Air Quality Assessment:
Stericycle Waste Facility, Knowsley

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Experts in air quality management & assessment

Document Control

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Executive Summary

The air quality impacts associated with the proposed extension of Stericyle's healthcare waste treatment facility, in Knowsley have been assessed. The development proposals include the installation of two new gas-fired steam boilers, as well as two new disinfectant lines to the existing facility.

The assessment has demonstrated that the development-generated changes in traffic volumes on the local road network will be below published screening criteria, and thus there will be no significant effects at any local roadside receptors.

The assessment has also demonstrated that the emissions of the proposed plant within the facility will not lead to any exceedances of the nitrogen dioxide and benzene air quality objectives. Furthermore, the combined effect of plant emissions and road traffic are not judged to have a significant impact on local air quality

Overall, the operational air quality effects of the proposed extension to the Stericyle facility are judged to be 'not significant'.

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed extension of Stericyle's medical waste treatment and transfer station on land adjacent to Acornfield Road, Knowsley.

1.2 The site currently receives healthcare waste, which is shredded, disinfected, compacted, and sent offsite for disposal. The proposal involves increasing the site's processing capacity from 22,000 tonnes per annum (tpa) to 50,000 tpa. As part of the expansion, the site is proposing to install two new 1.25 MW gas-fired steam boilers, as well as adding two new disinfectant lines, which will emit from two new stacks of the Heat Disinfection Units (HDUs) serving the process. These new emission points will be in addition to the emissions from the site's existing steam boiler and HDU plant stack, all of which will be referred to as the 'the plant'.

1.3 The Stericycle facility is currently operational and already releases emissions to air under the Environmental Permitting Regulations (Permit Number: EPR/KP3436NL). Within their current permit, Volatile Organic Compounds (VOCs) are controlled. Emissions of oxides of nitrogen (NOx) from the site's current plant are out of scope of the existing permit as the existing plant is <1MWth. These emissions will all increase as part of the expansion of the site; therefore, the impact of nitrogen dioxide (NO_2) and benzene[1] have been assessed.

1.4 The proposed development will lead to an increase of emissions from changes in vehicle flows on local roads, which may impact on air quality at existing sensitive properties in the near vicinity of the application site. The main air pollutants of concern related to road traffic emissions are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.5 The site also has the potential to impact on local amenity due to odours from the handling of waste. As a result, a separate odour impact assessment has been undertaken (report number: J10/12949B/10/1/F1).

1.6 This report describes existing local air quality conditions (base year 2019) and considers air quality conditions at the near vicinity of the proposed development in 2023, which is the anticipated year of operation.

1.7 This report has been prepared taking into account all relevant national and local guidance and regulations; particular consideration has been given to the Medium Combustion Plant Directive (The European Parliament and the Council of the European Union, 2015) and the Environmental Permitting (England and Wales) (Amendment) Regulations (2018), which are especially relevant to

[1] While the current speciation of the released VOC's are unknown, it is common practive to assume all VOC's are benzene.

the facility. Where appropriate, the assessment has followed a worst-case approach, so as not to underestimate the impacts of the proposed facility.

1.8 This report assesses the air quality impacts of the proposed development using an approach and structure that addresses the requirements of a planning submission. The requirements of an environmental permitting application to be submitted to the Environment Agency are specific, and differ from the requirements of a planning submission. This report should not, therefore, be submitted in support of an environmental permitting application.

1.9 The location and setting of the proposed development are shown in Figure 1, along with the nearby AQMA.

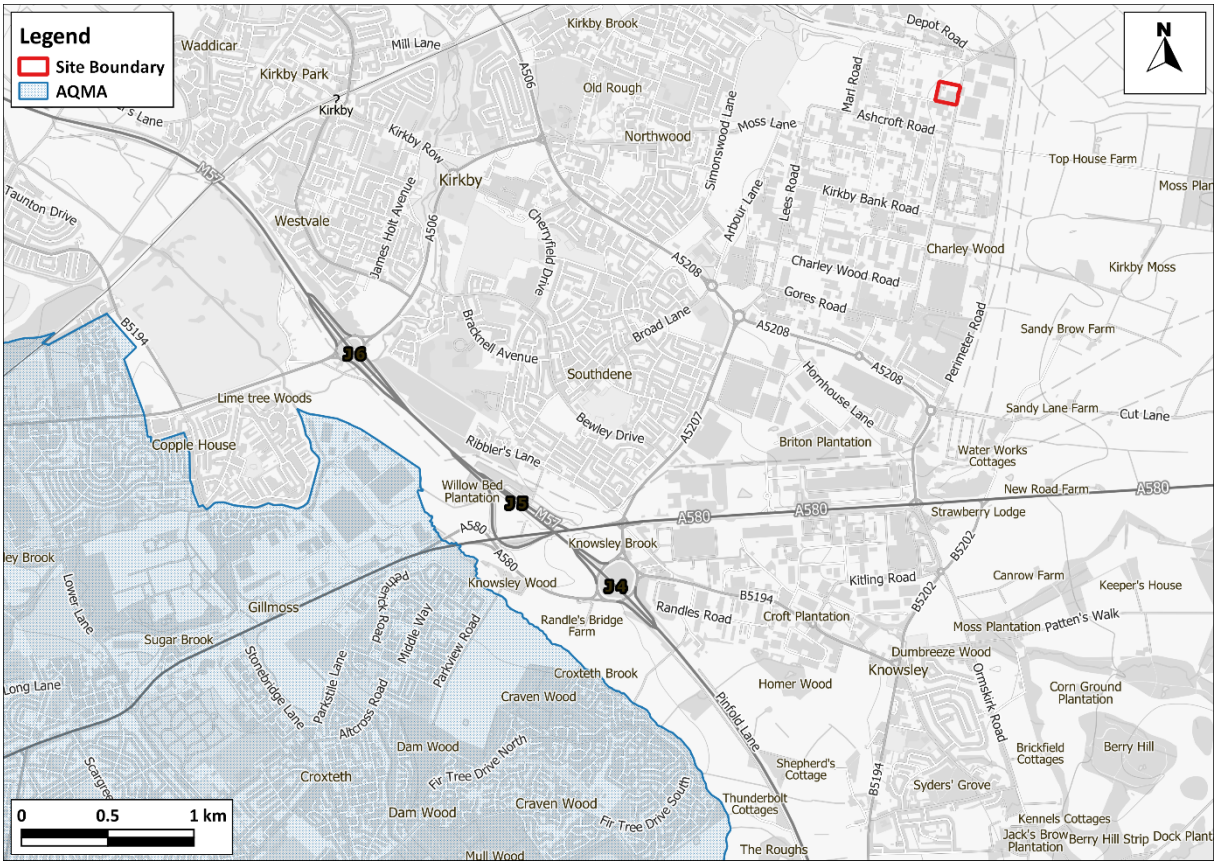

Figure 1: Proposed Development Setting in the Context of Air Quality

2 Policy Context

2.1 All European legislation referred to in this report is written into UK law and remains in place.

Air Quality Strategy

2.2 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

The Environmental Permitting (England and Wales) (Amendment) Regulations 2018

2.3 The Medium Combustion Plant Directive (MCPD) (The European Parliament and the Council of the European Union, 2015) regulates pollutant emissions from combustion plant with a rated input between 1 and 50 megawatts (MW_{th}) and was transposed into UK law in January 2018 through an amendment to the Environmental Permitting Regulations (2018). The legislation sets emission limits to be applied from December 2018 for new plant and from 2025 or 2030 for existing plant (depending on the rated input).

2.4 The two new boilers within the proposed development will require a permit under these regulations, as their thermal input rates are above the 1 MW threshold.

Clean Air Act 1993 & Environmental Protection Act

2.5 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993 (1993). This requires the local authority to approve the chimney height. Plant which are smaller than 366 kW have no such requirement. The local authority's approval will, therefore, be required for the plant to be installed in the proposed development.

2.6 Measures to ensure adequate dispersion of emissions from discharging stacks and vents are included in Technical Guidance Note D1 (Dispersion) (1993), issued in support of the Environmental Protection Act (1990).

Clean Air Strategy 2019

2.7 The Clean Air Strategy (Defra, 2019) sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Reducing Emissions from Road Transport: Road to Zero Strategy

2.8 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

2.9 The paper sets out a number of measures by which Government will support this transition but is clear that Government expects this transition to be industry and consumer led. The Government has since announced that the phase-out date for the sale of new petrol and diesel cars and vans will be brought forward to 2030 and that all new cars and vans must be fully zero emission at the tailpipe from 2035. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

Environment Act 2021

2.10 The UK's new legal framework for protection of the natural environment, the Environment Act (2021) passed into UK law in November 2021. The Act gives the Government the power to set long-term, legally binding environmental targets. It also establishes an Office for Environmental Protection (OEP), responsible for holding the government to account and ensuring compliance with these targets.

2.11 The Act requires the Government to set at least one long-term target (spanning a minimum of 15 years), supported by interim targets set in a five year cycle, in each of four identified areas: Air Quality, Biodiversity, Water and Resource Efficiency and Waste Reduction. An additional target for mean levels of $PM_{2.5}$ is also required. These must be set before November 2022. As the targets have not yet been either finalised or adopted by the Government, they cannot impact on current planning policy.

Planning Policy

National Policies

2.12 The National Planning Policy Framework (NPPF) (2021) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which (Paragraph 8c) is an environmental objective:

"to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

2.13 To prevent unacceptable risks from air pollution, Paragraph 174 of the NPPF states that:

"Planning policies and decisions should contribute to and enhance the natural and local environment by…preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality".

2.14 Paragraph 185 states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".

2.15 More specifically on air quality, Paragraph 186 makes clear that:

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan".

2.16 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified".

2.17 Regarding plan-making, the PPG states:

"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".

2.18 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*".

2.19 Regarding the need for an air quality assessment, the PPG states that:

"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity".

2.20 The PPG sets out the information that may be required in an air quality assessment, making clear that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

2.21 The PPG also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".

Local Policies

2.22 The Knowsley Metropolitan Borough Council's (KMBC) Local Plan Core Strategy (Knowsley Metropolitan Borough Council, 2016) was adopted in January 2016. Within the Strategy there are two policies relevant to air quality:

2.23 Policy CS2, 'Development Principles', states that:

"1) New development in Knowsley and the preparation of subsequent stages of the Local Plan will be expected to support the following development principles:

…Principle 4: Recognise environmental limits, protect and enhance environmental assets, enhance local character and promote quality of place by:

…e) Mitigating potential negative impacts of traffic growth and road traffic on highway safety, air quality, noise and health;

…j) Minimising negative impacts upon…air quality… and ensuring any negative impacts are appropriately mitigated."

2.24 Policy CS7, 'Transport Networks', states that:

"Location, Design and Management of New Development

2) New development will be required to be:

…e) Inclusive of measures that will mitigate carbon emissions and improve air quality where appropriate;…"

Air Quality Action Plans

National Air Quality Plan

2.25 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities (or the GLA in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a CAZ. There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement in this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

2.26 KMBC has not declared any AQMAs and thus has not prepared an air quality action plan.

3 Assessment Criteria

3.1 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002).

3.2 The UK-wide objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively and continue to apply in all future years thereafter. The $PM_{2.5}$ objective was to be achieved by 2020. The last benzene AQMA was revoked in 2005, and compliance has been maintained.

3.3 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2021). The annual mean objectives for nitrogen dioxide, PM_{10}, $PM_{2.5}$ and benzene are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour mean objective for PM_{10} and benzene is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

3.4 EU Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$, and is implemented in UK law through the Air Quality Standards Regulations (2010)[2]. The limit values for nitrogen dioxide and PM_{10} are the same numerical concentrations as the UK objectives, whilst the limit value for $PM_{2.5}$ is 20 $\mu g/m^3$. Achievement of the limit values is a national obligation rather than a local one. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not normally recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded, unless such studies have been audited and approved by Defra and DfT's Joint Air Quality Unit (JAQU).

3.5 The relevant air quality criteria for this assessment are provided in Table 1.

[2] As amended through The Air Quality Standards (Amendment) Regulations 2016 and The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10}, $PM_{2.5}$ and Benzene.

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
PM_{10}	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
$PM_{2.5}$ [a]	Annual Mean	25 µg/m^3
Benzene	Annual Mean	5 µg/m^3
	24-hour mean	30 µg/m^3 [b]

[a] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

[b] Designated as an Environmental Assessment Level (EAL).

3.6 In March 2022, Defra began consultation on new targets for $PM_{2.5}$ concentrations in England. One proposed target is to achieve $PM_{2.5}$ concentration of 10 µg/m^3 at relevant national monitoring sites by 2040. This would be accompanied by a target to reduce overall population exposure to $PM_{2.5}$, which will be assessed by national government using its own measurements. If adopted, these targets will apply to national government; it is not yet clear how these will apply to local government and, as such, are not considered further in this assessment.

Screening Criteria

Road Traffic Assessments

3.7 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[3] recommend a two-stage screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by a development have the potential for significant air quality impacts. The approach, as described in Appendix A1, first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment.

3.8 The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. The screening thresholds (described in full in Appendix A1) inside an AQMA are a change in flows of more than 25 heavy duty vehicles or 100 light duty vehicles per day; outside of an AQMA the thresholds are 100 heavy duty vehicles or 500 light duty vehicles. Where these criteria are exceeded, a detailed assessment is likely to be required,

[3] The IAQM is the professional body for air quality practitioners in the UK.

although the guidance advises that *"the criteria provided are precautionary and should be treated as indicative"*, and *"it may be appropriate to amend them on the basis of professional judgement"*.

4 Assessment Approach

Receptors

4.1 Impacts as a result of plant emissions have been predicted over a 1.5 km x 1.5 km model domain. Concentrations have been predicted across this area using a Cartesian grid. This grid has a spacing of 10 m x 10 m. The receptor grid has been modelled at a height of 1.5 m above ground level. The extent of this modelled receptor grid defines the 'Study Area', and is considered sufficient to capture the impacts of the plant emissions. In addition, three existing sensitive locations have been identified as receptors for the assessment. These locations are described in Table 2 and shown in Figure 2. Receptors 2 and 3 represent the Acorn Farm visitor attraction; since members of the public would not normally be present at these locations for a significant fraction of the hours in a day or in a year, the 24-hour mean and annual mean objectives do not apply at these receptors. Note that objectives do not apply to places of work unless there is public access.

Table 2: Description of Receptor Locations

Receptor	Type	X coordinate	Y coordinate	Heights Modelled (m) [a]
Receptor 1	Residential	343770	399561	1.5
Receptor 2 [b]	Acorn Farm	343786	399587	1.5
Receptor 3 [b]	Acorn Farm	343913	399532	1.5

[a] A height of 1.5 m is used to represent ground-floor level exposure.

[b] The location only represents relevant exposure to the short-term (1-hour) NO_2 objective.

Figure 2: Receptor Locations

Existing Conditions

4.2 Existing sources of emissions and baseline air quality conditions within the study area have been defined using a number of approaches:

- information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority;
- industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2022a);
- background concentrations have been defined using Defra's 2018-based background maps (Defra, 2022c). These cover the whole of the UK on a 1x1 km grid. The background annual mean nitrogen dioxide maps for 2019 have been calibrated against concurrent measurements from national monitoring sites (AQC, 2020). The calibration factor calculated has also been applied to future year backgrounds. Mapped background concentrations of PM_{10} and $PM_{2.5}$ have not been adjusted;

- the contribution of existing plant emissions from the Stericycle facility to nitrogen dioxide and benzene concentrations at sensitive receptors has been determined using dispersion modelling, as described below; and
- whether or not there are any exceedances of the annual mean limit value for nitrogen dioxide in the study area has been identified using the maps of roadside concentrations published by Defra (2020) (2022a). These are the maps used by the UK Government, together with the results from national Automatic Urban and Rural Network (AURN) monitoring sites that operate to the required data quality standards, to identify and report exceedances of the limit value. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2022a), which are available for the years 2009 to 2019, show no exceedances of the limit values anywhere in the UK in 2019.

Road Traffic Impacts

4.3 The first step in considering the road traffic impacts of the proposed development has been to screen the development and its traffic generation against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraph 3.7 and detailed further in Appendix A1. Where impacts can be screened out there is no need to progress to a more detailed assessment.

Proposed Plant Impacts

Modelling Methodology

4.4 The impacts of emissions from the proposed plant have been modelled using the ADMS-5.2 dispersion model. ADMS-5.2 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model input parameters are set out in Appendix A3.

4.5 The ADMS-5 model has also been used to model the contribution of existing plant emissions from the Stericycle facility at sensitive receptors.

Emissions Data

4.6 The proposed development will involve the installation of two new gas-fired boilers, with the primary emission being NOx. Emissions of VOCs will also be released from the two additional HDU plants serving the disinfectant process. While the current speciation of the released VOC's are unknown, it is common practive to assume all VOC's are benzene.

4.7 The two new boilers will be required to meet the emissions limits set out in the MCPD, as described in Paragraph 2.4. The site's environmental permit will also contain a VOC emission limit of 30 mg/m^3 for the HDU stacks. HEPA filters will be installed within the flues of the HDU stacks, removing the

vast majority of particulate matter emissions; as such, particulate matter will not be controlled within the site's permit and has not been included within the assessment.

4.8 The emissions data input into the model for the plant have been provided by Stericycle, who are the operators of the site. Further details of the emissions data used in this assessment are provided in Appendix A3.

Operating Hours

4.9 The proposed operations are expected to operate for the majority of the year, with planned closures for maintenance. As a worst-case approach, the plant has been assumed to operate continuously to allow some flexibility in the operational profile. As a result, the assessment is conservative and is likely to have over-predicted the actual impacts of the scheme in terms of concentrations of nitrogen dioxide and benzene.

Meteorological Data

4.10 In order to allow for uncertainties in local and future-year meteorological conditions, the dispersion model has been run five times, with each run using a different full year of hour-by-hour meteorological data from an appropriate meteorological station. For each individual receptor point (discrete receptors and cartesian receptor grid), the maximum predicted concentration across any of the five meteorological datasets has then been determined. It is these maxima which are presented in this report. This approach ensures that worst-case conditions are assessed. Further details of this approach, as well as the meteorological datasets used, are provided in Appendix A3.

Buildings

4.11 Entrainment of the plume into the wake of the buildings (the so-called building downwash effect) has been taken into account in the model. The building dimensions have been obtained from information provided by Stericycle. The locations and relative heights of the modelled buildings are shown in Figure A3.1.

Post-Processing

4.12 Details on how the model outputs have been processed, including the NOx to NO_2 relationship have been calculated, are set out in Appendix A3. Where appropriate, the assessment has followed a worst-case approach, so as not to underestimate the impacts of the proposed plant.

Uncertainty

4.13 The point source dispersion model used in the assessment is dependent upon emission rates, flow rates, exhaust temperatures and other parameters for each source, all of which in reality are variable as the plant will operate at different loads at different times. The actual plant to be installed within the development will also not be confirmed until the proposed development is definitely going ahead,

and thus could be different to that assumed for this assessment. The assessment has, however, addressed this by applying worst-case assumptions where necessary, and provided that the actual plant installed adheres to the restrictions set out in Appendix A3, the conclusions of this assessment will remain valid.

4.14 There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms. These uncertainties cannot be easily quantified and it is not possible to verify the point-source model outputs.

Assumptions

4.15 The following assumptions have been made in carrying out the energy plant emissions modelling, with the assumptions generally seeking to reflect a realistic worst-case scenario:

- that the plant will be installed and fully operational in the year 2023;
- that boilers will operate continuously at full load, which will over-state the emissions from this plant;
- for consideration of concentrations in relation to the short-term objective, that the CHP boilers will run continuously and at full load. This will have led to an over-prediction in modelled concentrations;
- that the assumption that the old boiler meets Tier one emission factors for gasous fuels combusted in boilers under 1 MWth within the European Environment Agency EMAP's guidance (European Environment Agency, 2019); and
- the assessment has assumed that specific plant will be installed; when in reality, the final specifications of the plant are not known at this stage. In this case, it is unclear if a single or multi-flue system will be used for the two disinfectant lines. It has assumed their will be two separate flues.

Descriptors for Air Quality Impacts and Assessment of Significance

Annual Mean Concentrations

IAQM Criteria

4.16 The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[4] (Moorcroft and Barrowcliffe et al., 2017) provides a method for describing the impacts on local air quality arising from development. Impact description involves expressing the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration. Table 3 sets out the matrix for determining the impact descriptor for annual mean concentrations at individual receptors, having

[4] The IAQM is the professional body for air quality practitioners in the UK.

been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards.

Table 3: Air Quality Impact Descriptors for Individual Receptors for All Pollutants [a]

Long-Term Average Concentration At Receptor In Assessment Year [b]	Change in concentration relative to AQAL [c]				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

[a] Values are rounded to the nearest whole number.

[b] This is the "Without Scheme" concentration where there is a decrease in pollutant concentration and the "With Scheme" concentration where there is an increase.

[c] AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, GLA target or an Environment Agency 'Environmental Assessment Level (EAL)'.

4.17 Where all impacts are negligible the overall effect will be 'not significant'.

Environment Agency Criteria

4.18 Furthermore, the Environment Agency has adopted criteria (Environment Agency, 2021) that allow Process Contributions (PC) to be screened out as 'not significant' regardless of the baseline environmental conditions if the long-term (annual mean) PC is <1% of the EAL.

4.19 The above criteria determines when an effect can be screened out irrespective of the baseline conditions. Where they are exceeded, it is necessary to calculate the total concentration (PEC). Guidance does not provide a method for determining the significance of any PEC. In this case, professional judgement should be used. Guidance does make it clear that an explanation of how significance is judged should be provided.

Short-term (1-hour mean) Concentrations

4.20 Given that the hourly mean nitrogen dioxide objective allows a certain number of hours with concentrations exceeding the standard, rather than being a single concentration not to be exceeded, it is not possible to usefully assign a magnitude of change. The objective and limit value allow 18 hours a year to exceed the standard of 200 µg/m^3, thus, in order for them not to be exceeded, the 19th highest hour in a year must not exceed this concentration. The 19th highest hour in a year can be expressed as a 99.79th percentile of hourly mean concentrations, and it is the proposed development's contribution to the 99.79th percentile of hourly mean concentrations that has been determined in this assessment. The 24-hour benzene EAL does not allow for a certain number of

hours of concentrations exceeding; the 100th percentile (maximum) of hourly mean concentrations has therefore been determined.

4.21 EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017) and Environment Agency guidance (Environment Agency, 2020) both recommend a screening criterion of 10% of the short-term environmental standard when assessing short-term concentrations. Thus, if the relevant percentile process contributions from the facility are less than 10% of the objective level, the contribution can be considered 'not significant' without the need to consider total concentrations.

5 Baseline Conditions

Relevant Features

5.1 The Stericycle facility is located on the outskirts of knowsley, approximately 12.6 km to the northeast of the centre of Liverpool. The immediate surrounding area comprises predominantly industrial and commercial properties, with agricultural fields further to the north and east. The nearest residential property is located approximately 330 m to the north of the facility.

Industrial sources

5.2 The current Stericycle facility is the closest major waste/industrial source to the identifed receptors (320 m to the south), as identified within Defra's UK Pollutant Release and Transfer Register (PRTR). Other nearby sources include Knowsley Rail Transfer Loading Station (590 m to the west), Acornfield Road Waste Management Centre (660 m to the south-east), Knowsley Stearate Plant (840 m to the south-west), Baker Petrolite: Kirkby (1 km to the south) and Kirkby Skips Limited (1 km to the south).

Local Air Quality Monitoring

5.3 KMBC operates three automatic monitoring stations within its area, with the closest monitoring site ('Kirkby (new)') located approximately 2.2 km to the west of the facility. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by ESG Didcot (using the 50% TEA in acetone method), with two diffusion tube monitoring sites located within 2 km of the facility.

5.4 Annual mean results for 2019 are summarised in Table 4. The monitoring locations are shown in Figure 3. The monitoring data have been taken from KMBC's 2020 Annual Status Report (Knowsley Metropolitan Borough Council, 2020). The were no recorced exceedances of the 1-hour mean objective in 2019.

Table 4: Summary of Annual Mean NO_2 Monitoring (2019) ($\mu g/m^3$)

Site ID	Site Type	Location	2019
Kirkby (new)	Roadside	Old Rough Lane, Kirkby	24.8
K7	Roadside	LC067 Corner of County Road and Webster	29.6
K10	Roadside	Outside 19 Moorgate Road (A5207)	29.4
Objective			**40**

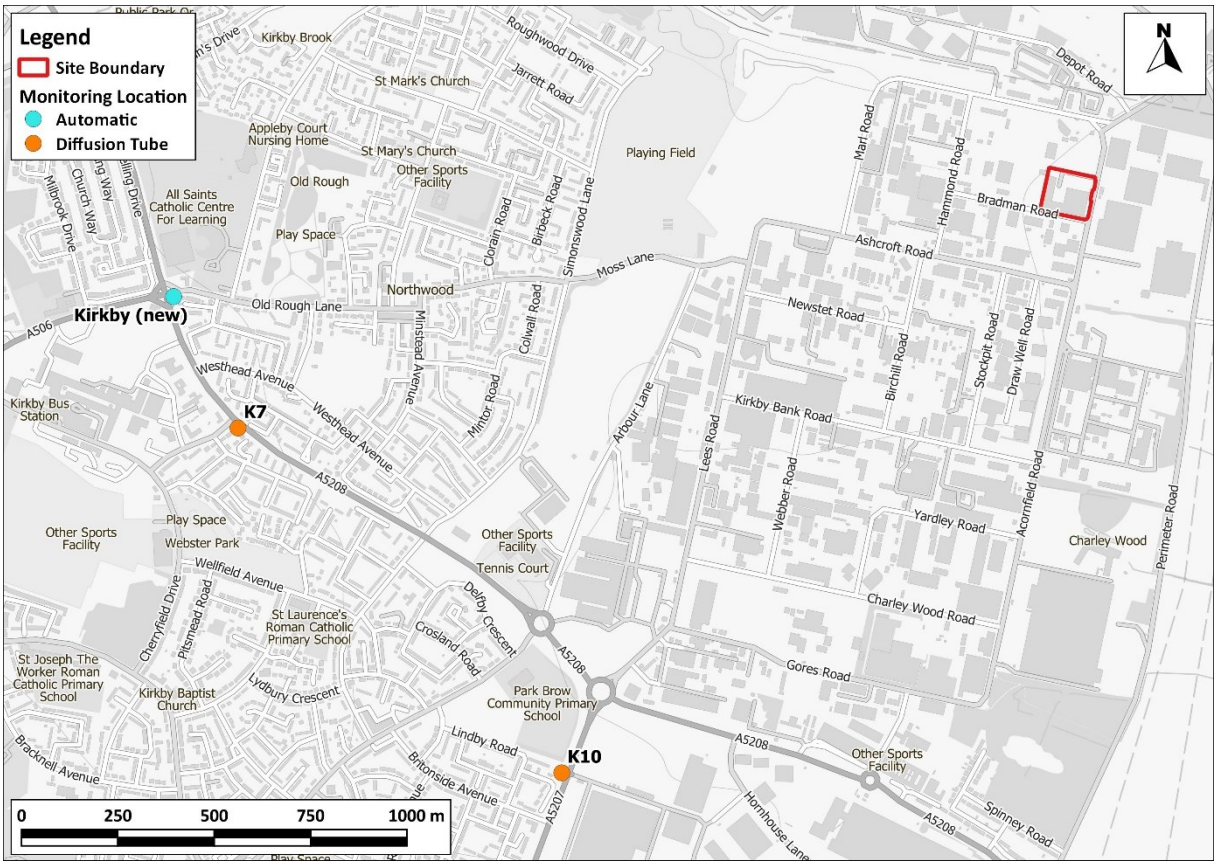

Figure 3: Monitoring Locations and the Application Site Boundary

5.5 As shown in Table 4, there were no recorded exceedances of the annual mean nitrogen dioxide objective at any of the locations in 2019.

5.6 The Kirkby (new) roadside automatic monitoring station is the closest station which measures PM_{10} concentrations. Annual mean results for 2019 are summarised in Table 5, while results relating to the daily mean objective are summarised in Table 6. The closest automatic monitoring site measuring $PM_{2.5}$ concentrations is 'Huyton' station, located approximately 10 km to the south of the

facility; at this distance it is anticipated that conditions at the monitoring station are not representative of conditions at the facility.

Table 5: Summary of Annual Mean PM_{10} Monitoring (2019) (µg/m³)

Site ID	Site Type	Location	2019
PM_{10}			
Kirkby (new)	Roadside	Old Rough Lane, Kirkby	37.6
Objective			**40**

Table 6: Number of Days With PM_{10} Concentrations Above 50 µg/m³

Site ID	Site Type	Location	2019
Kirkby (new)	Roadside	Old Rough Lane, Kirkby	9
Objective			**35**

Exceedances of Limit Value

5.7 There are no AURN (Defra, 2022b) monitoring sites within 1 km of the application site with which to identify exceedances of the annual mean nitrogen dioxide limit value. Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2022a), which are used to identify and report exceedances of the limit value, do not identify any exceedances within 1 km of the application site in 2019. As such, there is considered to be no risk of a limit value exceedance in the vicinity of the proposed development by the time that it is operational.

Background Concentrations

5.8 Estimated background concentrations provided by Defra (see Paragraph 4.2) at the proposed development are set out in Table 7 and are all well below the objectives.

Table 7: Estimated Annual Mean Background Pollutant Concentrations in 2019 and 2023 (µg/m³)

Year	NO_2	PM_{10}	$PM_{2.5}$	Benzene
2019	14.5	12.1	7.8	0.447 [b]
2023	12.7	11.5	7.4	n/a
Objective	**40**	**40**	**25** [a]	**5**

[a] The 25 µg/m³ $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

[b] Taken from 2001 Defra background maps (projected forward to 2010).

Baseline Dispersion Model Results

5.9 Table 8 and Table 9 presents annual and short-term baseline concentrations of nitrogen dioxide and benzene at the selected existing receptor location (see Table 2 and Figure 2 for the receptor location), respectively. The baseline includes the 2023 Defra background concentrations (Table 7) and modelled process contributions from the existing plant operations. The Defra background concentration is likely to capture some emissions from the existing plant's operations and therefore this approach is likely to over-estimate baseline concentrations.

Table 8: Predicted Baseline Concentrations (µg/m^3) of Annual Nitrogen Dioxide and Benzene at Nearby Residential Receptors in 2023

Receptor	Nitrogen Dioxide	Benzene
1	12.84	0.53
Objective	**40**	**5**

Table 9: Predicted Baseline Concentrations (µg/m^3) of Short-Term Nitrogen Dioxide and Benzene at Nearby Residential Receptors in 2023

Receptor	Nitrogen Dioxide	Benzene
1	26.86	1.79
2	26.76	1.67
3	26.67	2.32
Objective	**200**	**30**

5.10 As common practice for assessing against short-term standards (1-hour and 24-hour means), the annual mean backgrounds presented have been doubled before being added to the short-term process contributions to derive the total baseline concentrations.

6 Impact Assessment

Assessment of Development-Generated Road Traffic Emissions

6.1 The proposed development is expected to generate a total of 26 daily light vehicle trips and 60 daily heavy duty vehicle trips, which will either use Acornfield Road or North Perimeter Road to exit the industrial estate; these daily trip rates are below the screening threshold of 500 LDVs and 100 HDVs recommended for use outside of an AQMA in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017) (see Paragraph 3.8). As such, it is judged that the relevant screening thresholds will not be exceeded and there is no requirement for a detailed assessment of road traffic impacts at existing receptors. It can be therefore be concluded that the proposed development will not have a significant impact on local roadside air quality.

Assessment of Energy Plant Emissions

Annual Mean Concentrations

6.2 The predicted annual mean nitrogen dioxide and benzene concentrations at the existing receptor are shown in Table 10. The concentrations shown for "Without Plant" are the baseline (the sum of the background concentration and the existing Stericycle plant (see Table 8)), and the "With Plant" concentrations are the baseline and concentrations from the proposed plant. Concentrations have been calculated following the methodology set out in Section 4 and in Appendix A3.

6.3 The annual mean nitrogen dioxide and benzene concentrations are well below the objective at all receptors. The percentage changes in concentrations, relative to the air quality objective (when rounded), are predicted to be 0% for nitrogen dioxide and 3% for benzene. Using the matrix in Table 3, the nitrogen dioxide and benzene impacts are described as *negligible.*

6.4 In addition, using the Environmental Agency criterion, mentioned in Paragraph 4.19, the process contribution for benzene is higher than 1%, and as such it is not insignificant. However, the total long-term concentration (0.78 µg/m^3) is 16% of the long term benzene EAL (5 µg/m^3). Based on the low contribution from the Stericycle site and the low total concentration, the benzene impacts are judged to be 'not significant'.

Table 10: Predicted Total Contributions of Nitrogen Dioxide and Benzene at the Selected Residential Receptor (µg/m³)

Receptor	Without Plant	With Plant	% Change [a]	Impact Descriptor
Nitrogen Dioxide				
1	12.84	12.99	0%	Negligible
Objective	**40**		-	-
Benzene				
1	0.53	0.70	3%	Negligible
Objective	**5**		-	-

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

6.5 The results of the modelling across the receptor grid have been used to produce a contour plot of the process contributions, which is shown in Figure 4 below. The 0.2 µg/m³ (0.5%) and 0.6 µg/m³ (1.5%) contours represent the IAQM percentage change as displayed in Table 3. No relevant sensitive receptors are located within either contours.

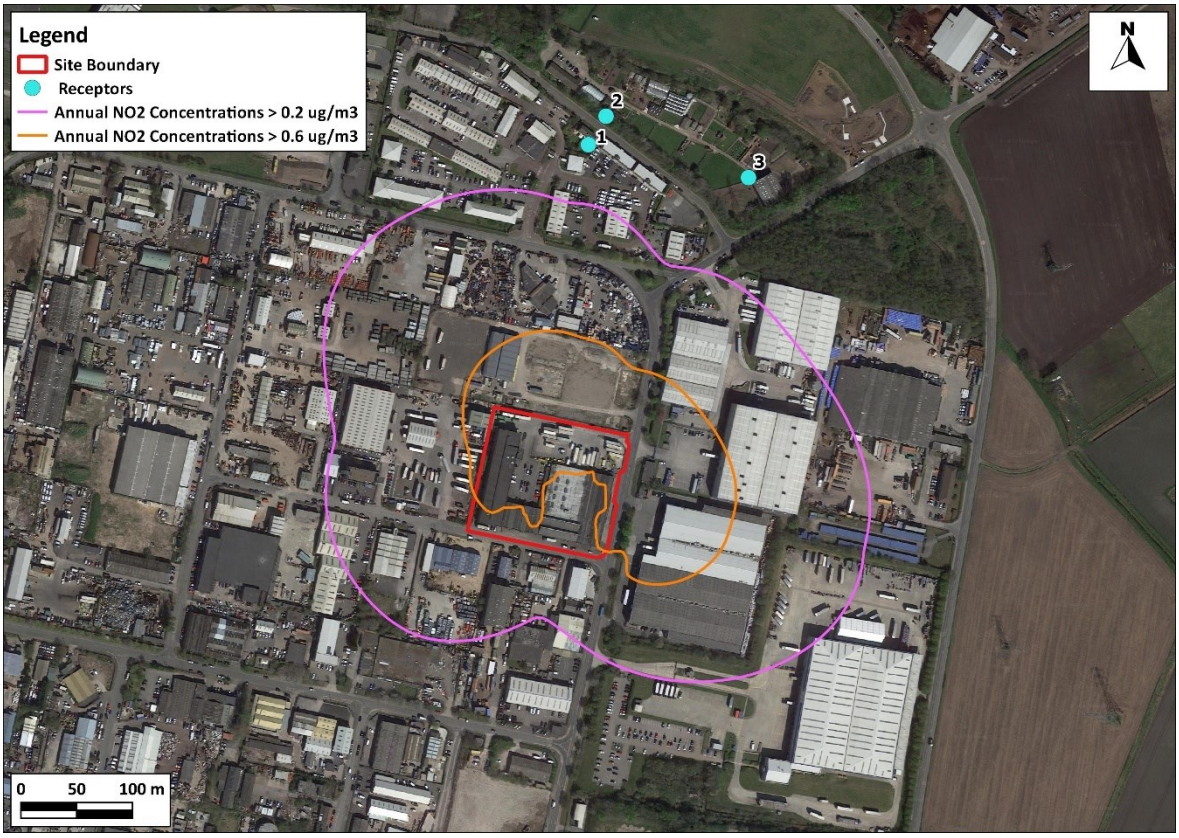

Figure 4: Annual NO_2 Contours – Proposed Plant Only

Short-term Impact Assessment

6.6 Relevant locations for the short-term objectives are locations where members of the public are likely to regularly spend 1-hour or 24-hours. For the short-term nitrogen dioxide objective all three receptor locations (shown in Figure 2) are relevant. For the short-term 24-hour benzene objective, it is not known for how long during the day people will be present at Acorn Farm and so all receptors are presented for completeness. The predicted short-term mean nitrogen dioxide and benzene concentrations are shown in Table 11. The concentrations shown for "Without Plant" are the baseline (2 x the background concentration and the existing Stericycle plant (see Table 8)), and the "With Plant" is 2 x the background concentration and concentrations from the entire plant.

Table 11: Predicted 99.79th Percentile of 1-hour Nitrogen Dioxide and 100th Percentile of 24-hour Benzene Process Contributions at Human Receptors (µg/m³) [b]

Receptor	Without Plant	With Plant	% Change [a]
Nitrogen Dioxide			
1	26.86	28.39	1%
2	26.76	28.23	1%
3	26.67	27.92	1%
Objective	**200**		**-**
Benzene			
1	1.79	3.58	6%
2	1.67	3.23	5%
3	2.32	5.16	9%
Objective	**30**		**-**

[a] % changes are relative to the objective and have been rounded to the nearest whole number.

[a] As common practice for assessing against short-term standards (1-hour and 24-hour means), the annual mean backgrounds presented in section 5 have been doubled before being added to the short-term process contributions to derive the total concentrations

6.7 Table 11 demonstrates that the maximum change in the 99.79th percentile of 1-hour nitrogen dioxide concentrations at any receptor will not exceed 20 µg/m³, or 10% of the 1-hour mean nitrogen dioxide objective, and the maximum change of the 24-hour benzene concentrations will not exceed 3 µg/m³, or 10% of the 24-hour mean benzene objective. Thus, the process contributions are judged to be 'not significant', inline with IAQM and EA guidances (see Paragraph 4.20).

6.8 Furthermore, it can be concluded that the nitrogen dioxide hourly mean and 24-hour mean benzene objectives will not be exceeded at any receptor and thus the impacts will be 'not significant'.

6.9 Figure 5 presents the modelled short-term benzene concentration contour from the proposed plant only. The 3 µg/m^3 contour represents the 10% IAQM screening criterion of the short-term environmental standard (30 µg/m^3); no relevant sensitive receptors are located within the contour.

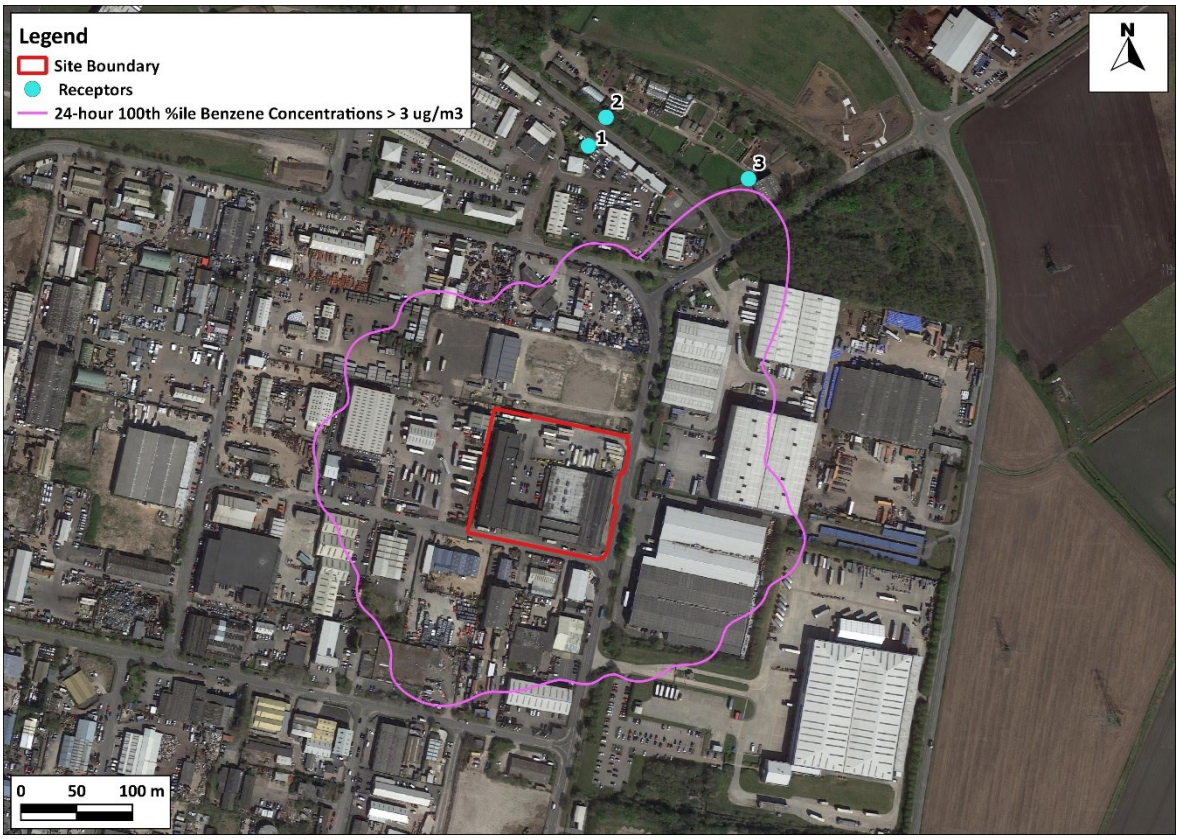

Figure 5: Short-Term Benzene Contour – Proposed Plant Only

Combined Effect of Road Transport and Plant

6.10 The residential receptor where the plant impacts are predicted to be greatest is unlikely be impacted by the road traffic from the site. Vehicles would normally access the site via Acornfield Road or North Perimeter Road, while the residential receptor is located on Depot Road. Therefore the impacts of both emissions sources are not judged to combine to create the risk of significant impacts.

Significance of Operational Air Quality Effects

6.11 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A1 and takes account of the assessment that:

- proposed additional traffic generation will be all below IAQM screening thresholds;

- pollutant concentrations at all of the selected worst-case existing receptors will be well below the air quality objectives, and all of the impacts from the plant are predicted to be *negligible*; and
- the combined effect of plant emissions and road traffic are not judged to have a significant impact on local air quality.

7 Mitigation

7.1 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures, which have been accounted for in the assessment as far as is possible:

- HEPA filters installed within the flues of the HDU stacks.
- installation of boilers that will meet MCDP emission limits; and
- running of the boiler flues to 1 m above roof level and operating with a minimum efflux velocity of 10 m/s to ensure a satisfactory dispersion environment.

7.2 The assessment has demonstrated that the overall air quality effect of the proposed development will be not significant; development-generated traffic or stack emissions will not have a significant impact on local air quality. It is, therefore, not considered necessary to propose further mitigation measures for this development.

8 Conclusions

8.1 The impacts associated with the proposed expansion of the Stericycle healthcare waste treatment facility have been assessed in relation to the air quality objectives to protect human health.

8.2 The assessment has demonstrated that the proposed development will generate additional traffic, along the local road network, below published screening criteria, hence it will not have a significant impact on local roadside air quality. It has also demonstrated that the impacts in terms of annual mean nitrogen dioxide and benzene concentrations at local sensitive receptos are all *negligible*, and their respective short-term objectives will not be exceeded. Furthermore, the combined effect of plant emissions and road traffic are not judged to have a significant impact on local air quality

8.3 The overall operational air quality effects of the proposed development are judged to be 'not significant'.

8.4 Taking into account these conclusions, it is judged that the proposed development is consistent with Paragraph 185 of the NPPF, being appropriate for its location both in terms of its effects on the local air quality environment. It is also consistent with Paragraph 186, as it will not affect compliance with relevant limit values or national objectives.

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10 Glossary

ADMS-5	Atmospheric Dispersion Modelling System model for point sources
AQAL	Air Quality Assessment Level
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EPUK	Environmental Protection UK
EU	European Union
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
IAQM	Institute of Air Quality Management
JAQU	Joint Air Quality Unit
kW	Kilowatt
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
µg/m^3	Microgrammes per cubic metre
MCPD	Medium Combustion Plant Directive
MW$_{th}$	Megawatts Thermal
NO$_2$	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
OEP	Office for Environmental Protection
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides

PC	Process Contribution
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide

11 Appendices

A1 EPUK & IAQM Planning for Air Quality Guidance

A1.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

A1.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

A1.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A1.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;

- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A1.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

"It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the "damage cost approach" used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential".

A1.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

A1.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use; and/or
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.

A1.8 Coupled with any of the following:

- the development has more than 10 parking spaces; and/or
- the development will have a centralised energy facility or other centralised combustion process.

A1.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

A1.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A1.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm^3.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

A1.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

A1.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".

A1.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Assessment of Significance

A1.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

A1.16 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A1.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A1.18 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A2.

A2 Professional Experience

Martin Peirce, BSc (Hons), MSc, MIEncSci, MIAQM

Mr Peirce has some thirty years' experience in environmental modelling and assessment, most relating to air quality and carbon and greenhouse gases (GHGs). He has extensive experience in the calculation of emissions to air and compiling emission inventories, for both local air quality assessments and carbon footprinting. For air quality, he also has extensive expertise in modelling the atmospheric dispersion of pollutants for comparison against regulatory limits and for assessment of health and environmental impacts. He has prepared assessments in support of Environmental Impact Assessments (EIA), permit applications and planning applications (under both Town and Country Planning Act (TCPA) and Development Consent Order (DCO) regimes). He has particular experience in modelling aviation and transport sources, non-road mobile machinery, construction and industrial sources.

Mr Adam Dawson, BSc (Hons) MSc MIAQM AMIEnvSc

Mr Dawson is a Senior Consultant with AQC with over eight years' experience in the field of air quality assessment. He undertakes air quality and odour assessments for AQC, covering residential and commercial developments, industrial installations, energy centres and waste facilities. He has experience using a range of dispersion models including ADMS-Roads, ADMS-5 and Breeze AERMOD to complete quantitative modelling assessments, for both planning and permitting purposes. He previously spent over two years as part of the Environment Agency's permitting team, so has extensive experience of the permitting process and industrial emissions. He is a Member of the Institute of Air Quality Management and an Associate Member of the Institution of Environmental Sciences.

George Chousos, BSc MSc AMIEnvSc AMIAQM

Mr Chousos is a Consultant with AQC, having joined in May 2019. Prior to joining AQC, he completed an MSc in Air Pollution Management and Control at the University of Birmingham, specialising in air pollution control technologies and management, and data processing using R. He also holds a degree in Environmental Geoscience from the University of Cardiff, where he undertook a year in industry working in the field of photo-catalytic technology. He is now gaining experience in the field of air quality monitoring and assessment.

A3 Modelling Methodology

Model Inputs

A3.1 The impacts of emissions from the proposed steam boilers and HDU plant have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The model has been run to predict the contribution to annual mean concentrations of nitrogen oxides and benzene, the 99.79th percentile of 1-hour mean nitrogen oxides concentrations, and the 100th percentile of 24-hour mean benzene concentrations. Model input selections are summarised in Table A3.1, and, where considered necessary, discussed further below. Input emission parameters are presented later in Table A3.2.

Table A3.1: Summary of Model Inputs

Model Parameter	Value Used
Terrain Effects Modelled?	No
Variable Surface Roughness File Used?	Yes – 1.5km x 1.5km Cartesian grid at 50m resolution
Urban Canopy Flow Used?	No
Building Downwash Effects Modelled?	Yes
Meteorological Monitoring Site	Crosby
Meteorological Data Years	2017 - 2021
Dispersion Site Surface Roughness Length (m)	n/a (variable surface roughness file used)
Dispersion Site Minimum MO Length (m)	30
Met Site Surface Roughness Length (m)	0.3
Met Site Surface Minimum MO Length (m)	1

Emissions and Release Conditions

A3.1 The proposal is for the addition of two 1.25 MW natural gas steam boilers and two HDU stacks serving the disinfectant process. The model input parameters for the proposed plant have been derived from the information and datasheets provided by Stericyle. It should be noted that the baseline conditions have been informed by modelling the existing 850 kW boiler and a single HDU stack. Detailed specifications for all on-site combustion plant have been provided by Stericyle.

A3.2 The new boilers will be required to conform to the requirements of the MCPD, having NOx emissions below 100 mg/Nm^3 at 3% O_2. The current HDU operations are required to conform to the VOC emission limit values set out in their permit, as will the new HDU plant; however, emissions of VOCs from the boilers are negligible and are not normally regulated.

A3.3 The emissions parameters employed in the modelling are given in Table A3.2. The model input parameters have been calculated based on information provided by the Stericycle and summarised

in Table A3.2. The table shows the technical details and model input parameters for the new and existing boilers and HDU units.

Table A3.2: Plant Specifications, Emissions and Release Conditions

Parameter	Unit	Boiler 1 (new)	Boiler 2 (new)	Boiler 3 (existing)	HDU Stack 1 (existing)	HDU Stack 2 (new)	HDU Stack 3 (new)
Stack Location	OSGB (m)	343773, 399267	343775, 399266	343783, 399234	343775, 99250	343775, 399250	343775, 399249
Stack Height (above ground level)	m	11.554	11.554	5.8	11.554	11.554	11.554
Net Fuel Input	kW	1,250	1,250	850	n/a	n/a	n/a
Gross Fuel Input	kW	1,384	1,384	886	n/a	n/a	n/a
NOx Emission Rate	mg/Nm^3 [a]	100	100	289.2 [e]	n/a	n/a	n/a
	g/s	0.03497	0.03497	0.06473	n/a	n/a	n/a
Benzene Emission Rate	mg/Nm^3 [b]	n/a	n/a	n/a	30	30	30
	g/s	n/a	n/a	n/a	0.03	0.03	0.03
Exit Diameter	m	0.305	0.305	0.305	0.61 [c]	0.61 [c]	0.61 [c]
Exit Temperature	°C	100 [d]	100 [d]	100 [d]	22	22	22
Volumetric Flow Rate	Nm^3/s	0.350 [a]	0.350 [a]	0.224 [a]	0.84 [b]	0.84 [b]	0.84 [b]
	m^3/s	1.016	1.016	0.650	0.92	0.92	0.92
Efflux Velocity	m/s	13.91	13.91	8.90	3.14	3.14	3.14
Operational Hours per Annum	Hours	8760	8760	8760	8760	8760	8760

[a] Normalised conditions are 0 °C, 101 kPa, 3 % O_2 in dry gas.

[b] Normalised conditions are 0 °C, 101 kPa

[c] Derived from the provided volumetric flow rate and flue gasexit velocity.

[d] Unknown at this stage; a worst case temperature based on professional judgement has been assumed.

[e] it has been assumed that the existing boiler exhausts at Tier one emission factors for gasous fuels combusted in boilers under 1 MWth, within the European Environment Agency EMAP's guidance (European Environment Agency, 2019)

A3.4 Entrainment of the plume into the wake of the nearby buildings (the so-called building downwash effect) has been taken into account by including these as buildings within the model. Two separate modelling scenarios have been run, with and without building effects, and the maximum contribution from any scenario has been presented in this report. The modelled buildings are shown in Figure A2.1 and A2.2.

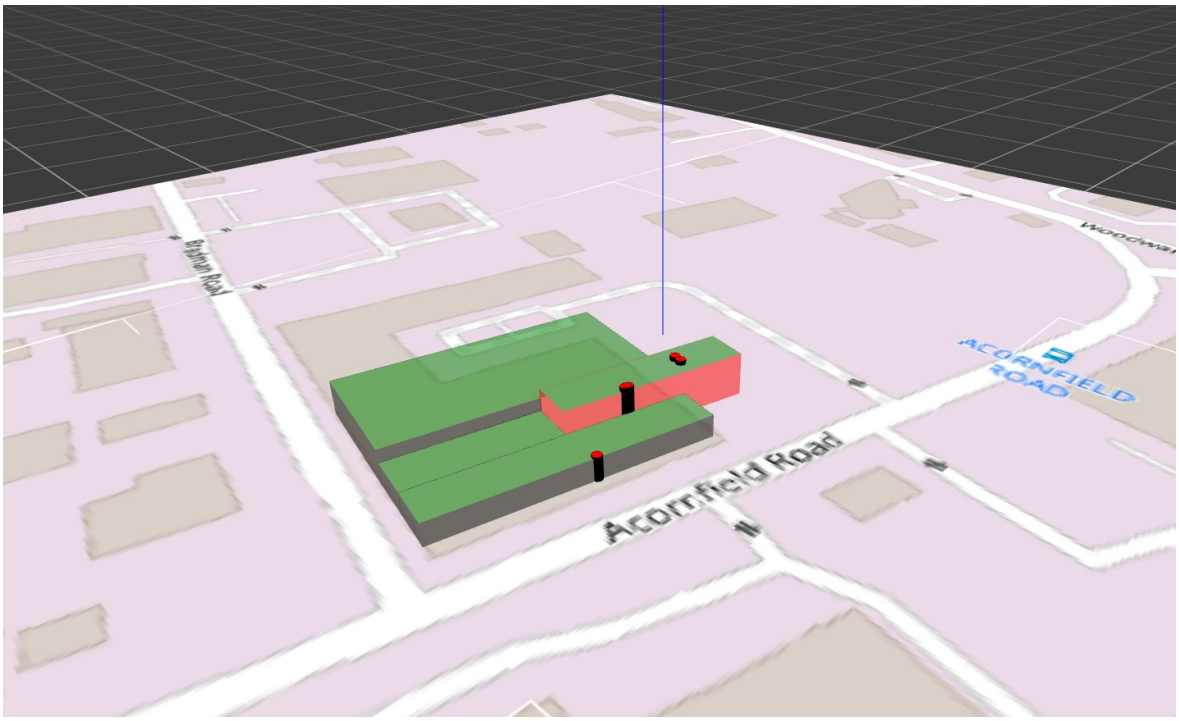

Figure A3.1: Modelled Buildings and Stacks

Meteorological Inputs

A3.5 Hourly sequential meteorological data from Crosby meteorological station for the years 2017 - 2021 have been used. Crosby meteorological monitoring station is located approximately 6.5 km to the southeast of the proposed development site. It is deemed to be the nearest monitoring station representative of meteorological conditions at the proposed development site, with both being inland sites.

A3.6 The maximum concentrations predicted using any of the five years of meteorological data and either of the building scenarios have been used in the preparation of the results set out in Section 5.

A3.7 The study area encompasses a range of land types. A variable surface roughness file has been used to represent the spatial variation of the surface roughness over each land type. The following parameters have been used in creating this file:

- forest – 1 m;
- built-up area – 1 m;

- grassland – 0.2 m; and
- water – 0.0001 m.

Model Post-processing

A3.8 For the initial screening of nitrogen dioxide process contributions, the approach recommended by the Environment Agency (2020) has been used assuming that:

- annual mean nitrogen dioxide contributions = annual mean nitrogen oxides x 0.7; and
- 99.79th percentile of 1-hour mean nitrogen dioxide contributions = 99.79th percentile of 1-hour mean nitrogen oxides x 0.35.

A3.9 These NOx to NO_2 ratios are likely to be pessimistic within close proximity of the facility. The NOx emissions require time and O_3 available to react and convert to NO_2, thus 35% NO_X to NO_2 ratio for short-term impacts is considered worst-case for receptors within 500 m of the site.