GRAYS INN ROAD, CAMDEN

AIR QUALITY ASSESSMENT

VC-0060461-EN-RP-0001
R00

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VANGUARDIA

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1. INTRODUCTION

1.1. Vanguardia has been commissioned by Hollis Global to undertake an Air Quality Assessment (AQA) to discharge a planning condition for the consented development (planning ref: 2021/3673/P) at 85 Gray's Inn Road, London. The National Grid Reference for the centre of the site is TQ 30876 82145. The location of the consented site is shown in Figure 1.

Figure 1 Site Location

1.2. The proposals for the consented development are for the alterations and extension of building to rear at basement level to level 4, installation of fume extract and mechanical plant, front entrance canopy and associated alterations and infrastructure work. Part of the alterations are for the creation of up to six fume cupboards per floor, which will be ducted through six 9 m flues on the roof of the building, as illustrated in Figure 3.

1.3. The planning condition to which this AQA relates to is no.6, which states:

"Prior to occupation, a revised air quality assessment report, written in accordance with the relevant current guidance, for the existing site and proposed development shall be submitted to and approved by the Local Planning Authority. The development shall be at least Air Quality Neutral and an air quality neutral assessment for both buildings and transport shall be

included in the report. The assessment shall include details of the flue stack for the fume cupboards. The assessment shall assess the current baseline situation in the vicinity of the proposed development. The report shall include all calculations and baseline data, and be set out so that the Local Planning Authority can fully audit the report and critically analyse the content and recommendations. If required a scheme for air pollution design solutions or mitigation measures based on the findings of the report shall be submitted to and approved by the Local Planning Authority prior to development. This shall include mitigation for when air quality neutral transport and building assessments do not meet the benchmarks. The approved design or mitigation scheme shall be constructed and maintained in accordance with the approved details."

Reason: To protect the amenity of residents in accordance with London Borough of Camden Local Plan Policy CC4 and London Plan policy SI 1.

1.4. This assessment has been undertaken to assess if the consented development is likely to give rise to any significant air quality impacts, and to establish the magnitude and the significance of such impacts caused as a result of the consented development in respect to the prevailing environmental conditions.

1.5. The report is structured as follows:

- Section 2 sets out an overview of the national, regional and local air quality policy context, in relation to the development proposals;
- Section 3 details the methodology for estimating the air quality impacts;
- Section 4 assesses the operational impacts as a result of the consented development;
- Section 5 describes potential mitigation measures for the operational phase(s) (where required);
- Section 6 assesses whether the consented development is 'air quality neutral'; and
- Section 7 summarises and concludes the assessment.

1.6. To note, the end users of the fume cupboards is not known at the time of writing. However, it is anticipated solvents are expected to be in common use in the fume cupboards in all laboratories on a daily basis. There will be regular emissions at low levels, and accidental spillages can be expected to occur occasionally.

1.7. Common solvents include ethanol, n-heptane and methanol. The assessment has assumed a continuous emission of methanol, expected to be one of the most commonly used solvents in the fume cupboards and the one which has the most stringent workplace exposure limits (WELs), as outlined by the Environment Agency.

1.8. To note, this is consistent with other AQA's Vanguardia have undertaken within Camden (planning ref: 2022/5563/P),

2. LEGISLATION / STRATEGY / POLICY CONTEXT

EUROPEAN LEGISLATION

2.1. Air pollutants at high concentrations can give rise to adverse effects upon the health of both humans and ecosystems. The European Union (EU) legislation on air quality forms the basis for the national UK legislation and policy.

2.2. The EU Framework Directive 2008/50/EC came into force in May 2008 and sets out legally binding limits for concentrations of the major air pollutants that can impact on public health. This Directive came into force in England in June 2010. Amendments to this Directive was made following amendments to the 2008/50/EC and 1004/107/EC on air quality made by Directive 2015/1480/EC. The updated Directive, The Air Quality Standards (Amendment) Regulations 2016, came into force on 31st December 2016[1].

2.3. Following the UK's departure from the EU and the Brexit transition period the previous EU Legislation has been retained in the United Kingdom. The following text is taken from the legislation.gov.uk website[2] setting out details of the retention:

"The UK is no longer a member of the European Union. EU legislation as it applied to the UK on 31 December 2020 is now a part of UK domestic legislation, under the control of the UK's Parliaments and Assemblies, and is published on legislation.gov.uk.

[...]

EU legislation which applied directly or indirectly to the UK before 11.00 p.m. on 31 December 2020 has been retained in UK law as a form of domestic legislation known as 'retained EU legislation'. This is set out in sections 2 and 3 of the European Union (Withdrawal) Act 2018 (c. 16)."

NATIONAL LEGISLATION

2.4. Part IV of the Environment Act 1995[3] requires local authorities to review and assess the air quality within their boundaries. As a result, the Air Quality Strategy was adopted in 1997, with national health-based standards and objectives set out for the, then, eight key air pollutants including benzene, 1-3 butadiene, carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter and sulphur dioxide.

[1] Statutory Instrument, 2016. The Air Quality Standards Regulations,' No. 1184. Queen's Printer of Acts of Parliament.
[2] EU legislation and UK law. Accessible at: https://www.legislation.gov.uk/eu-legislation-and-uk-law
[3] Department for Environment, Food and Rural Affairs (1995) The Environment Act. HMSO, London.

2.5. Part IV of the Environment Act 2021[4] amends both the Environment Act 1995 and the Clean Air Act 1993. It builds on the foundations provided by Part IV of the Environment Act 1995 and strengthens the local air quality management framework. The act allows the Secretary of State to make provisions for, about or connect with the recall of relevant products that do not meet relevant environmental standards.

2.6. The government has resisted calls for the adoption of the recently updated World Health Organisation (WHO) air quality guidelines, specifically targeting particulate matter pollution. The act does introduce a duty on the government to bring forward at least two air quality targets by October 2022 for consultation that will be set in secondary legislation, which, after a delay[5], has now been introduced in secondary legislation. The first aim of the legislation is to reduce the annual average level of fine particulate matter ($PM_{2.5}$) in ambient air. The second aim is to set a long-term target (set a minimum of 15 years in the future), which the government says, *"will encourage long-term investment and provide certainty for businesses and other stakeholders."*

England Air Quality Standards

2.7. The Air Quality Strategy[6] sets out air quality objectives and policy options to further improve air quality in the UK from today into the long term. The Air Quality Strategy has since been updated[7] and includes a range of actions, for both local authorities and the UK government, to improve air quality across the UK. Examples of actions set out in the Air Quality Strategy include tighter emissions standards for vehicles and machinery, greater use of low-emission vehicles, and new rules on burning solid fuels, as well as local action to support the delivery of the recently implemented $PM_{2.5}$ targets.

2.8. The pollutant standards relate to ambient pollutant concentrations in air, set on the basis of medical and scientific evidence regarding how each pollutant affects human health. Pollutant objectives are the future dates by which each standard is to be achieved, taking into account economic considerations, practical and technical feasibility.

2.9. The air quality objectives are managed through the Local Air Quality Management, (LAQM) regime, which is defined within the Air Quality (England) Regulations 2000, (SI 928) and the Air Quality (England) (Amendment) Regulations 2002, (SI 3043). Table 1 lists the Environmental Assessment Levels (EALs) that are relevant to this AQA.

[4] Department for Environment, Food and Rural Affairs (2021) The Environment Act. HMSO, London.
[5] UK Government, Update on Progress on Environmental Targets. Accessible at: https://www.gov.uk/government/news/update-on-progress-on-environmental-targets
[6] Department for Environment Food and Rural Affairs, 2007. *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*, Cm 7169, Department for Environment Food and Rural Affairs.
[7] Department for Environment Food and Rural Affairs, 2023. *Air quality strategy: framework for local authority delivery.*

Table 1 Environmental Assessment Levels (England)

Pollutant	Average Period	Standard	Percentile Equivalent
Methanol (CH_3OH)	Annual Mean	2,660 µg/m^3	-
	1-hour Mean	33,300 µg/m^3	-

PLANNING POLICY

NATIONAL POLICY AND STRATEGY

National Planning Policy Framework

2.10. The National Planning Policy Framework (NPPF) (2023)[8] sets out the planning policy for England, to help achieve sustainable development within the planning sector, 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"*

2.11. . Paragraph 105 states:

> *"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making."*

2.12. Paragraph 174 states:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *[..]*
>
> *e) 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*

[8] Department of Levelling Up, Housing & Communities, 2023. National Planning Policy Framework

improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

[..]"

2.13. 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."

2.14. Paragraph 186 states:

"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."

2.15. Paragraph 188 states:

"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 should not be revisited through the permitting regimes operated by pollution control authorities."

2.16. The NPPF also sets out the national planning policy on biodiversity and conservation. This emphasises that the planning system should seek to minimise effects on and provide net gains in biodiversity, wherever possible, as part of the Government's commitment to halting decline and establishing coherent and resilient ecological networks.

Planning Practice Guidance

2.17. The NPPF is supported by Planning Practice Guidance (PPG)[9] (DMBCLG, 2021), which includes guiding principles on how planning can take account of the impacts of new development on air quality.

2.18. Paragraph 001 Reference ID: 32-001-20191101 states:

"The 2008 Ambient Air Quality Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that affect public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2).

The UK also has national emission reduction commitments for overall UK emissions of 5 damaging air pollutants:

- *fine particulate matter ($PM_{2.5}$)*
- *ammonia (NH_3)*
- *nitrogen oxides (NO_x)*
- *sulphur dioxide (SO_2)*
- *non-methane volatile organic compounds (NMVOCs)*

As well as having direct effects on public health, habitats and biodiversity, these pollutants can combine in the atmosphere to form ozone, a harmful air pollutant (and potent greenhouse gas) which can be transported great distances by weather systems. Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

2.19. Paragraph: 005 Reference ID: 32-005-20191101 states:

"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.

Where air quality is a relevant consideration the local planning authority may need to establish:

[9] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government. Planning Practice Guidance. Accessible at: http://planningguidance.planningportal.gov.uk/

- *The 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality"*

Environmental Improvement Plan

2.20. The Environmental Improvement Plan 2023 is the first revision of the 25 year Environment Plan[10], and sets out how the 25 Year Environmental Plan goals, Environment Act targets, and other commitments that have been made domestically and internationally will combine to drive specific improvements in the natural environment. This is to be reviewed every five years, with the next review due in 2028.

2.21. Goal 2 – Clean Air sets out what the government has achieved since 2018, which includes publishing the Clean Air Strategy[11] in 2019, reducing pollution from domestic burning and publishing the Transport Decarbonisation Plan[12], all of which aim to improve air quality.

2.22. The document sets out the following measures and interventions to be implemented in order to tackle poor air pollution:

- A legal target to reduce population exposure to $PM_{2.5}$ by 35% in 2040 compared to 2018 levels, with a new interim target to reduce by 22% by the end of January 2028.
    - Interim target - Compared to 2018, the reduction in population exposure to $PM_{2.5}$ in the most recent full calendar year must be 22% or greater.
- Legal concentration limits for a number of other key pollutants. The majority of these limits, including for sulphur dioxide and coarse particulate matter, are already met; however, nitrogen dioxide still exceeds its annual mean objective, therefore the government is working towards meeting compliance with the 40 $\mu g/m^3$ limit.
- A legal target to require a maximum annual mean concentration of 10 micrograms of $PM_{2.5}$ per cubic metre ($\mu g/m^3$) by 2040, with a new interim target of 12 $\mu g/m^3$ by the end of January 2028.
    - The highest annual mean concentration in the most recent full calendar year must not exceed 12 $\mu g/m^3$ of $PM_{2.5}$.

[10] Department for Environment, Food and Rural Affairs, 2018. *A Green Future: Our 25 Year Plan to Improve the Environment.*
[11] Department for Environment, Food and Rural Affairs, 2019. *Clean Air Strategy 2019.*
[12] Department for Transport, 2021. *Decarbonising Transport. A Better, Greener Britain.*

- Legal emission reduction targets for five damaging pollutants by 2030 relative to 2005 levels:
  - Reduce emissions of nitrogen oxides by 73%.
  - Reduce emissions of sulphur dioxide by 88%.
  - Reduce emission of $PM_{2.5}$ by 46%.
  - Reduce emissions of ammonia by 16%.
  - Reduce emissions of non-methane volatile organic compounds by 39%.

2.23. These measures will be monitored through the Annual Progress Report and the Outcome Indicator Framework. As noted previously, these targets have been set by central government, as opposed to local authorities directly assessing $PM_{2.5}$ concentrations against these targets.

National Clean Air Strategy

2.24. The Clean Air Strategy[13] was published in January 2019 and sets out how the government will improve air quality nationally. The document aims to tackle the issue of air quality across all parts of government and society to protect public health and the environment, and identifies what needs to be done to achieve this. The document complements the Industrial Strategy (archived), the Clean Growth Strategy[14] and the 25 Year Environment Plan[15] and is a key part of delivering the government's 25 Year Environmental Plan.

2.25. The document has adopted international targets to reduce emissions of fine particulate matter, ammonia, nitrogen oxides, sulphur dioxide and non-methane volatile organic compounds by 2020 and 2030. The document proposes tougher goals to cut public exposure to particulate matter pollution, as recommended by the WHO.

2.26. The strategy not only targets the reduction of emissions, but also a reduction in exposure.

REGIONAL POLICY AND STRATEGY

London Plan

2.27. The London Plan[16] is the third London Plan and was published in March 2021. It is a new plan and brings together the geographical and locational aspects of the Mayors other strategies, which includes the environment. The plan provides an appropriate spatial strategy that plans for London's growth in a sustainable way.

2.28. The new London Plan includes one policy that is specifically related to air quality.

[13] Department for Environment, Food and Rural Affairs, 2019. Clean Air Strategy 2019.
[14] Department for Business, Energy and Industrial Strategy, 2017. The Clean Growth Strategy.
[15] Department for Environment, Food and Rural Affairs, 2018. A Green Future: Our 25 Year Plan to Improve the Environment.
[16] Greater London Authority, 2021, *The London Plan 2021.*

2.29. Policy SI 1 Improving air quality, states:

"A. Development Plans, through relevant strategic, site-specific and area based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B. To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1. Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) create unacceptable risk of high levels of exposure to poor air quality.

2. In order to meet the requirements in Part 1, as a minimum:

a) Development proposals must be at least air quality neutral

b) Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retrofitted mitigation measures

c) Major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) Development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people, should demonstrate that design measures have been used to minimise exposure.

C. Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

1) How proposals have considered ways to maximise benefits to local air quality, and

2) What measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D. In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E. Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development."

2.30. The new London Plan also has several other policies which make reference to air quality. The relevant aspects of these polices can be found in the London Plan document, and include areas such as parking, energy infrastructure and many more.

Mayor of London Air Quality Strategy

2.31. The Mayor of London Air Quality Strategy[17] was published in December 2010 and aims to reduce air pollution in London so that the health of Londoners is improved. In order to achieve this the EU air quality limits values need to be achieved as soon as possible. This will be achieved through a number of measures, some of which include the Congestion charging and London Low Emission Zone (LEZ), development of electric vehicle infrastructure, funding and supporting car clubs. Additional measures are outlined in the document.

Mayor of London Environmental Strategy

2.32. The Mayor of London Environment Strategy[18] , published in May 2018, integrates every aspect of London's environment into different categorised areas, including air quality. The document includes several transport and non-transport related policy measures outlined in Chapter 4, highlighting the need for improvement in London's air quality and ensuring London is greener, cleaner and ready for the future. The Mayors main aim is to create a zero emission London by 2050, and aims to do this my outlining a number of proposals.

2.33. Policy 4.2.1 states:

[17] Greater London Authority, 2010. *The Mayor's Air Quality Strategy.*
[18] Greater London Authority, 2018. *London Environment Strategy.*

"Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport."

2.34. Policy 4.2.2 states:

"Reduce emissions from non-road transport sources, including by phasing out fossil fuels."

2.35. Proposals for this policies promoting more sustainable forms of travel in London as well as proposing a reduction in emission from Non-Road Mobile Machinery (NRMM), construction and demolition sites, homes and workplaces and large-scale generators.

2.36. Policy 4.3.1 states:

"The Mayor will establish new targets for $PM_{2.5}$ and other pollutants where needed. The Mayor will seek to meet these targets as soon as possible, working with government and other partners."

2.37. Policy 4.3.2 states:

"The Mayor will encourage the take up of ultra low and zero emission technologies to make sure London's entire transport system is zero emission by 2050 to further reduce levels of pollution and achieve WHO air quality guidelines."

2.38. Policy 4.3.3 states:

"Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces, and reduce the impact of building emissions on air quality."

2.39. Policy 4.3.4 states:

"Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces."

2.40. As well as aiming to meet the WHO guidelines by 2030, the proposals for these policies include the switching of fleet vehicles to zero emission capability, implementation of local zero emission zones from 2020, ensure all new large-scale developments are 'Air Quality Positive' and maintain Air Quality Neutral requirements for all developments. Furthermore, the reduction in emissions from wood and other solid fuel burning, using the planning system to reduce indoor exposure though design measures, preventing poor air quality entering the building are all proposed.

LOCAL POLICY AND GUIDANCE

LOCAL POLICY

Camden Local Plan

2.41. The Camden Local Plan[19] was adopted in 2017 and has a number of policies which are relevant to this assessment.

2.42. *Policy A1 Managing the Impact of Development states:*

"The Council will seek to protect the quality of life of occupiers and neighbours. We will grant permission for development unless this causes unacceptable harm to amenity.

We will:

[..]

d. require mitigation measures where necessary.

[..]"

2.43. Policy CC4 *Air Quality* states:

"The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan."

[19] London Borough of Camden, 2017 *Camden Local Plan 2016 – 2031*

Camden Planning Guidance – Air Quality

2.44. LBC has also published their own planning guidance[20]. This provides information on air quality in the borough and supports Local Plan Policy CC4 Air Quality.

AIR QUALITY ACTION PLAN

National Air Quality Plan

2.45. DEFRA has produced an Air Quality Plan[21] to tackle roadside nitrogen dioxide (NO_2) throughout the United Kingdom. Along with a package of infrastructure, initiatives and grants, the plan required Local Authorities to produce local action plans by March 2018, with the aim of reducing the air quality concentrations below the objective as soon as practically possible, should they be predicting exceedances of the air quality objectives beyond 2020.

Local Air Quality Action Plan – Camden

2.46. The Camden Clean Air Action Plan (CAAP) 2023 – 2026[22] lists a number of measures to be carried out in the jurisdiction to improve air quality. The CAAP has measures under the following themes:

- Theme 1: Reducing emissions from construction and development;
- Theme 2: Reducing emissions from buildings;
- Theme 3: Reducing emissions from transport;
- Theme 4: Supporting communities and schools;
- Theme 5: Indirect emissions and lobbying;
- Theme 6: Public health and awareness; and
- Theme 7: Indoor air quality and occupational exposure.

2.47. Further details of specific actions are set out in both the CAAP and the Air Quality Annual Status Report (ASR)[23].

[20] London Borough of Camden, 2021. *Camden Planning Guidance Air Quality.*
[21] Department for Environment, Food and Rural Affairs, 2018. *UK plan for tackling roadside nitrogen dioxide concentrations*
[22] London Borough of Camden. *Clean Air Action Plan 2023 – 2023.*
[23] London Borough of Camden, 2022. *London Borough Camden Air Quality Annual Status Report for 2021.*

3. ASSESSMENT METHODOLOGY

SCOPE OF THE ASSESSMENT

3.1. The assessment is based on the following scope of work:

- Spatial – The assessment considers the impact of emissions from the site (from the proposed fume stacks) on local air quality; and
- Temporal – The operational phase impacts resulting from the consented development have been considered.

SCREENING CRITERIA

Point Source Emissions

3.2. The Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) (2017) Land-Use Planning and Development Control: Planning for Air Quality document[24] has a screening criteria for point source assessments, which determines if the impacts of emissions from point source are significant or not.

3.3. The first stage of the guidance is to determine whether a point source assessment is required based on the emissions. This is illustrated in Table 6.2 of the guidance, and states:

"Typically, any combustion plant where the single or combined NO_x 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.

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."

3.4. Should the point source not meet any of the conditions above, an assessment on the impacts are required.

[24] Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM), 2017. *Land-use Planning & Development Control: Planning for Air Quality.*

3.5. Both the EPUK & IAQM and the EA risk assessment guidance[25] provides criteria for assessing the significance of emissions with respect to the background air quality and air quality standards.

Criteria for screening out insignificant Process Contributions (PCs)

3.6. PCs can be screened out from detailed dispersion modelling if both of the below criteria are met:

- PC long-term < 0.5% of the long-term air quality standard; and
- PC short-term < 10% of the short-term air quality standard.

3.7. If both of these criteria are met, no further assessment of the pollutant in question is required as the impacts are considered negligible and 'not significant'. If the criteria is not met, then a detailed assessment of the Predicted Environmental Concentrations (PEC) are required.

3.8. Detailed modelling is also required if:

- Emissions affect an Air Quality Management Area (AQMA); or
- Restrictions apply for any substance emitted in this area.

3.9. The results of the detailed modelling are assessed for the resulting PECs against the relevant EALs. Significance criteria are used to inform the assessment and are discussed further in this Section.

SENSITIVE HUMAN RECEPTORS

3.10. This assessment includes the nearest on-site (discrete) and off-site receptors. Table A.1 in Appendix A presents the receptors specified for this assessment, and Figure A.1 in Appendix A illustrates these receptor locations.

ASSESSMENT SCENARIOS

3.11. The following scenarios have been considered for the AQA:

- 2018 to 2022 meteorological year baseline.

[25] Environment Agency and Department for Environment, Food and Rural Affairs, 2022. *Air emissions risk assessment for your environmental permit.*

MODELLING METHODOLOGY

Dispersion Model

3.12. Dispersion modelling was undertaken using the latest version of the air dispersion model: ADMS-6.0 (v6.0.0.1), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-6 is a PC based dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere from either single or multiple sources. The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages. Building and source parameters have been taken from the architect's drawings and emissions parameters for the consented development. The maximum predicted concentrations have been utilised for this assessment. The model typically requires the following input data:

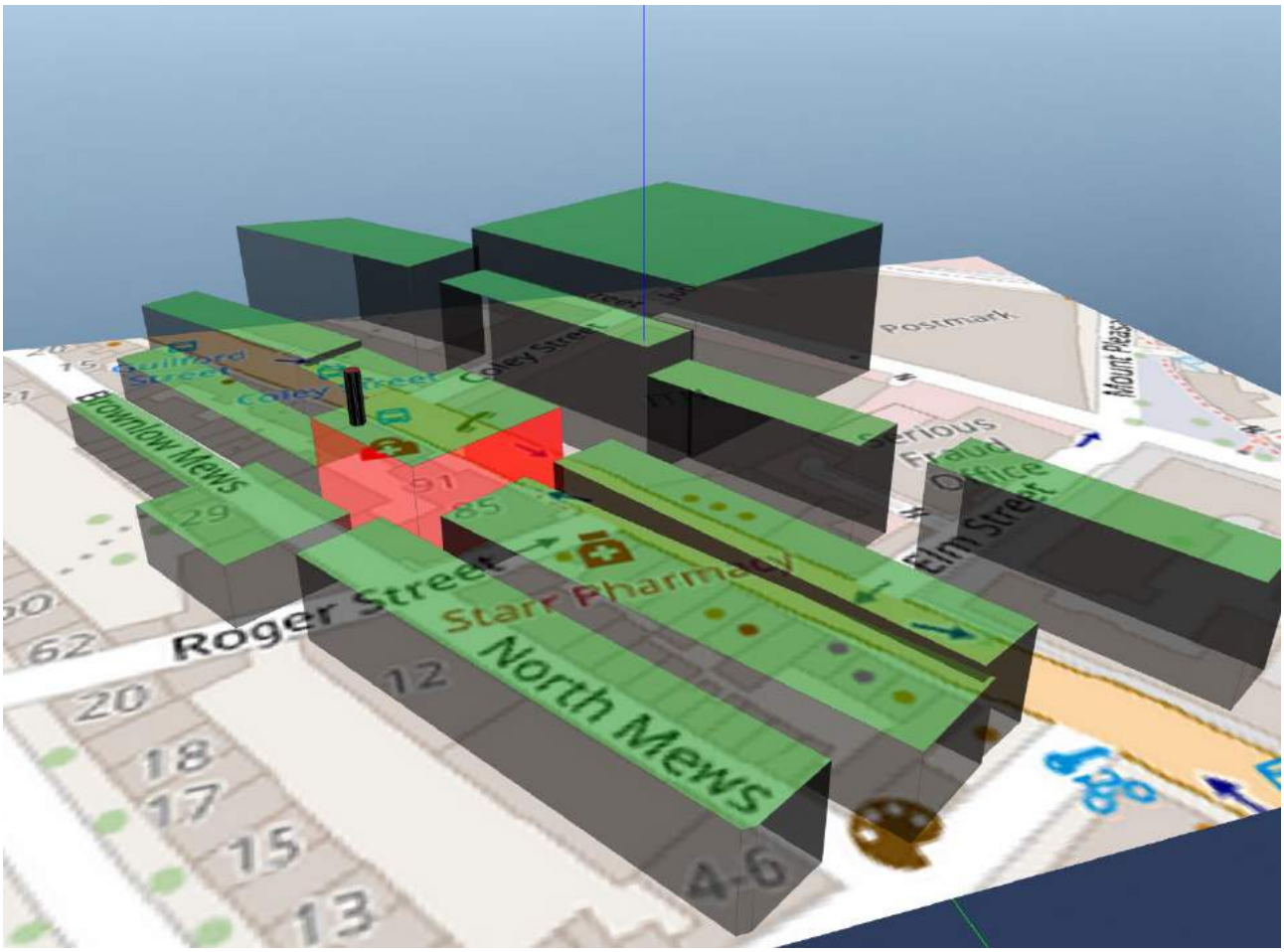
- Extent of the modelling area;
- Locations and dimensions of all sources and nearby structures;
- Output receptor locations;
- Meteorological data;
- Terrain data (if modelling terrain effects);
- Emission rates, emission parameters (e.g. temperature) and emission profiles (e.g. one hour per day) for modelled pollutants; and
- Surface roughness and Monin-Obukhov length.

SITE LAYOUT (BUILDING AND STRUCTURAL EFFECTS)

3.13. The dispersion of substances released from elevated sources can be influenced by the presence of buildings close to the emission point. Structures that are in excess of one third of the height of the stack can have a significant effect on dispersion by interrupting wind flows and causing significantly higher ground-level concentrations close to the source than would arise.

3.14. The buildings included in the dispersion model are illustrated below in Figure 2.

Figure 2 Modelled Buildings - 3D View



EMISSION PARAMETERS

Fume Cupboard Flue

3.15. Emissions from the proposed fume cupboards have been included in the modelling. 48 fume cupboards (6 per floor) are anticipated to be used, with the ducting for these fume cupboards proposed to exhaust via six flues.

3.16. As per Section 1, common solvents that are anticipated to be used include ethanol, n-heptane and methanol. The assessment has assumed a continuous emission of methanol, expected to be one of the most commonly used solvents in the fume cupboards and the one which has the most stringent workplace exposure limits (WELs), as outlined by the Environment Agency.

3.17. Two modelling scenarios have been considered as follows (based upon a similar scheme as being proposed here):

- A typical event, in which 5 litres of solvent is used within each fume cupboard per day (It is understood up to 36 fume cupboards will be provided) is assumed over

the four stacks. Of this 10% is assumed to evaporate and be discharged by the chemical flues. This gives a daily discharge from each fume cupboard of 500ml (liquid), calculated to be 0.0046g/s of methanol; and

- A spillage event, in which 2.5 litres of solvent is spilt in one locations in the building and discharged during a 30 second period out of one flue, which has been calculated to be 66g/s of methanol. It is expected that this would be a rare event and is likely to occur on a less than annual frequency. As a worst-case assessment, emissions of methanol at a rate of 66g/s have been assumed to persist for an hour-long period.

3.18. The calculations for determining the emissions rates for both scenarios are set out in Appendix C.

3.19. The flue source locations are illustrated in Figure 3, with a 3D view of the stack in relation to the surrounding buildings shown in Figure 2. The location and parameters included in the model (based upon estimates from the plans given) are summarised in Table 2 and Table 3.

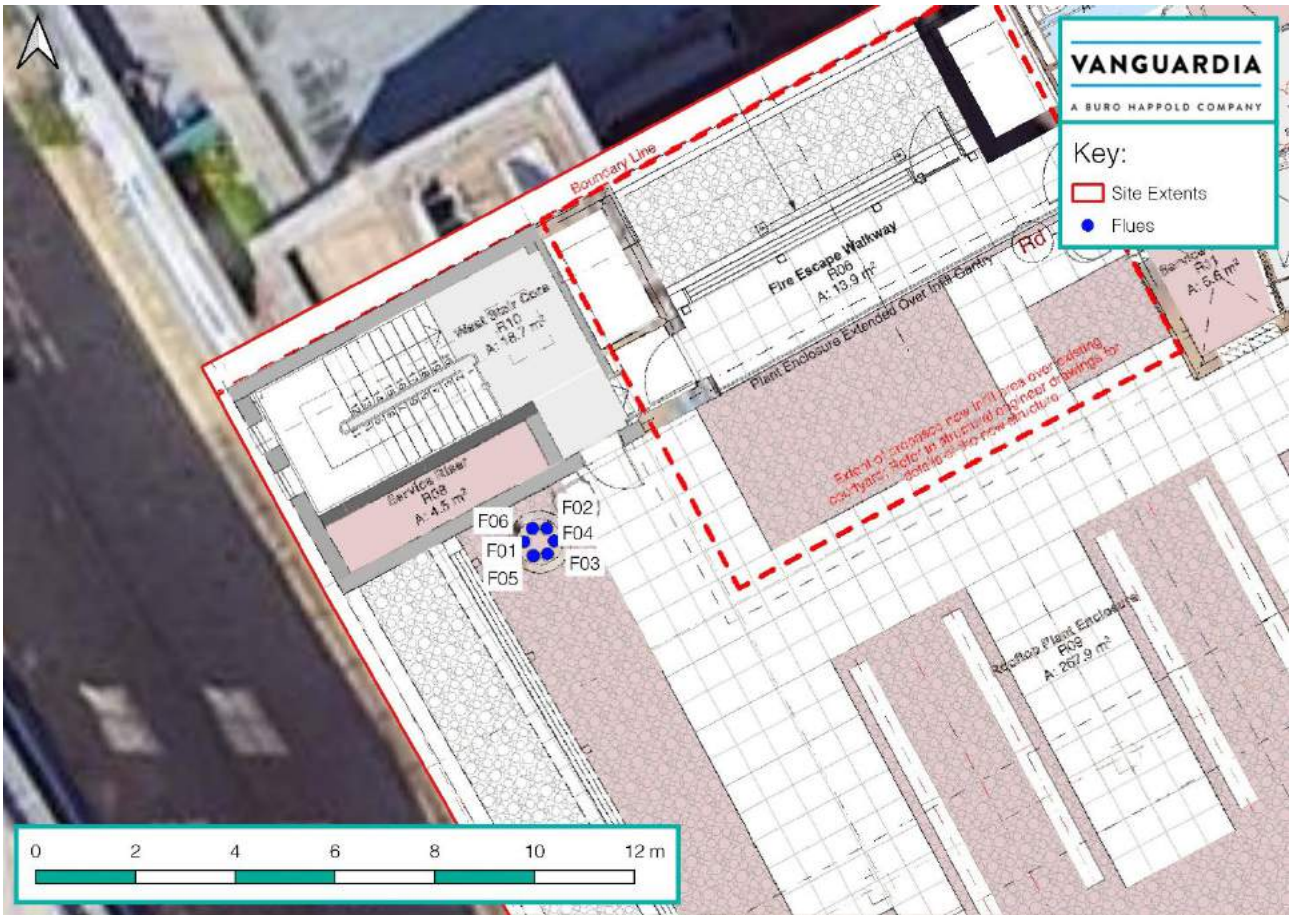
Table 2 Flue Locations

Flues	X (m)	Y (m)
F01	530865.2	182145.3
F02	530865.5	182145.3
F03	530865.5	182145.0
F04	530865.5	182144.8
F05	530865.2	182144.7
F06	530865.0	182145.0

Table 3 Parameters

Parameter (unit)	Stacks
Internal Stack Diameter (m)	0.134
Stack Height (m)	26.7
Flue Heights (m)	27
Temperature of release (°C)	22
Velocity (m/s)	15

Figure 3 Flue Locations



METEOROLOGICAL DATA

3.20. The key meteorological parameters for dispersion modelling are wind speed and wind direction. Meteorological parameters such as cloud cover, surface temperature, precipitation rate and relative humidity are also considered.

3.21. For dispersion modelling, hourly-resolved data are required and often it is difficult to find a local site that can provide reliable data for all the meteorological parameters at this resolution.

3.22. Based on the above, a suitably representative meteorological monitoring station identified is Heathrow Airport meteorological station, which is located approximately 22 km southwest of the subject site.

3.23. To account for variation in meteorological conditions, the qualitative assessment and dispersion modelling have been carried out with the latest available meteorological data from the period 2018 to 2022 (inclusive).

TOPOGRAPHY

3.24. The presence of elevated terrain can significantly affect ground level concentrations of pollutants emitted from elevated sources, such as stacks, by reducing the distance between the plume centre line and ground level, increasing turbulence and, hence, plume mixing.

3.25. Guidance for the use of the ADMS-6 model suggests that terrain is normally incorporated within a modelling study when the gradient exceeds 1:10. Terrain is not included in the model.

SURFACE ROUGHNESS

3.26. A surface roughness length (z0) of 0.2 m (Agricultural areas (min)) was set for the dispersion meteorological site, and 1 m (Cities) for the study area.

MINIMUM MONIN-OBUKHOV LENGTH

3.27. The Minimum Monin-Obukhov Length (MMOL) provides a measure of the stability of the atmosphere. An MMOL value of 100 m (large conurbations > 1 million) was used in the dispersion meteorological site and the study area. These values are considered representative of the respective surrounding areas.

SIGNIFICANCE IMPACT CRITERIA

3.28. Currently there is no formal guidance on the absolute magnitude and significance criteria for the assessment of air quality impacts.

3.29. To note, the approach is that any change in concentration smaller than 0.5% of the long-term environmental standard will be negligible, regardless of the existing air quality conditions. Any change smaller than 1.5% of the long-term environmental standard will be negligible so long as the total concentration is less than 94% of the standard and any change smaller than 5.5% of the long-term environmental standard will be negligible so long as the total concentration is less than 75% of the standard. The guidance also explains that:

> *"Where peak short term concentrations (those averaged over periods of an hour or less) from an elevated source are in the range 11-20% of the relevant Air Quality Assessment Level (AQAL), then their magnitude can be described as small, those in the range 21-50% medium and those above 51% 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. In most cases, the assessment of impact severity for a proposed development will be governed by the long-term exposure experienced by receptors and it will not be a necessity to define the significance of effects by reference to short-term*

impacts. The severity of the impact will be substantial when there is a risk that the relevant AQAL for short-term concentrations is approached through the presence of the new source, taking into account the contribution of other local sources".

3.30. The IAQM & EPUK (2017) document provides a framework as set out in Table 4, on the severity of an impact as a descriptor. Although the impacts might be considered 'Slight', 'Moderate' or 'Substantial' at one or more receptor location, the overall effects of a proposed development may not always be judged as being significant.

Table 4 Air Quality Impact Descriptors for Individual Receptors

Long term average Concentration at receptor in assessment year.	% Change in concentration relative to Air Quality Action Level (AQAL*)				
	<0.5	1	2-5	6-10	>10
75% of 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

Notes:
Vales are rounded to the nearest whole number.
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.
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).'

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

- The number of properties/receptors affected by different levels of impacts;
- The magnitude of any changes and descriptors;
- Whether a new exceedance of an objective or limit value is predicted to arise or an existing exceedance is removed, or an existing exceedance is substantially increased or reduced;
- The level of uncertainty, including the extent to which worst case assumptions have been made; and
- The extent of any exceedance of an objective or limit value.

3.32. The judgement of the significance should be made by a competent professional who is suitably qualified.

MODELLING UNCERTAINTY

3.33. In addition to the parameters outlined above, some assumptions have been made for the modelling, including:

- The spillage event has been assumed to last 1-hour, when in reality is it likely to last for approximately 30 seconds; and
- Due to the uncertainty regarding the end user and the possible liquids/gases that will be used within the fume cupboards, methanol has been used as an indicator using emission rates from a similar scheme.

3.34. Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model limitations;
- Data uncertainty due to errors in input data, emission estimates, operational procedures, land use characteristics and meteorology; and
- Variability - randomness of measurements used.

3.35. Potential uncertainties in the model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS-6 is a widely used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Emission rates - Emission rates were calculated based upon Vanguardias experience from other recent schemes. As such, they are considered to be representative of potential releases during normal operation;
- Receptor locations - Specified receptors, including discrete receptors located on the proposed roof terrace and the roof terrace at 200 Gray's Inn Road, have been identified and modelled;
- Variability - Where site specific input parameters were not available, assumptions were made with consideration of the worst-case conditions as necessary in order to ensure a robust assessment of potential pollutant concentrations; and
- All results presented are the maximum concentrations from a 5-year modelling period, so represent the worst case.

3.36. The analysis of the component uncertainties indicates that, overall, the predicted total concentration is likely to be towards the conservative end of the uncertainty range rather than being a central estimate. The actual concentrations that will be found when the consented

development is operational are unlikely to be higher than those presented within this report and are more likely to be lower.

4. OPERATIONAL PHASE IMPACT ASSESSMENT

FUME CUPBOARD EMISSIONS

4.1. For the typical daily usage of the fume cupboards, annual mean concentrations have been predicted and compared to the long-term environmental assessment level (EAL). The predicted annual mean methanol process contributions for the discrete receptors and surrounding residential receptors are shown below.

4.2. For the spillage event, the point of maximum impact on the discrete receptors and residential receptors has been calculated for a worst-case hourly period, and the greatest concentration of methanol is predicted to be. This is a conservative and pessimistic assessment, as the emission was assumed to persist for one hour, whereas the spillage event is likely to occur for only 30 seconds.

Process Contribution Screening

4.3. Methanol backgrounds are not available in the United Kingdom; therefore, this assessment focuses on the Process Contribution (PC) as a result of the development.

4.4. Dispersion modelling of emissions related to the fume cupboards has been carried out at the discrete receptors and surrounding residential receptors identified in Table A.1 in Appendix A. Table 5 sets out the precited maximum Process Contribution of methanol at the modelled receptor locations and across the modelled grids, for annual mean and hourly mean methanol concentrations, and have been compared to the relevant environmental assessment levels (EALs). Predicted concentrations at the modelled receptor locations are set out in Appendix C, with the annual mean and hourly mean concentrations across a grids modelled at ground level set out in Appendix D and Appendix E respectively.

Table 5 Modelled Methanol PC

	Max Concentration (µg/m^3)	EAL (µg/m^3)	% of EAL
Receptors			
Annual Mean	8.2	2660	0.3
Hourly Mean	61,096.5	33,300	183.5
Ground Level Grid (Max Conc.)			
Annual Mean	3211.1	2660	9.7
Hourly Mean	24,558.2	33,300	73.7

4.5. The predicted impacts as a result of operation of the fume cupboards for the annual level do not exceed the relevant EALs, with the maximum annual mean concentrations at the modelled receptors not exceeding the 10% screening criteria for the long term PC. On this basis, the

impacts on the receptors against the 'typical' operation of the fume cupboard can be considered to be 'negligible' in line with the EPUK & IAQM (2017) criteria in Table 4, and therefore the impacts are considered to be 'not significant.'

4.6. However, during the spillage event, there are exceedances predicted at four receptor locations, two 'future receptors' and two 'office' receptors. These have been discussed below.

4.7. The exceedances are as followed:

- FR02 – OA Intake Louvre
- FR03 – Rooftop Terrace; and
- O10 & O11 – Rooftop Terrance at the ITN Building (200 Gray's Inn Road).

4.8. For the spillage event, the point of maximum impact on the modelled receptors (O10) has been calculated for a worst case hourly period, and the greatest concentration of methanol is predicted to be 61,096.5 µg/m^3, which is above the short term EAL of 33,300µg/m^3. This is an extremely conservative and pessimistic assessment, as the emission was assumed to persist for one hour, whereas the spillage event is likely to occur for only 30 seconds.

4.9. To note, the exceedance at FR02 was only for the meteorological year 2021, and did not exceed for any other year, which suggests that infrequent meteorological conditions are responsible for the exceedance at this location.

4.10. The spillage event is based upon a worst-case isolated spillage, and unlikely to be a regular occurrence, considered to occur on a less than annually basis. The impact of this cannot be determined as this is not a long-term concentrations; however, such spillage events are extremely infrequent (anticipated to occur less than once annually), and would only last approximately 30 seconds.

5. AIR QUALITY NEUTRAL ASSESSMENT

5.1. As set out in Policy SI 1 of the London Plan, developments are required to be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality. This section sets out the Air Quality Neutral Assessment (AQNA), to determine whether the development will be 'air quality neutral.'

5.2. The air quality neutral assessment has considered the methodology outlined in the GLA (2023) Air Quality Neutral London Planning Guidance (LPG) document.

5.3. Within this document, benchmarks have been provided in relation to building and transport emissions, together with a methodology for calculating the building and transport related emissions for a particular development depending on land use.

Building Emissions

5.4. The consented developments heat demands will be met by Air Source Heat Pumps (ASHP). On this basis, it is assumed that there are no direct NOx emissions, and therefore the consented development is considered to be 'air quality neutral.'

Transport Emissions

5.5. The consented development is classified as "car-free", with only servicing and delivery trips anticipated for the consented development.

5.6. To note, the guidance states:

"The TEB only estimates car or light van trips undertaken directly by the development occupiers (residents, businesses etc and their staff / customers). The TEB does not include 'operational' trips generated by the developments. Deliveries and servicing, taxis or heavy vehicle movements from non-occupiers' assessment of these trips, for example, should be captured in the wider air quality impact assessment where one is required and should therefore be excluded from TEB calculations."

5.7. On this basis. delivery and servicing trips have not been included in this assessment. On the basis the development is considered to be 'car free,' the development is 'air quality neutral' in terms of transport emissions.

6. MITIGIATION MEASURES

OPERATIONAL

Fume Cupboard Impacts

6.1. Methanol is considered to be the main substance used in the fume cupboards. The resulting concentrations at the discrete receptors and surrounding residential receptors as a result of the operation of 36 fume cupboards are predicted to be below the relevant EALs. The impacts are anticipated to be negligible on these receptors. Therefore, it is considered that additional mitigation is not required.

6.2. It is recommended that the fume cupboards comply with British Standards EN 14175. To ensure effective dispersion and compliance with this British Standard, fume cupboards should be regularly inspected at least every 14 months.

6.3. To ensure no recirculation of emissions in the building from the fume cupboards or the combustion plant, it is recommended that ventilation air handling unit intakes are distanced from flue openings.

Air Quality Neutral Assessment

6.4. Emissions from the building and vehicles are considered to be ‘air quality neutral’ and thus no mitigation measures are deemed necessary.

7. CONCLUSIONS

OPERATIONAL PHASE

7.1. Modelling was undertaken using emissions information provided by the client, and a series of conservative assumptions. The development was modelled to operate continuously and in the event of a spill.

7.2. The results of the dispersion modelling show that the operation of the fume cupboards are anticipated to result in a negligible adverse impact at the specified discrete receptor for the 'typical' daily use of the cupboards at the modelled receptor locations and across the grid at ground level, and therefore the associated impacts are considered to be '**not significant**.' It was, however, noted that during the 'event' spillage, exceedances were modelled at four receptor locations, two future receptor points and two existing receptor. The spillage event was assumed to occur over a 1-hour period, whereas in reality a spillage event is likely to occur over a 30-second period, with such events occurring on a less than annually basis.

7.3. On the basis the impacts of the typical operation are 'not significant', and the 'Event' emissions are infrequent and anticipated to be for a very short duration as opposed to over a 1-hour period, condition no.6 can be discharged.

APPENDIX A – MODELLED RECEPTOR LOCATIONS

Table A1 Modelled Receptor Locations

Receptor	X (m)	Y (m)	Z (m)
Existing Residential Receptors			
R01	530884.6	182127.0	1.5
R01a	530884.6	182127.0	4.5
R01b	530884.6	182127.0	10.5
R02	530876.6	182122.5	1.5
R02a	530876.6	182122.5	4.5
R02b	530876.6	182122.5	10.5
R03	530895.6	182129.9	4.5
R03	530895.6	182129.9	7.5
R03	530895.6	182129.9	10.5
R04	530916.1	182141.7	4.5
R04a	530916.1	182141.7	18.5
R05	530927.8	182121.6	4.5
R05a	530927.8	182121.6	18.5
R06	530942.9	182097.0	4.5
R06a	530942.9	182097.0	18.5
R07	530951.6	182082.5	4.5
R07a	530951.6	182082.5	18.5
R08	530847.5	182153.3	1.5
R08	530847.5	182153.3	4.5
R09	530858.2	182149.5	1.5
R09a	530858.2	182149.5	4.5
R10	530849.6	182165.1	1.5
R10a	530849.6	182165.1	4.5
R11	530840.1	182166.8	1.5
R11a	530840.1	182166.8	4.5
R12	530843.9	182175.4	1.5
R12a	530843.9	182175.4	4.5
R13	530834.8	182176.5	1.5
R13a	530834.8	182176.5	4.5
R14	530838.9	182184.4	1.5
R14a	530838.9	182184.4	4.5

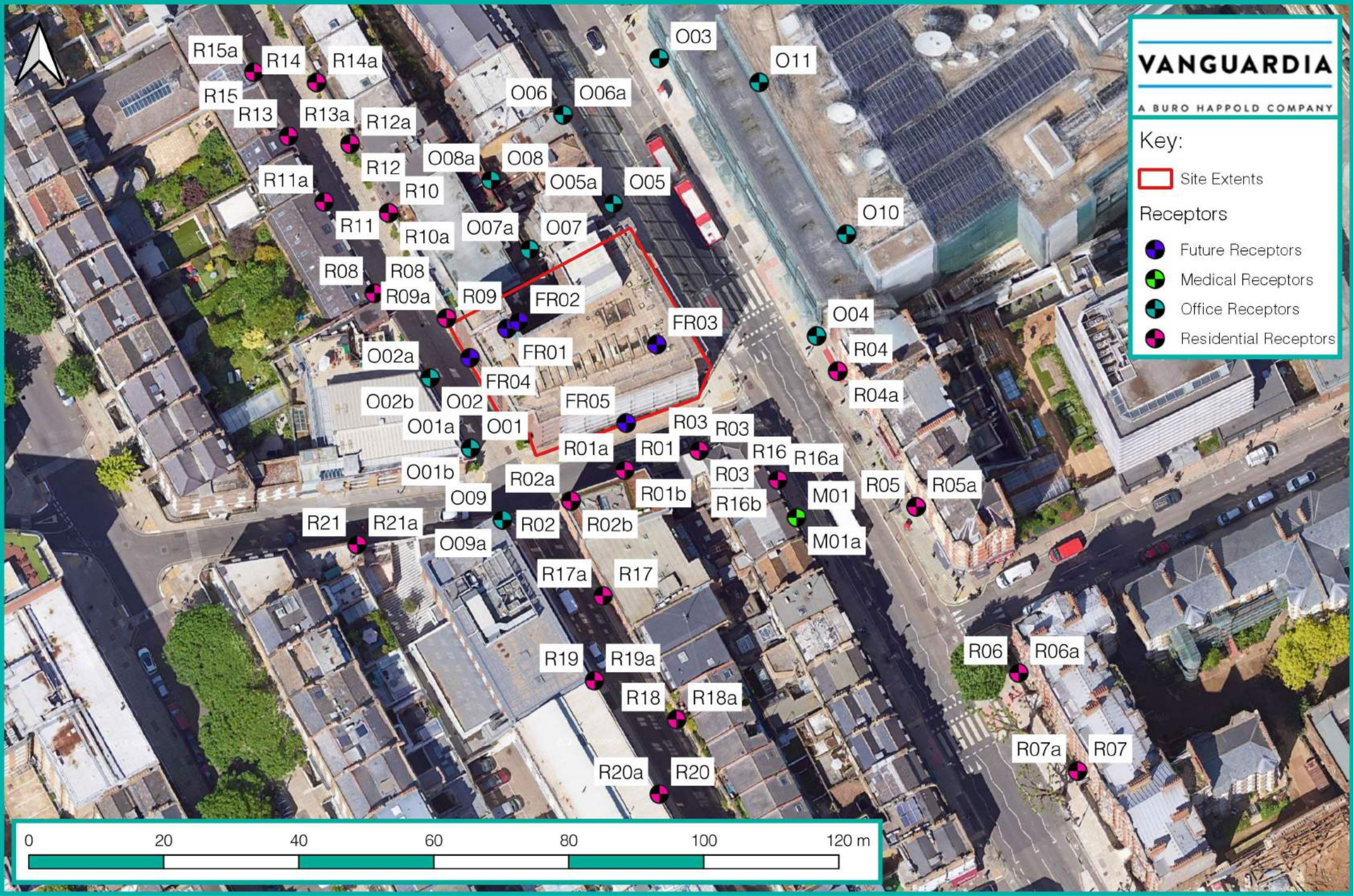
Receptor	X (m)	Y (m)	Z (m)
R15	530829.6	182186.0	1.5
R15a	530829.6	182186.0	4.5
R16	530907.3	182125.6	1.5
R16a	530907.3	182125.6	4.5
R16b	530907.3	182125.6	10.5
R17	530881.3	182108.4	1.5
R17a	530881.3	182108.4	7.5
R18	530892.3	182090.1	1.5
R18a	530892.3	182090.1	7.5
R19	530880.1	182095.8	4.5
R19a	530880.1	182095.8	13.5
R20	530889.8	182079.0	4.5
R20a	530889.8	182079.0	13.5
R21	530844.9	182116.0	0
R21a	530844.9	182116.0	6
Medical Centre Receptors			
M01	530910.06	182119.98	1.5
M01a	530910.06	182119.98	4.5
Office Receptors			
O01	530861.8	182130.3	1.5
O01a	530861.8	182130.3	4.5
O01b	530861.8	182130.3	7.5
O02	530855.8	182140.7	1.5
O02a	530855.8	182140.7	4.5
O02b	530855.8	182140.7	7.5
O03	530889.7	182188.0	1.5
O04	530913.0	182146.9	16
O05	530882.9	182166.5	1.5
O05a	530882.9	182166.5	13.5
O06	530875.4	182179.7	1.5
O06a	530875.4	182179.7	10.5
O07	530870.5	182159.7	1.5
O07a	530870.5	182159.7	13.5
O08	530864.8	182170.0	1.5
O08a	530864.8	182170.0	13.5
O09	530866.5	182119.7	1.5
O09a	530866.5	182119.7	13.5

Receptor	X (m)	Y (m)	Z (m)
O10	530917.4	182162.0	26.5
O11	530904.5	182184.5	26.5
Future Receptors			
FR01	530865.8	182150.1	23
FR02	530867.4	182150.8	23
FR03	530889.4	182147.3	21
FR04	530861.6	182143.7	16.5
FR05	530884.8	182134.0	16.5

Table A2 Modelled Grid

Receptor	X (m)	Y (m)	Z (m)
Start	530758.8	531004.8	0
End	182072.5	182215.2	0
Points	246	142	0

Figure A.1. Receptor Locations



APPENDIX B – CALCULATED EMISSION RATES

Table B1 Calculating the daily emission rate

Number of Fume Cupboards	36 (6 per floor – Basement to Fourth Floor)
10% of the 5000 ml liquid will evaporate and be discharged	500 ml
Covert volume to grams using density of methanol (0.7913 g/mol)	395.65g
Calculate daily discharge for each fume cupboard in g/s (Daily discharge = Total mass / (24 hours * 3600 seconds/hour))	0.0046 g/s
Daily discharge from all 36 fume cupboards	0.1649 g/s
Discharge rate out of each flue (6 in total)	0.0275 g/s

Table B2 Calculating the daily emission rate

Number of Fume Cupboards	1
100% of the 2500 ml liquid will evaporate and be discharged	2500 ml
Covert volume to grams using density of methanol (0.7913 g/mol)	1978.3g
Calculate daily discharge for each fume cupboard in g/s (Daily discharge = Total mass / (24 hours * 3600 seconds/hour))	66 g/s
Discharge rate out of one flue for one fume cupboard	66 g/s

APPENDIX C – MODELLED METHANOL RESULTS

Table C1 Modelled Annual Mean Methanol PC (Daily Emissions)

Receptor	PC (Max over 5 Years Wind Data) (µg/m^3)	Objective (µg/m^3)	% of Objective
	Existing Residential Receptors		
R01	7.24	2660	0.27
R01a	7.24		0.27
R01b	7.27		0.27
R02	7.24		0.27
R02a	7.24		0.27
R02b	7.26		0.27
R03	3.41		0.13
R03	3.41		0.13
R03	3.41		0.13
R04	2.38		0.09
R04a	4.88		0.18
R05	1.99		0.07
R05a	3.94		0.15
R06	1.46		0.06
R06a	2.77		0.10
R07	1.27		0.05
R07a	2.25		0.08
R08	7.01		0.26
R08	7.01		0.26
R09	7.42		0.28
R09a	7.42		0.28
R10	6.90		0.26
R10a	6.90		0.26
R11	3.07		0.12
R11a	3.07		0.12
R12	2.63		0.10
R12a	2.64		0.10
R13	0.46		0.02
R13a	0.48		0.02
R14	1.19		0.04
R14a	1.22		0.05
R15	0.27		0.01

Receptor	PC (Max over 5 Years Wind Data) (µg/m^3)	Objective (µg/m^3)	% of Objective
R15a	0.33		0.01
R16	2.89		0.11
R16a	2.91		0.11
R16b	3.10		0.12
R17	3.92		0.15
R17a	3.96		0.15
R18	1.83		0.07
R18a	1.93		0.07
R19	2.59		0.10
R19a	3.00		0.11
R20	1.44		0.05
R20a	1.92		0.07
R21	4.12		0.16
R21a	4.15		0.16
Medical Centre Receptors			
M01	2.39	2660	0.09
M01a	2.42		0.09
Office Receptors			
O01	7.94		0.30
O01a	7.94		0.30
O01b	7.95		0.30
O02	7.70		0.29
O02a	7.70		0.29
O02b	7.70		0.29
O03	5.14		0.19
O04	4.17		0.16
O05	6.90		0.26
O05a	7.08		0.27
O06	5.17		0.19
O06a	5.28		0.20
O07	7.20		0.27
O07a	7.21		0.27
O08	6.66		0.25
O08a	6.74		0.25
O09	7.10		0.27
O09a	7.19		0.27

Receptor	PC (Max over 5 Years Wind Data) (µg/m³)	Objective (µg/m³)	% of Objective
O10	7.45		0.28
O11	6.95		0.26
Future Receptors			
FR01	0.02	2660	0.00
FR02	0.11		0.00
FR03	3.87		0.15
FR04	7.92		0.30
FR05	8.19		0.31

Table C2 Modelled 1-Hour Mean Methanol PC (Event Emissions)

Receptor	PC (Max over 5 Years Wind Data) (µg/m³)	Objective (µg/m³)	% of Objective
Existing Residential Receptors			
R01	14044.7	33,300	42.2
R01a	14044.7		42.2
R01b	15197.7		45.6
R02	14044.7		42.2
R02a	14044.7		42.2
R02b	15493.2		46.5
R03	14044.7		42.2
R03	14044.7		42.2
R03	14044.7		42.2
R04	16716.2		50.2
R04a	31169.2		93.6
R05	17668.6		53.1
R05a	27249.3		81.8
R06	16322.8		49.0
R06a	23515.6		70.6
R07	16520.1		49.6
R07a	22573.4		67.8
R08	14049.3		42.2
R08	14049.3		42.2
R09	16143.2		48.5
R09a	16143.2		48.5
R10	15332.8		46.0
R10a	16624.6		49.9
R11	19244.8		57.8

Receptor	PC (Max over 5 Years Wind Data) (µg/m^3)	Objective (µg/m^3)	% of Objective
R11a	20073.3		60.3
R12	20005.2		60.1
R12a	20468.8		61.5
R13	21063.2		63.3
R13a	21380.3		64.2
R14	20370.3		61.2
R14a	20608.8		61.9
R15	20679.3		62.1
R15a	20708.5		62.2
R16	15033.7		45.1
R16a	15499.4		46.5
R16b	18819.7		56.5
R17	14044.7		42.2
R17a	16193.4		48.6
R18	15527.7		46.6
R18a	16301.0		49.0
R19	16846.3		50.6
R19a	21717.2		65.2
R20	16720.6		50.2
R20a	19853.7		59.6
R21	17637.1		53.0
R21a	19765.5		59.4
Medical Centre Receptors			
M01	15249.7	33,300	45.8
M01a	15500.3		46.5
Office Receptors			
O01	16143.2	33,300	48.5
O01a	16143.2		48.5
O01b	16143.2		48.5
O02	16143.2		48.5
O02a	16143.2		48.5
O02b	16143.2		48.5
O03	18826.5		56.5
O04	27553.4		82.7
O05	16437.4		49.4
O05a	28095.0		84.4

Receptor	PC (Max over 5 Years Wind Data) (µg/m^3)	Objective (µg/m^3)	% of Objective
O06	13729.6		41.2
O06a	17854.2		53.6
O07	16143.2		48.5
O07a	16161.4		48.5
O08	14044.7		42.2
O08a	22351.1		67.1
O09	14044.7		42.2
O09a	23910.3		71.8
O10	61096.5		183.5
O11	58089.9		174.4
Future Receptors			
FR01	15349.8	33,300	46.1
FR02	40814.1		122.6
FR03	54311.2		163.1
FR04	16143.2		48.5
FR05	31311.2		94.0

APPENDIX D – DAILY METHANOL GRIDS

Figure D.1. Methanol Hourly Grids 2018 (Z = 0m)

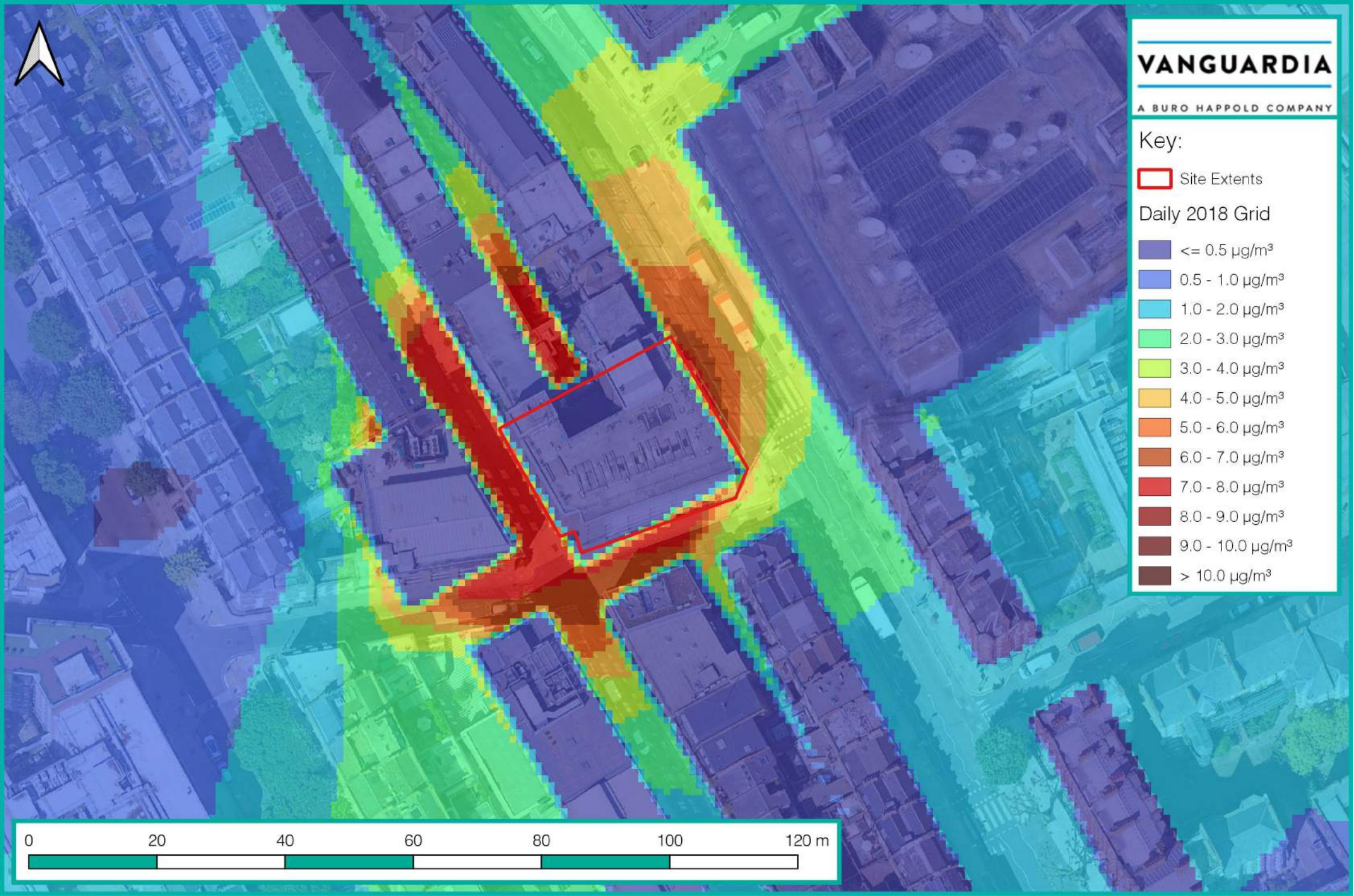


Figure D.2. Methanol Hourly Grids 2019 (Z = 0m)

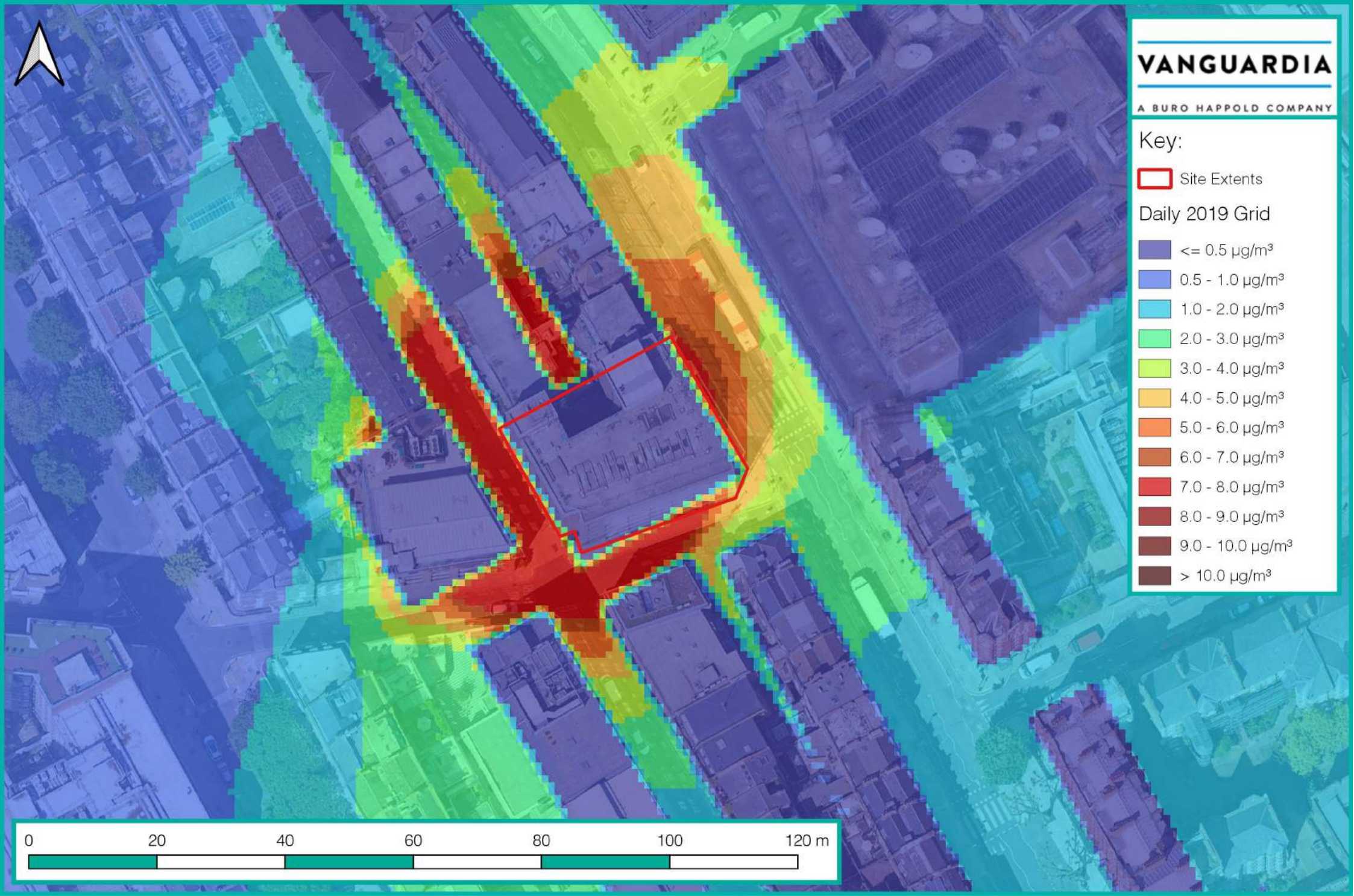


Figure D.3. Methanol Hourly Grids 2020 (Z = 0m)

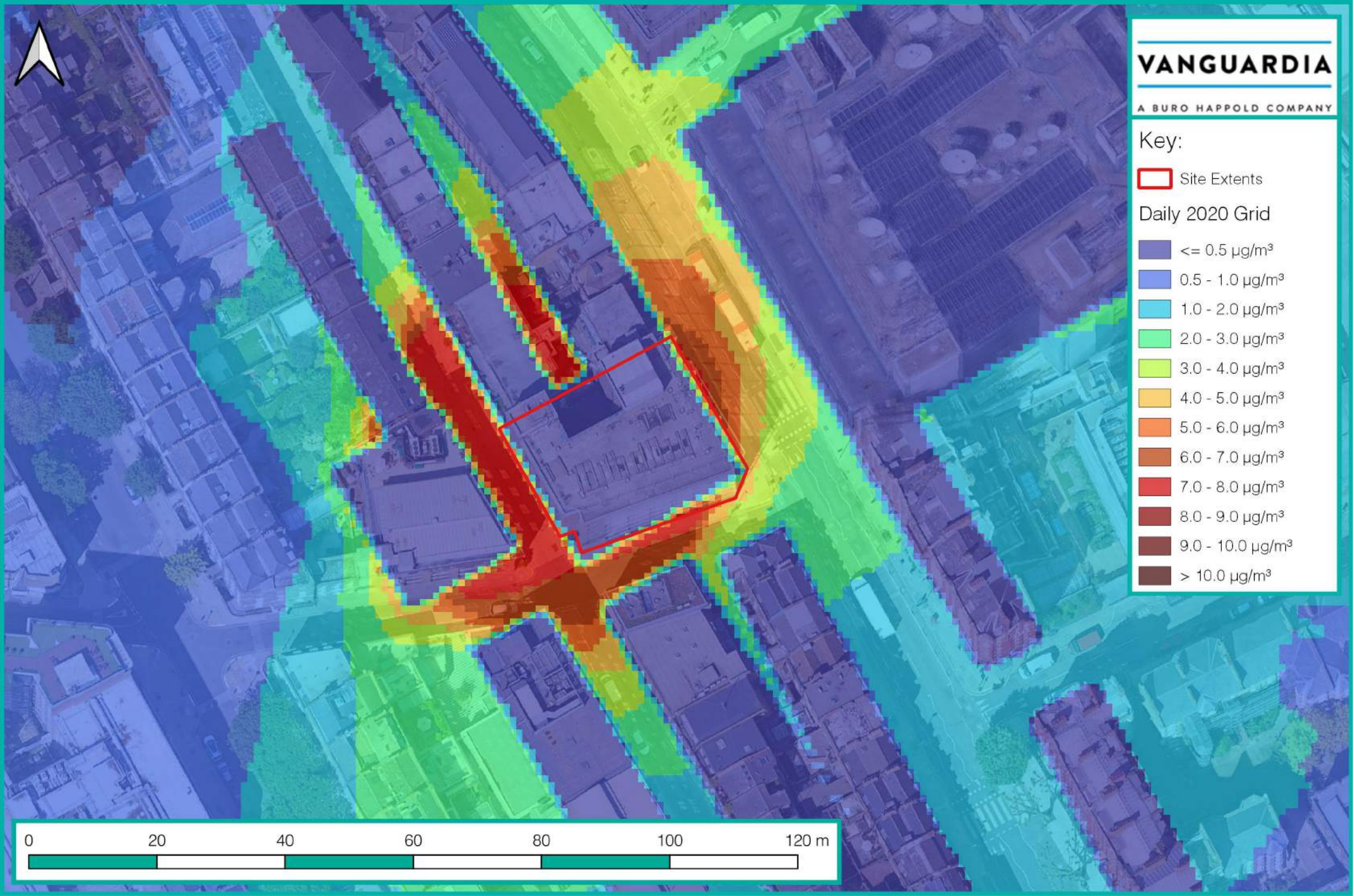


Figure D.4. Methanol Hourly Grids 2021 (Z = 0m)

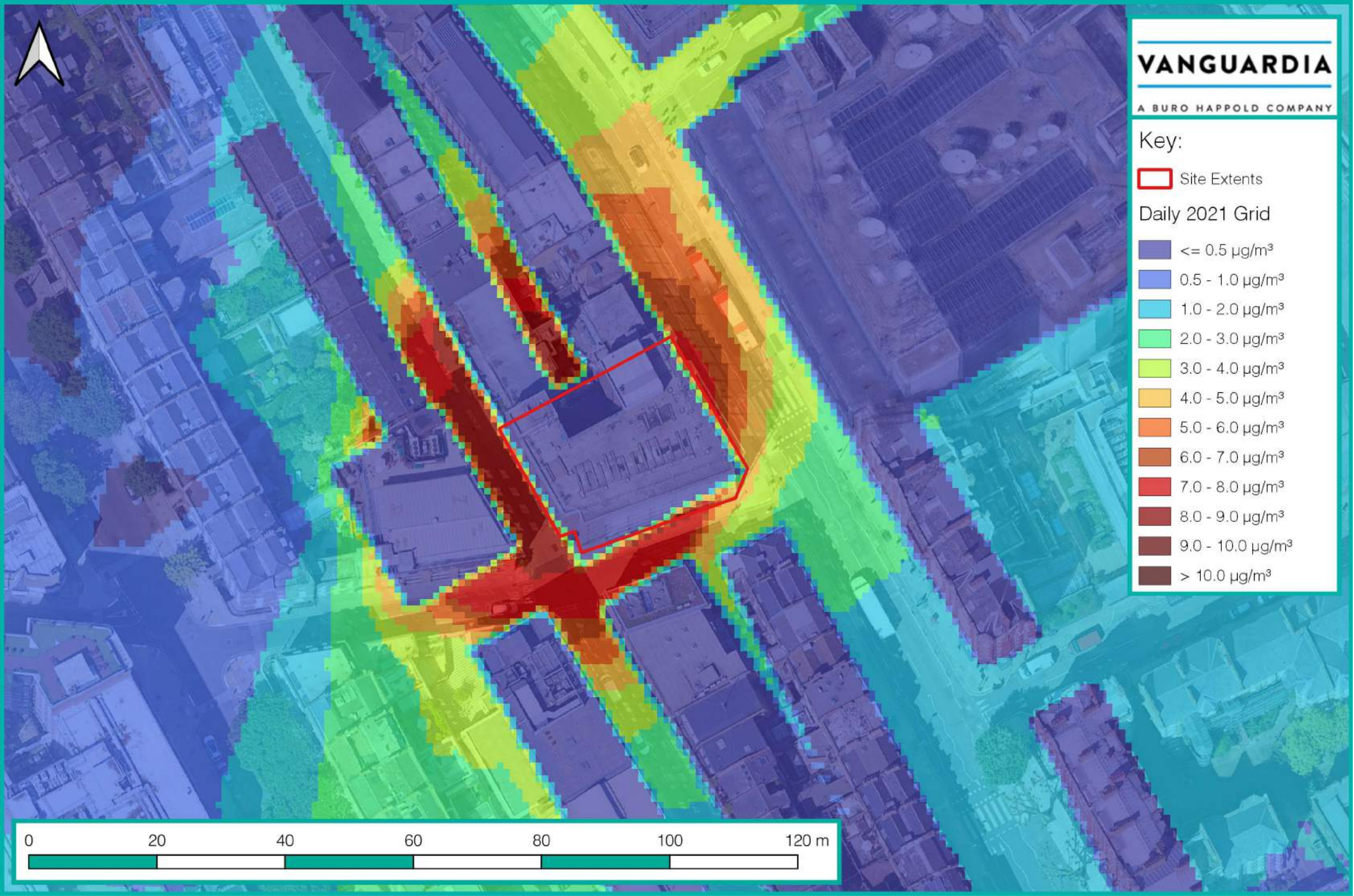
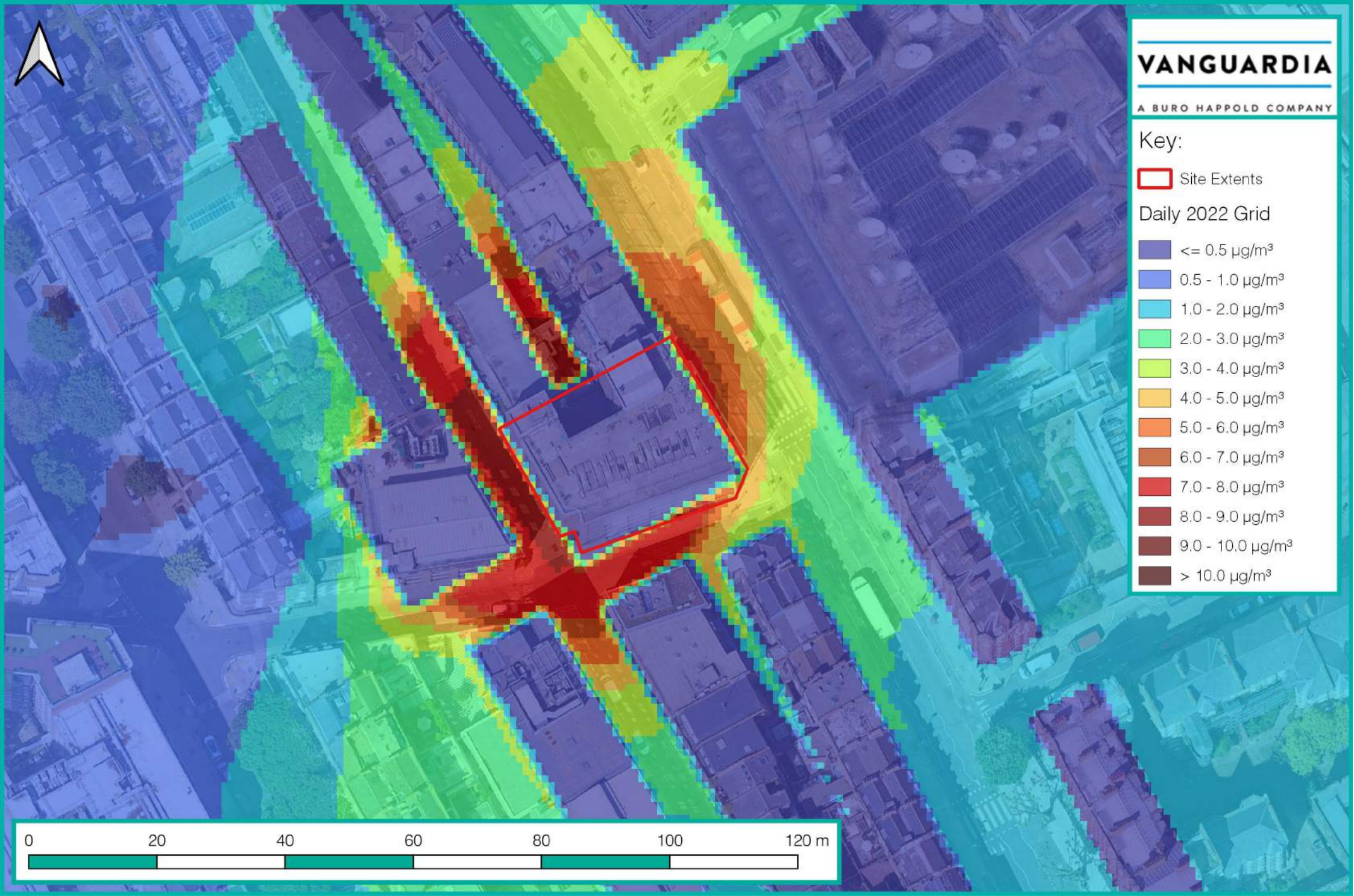


Figure D.5. Methanol Hourly Grids 2022 (Z = 0m)



APPENDIX E – HOURLY METHANOL GRIDS

Figure E.1. Methanol Hourly Grids 2018 (Z = 0m)

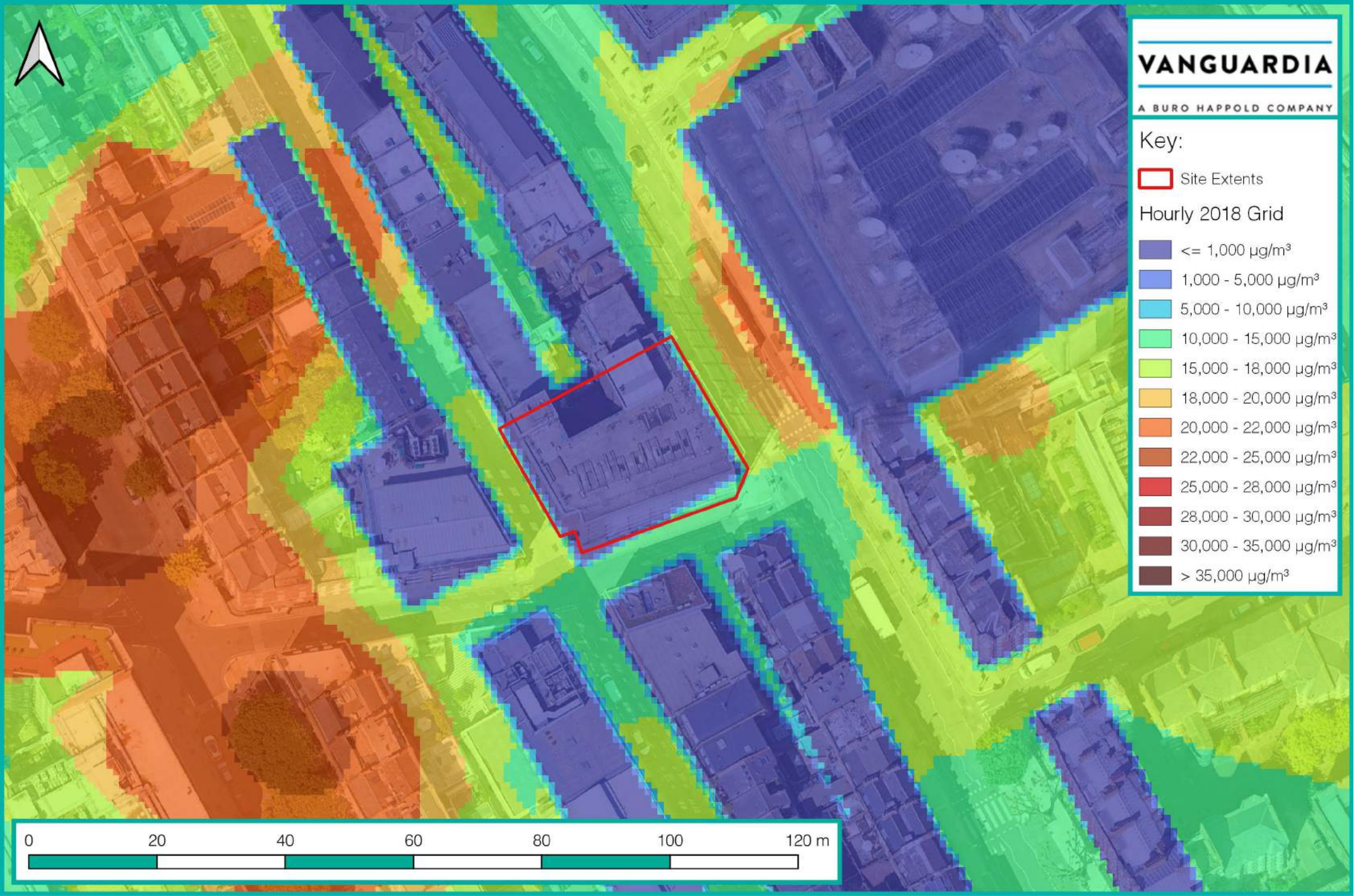


Figure E.2. Methanol Hourly Grids 2019 (Z = 0m)

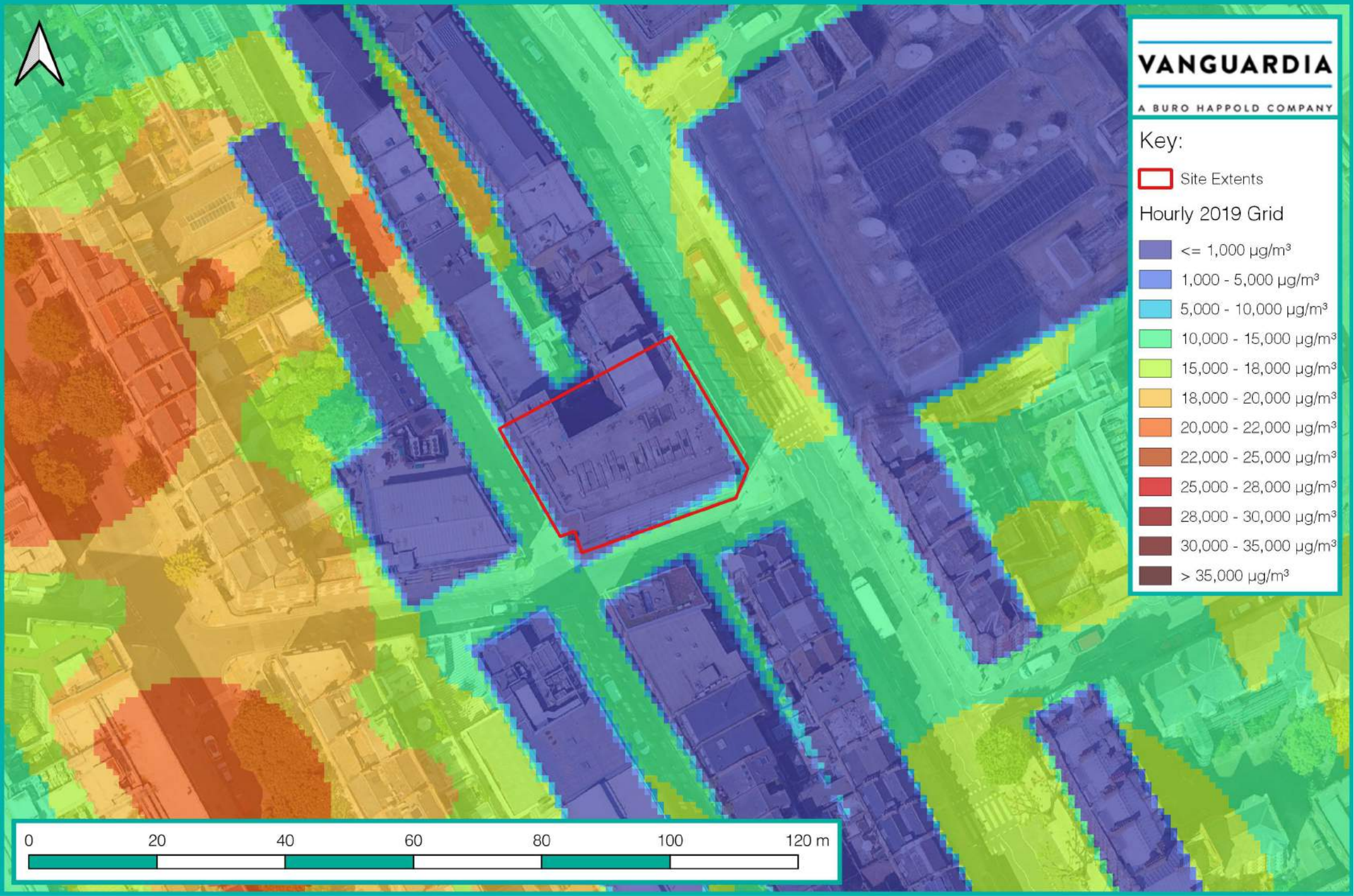


Figure E.3. Methanol Hourly Grids 2020 (Z = 0m)

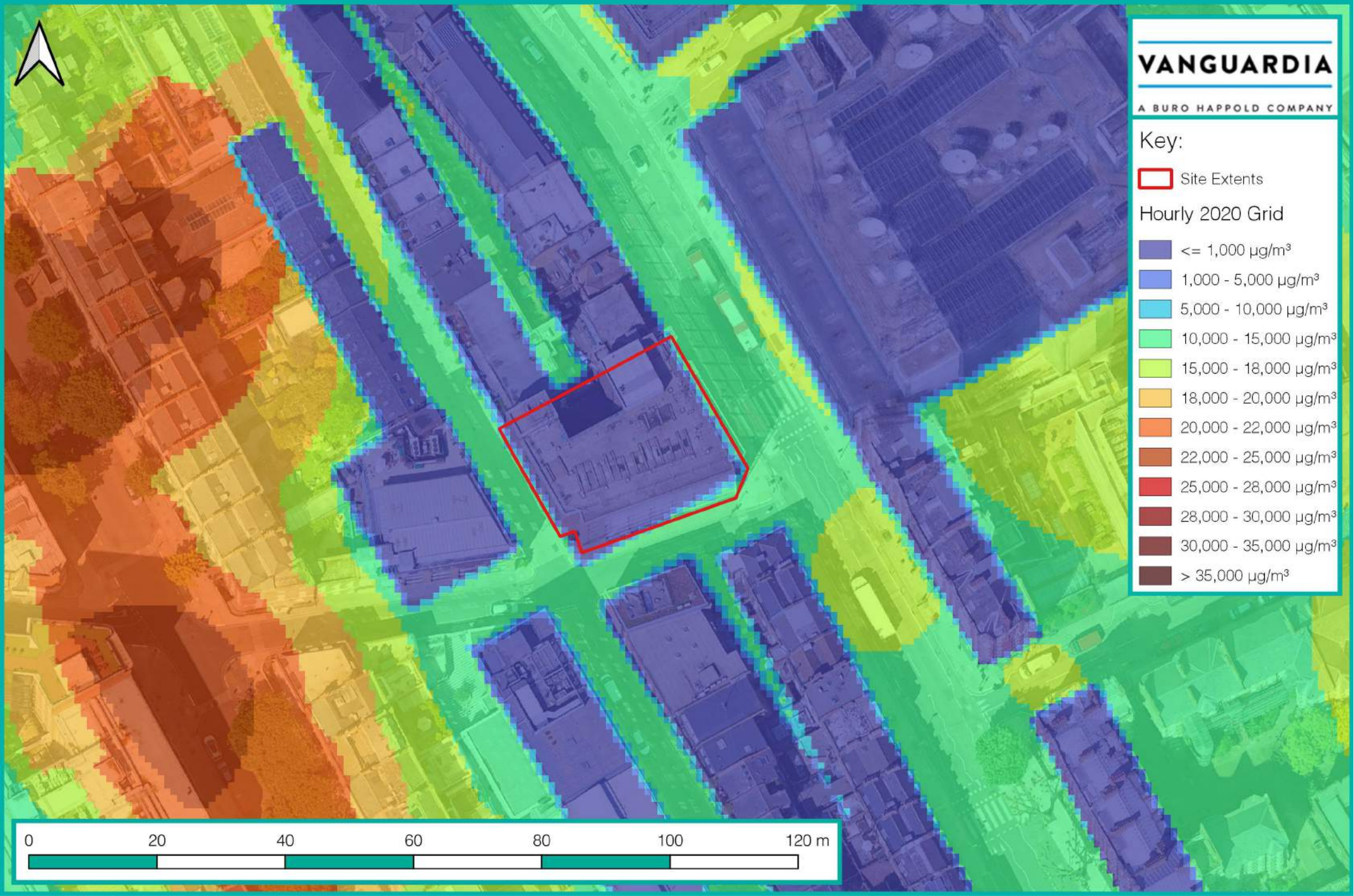


Figure E.4. Methanol Hourly Grids 2021 (Z = 0m)

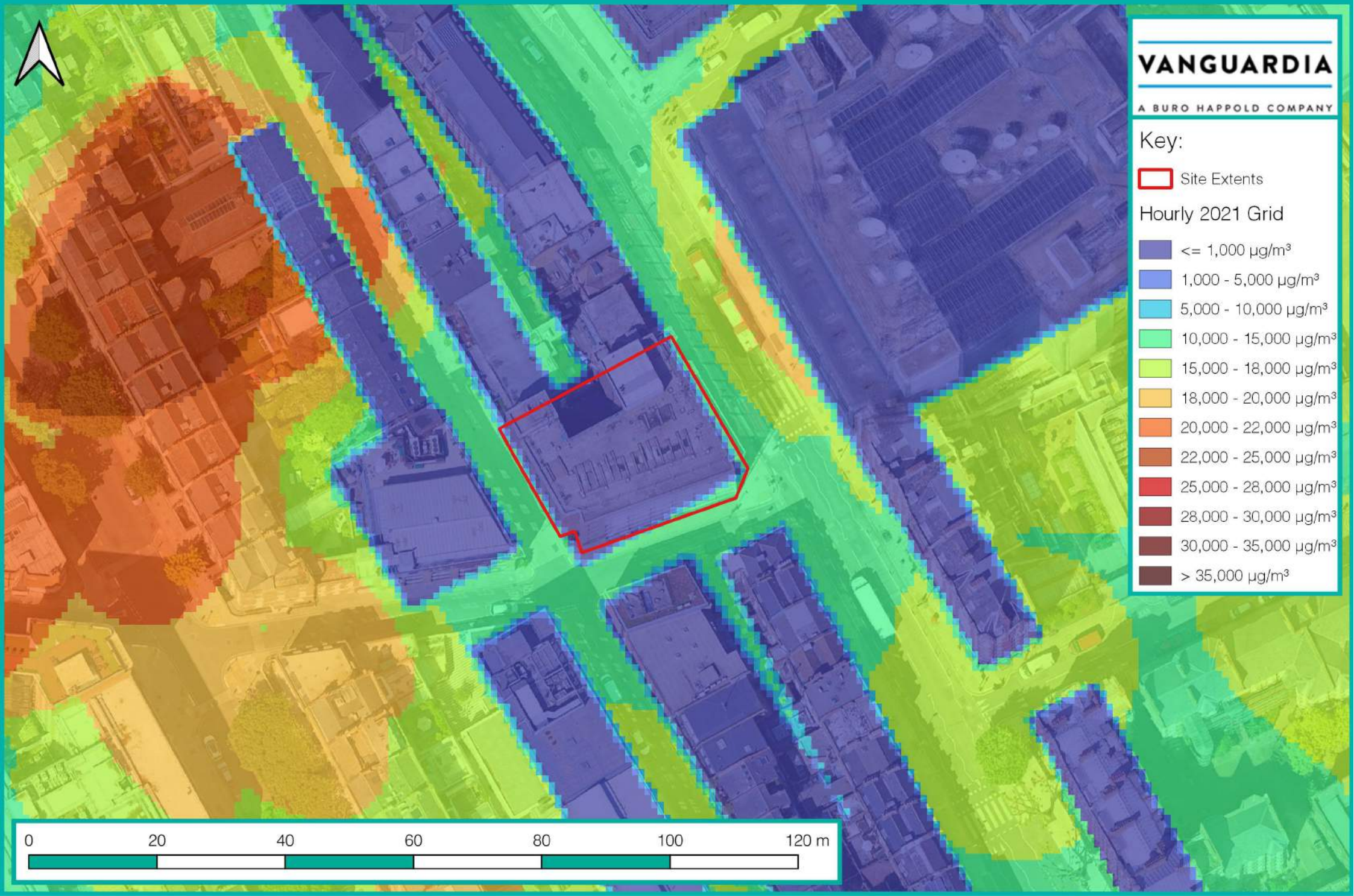


Figure E.5. Methanol Hourly Grids 2022 (Z = 0m)