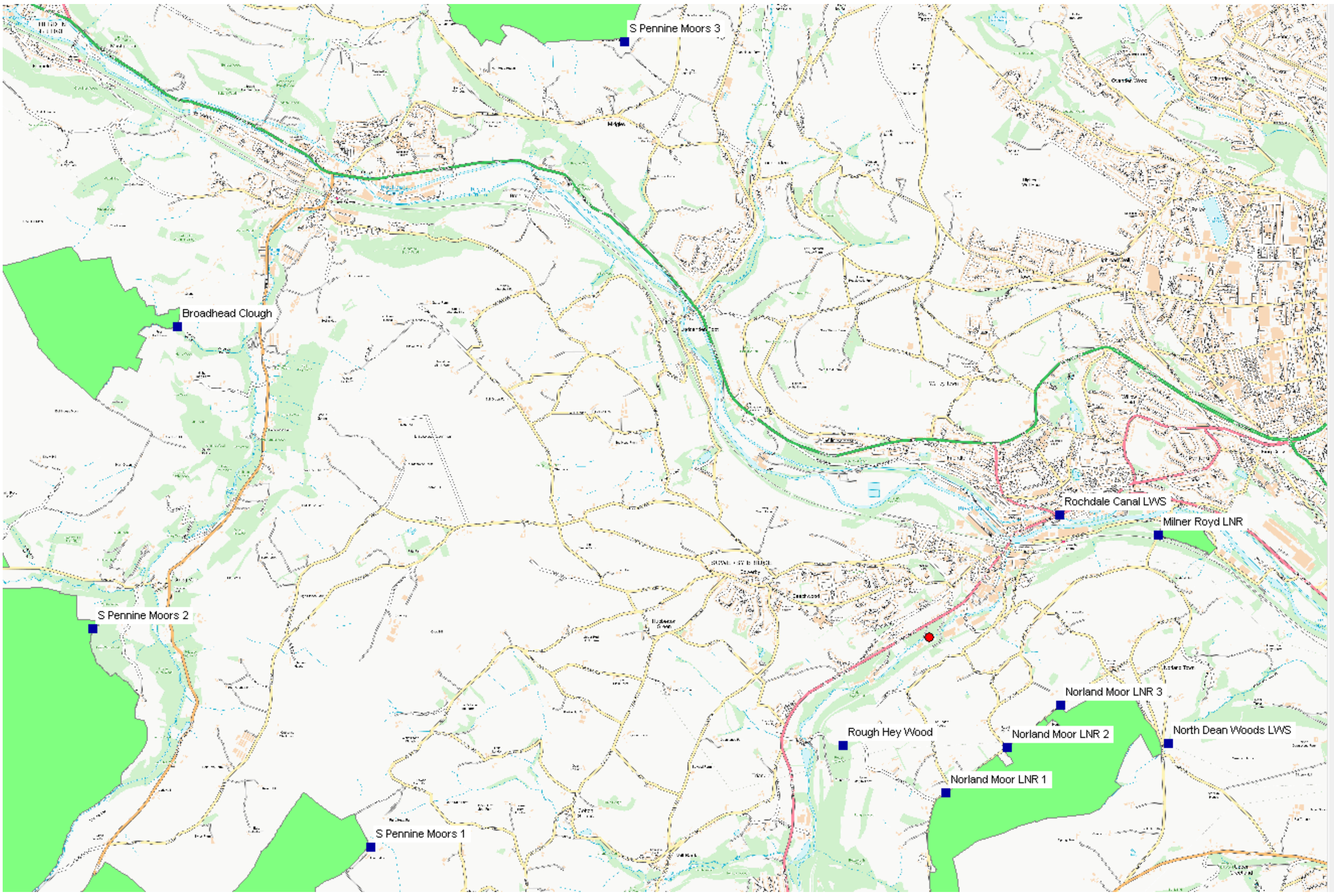
6.4 Air quality impacts have been predicted at discrete locations within the nature designations closest to the source of emissions, at the following sites as shown in Figure 1.

- South Pennine Moors Special Area of Conservation (SAC), Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI)
- North Dean Woods Local Wildlife Site (LWS);
- Norland Moor LWS/ Local Nature Reserve (LNR);
- Milner Royd LNR;
- Rochdale Canal LWS;
- Rough Hey Wood (ancient woodland); and

- Rochdale Canal LWS.

6.5 This covers all the nature designations assessed in the 2017 ES chapter and the 2019 ES Addendum and uses the more detailed terrain data outlined in paragraphs A.36 to A.38 of Appendix A. Whereas the 2017 ES chapter used AERMOD dispersion model and the 2019 ES Addendum used the ADMS dispersion model, the assessment of ecological impacts referred to below has been carried out using the ADMS dispersion modelling software throughout. We address and answer below AQC's comment about ammonia and hydrogen fluoride emissions.

Figure 1 Ecological Receptors Modelled



Critical Levels

6.6 Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations. Process Contributions (PCs) and Predicted Environmental Concentrations (PECs) of nitrogen oxides (NOx), sulphur dioxide (SO_2) ammonia (NH_3) and hydrogen fluoride (HF) have been calculated for comparison with the relevant critical levels.

Critical Loads

6.7 Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.

6.8 HF was not considered in the nutrient nitrogen (as it contains no nitrogen) or acid deposition calculations. HF is very reactive and will be preferentially removed by the acid gas abatement. Any deposition from residual HF in the flue gas emissions will occur very close to the stack and HF is unlikely to travel as far as the nearest nature conservation site (approx. 1 km away). On that basis, HF has not been included in the acid deposition calculations. This has been agreed with AQC.

Critical Loads – Nutrient Nitrogen Deposition

6.9 Percentage contributions to nutrient nitrogen deposition have been derived from the results of the ADMS dispersion modelling. Deposition rates have been calculated using empirical methods recommended by the EA, as follows:

- The deposition flux ($\mu g.m^{-2}.s^{-1}$) has been calculated by multiplying the ground level NO_2 and NH_3 concentrations ($\mu g.m^{-3}$) by the deposition velocity. The EA guidance provides deposition velocities of 0.0015 $m.s^{-1}$ for short habitats and 0.003 $m.s^{-1}$ for forests for NO_2 and 0.02 $m.s^{-1}$ for short habitats and 0.03 $m.s^{-1}$ for forests for NH_3.
- Units of $\mu g.m^{-2}.s^{-1}$ have been converted to units of $kg.ha^{-1}.year^{-1}$ by multiplying the dry deposition flux by the standard conversion factor of 96 for NO_2 and the wet deposition flux by 259.7 for NH_3.

6.10 Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database. Where no 'site relevant critical loads' are available in the APIS database, site specific data has been sourced from the APIS database for the location instead. Where the habitat type is unknown the most sensitive habitat is used. Data sourced from the location are shown with an asterisk.

Critical Loads – Acidification

6.11 The acid deposition rate, in equivalents $keq.ha^{-1}.year^{-1}$, has been calculated by multiplying the dry deposition flux ($kg.ha^{-1}.year^{-1}$) by a conversion factor of 0.071428 for N and adding the deposition rate for S. The acid deposition rate for S has been calculated by multiplying the ground level SO_2 concentration by the deposition velocity to derive the deposition flux $\mu g.m^{-2}.s^{-1}$. For short habitats the deposition velocity is 0.012 $m.s^{-1}$ and for forests it is 0.024 $m.s^{-1}$. This has then been multiplied by a conversion factor of 157.7 and 0.0625 (i.e. 9.86) to determine the acid deposition arising from S (keq.ha^{-1}.year^{-1}). This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N or S within the molecule.

6.12 The acid contribution from HCl has been added to the S contribution. The acid deposition rate for HCl has been calculated by multiplying the ground level HCl concentration by the deposition velocity to derive the deposition flux in units of µg.m^{-2}.s. For short habitats the deposition velocity is 0.025 m.s^{-1} and for forests it is 0.060 m.s^{-1}. This has then been multiplied by a conversion factor of 8.63 to convert to keq.ha^{-1}.year^{-1}.

6.13 Wet deposition in the near field is not significant compared with dry deposition for N [1] and therefore for the purposes of this assessment, wet deposition has not been considered.

6.14 Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with each designated site as derived from the APIS database.

Significance Criteria

6.15 The PCs and PECs have been compared against the relevant critical level/load for the relevant habitat type/interest feature. Based on current Environment Agency guidelines [2] and the Institute of Air Quality Management *A guide to the assessment of air quality impacts on designated nature conservation sites* [3] the following criteria have been used to determine if the impacts are significant:

- If the long-term PC does not exceed 1% of relevant critical level/load the emission is considered not significant;
- If the short-term PC does not exceed 10% of relevant critical level/load the emission is considered not significant; and
- If the long-term PC exceeds 1% or the short-term PC exceeds 10% but the resulting PEC is below 100% of the relevant critical level/load, the emission is not considered significant.

Results

6.16 The maximum predicted PCs of NOx, SO_2, NH_3 and HF (from ADMS modelling utilising Leeds-Bradford 2013 – 2017 meteorological data) are compared with the relevant Critical Levels in Table 6.1 and Table 6.2.

Table 6.1 Predicted Annual-Mean Nox, SO_2 and NH_3 Concentrations at Designated Habitat Sites

Habitat Receptor	Annual-Mean NO_X PC ($\mu g.m^{-3}$)	NO_X PC/Critical Level (%)	Annual-Mean SO_2 PC ($\mu g.m^{-3}$)	SO_2 PC/Critical Level (%)	Annual-Mean NH_3 PC ($\mu g.m^{-3}$)	NH_3 PC/Critical Level (%)
S Pennine Moors 1	0.01	0	<0.005	0	<0.0005	0
Broadhead Clough	<0.005	0	<0.005	0	<0.0005	0
S Pennine Moors 2	<0.005	0	<0.005	0	<0.0005	0
S Pennine Moors 3	<0.005	0	<0.005	0	<0.0005	0
S Pennine Moors 4	<0.005	0	<0.005	0	<0.0005	0
Rough Hey Wood	0.07	0	0.02	0	0.002	0
Norland Moor LNR 1	0.02	0	0.01	0	0.001	0
Norland Moor LNR 2	0.02	0	0.01	0	0.001	0
Norland Moor LNR 3	0.05	0	0.01	0	0.001	0
Milner Royd LNR	0.09	0	0.02	0	0.002	0
North Dean Woods LWS	0.03	0	0.01	0	0.001	0
Rochdale Canal LWS	0.12	0	0.03	0	0.003	0
Maximum	0.09	0	0.03	0	0.003	0

Annual-Mean NO_X Critical Level = 30 $\mu g.m^{-3}$
Annual-Mean SO_2 Critical Level = 10 $\mu g.m^{-3}$
Annual-Mean NH_3 Critical Level = 1 $\mu g.m^{-3}$

Table 6.2 Predicted HF and Daily-Mean Nox Concentrations at Designated Habitat Sites

Habitat Receptor	Weekly-Mean HF PC ($\mu g.m^{-3}$)	HF PC/Critical Level (%)	Daily-Mean HF PC ($\mu g.m^{-3}$)	HF PC/Critical Level (%)	Daily-Mean NOx PC ($\mu g.m^{-3}$)	NOx PC/Critical Level (%)
S Pennine Moors 1	0.002	0	0.004	0	0.43	1
Broadhead Clough	<0.0005	0	0.002	0	0.19	0
S Pennine Moors 2	0.001	0	0.003	0	0.34	0
S Pennine Moors 3	<0.0005	0	0.001	0	0.07	0
S Pennine Moors 4	<0.0005	0	0.001	0	0.05	0
Rough Hey Wood	0.012	2	0.015	0	1.47	2
Norland Moor LNR 1	0.002	0	0.005	0	0.53	1
Norland Moor LNR 2	0.002	0	0.006	0	0.63	1
Norland Moor LNR 3	0.006	1	0.014	0	1.41	2
Milner Royd LNR	0.004	1	0.008	0	0.81	1
North Dean Woods LWS	0.003	1	0.008	0	0.79	1
Rochdale Canal LWS	0.008	2	0.015	0	1.47	2
Maximum	0.008	2	0.015	0	1.47	2

Weekly-Mean HF Critical Level = 0.5 $\mu g.m^{-3}$
Daily-Mean HF Critical Level = 5 $\mu g.m^{-3}$
Daily-Mean Nox Critical Level = 75 $\mu g.m^{-3}$

6.17 The maximum PCs of nutrient nitrogen (N) deposition are compared against the relevant Critical Loads (CLs) in Table 6.3. As outlined in paragraph 6.9, the N Deposition PC considers the NOx and NH_3 contribution. There are various interest features within the habitat sites that are sensitive to N deposition. Only the results for the most-sensitive interest features are shown. Data on Critical Loads have been obtained from the UK Air Pollution Information System (APIS) database [4].

Table 6.3 Predicted Nitrogen Deposition at Designated Habitat Sites

Designation	Habitat Site	N Deposition Critical Load ($kgN.ha^{-1}.yr^{-1}$)	N Deposition PC ($kgN.ha^{-1}.yr^{-1}$)	N Deposition PC/ Critical Load (%)
SAC	South Pennine Moors (maximum)	5	0.002	0
SPA	South Pennine Moors (maximum)	3	0.002	0
SSSI	South Pennine Moors (maximum)	5	0.002	0

Designation	Habitat Site	N Deposition Critical Load ($kgN.ha^{-1}.yr^{-1}$)	N Deposition PC ($kgN.ha^{-1}.yr^{-1}$)	N Deposition PC/ Critical Load (%)
SSSI	Broadhead Clough	5	0.001	0
Ancient Woodland	Rough Hey Wood	10*	0.029	0
LNR	Norland Moor (maximum)	5*	0.012	0
LNR	Milner Royd	10*	0.022	0
LWS	North Dean Woods	10*	0.013	0
LWS	Rochdale Canal	5*	0.028	1

CLF = Critical Load Function (info at http://www.apis.ac.uk/clf-guidance)
* Where no 'site relevant critical loads' are available in the APIS database, site specific data has been sourced from the APIS database for the location instead. Where the habitat type is unknown the most sensitive habitat is used. Data sourced from the location are shown with an asterisk.

6.18 The maximum PCs of acid deposition are compared against the relevant Critical Loads in Table 6.4. As outlined in paragraph 6.11, the nitrogen component of acid deposition is derived from the N Deposition PC and therefore considers the contribution from NOx and NH_3. Paragraph 6.12 outlines that the sulphur component of acid deposition considers the contribution from SO_2, to which the contribution from HCl concentrations has been added. There are various interest features within the habitat sites that are sensitive to acid deposition. Only the results for the most-sensitive interest features are shown. Data on Critical Loads have been obtained from the UK Air Pollution Information System (APIS) database.

Table 6.4 Predicted Acid Deposition at Designated Habitat Sites

Designation	Habitat Site	Critical Loads ($keq.ha^{-1}.yr^{-1}$)			PC ($keq.ha^{-1}.yr^{-1}$)		PC / CLF (%)
		Min N	Max N	Max S	N	S	
SAC	South Pennine Moors (maximum)	0.32	0.57	0.25	1.66E-04	4.06E-04	0
SPA	South Pennine Moors (maximum)	0.18	0.51	0.19	1.66E-04	4.06E-04	0
SSSI	South Pennine Moors (maximum)	0.22	0.56	0.19	1.66E-04	4.06E-04	0
SSSI	Broadhead Clough	0.22	0.66	0.24	6.62E-05	1.62E-04	0
Ancient Woodland	Rough Hey Wood	0.14*	1.56*	1.413*	2.09E-03	4.09E-03	0
LNR	Norland Moor (maximum)	0.18*	0.67*	0.49*	3.31E-04	8.11E-04	0
LNR	Milner Royd	0.14*	1.56*	1.413*	1.56E-03	3.82E-03	0

Designation	Habitat Site	Critical Loads (keq.ha^{-1}.yr^{-1})			PC (keq.ha^{-1}.yr^{-1})		PC / CLF (%)
		Min N	Max N	Max S	N	S	
LWS	North Dean Woods	0.14*	1.56*	1.413*	9.46E-04	1.85E-03	0
LWS	Rochdale Canal	0.18*	0.67*	0.49*	2.02E-03	4.94E-03	1

CLF = Critical Load Function (info at http://www.apis.ac.uk/clf-guidance)

Conclusion

6.19 The maximum predicted PCs do not exceed 1% of the relevant annual-mean or 10% of the relevant weekly/daily-mean Critical Levels / Critical Loads at all habitat sites. In line with current Environment Agency guidelines [5], the effects can be screened out as insignificant.

Appendix A - Policy and Legislative Context and Assessment Methodology

A.1 The additional assessment work undertaken to respond to the issues raised has followed the same methodology as the original assessment work. Appendix A reproduces the relevant policy and legislative context and the assessment methodology for ease of reference. All table and figure numbers are identical to those in the original assessment report.

Emission Limits

Industrial Emissions Directive Limits

A.2 The plant would be designed and operated in accordance with the requirements of the Industrial Emissions Directive (2010/75/EU) [6], known hereafter as the IED, which requires adherence to emission limits for a range of pollutants.

A.3 Emission limits in the IED are specified in the form of half-hourly mean concentrations; daily-mean concentrations; mean concentrations over a period of between 30 minutes and 8 hours; or, for dioxins and furans, mean concentrations evaluated over a period of between six and eight hours.

A.4 For the purposes of this assessment for those pollutants having only one emission limit (for a single averaging period), the facility has been assumed to operate at that limit (with the exception of arsenic and Chromium VI, as discussed later). Where more than one limit exists for a pollutant, the half-hourly mean emission limit value has been used to calculate short-term (≤ 24-hour average) peak ground-level concentrations (Scenario 1) (again, with the exception of arsenic and Chromium VI, as discussed later). The daily mean emission limit value has been used for these pollutants to calculate long-term (greater than 24-hour average) mean ground-level concentrations (Scenario 2). The IED emission limit values are provided in Table 2.1.

Table 2.1 Relevant Industrial Emissions Directive Limit Values

Pollutant	Scenario 1 Short-Term Emission Limits ($mg.Nm^{-3}$)	Scenario 2 Daily-Mean Emission Limits ($mg.Nm^{-3}$)
Particles	30	10
Hydrogen Chloride (HCl)	60	10
Hydrogen Fluoride (HF)	4	1
Sulphur Dioxide (SO_2)	200	50
Nitrogen Oxides (NO_X)	400	200
Carbon Monoxide (CO)		50
Group 1 metals (a)	-	0.05 (d)
Group 2 metals (b)	-	0.05 (d)

Pollutant	Scenario 1 Short-Term Emission Limits ($mg.Nm^{-3}$)	Scenario 2 Daily-Mean Emission Limits ($mg.Nm^{-3}$)
Group 3 metals (c)	-	0.5 (d)
Dioxins and furans	-	0.0000001 (e)

Notes: All concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.
(a) Cadmium (Cd) and thallium (Tl).
(b) Mercury (Hg).
(c) Antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni), and vanadium (V).
(d) All average values over a sample period of a minimum of 30 minutes and a maximum of 8 hours.
(e) Average values over a sample period of a minimum of 6 hours and a maximum of 8 hours. The emission limit value refers to the total concentration of dioxins and furans calculated using the concept of toxic equivalence (TEQ).

A.5 Ammonia (NH_3), polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) are not specifically regulated under the IED. For the purposes of this assessment, the emission concentrations in Table 2.2 have been used for these pollutants to calculate long-term (greater than 24-hour average) mean ground-level concentrations (Scenario 2).

Table 2.2 Modelled Emission Concentrations for non-IED-Regulated Pollutants

Pollutant	Scenario 2 Emission Concentrations ($mg.Nm^{-3}$)
NH_3	5
PCBs	0.005
B[a]P	0.001

Notes: All concentrations referenced to temperature 273 K, pressure 101.3 kPa, 11% oxygen, dry gas.
Emission concentrations obtained from the IPPC Reference Document on the Best Available Techniques for Waste Incineration (August 2006)

Waste Framework Directive

A.6 Directive 2008/98/EC [7] of the European Parliament and Council on Waste requires member states to ensure that waste is recovered or disposed of without harm to human health and the environment. It requires member states to impose certain obligations on all those dealing with waste at various stages. Operators of waste disposal and recovery facilities are required to obtain a permit, or register a permit exemption. Retention of the permit requires periodic inspections and documented evidence of the activities in respect of waste.

A.7 The Waste Framework Directive (WFD) requires member states to take appropriate measures to establish an integrated and adequate network of disposal installations. The WFD also promotes environmental protection by optimising the use of resources, promoting the recovery of waste over its disposal (the "waste hierarchy").

A.8 Annex II A and B of the WFD provide lists of the operations which are deemed to be "disposal" and "recovery", respectively. The terms are mutually exclusive and an operation cannot be a disposal and recovery operation simultaneously. Where the operation is deemed to be a disposal operation, the permit will contain more extensive conditions than for a recovery operation.

A.9 The principal objective of a recovery operation is to ensure that the waste serves a useful purpose, replacing other substances which would have been used for that purpose. Where the combustion of waste is used to provide a source of energy, the operation is deemed to be a recovery operation.

A.10 The EPR 2016 implements the WFD in the UK. As such, the Environment Agency is responsible for implementing the obligations set out in the WFD for most activities and waste operations but local authorities are responsible for implementing the WFD obligations in respect of generally smaller scale facilities including SWIPs.

Ambient Air Quality Legislation and National Policy

Ambient Air Quality Criteria

A.11 There are several European Union (EU) Air Quality Directives and UK Air Quality Regulations that will apply to the operation of the proposed facility. These provide a series of statutory air quality limit values, target values and objectives for pollutants, emissions of which are regulated through the IED.

A.12 There are some pollutants regulated by the IED which do not have statutory air quality standards prescribed under current legislation. For these pollutants, a number of non-statutory air quality objectives and guidelines exist which have been applied within this assessment. The Environment Agency website provides further assessment criteria in its online guidance.

The Ambient Air Quality Directive and Air Quality Standards Regulations

A.13 The 2008 Ambient Air Quality Directive (2008/50/EC) [8] aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants; it sets legally binding concentration-based limit values, as well as target values. There are also information and alert thresholds for reporting purposes. These are to be achieved for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. This Directive replaced most of the previous EU air quality legislation and in England was transposed into domestic law by the Air Quality Standards (England) Regulations 2010 [9], which in addition incorporates the 4th Air Quality Daughter Directive (2004/107/EC) that sets targets for ambient air concentrations of certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). Member states must comply with the limit values (which are legally binding on the Secretary of State) and the Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values. The objectives are not legally binding. The statutory air quality limit values are listed in Table 2.3.

Table 2.3 Summary of Relevant Statutory Air Quality Limit Values and Air Quality Objectives

Pollutant	Averaging Period	Objectives/ Limit Values	Not to be Exceeded More Than	Target Date
Nitrogen Dioxide (NO_2)	1 hour	200 µg.m^{-3}	18 times per calendar year	-
	Annual	40 µg.m^{-3}	-	-
Particulate Matter (PM_{10})	24 Hour	50 µg.m^{-3}	35 times per calendar year	-
	Annual	40 µg.m^{-3}	-	-
Particulate Matter ($PM_{2.5}$)	Annual	25 µg.m^{-3}	-	01.01.2020 (a)
				01.01.2015 (b)
Carbon Monoxide	Maximum daily running 8 hour mean	10,000 µg.m^{-3}	-	-
Sulphur Dioxide (SO_2)	15 minute	266 µg.m^{-3}	> 35 times per calendar year	-
	1 hour	350 µg.m^{-3}	> 24 times per calendar year	-
	24 hour	125 µg.m^{-3}	> 3 times per calendar year	-
Lead	Annual	0.25 µg.m^{-3}	-	-
Arsenic (As)	Annual (b)	0.006 µg.m^{-3}	-	-
Cadmium (Cd)	Annual (b)	0.005 µg.m^{-3}	-	-
Nickel (Ni)	Annual (b)	0.02 µg.m^{-3}	-	-

(a) Target date set in UK Air Quality Strategy 2007
(b) Target date set in Air Quality Standards Regulations 2010

Non-Statutory Air Quality Objectives and Guidelines

A.14 The Environment Act 1995 established the requirement for the Government and the devolved administrations to produce a National Air Quality Strategy (AQS) for improving ambient air quality, the first being published in 1997 and having been revised several times since, with the latest published in 2007 [10]. The Strategy sets UK air quality standards and objectives for the pollutants in the Air Quality Standards Regulations plus 1,3-butadiene and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem.

A.15 Non-statutory air quality objectives and guidelines also exist within the World Health Organisation Guidelines [11] and the Expert Panel on Air Quality Standards Guidelines (EPAQS) [12]. The non-statutory objectives and guidelines are presented in Table 2.4.

Table 2.4 Non-Statutory Air Quality Objectives and Guidelines

Pollutant	Averaging Period	Guideline	Target Date
Particulate Matter ($PM_{2.5}$)	Annual	Target of 15% reduction in concentrations at urban background locations	Between 2010 and 2020 (a)
	Annual	25 $\mu g.m^{-3}$	2020 (a)
PAHs	Annual (a)	0.00025 $\mu g.m^{-3}$ B[a]P	-
Sulphur Dioxide (SO_2)	Annual (b)	50 $\mu g.m^{-3}$	-
Hydrogen Chloride	1 hour (c)	750 $\mu g.m^{-3}$	-
Hydrogen Fluoride	1 hour (c)	160 $\mu g.m^{-3}$	-

Notes:
(a) Target date set in UK Air Quality Strategy 2007
(b) World Health Organisation Guidelines
(c) EPAQS recommended guideline values

Environmental Assessment Levels

A.16 The Environment Agency's on-line guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit*' [13] provides further assessment criteria in the form of Environmental Assessment Levels (EALs).

A.17 Table 2.5 presents all available EALs for the pollutants relevant to this assessment.

Table 2.5 Environmental Assessment Levels (EALs)

Pollutant	Long-Term EAL ($\mu g.m^{-3}$)	Short-Term EAL ($\mu g.m^{-3}$)
Nitrogen Dioxide (NO_2)	40	200
Carbon Monoxide (CO)	-	10,000
Sulphur Dioxide (SO_2)	50	266
Particulates (PM_{10})	40	50
Particulates ($PM_{2.5}$)	25	-
Hydrogen chloride (HCl)	-	750
Hydrogen fluoride (HF)	16 (monthly average)	160
Arsenic (As)	0.003	-
Antimony (Sb)	5	150

Pollutant	Long-Term EAL (µg.m^{-3})	Short-Term EAL (µg.m^{-3})
Cadmium (Cd)	0.005	-
Chromium (Cr)	5	150
Chromium VI ((oxidation state in the PM_{10} fraction)	0.0002	-
Cobalt (Co)	0.2 (a)	6 (a)
Copper (Cu)	10	200
Lead (Pb)	0.25	-
Manganese (Mn)	0.15	1500
Mercury (Hg)	0.25	7.5
Nickel (Ni)	0.02	-
Thallium (Tl)	1 (a)	30 (a)
Vanadium (V)	5	1
PAHs	0.00025 B[a]P	-

Notes: (a) EALs have been obtained from the EA's earlier Horizontal Guidance Note EPR H1 guidance note as no levels are provided in the current guidance.

A.18 Within the assessment, the statutory air quality limit and target values are assumed to take precedence over objectives, guidelines and the EALs, where appropriate. In addition, for those pollutants which do not have any statutory air quality standards, the assessment assumes the lower of either the EAL or the non-statutory air quality objective or guideline where they exist.

Assessment Methodology

A.19 Neither the NPPF nor the NPPG is prescriptive on the methodology for assessing air quality effects or describing significance; practitioners continue to use guidance provided by Defra and non-governmental organisations, including Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM). However, the NPPG does advise that "*Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific. The scope and content of supporting information is therefore best discussed and agreed between the local planning authority and applicant before it is commissioned.*" It lists a number of areas that might be usefully agreed at the outset.

A.20 This air quality assessment covers the elements recommended in the NPPG. The approach is consistent with Defra's Local Air Quality Management Technical Guidance: LAQM.TG16 [14]. It includes the key elements listed below:

- assessment of the existing air quality in the study area (existing baseline) and prediction of the future air quality without the development in place (future baseline), using official government estimates from Defra, publicly available air quality monitoring data for the area, and relevant Air Quality Review and Assessment (R&A) documents;

- a quantitative prediction of the future operational-phase air quality impact with the development in place (with any necessary mitigation), focusing on the impacts of the stack emissions on the local area, including Sowerby Bridge AQMA.

A.21 In line with the guidance set out in the NPPG, the Environmental Health Department at CMBC was consulted to agree the scope and methodology for this assessment. The Pollution Control Officer, Tommy Moorhouse, agreed that the approach to the assessment was reasonable [15].

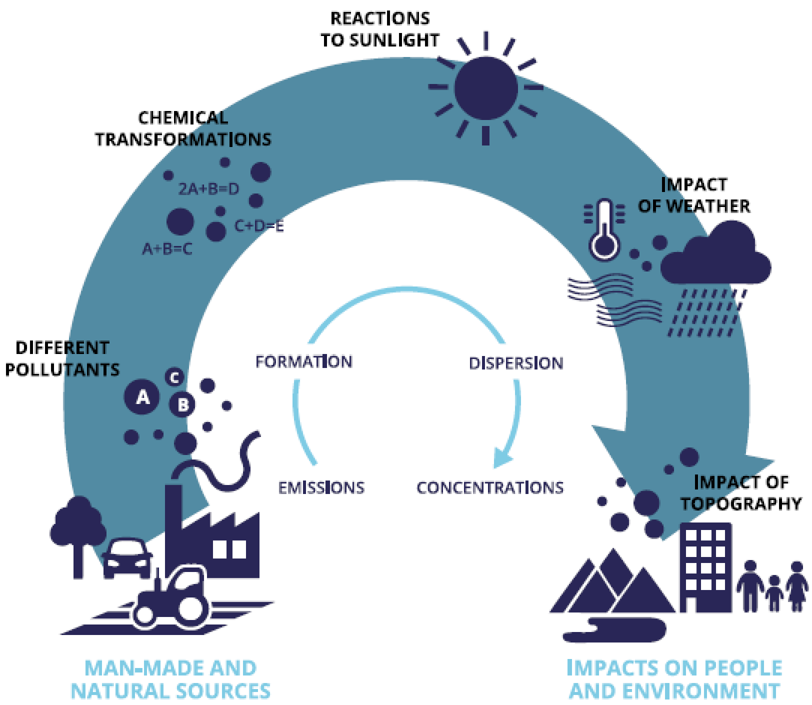
A.22 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The RPS air quality team members involved at various stages of this assessment have professional affiliations that include Fellow and Member of the Institute of Air Quality Management, Chartered Chemist, Chartered Scientist, Chartered Environmentalist and Member of the Royal Society of Chemistry and have the required academic qualifications for these professional bodies. In addition, the Director responsible for authorising all deliverables has over 25 years' experience.

Operational Phase - Methodology

Atmospheric Dispersion Modelling of Pollutant Concentrations

A.23 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; such a model requires a range of input data, which can include emissions rates, meteorological data and local topographical information. The model used and the input data relevant to this assessment are described in the following sub-sections.

Figure 6.2 Air Pollution: From Emissions to Exposure



Source: European Environment Agency (2016) Explaining Road Transport Emissions: A Non-technical Guide

A.24 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4.

Dispersion Model Selection

A.25 A number of commercially available dispersion models are able to predict ground level concentrations arising from emissions to atmosphere from elevated point sources. Modelling for this study has been undertaken using ADMS 5, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants (CERC) that models a wide range of buoyant and passive releases to atmosphere either individually or in combination. The model calculates the mean concentration over flat terrain and also allows for the effect of plume rise, complex terrain, buildings and deposition. Dispersion models predict atmospheric concentrations within a set level of confidence and there can be variations in results between models under certain conditions; the ADMS 5 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

A.26 ADMS comprises a number of individual modules each representing one of the processes contributing to dispersion or an aspect of data input and output. Amongst the features of ADMS are:

- An up-to-date dispersion model in which the boundary layer structure is characterised by the height of the boundary layer and the Monin-Obukhov length, a length scale dependent on the friction velocity and the heat flux at the surface. This approach allows the vertical structure of the boundary layer, and hence concentrations, to be calculated more accurately than does the use of Pasquill-Gifford stability categories, which were used in many previous models (e.g. ISCST3). The restriction implied by the Pasquill-Gifford approach that the dispersion parameters are independent of height is avoided. In ADMS the concentration distribution is Gaussian in stable and neutral conditions, but the vertical distribution is non-Gaussian in convective conditions, to take account of the skewed structure of the vertical component of turbulence;
- A number of complex modules including the effects of plume rise, complex terrain, coastlines, concentration fluctuations and buildings;
- A facility to calculate long-term averages of hourly mean concentration, dry and wet deposition fluxes and radioactivity, and percentiles of hourly mean concentrations, from either statistical meteorological data or hourly average data; and
- A facility to run the main model options of the US EPA-approved dispersion model, AERMOD, using ADMS meteorological data from the ADMS 5 interface.

Model Input Data

Meteorological Data

A.27 The most important meteorological parameters governing the atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed;
- Wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

A.28 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

A.29 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using five years of data from Leeds-Bradford Airport between 2013 and 2017.

A.30 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 1.

Stack Parameters and Emissions Rates used in the Model

A.31 Flue gases are emitted from an elevated stack to allow dispersion and dilution of the residual combustion emissions. The stack needs to be of sufficient height to ensure that pollutant concentrations are acceptable by the time they reach ground level. The stack also needs to be high enough to ensure that releases are not within the aerodynamic influence of nearby buildings, or else wake effects can quickly bring the undiluted plume down to the ground.

A.32 A stack height determination has been undertaken to establish the height at which there is minimal additional environmental benefit associated with the cost of further increasing the stack. The Environment Agency removed their detailed guidance, Horizontal Guidance Note EPR H1 [13] for undertaking risk assessments on 1 February 2016; however, the approach used here by RPS is consistent with that EA guidance which required the identification of "*an option that gives acceptable environmental performance but balances costs and benefits of implementing it*."

A.33 The stack height determination has focused on identifying the stack height required to overcome the wake effects of nearby buildings. This involved running a series of atmospheric dispersion modelling simulations to predict the ground-level concentrations with the stack at different heights: starting at 12 metres and extending up in 1 metre increments, until a height of 18 metres was reached. The stack height determination indicated a 12 m stack height was appropriate.

A.34 Stack emissions characteristics modelled are provided in Table 3.1 and the mass emissions are provided in Table 3.2.

Table 3.1 Stack Characteristics

Parameter	Unit	Value
Stack height	m	12
Internal diameter	m	0.4
Efflux velocity	$m.s^{-1}$	21.3
Efflux temperature	^{o}C	300
Normalised volumetric flow (Dry, 0°C, 11% O_2)	$m^3.s^{-1}$	1.28

Table 3.2 Mass Emissions of Released Pollutants

Pollutant	Short-Term Mass Emission Rate ($g.s^{-1}$)	Long-Term (a) Mass Emission Rate ($g.s^{-1}$)
Particulates	0.04	0.01
HCl	0.08	0.01
HF	5.11E-03	1.28-03
SO_2	0.26	0.06
NO_X	0.51	0.26
CO	0.13	0.06
Group 1 Metals Total (b)	-	6.38E-05
Group 2 Metals (c)	-	6.38E-05
Group 3 Metals Total (d)	-	6.38E-04
Dioxins and furans	-	1.28E-10
NH_3	-	6.38E-03
PCBs	-	6.38E-06
B[a]P	-	1.28E-06

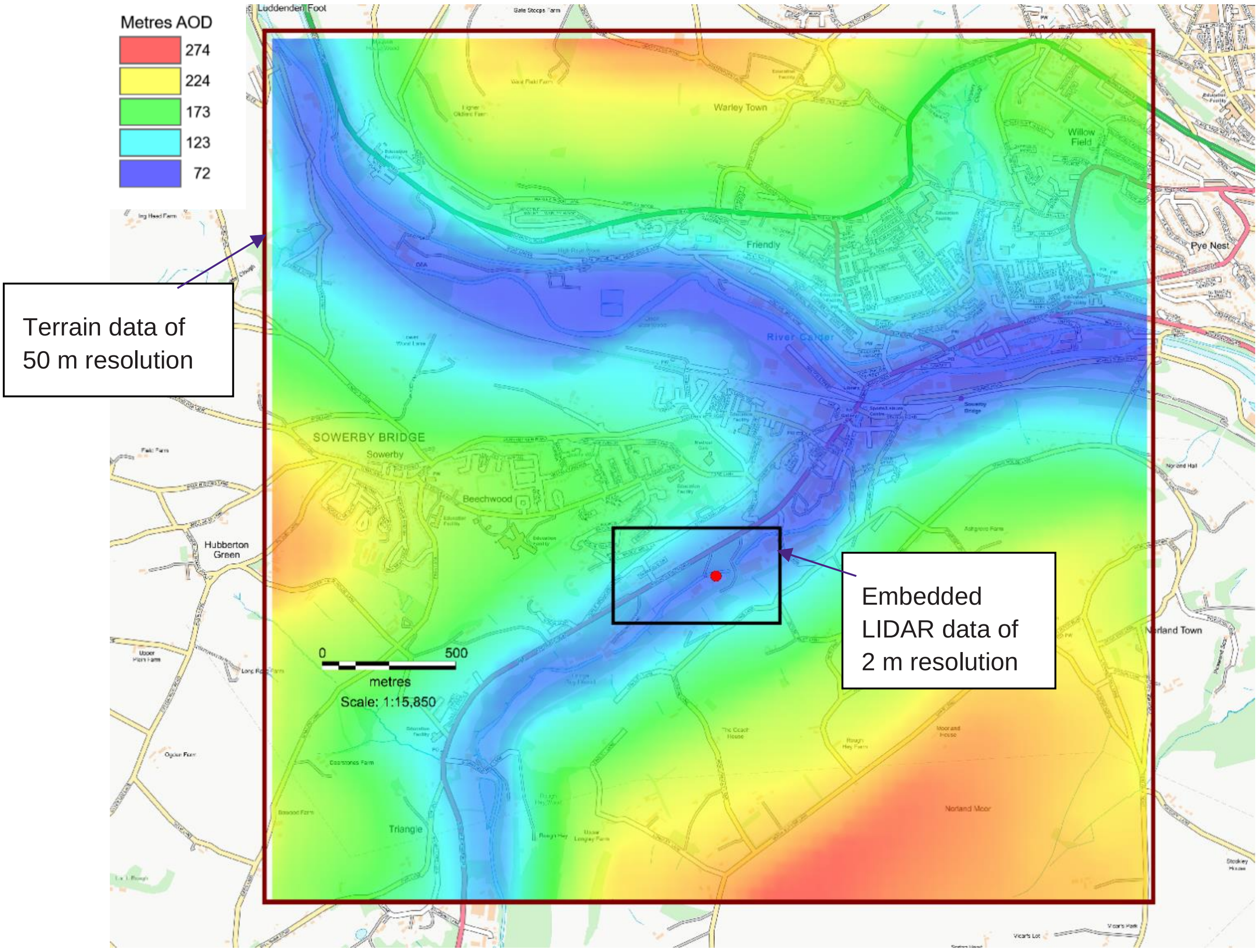
Notes:
(a) For averaging periods of 24 hours or greater.
(b) Cadmium (Cd) and thallium (Tl)
(c) Mercury (Hg)
(d) Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni), and Vanadium (V)

A.35 Emission limits in the IED are provided for total particles. For the purposes of this assessment, all particles are assumed to be less than 10 µm in diameter (i.e. PM_{10}). Furthermore, all particles are also assumed to be less than 2.5 µm in diameter (i.e. $PM_{2.5}$). In reality, the PM_{10} and $PM_{2.5}$ concentrations will be a smaller proportion of the total particulate emissions and the $PM_{2.5}$ concentration will be a smaller proportion of the PM_{10} concentration. Therefore, this can be considered a conservative estimate of the likely particulate emissions in each size fraction.

Terrain

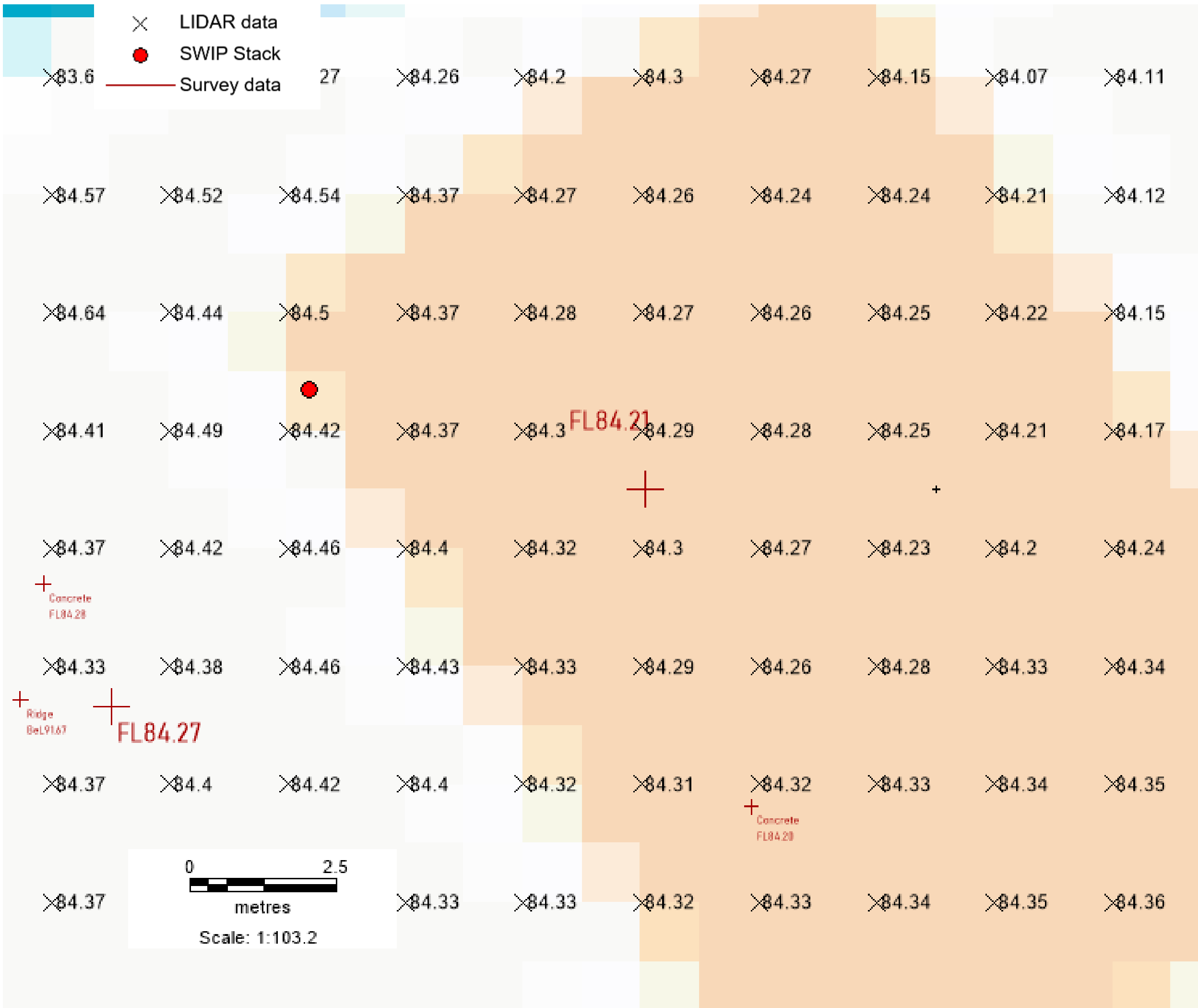
A.36 The presence of elevated terrain can significantly affect (usually increase) ground level concentrations of pollutants emitted from elevated sources such as stacks, by reducing the distance between the plume centre line and ground level and by increasing turbulence and, hence, plume mixing. A complex terrain file was used within the model. The terrain data used in the model comprises terrain data of 50 m resolution for the whole study area, supplemented with 2 m resolution government-published LIDAR data [[16]] for a smaller area encompassing the Application Site. This is shown graphically in Figure 3.2 below.

Figure 3.2 Complex Terrain Data Used in Model



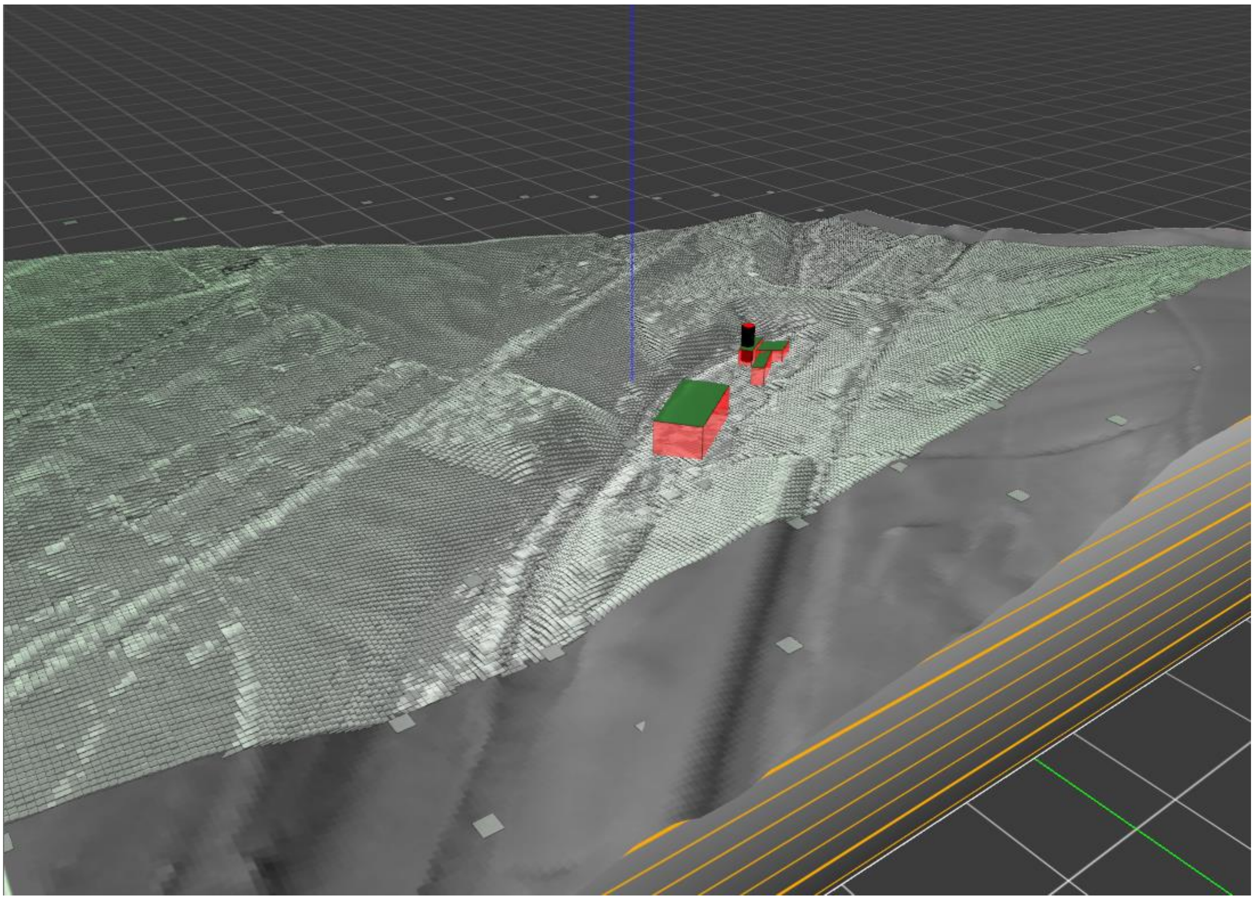
A.37 Figure 3.3 below shows the LIDAR data values and topographical survey values closest to the SWIP stack. This figure shows close agreement between the LIDAR data and the surveyed data. The LIDAR data value closest to the SWIP stack is 84.42 m AOD. This indicates that the stack height would be approximately 96.4 m AOD (i.e., 12 m above ground level).

Figure 3.3 LIDAR Data and Topographical Survey Data Close to SWIP Stack



A.38 Figure 3.4 is a 3D view of the complex terrain file, stack and buildings modelled (note that the stack is not to scale). This figure demonstrates that the high-resolution of the terrain data used represents well the features of the valley in the vicinity of the Application Site.

Figure 3.4 3D View of Complex Terrain Data Used in Model



Surface Roughness

A.39 The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length.

A.40 A surface roughness length of 1 m, which the software developer recommends for use in woodland, was used within the ADMS model to represent the average surface characteristics across the study area.

A.41 A sensitivity test has been undertaken using a variable surface roughness file. This is detailed within Appendix F.

Building Wake Effects

A.42 The dominant building structures (i.e. with the greatest dimensions likely to promote turbulence) were confirmed with Paul Nutton at Ryley and are listed in Table 3.3. These were included in the model.

Table 3.3 Dimensions of Buildings Included Within the Dispersion Model

Name	Building Centre (x, y)	Height (m)	Length (m)	Width (m)	Angle (Degrees)
SWIP Process Building	405352, 422842	8	18.5	6.5	57
Feed Storage	405360, 422836	6	13.2	12.2	148
Office	405340, 422821	9	5.9	18.9	142
Recycling Building	405279, 42295	15	20.7	42.8	144

Receptors

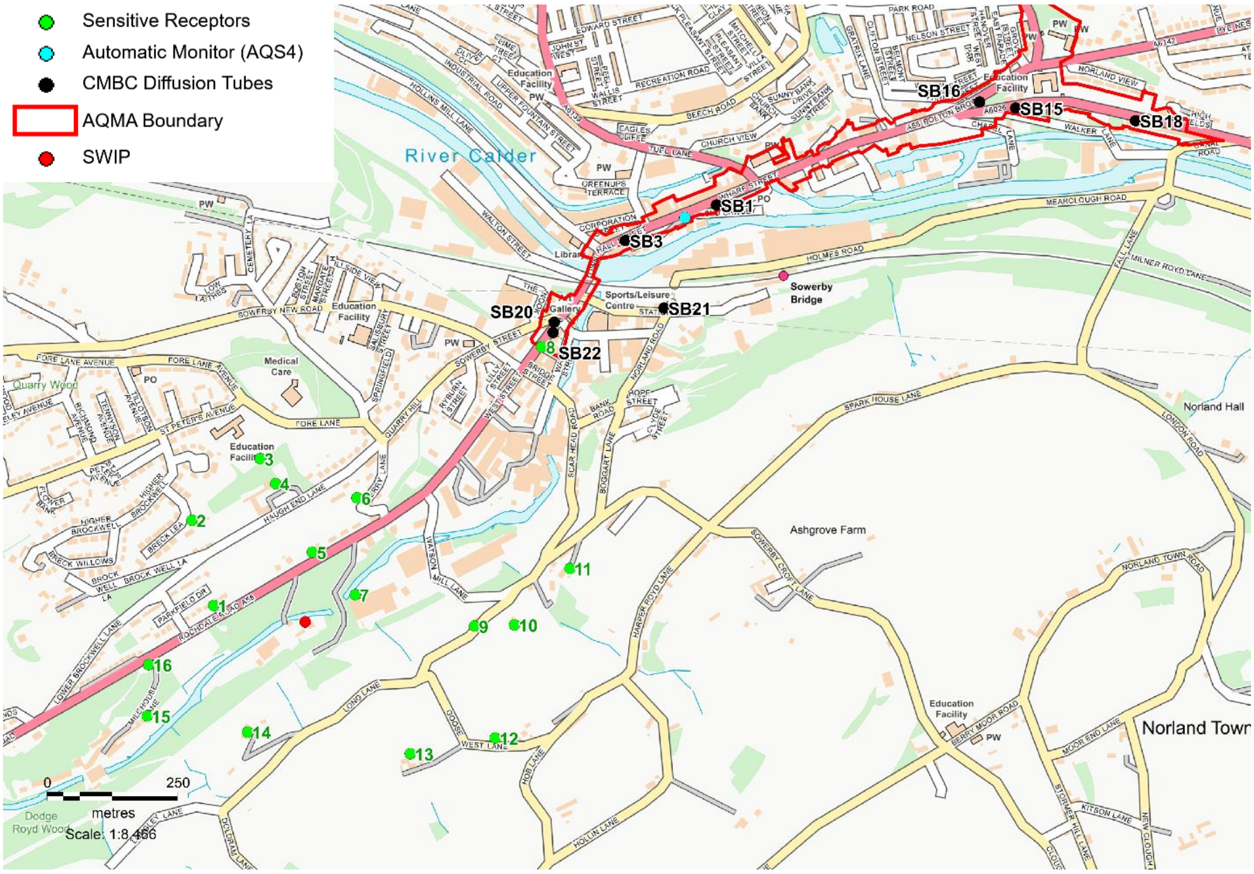
A.43 Concentrations have been modelled across a 1 km by 1 km grid, with a spacing of 20 m, at a height of 1.5 m, centred on the proposed development.

A.44 In addition, concentrations have been modelled at the 16 selected sensitive receptors modelled in the 2017 Environmental Statement. These receptors are listed in Table 3.4 and shown in Figure 3.5.

Table 3.4 Modelled Sensitive Receptors

ID	Description	x	y
1	28 Rochdale Road	405174	422873
2	9 Breck Lea	405133	423036
3	Sacred Heart Catholic Primary School	405263	423154
4	Haugh End House	405293	423106
5	84 Rochdale Road	405363	422975
6	Highfield Jerry Lane	405448	423079
7	Spring Bank Industrial Estate	405445	422894
8	Mill West (AQMA)	405801	423368
9	Ivy Cottage	405673	422834
10	Cottage	405749	422836
11	Black Sowerby Croft	405855	422944
12	Prospect Terrace	405712	422620
13	Hullen Edge	405550	422590
14	Bank House	405239	422631
15	Mill House Farm	405047	422662
16	Mill House Lodge	405050	422760

Figure 3.5 Modelled Sensiitve Receptors and Local Air Quality Monitors



A.45 The annual, daily and hourly-mean AQS objectives apply at the front and rear façades of all residential properties and at Sacred Heart Catholic Primary School. The daily and hourly-mean AQS objectives only, apply at Spring Bank Industrial Estate.

Planning Significance Criteria for Development Impacts on the Local Area

A.46 The Environmental Protection UK (EPUK)/ Institute of Air Quality Management (IAQM) Land-Use Planning & Development Control: Planning For Air Quality document has been used for assessing the impacts of NO_2, and long-term PM_{10} and $PM_{2.5}$, as the pollutants most commonly associated with assessment by that method. (For assessing the significance of other pollutants, the Environment Agency's approach has been used, as discussed later)

A.47 The EPUK & IAQM Land-Use Planning & Development Control: Planning For Air Quality document advises that:

"The significance of the effects arising from the impacts on air quality will depend on a number of factors and will need to be considered alongside the benefits of the development in question. Development under current planning policy is required to be sustainable and the definition of this includes social and economic dimensions, as well as environmental. Development brings opportunities for reducing emissions at a wider level through the use of more efficient technologies and better designed buildings, which could well displace emissions elsewhere, even if they increase at the development site. Conversely, development can also have adverse consequences for air quality at a wider level through its effects on trip generation."

A.48 When describing the air quality impact at a sensitive receptor, the change in magnitude of the concentration should be considered in the context of the absolute concentration at the sensitive receptor. Table 3.5 provides the EPUK & IAQM approach for describing the long-term air quality impacts at sensitive human-health receptors in the surrounding area.

Table 3.5 Impact Descriptors for Individual Sensitive Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level			
	1	2-5	6-10	>10
75 % or less of AQAL	Negligible	Negligible	Slight	Moderate
76 -94 % of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102 % of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109 % of AQAL	Moderate	Moderate	Substantial	Substantial
110 % or more than AQAL	Moderate	Substantial	Substantial	Substantial

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as negligible.
3. The table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

A.49 The human-health impact descriptors above apply at individual receptors. The EPUK & IAQM guidance states that the impact descriptors *"are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it maybe that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances."*

A.50 The above criteria and matrix are for assessing the long-term impacts; for short term impacts the EPUK/IAQM guidance states that:

"*The Environment Agency uses a threshold criterion of 10% of the short term AQAL as a screening criterion for the maximum short term impact. This is a reasonable value to take and this guidance also adopts this as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect. Background concentrations are less important in determining the severity of impact for short-term concentrations, not least because the peak concentrations attributable to the source and the background are not additive.*

Where such peak short term concentrations from an elevated source are in the range 10-20% of the relevant AQAL, then their magnitude can be described as small, those in the range 20-50% medium and those above 50% as large. These are the maximum concentrations experienced in any year and the severity of this impact can be described as slight, moderate and substantial respectively, without the need to reference background or baseline concentrations. That is not to say that background concentrations are unimportant, but they will, on an annual average basis, be a much smaller quantity than the peak concentration caused by a substantial plume and it is the contribution that is used as a measure of the impact, not the overall concentration at a receptor. This approach is intended to be a streamlined and pragmatic assessment procedure that avoids undue complexity."

A.51 Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts. This judgement is likely to take into account the extent of the current and future population exposure to the impacts and the influence and/or validity of any assumptions adopted during the assessment process.

Environment Agency Significance Criteria

A.52 For assessing the significance of other pollutants, the on-line Environment Agency (EA) guidance entitled 'Environmental management – guidance, Air emissions risk assessment for your environmental permit' [13] has been used. This guidance provides details for screening out substances for detailed assessment. In particular, it states that:

"To *screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:*

- *the short-term PC is less than 10% of the short-term environmental standard*
- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

A.53 It continues by stating that:

"You must do detailed modelling for any PECs not screened out as insignificant."

A.54 It then states that further action may be required where:

- *"your PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributions – if you think this is the case contact the Environment Agency)*
- *The PEC is already exceeding an environmental standard"*

A.55 On that basis, the results of the detailed modelling presented in this report have been used as follows:

- The effects are not considered significant if the short-term PC is less than 10 % of the short-term Air Quality Assessment Level (AQAL) or the PEC is below the AQAL; and
- The effects are not considered significant if the long-term PC is less than 1 % of the long-term AQAL or the PEC is below the AQAL.

A.56 The Air Quality Assessment Level refers to the AQS air quality objective and the EU limit value.

References

1 Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4

2 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas

3 IAQM (2019) A guide to the assessment of air quality impacts on designated nature conservation sites

4 Air Pollution Information System, www.apis.ac.uk

5 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas

6 Directive 2010/75/EC Of The European Parliament And Of The Council of 24 November 2010 on industrial emissions

7 Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on Waste

8 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.

9 Defra, 2010, The Air Quality Standards (Wales) Regulations.

10 Defra, 2007, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Volume 2.

11 World Health Organisation Guidelines (http://www.who.int/en/)

12 Expert Panel on Air Quality Standards (www.defra.gov.uk/environment/airquality/panels/aqs/index.htm)

13 Environment Agency 2016, Environmental management – guidance. Air emissions risk assessment for your environmental permit. .gov.uk website: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions.

14 Defra (2016) Local Air Quality Management Technical Guidance, 2016 (LAQM.TG16)

15 Email from Tommy Moorhouse (CMBC) to Rosemary Challen (RPS) dated 07/06/2019

16 Defra Digital Terrain Model (DTM) Lidar Data available from: https://environment.maps.arcgis.com/apps/MapJournal/index.html?appid=c6cef6cc642a48838d38e722ea8ccfee

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Contact

Kathryn Barker
Senior Air Quality Consultant
RPS Consulting Services Ltd
6-7 Lovers Walk
Brighton
BN1 6AH
T: +44(0) 1237 546 800
E: kathryn.barker@rpsgroup.com