Lumentum Technology UK

Air Quality Assessment

Caswell Production Facility, Caswell Science and Technology Park

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TETRA TECH

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Executive summary

This report details the air quality assessment undertaken to accompany the permit variation EPR/WP3633BB for Lumentum Technology UK Limited's site at Caswell Science and Technology Park, Caswell, Towcester, Northants, NN12 8EQ. The assessment has been undertaken based upon appropriate information provided by Lumentum Technology UK and its project team. In undertaking this assessment, Tetra Tech experts have exercised professional skills and judgement to the best of their abilities and have given professional opinions that are objective, reliable and backed with scientific rigour. These professional responsibilities are in accordance with the code of professional conduct set by the Institution of Environmental Sciences for members of the Institute of Air Quality Management (IAQM).

Regarding the operational phase, the most important consideration is stack emissions. This assessment predicts that ground-level concentrations will be within acceptable levels across the modelled grid and at sensitive receptors and will not give rise to any significant adverse effects.

The proposed development does not, in air quality terms, conflict with national or local policies. There are no constraints to the development in the context of air quality.

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1.0 Introduction

1.1 This report details the air quality assessment undertaken to accompany the permit variation EPR/WP3633BB for Lumentum Technology UK Limited's site at Caswell Science and Technology Park, Caswell, Towcester, Northants, NN12 8EQ. It covers the emissions to air from two stacks on the site; one emits Chlorobenzene and the other emits Dinonyl Phthalate.

1.2 A H1 assessment with emissions to air was initially submitted to the Environment Agency including all existing and proposed emissions points for the site.

1.3 The Pre-application Meeting with the Environment Agency raised concerns about the use of Dibutyl Phthalate as a proxy Environmental Assessment Level for Dinonyl Phthalate. The EA stated that as there will be uncertainty in the selected EAL, dispersion modelling would be required. As such, Tetra Tech have undertaken dispersion modelling of the two emission points where pollutants with proxy EALs have been used. Stack 030/068 which emits Dinonyl Phthalate and Stack 030/029 which emits Chlorobenzene.

1.4 The enhanced pre-application advice from the EA stated the following:

*"**2. Air Emissions Risk Assessment***

2.1 Use of Proxies / Read Across. No toxicology-based justification has been provided for the selected proxies. Whilst we don't rule out accepting them as read-across, this will be on advice from the UKHSA. The EA has developed guidance to be followed on the methodology to derive EALs:

Methodology for the scientific derivation of Environmental Assessment Levels (EALs)

Derivation of EALs, including proposal of read-across (also referred to as 'proxy') should be based on robust hazard identification and hazard characterisation (the first two stages of the toxicological risk assessment presented in our guidance, i.e. hazard identification, hazard characterisation, exposure assessment, and risk characterisation) carried out by suitably qualified assessors with relevant experience in toxicology.

2.2 Substances Identity. For the emitted substance referred to as Dinonyl phthalate ($C_{26}H_{42}O_4$) it is not clear which isomer is emitted, i.e. whether the emitted substance would could be Di-isononyl phthalate (CAS 28553-12-0), as opposed to CAS 84-76-4 (if this can be determined). Both of these isomers have the same brute formula (C26H42O4), but may present different hazards according to risk phrases on ECHA, with reprotoxicity reported for the second. You should include CAS numbers for all the emitted substances, where there potential ambiguity.

2.3 Screening and Modelling. Where uncertainties exist in read across and EAL derivation, and where H1 does not screen out on process contribution (i.e.

PC_LongTerm is >1% or PC_ShortTerm is >10%), we would advise you provide air dispersion modelling to refine the risk assessment."

1.5 This report begins by setting out the policy and legislative context for the assessment. The methods and criteria used to assess potential air quality effects have then been described. The baseline air quality conditions have been established taking into account Defra estimates, local authority documents and the results of any local monitoring. The results of the assessment of air quality impacts have been presented. A conclusion has been drawn on the significance of the residual construction-phase effects and the residual operational-phase effects.

2.0 Policy and Legislative Context

Environmental Permitting Regulations

2.1 EU Directive 96/61/EC concerning Integrated Pollution Prevention and Control ("the IPPC Directive") [2] applies an integrated environmental approach to the regulation of certain industrial activities. The Environmental Permitting Regulations (EPR) 2016 [1] implement the Directive relating to installations in England and Wales. The Regulations define activities that require an Environmental Permit from the Environment Agency (EA).

2.2 EPR is a regulatory system that employs an integrated approach to control the environmental impacts of certain listed industrial activities including the generation of energy from waste. The intention of the regulatory system is to ensure that BAT, required by the IED, are used to prevent or minimise the effects of an activity on the environment, having regard to the effects of emissions to air, land and water via a single permitting process.

2.3 To gain a permit, Operators have to demonstrate in their applications, in a systematic way, that the techniques they are using or are proposing to use are the BAT for their installation and meet certain other requirements taking account of relevant local factors. The permitting process also places a duty on the regulating body to ensure that the requirements of the IED are included for permitted sites to which these apply.

2.4 The essence of BAT is that the techniques selected to protect the environment should achieve a high degree of protection of people and the environment taken as a whole. Indicative BAT standards are laid out in national guidance and where relevant, should be applied unless a different standard can be justified for a particular installation. The EA is legally obliged to go beyond BAT requirements where Air Quality Limit Values may be exceeded by an existing operator.

2.5 The Environment Agency's on-line guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit'* [2] provides guidelines for air dispersion modelling. The assessment of air quality effects for the proposed development is consistent with this guidance.

Air Quality Standards Regulations

Environmental Assessment Levels

2.6 The Environment Agency's on-line guidance entitled '*Environmental management – guidance, Air emissions risk assessment for your environmental permit'* [2] provides further assessment criteria in the form of EALs.

2.7 There are no EALs for Chlorobenzene, however for Total Volatile Organic Compounds (TVOCs) the EA's on-line guidance states *"If you cannot identify what all* *the substances in them are, treat the unknowns as 100% benzene in your risk assessment. If you want to treat them as something else, you'll need to explain why".*

2.8 For the purpose of this assessment, chlorobenzene has been compared against the EAL for benzene in line with the EA recommendation.

2.9 The Air Quality Standards Regulations 2010 [3] amended by The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 [4], sets limit values for ambient air concentrations for the main air pollutants: particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene, certain toxic heavy metals (arsenic, cadmium and nickel) and polycyclic aromatic hydrocarbons (PAHs). These limit values are legally binding on the Secretary of State. The Government and devolved administrations operate various national ambient air quality monitoring networks to measure compliance and develop plans to meet the limit values.

2.10 Benzene has a statutory annual mean Air Quality Limit Value of 5 $\mu g.m^{-3}$

2.11 There is no EAL for Dinonyl Phthalate, and therefore an EAL has been derived in accordance with the EA's *'Methodology for the scientific derivation of Environmental Assessment Levels (EALs)*'.

2.12 Table 2.1 presents the EALs used in this assessment.

Table 2.1: Environmental Assessment Levels (EALs)

Pollutant	Long-term EAL ($\mu g.m^{-3}$)	Short-term EAL ($\mu g.m^{-3}$)
Dinonyl Phthalate (Derived)	3,080 (24 hour mean) for adults 1,320 (24 hour mean) for children	73,920 for adults 31,680 for children
Chlorobenzene (Benzene)	5 (annual mean)	30 (24 hour mean)

2.13 Table 2.2 shows how the EALs for Dinonyl Phthalate have been derived.

Table 2.2: Derivation of Dinonyl Phthalate

Stage	Answer	Comment
Is a suitable point of departure available from an inhalation study?	No	A literature review of the toxicity of Dinonyl Phthalate was undertaken. No studies involving the inhalation route were available, however oral studies were.
Is a suitable point of departure available from an oral study?	Yes	No Observable Acute Exposure Limits (NOAELs) available from various oral studies (page 9 and Table 3 of Diisononyl phthalate DINP.pdf[5]). 88-108 mg/kg bw/d (milligrams per kilogram of body weight per day) from two-year repeat dose toxicity/carcinogenicity study in rats (liver and kidney toxicity).

		77 mg/kg bw/d from 13-week dietary study in rats (kidney and liver toxicity). 972 mg/kg bw/d or 365 mg/kg/d from 13-week dietary study in mice (liver toxicity). 90-112 mg/kg bw/d from two-year dietary carcinogenicity study in mice (kidney and liver toxicity). 500 mg/kg bw/d from 13-week monkey study (body weight).
Apply route-to-route extrapolation	Yes	*"In many cases for the estimation of the POD for inhalation exposure, the oral dose in mg per kg bodyweight per day from a relevant animal or human study can be converted to an equivalent air concentration by multiplying the oral dose by 70 kg for an adult bodyweight and dividing by an adult respiration rate of 20 m^3 per day. In some cases, it is more relevant to use child factors of 15 kg bodyweight and 10 m^3 per day, respectively"* From the two-year repeat dose study in rats of 88-108 mg/kg bw/d this gives a point of departure (POD) of 308 - 378 $mg/m^3/d$ for adults. For children the POD is 132-162 $mg/m^3/d$. The two-year repeat dose study in rats has been chosen due to the significantly longer study period than the majority other available studies and lower NOAEL than the two-year study in mice.
Apply an uncertainty factor	Yes	EAL = POD / Uncertainty factors (UF) Interspecies variability UF = 10 Intraspecies variability UF = 10 Duration UF not required as study is 2-years or longer. EAL = 308 (378) / (10 * 10) = 3.08 - 3.78 $mg/m^3/d$ for adults or 132 (162) / (10 * 10) = 1.32 – 1.62 $mg/m^3/d$ for children.
Short- or long-term EAL derived	Yes	*"For substances with an identifiable threshold for effect, the time-weighted averaging time for exposure for long-term EALs is considered to be 24-hours. This is consistent with the convention to base oral assessments of such effects on a tolerable daily intake, and the potential for people to be continually present, for example, at their residence close to a permitted site"* Long-term EAL should be 24-hour time-weighted mean concentration of 3.08 - 3.78 mg/m^3. Short-term 1-hour maximum EAL of 73 - 90 mg/m^3 (long-term multiplied by 24).

		Conservative EALs: Long-term 24-hour maximum 3,080 μg.m^{-3} for adults or 1,320 μg.m^{-3} for children Short-term 1-hour maximum 73,920 μg.m^{-3} for adults or 31,680 μg.m^{-3} for children.

3.0 Assessment Methodology

Approach

3.1 This air quality assessment includes the key elements listed below:

- Establishing the background Ambient Concentration (AC) from consideration of Air Quality Review & Assessment findings and assessment of existing local air quality through a review of available air quality monitoring and Defra background map data in the vicinity of the proposed site.
- Quantitative assessment of the operational effects on local air quality from stack emissions utilising a “new generation” Gaussian dispersion model, ADMS 6. Assessment of Process Contributions (PC) from the facility in isolation, and assessment of resultant Predicted Environmental Concentrations (PEC), taking into account cumulative impacts through incorporation of the AC.

3.2 Air quality guidance advises that the organisation engaged in assessing the overall risks should hold relevant qualifications and/or extensive experience in undertaking air quality assessments. The air quality team members involved at various stages of this assessment have professional affiliations that include Member of the Institute of Air Quality Management and Member of the Institution of Environmental Sciences and have the required academic qualifications for these professional bodies.

Pollutant Concentrations

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

3.4 The atmospheric pollutant concentrations in an urban area depend not only on local sources at a street scale, but also on the background pollutant level made up of the local urban-wide background, together with regional pollution and pollution from more remote sources brought in on the incoming air mass. This background contribution needs to be added to the fraction from the modelled sources, and is usually obtained from measurements or estimates of urban background concentrations for the area in locations that are not directly affected by local emissions sources. Background pollution levels are described in detail in Section 4.0.

Dispersion Model Selection

3.5 A number of commercially available dispersion models are able to predict ground level concentrations arising from emissions to atmosphere from elevated point sources. Modelling for this study has been undertaken using ADMS 6, a version of the ADMS (Atmospheric Dispersion Modelling System) developed by Cambridge Environmental Research Consultants (CERC) that models a wide range of buoyant and passive releases to atmosphere either individually or in combination. The model calculates the mean concentration over flat terrain and also allows for the effect of plume rise, complex terrain, buildings and deposition. Dispersion models predict atmospheric concentrations within a set level of confidence and there can be variations in results between models under certain conditions; the ADMS 6 model has been formally validated and is widely used in the UK and internationally for regulatory purposes.

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

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

Model Inputs

Meteorological Data

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

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

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

3.9 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using five years of data from Church Lawford between 2021 and 2025.

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

Stack Parameters and Emissions Rates used in the Model

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

3.12 Stack emissions characteristics modelled are provided in Table 3.1. The stack location is shown in Figure 2.

Table 3.1: Stack Characteristics

Parameter	Unit	Value (30/068)	Value (30/029)	Data Source
Stack height	m	10.5	8.7	Site plans
Internal diameter	m	0.42 (effective diameter).	0.24	Exhaust is rectangular 0.48 x 0.3 m so effective circular

Parameter	Unit	Value (30/068)	Value (30/029)	Data Source
				diameter has been calculated)
Efflux velocity	$m.s^{-1}$	9.9	14	Measured
Efflux temperature	°C	20	20	Assumed ambient temperature of stack gas
Actual Volumetric Flow Rate	$m^3.s^{-1}$	1.43	0.63	Calculated
Concentration (Dinonyl Phthalate)	$mg.m^{-3}$	44.51*		Measured total VOC emission provided in ppm. $mg.m^{-3}$ calculated using molecular weight of Dinonyl Phthalate
Mass emission rate (Dinonyl Phthalate)	$g.s^{-1}$	0.063	-	Calculated
Concentration (Chlorobenzene)	$mg.m^{-3}$	-	2**	Measured total VOC emission provided in ppm. $mg.m^{-3}$ calculated using molecular weight of chlorobenzene
Mass emission rate (Chlorobenzene)	$g.s^{-1}$	-	0.001	

*assumed that total VOC emission is all Dinonyl Phthalate when it comprises of a mix of Acetone, 2-propanol and Dinonyl Phthalate.

** assumed that total VOC emission is all Chlorobenzene when it comprises of a mix of Acetone, 2-propanol and Chlorobenzene. BAT AEL of 2 $mg.m^{-3}$ used.

***Acetone and 2-propanol screened out during the H1 assessment and have not been considered in this assessment.

3.13 To be conservative, it is assumed the stacks will be in operation 8,760 hours a year at constant emission rates.

Terrain

3.14 The presence of elevated terrain can significantly affect (usually increase) ground level concentrations of pollutants emitted from elevated sources such as stacks, by reducing the distance between the plume centre line and ground level and by increasing turbulence and, hence, plume mixing. A complex terrain file has been used within the model.

Surface Roughness

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

3.16 A surface roughness length of 0.3 m, which the software developer recommends for use in agricultural areas, has been used within the model to represent the average surface characteristics across the study area.

Building Wake Effects

3.17 The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. The dominant structures (i.e. with the greatest dimensions likely to promote turbulence) included within the model are listed in Table 3.2.

Table 3.2: Dimensions of Buildings Included Within the Dispersion Model

ID	Name	X (m) Approx Centre Location	Y (m) Approx Centre Location	Height (m)	Length (m)	Width (m)	Angle (Degrees)
1	Building 30	465193	251019	7.8	62	47	83.5
2	Building 3A	465124	251010	8.47	62.5	47	83.5
3	Substation	465180	250988	7.8	8.2	9.5	83.5

Model outputs

Receptors

3.18 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For assessing human-health impacts, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG22 [6] provides examples of exposure locations and these are summarised in Table 3.3.

Table 3.3: Examples of Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building's façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building's façade), or any other location where public exposure is expected to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.19 The ground level concentrations have been modelled at locations across a grid of 3 km by 3 km, with a spacing of 30 m, centred on the stack.

3.20 In addition, the effects of the proposed development have been assessed at the façades of a representative selection of discrete local existing receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 3.4 and illustrated in Figure 2.

Table 3.4: Modelled Sensitive Receptors

ID	Description	X	Y
1	Caswell Farm	465326	250772
2	Blackbridge Farm 1	464813	250602
3	Blackbridge Farm 2	464830	250537
4	The Wilds	466048	251132
5	Manor Cottage	463960	251763
6	The Gables	465388	250544

3.21 The EALSs for all the different averaging periods apply at the façades of the modelled sensitive receptors.

Significance Criteria

3.22 The on-line EA guidance entitled *'Environmental management – guidance, Air emissions risk assessment for your environmental permit'* [2] has been used. This guidance provides details for screening out substances for detailed assessment. In particular, it states that:

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

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

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

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

3.23 It continues by stating that:

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

3.24 It then states that further action may be required where:

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

3.25 The EA online guidance '*Environmental permitting: air dispersion modelling reports'* [7] states:

"For a detailed modelling assessment PCs are insignificant where they are less than:

- *10% of a short-term environmental standard*
- *1% of a long-term environmental standard*

At the detailed modelling stage there are no criteria to determine whether:

- *PCs are significant*
- *PECs are insignificant or significant*

You must explain how you judged significance and base this on the site specific circumstances."

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

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

Uncertainty

3.27 All air quality assessment tools, whether models or monitoring measurements, have a degree of uncertainty associated with the results. The choices that the practitioner makes in setting-up the model, choosing the input data, and selecting the baseline monitoring data will decide whether the final predicted impact should be considered a central estimate, or an estimate tending towards the upper bounds of the uncertainty range (i.e. tending towards worst-case).

3.28 The atmospheric dispersion model itself contributes some of this uncertainty, due to it being a simplified version of the real situation: it uses a sophisticated set of mathematical equations to approximate the complex physical and chemical atmospheric processes taking place as a pollutant is released and as it travels to a receptor. The predictive ability of even the best model is limited by how well the turbulent nature of the atmosphere can be represented.

3.29 Each of the data inputs for the model, listed earlier, will also have some uncertainty associated with them. Where it has been necessary to make assumptions, these have mainly been made towards the upper end of the range informed by an analysis of relevant, available data.

3.30 The main components of uncertainty in the total predicted concentrations, made up of the background concentration and the modelled fraction, include those summarised in Table 3.5.

Table 3.5: Approaches to Dealing with Uncertainty used Within the Assessment

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
Background Concentration	Characterisation of future baseline air quality (i.e. the air quality conditions in the future assuming that the development does not proceed)	The future background concentration used in the assessment is the same as the current background concentration and no reduction has been assumed. This is a conservative assumption as, in reality, background concentrations are likely to reduce over time as cleaner vehicle technologies form an increasing proportion of the fleet.	The background concentration is the major proportion of the total predicted concentration. The conservative assumptions adopted ensure that the background concentration used within the model contributes towards the results being towards the top of the uncertainty range, rather than a central estimate.
Model Input/ Output Data	Meteorological Data	Uncertainties arise from any differences between the conditions at the met station and the development site, and between the historical met years and the future years. These have been minimised by using meteorological data collated at a representative measuring site. The model has been run for 5 full years of meteorological conditions.	
	Receptors	The model has been run for a grid of receptors. In addition, receptor locations have been identified where concentrations are highest or where the greatest changes are expected.	

Concentration	Source of Uncertainty	Approach to Dealing with Uncertainty	Comments
	Emissions Data	The two modelled stacks emit a combination of VOCs (Acetone, 2-propanol and either Dinonyl Phthalate or Chlorobenzene). It has been assumed that the total VOCs are all comprised of one pollutant in each stack. It has also been assumed that stacks will operate continuously for 8760 hours per year.	
	EALs	The EALs for Dinonyl Phthalate have been derived for adults and children and the predicted concentrations compared against both.	

4.0 Baseline Air Quality Conditions

Overview

4.1 The ambient concentration often represents a large proportion of the total pollution concentration, so it is important that the ambient concentration selected for the assessment is realistic. EPUK & IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on air quality.

4.2 For this assessment, the background air quality has been characterised by drawing on information from:

- results published by national monitoring networks.

4.3 The ambient concentrations (AC) used in the assessment are set out in Table 4.1.

Table 4.1: Summary of Assumed Ambient Concentrations

Pollutant	Long-term	Data Source
Benzene*	0.43	Leamington Spa (five-year average 2020-2024)

*No monitoring for Dinonyl Phthalate or Chlorobenzene is undertaken in the UK. As such Benzene has been used as a proxy the EA guidance advises to treat VOCs as Benzene if unknown.

5.0 Assessment of Operational-Phase Air Quality Impacts

Stack Emissions

5.1 For each of the five years of meteorological data (2021 to 2025), the maximum predicted ground-level concentration across the modelled domain and concentrations at sensitive receptors have been derived and are reported below.

5.2 Table 5.1 summarises the maximum predicted PC across the modelled grid to ground-level concentrations and predicted concentrations for Dinonyl Phthalate.

5.3 Table 5.2 summarises the predicted PCs at sensitive receptors for Dinonyl Phthalate.

Table 5.1: Maximum Predicted Dinonyl Phthalate Process Contributions across the Grid

Averaging period	EAL ($\mu g.m^{-3}$)	Max PC ($\mu g.m^{-3}$)	Max PC as % of EAL	Criteria (%)	PC is Potentially Significant?	AC ($\mu g.m^{-3}$)	PEC ($\mu g.m^{-3}$)	PEC as % of EAL	PEC is Potentially Significant?
24-hour (maximum)	3080 (adults) 1320 (children)	18.1	0.6	1	No	0.43 (benzene)	-	-	-
	1320 (children)		1.4		Yes		18.5	1.4	No
1 hour (maximum)	73920 (adults)	72.1	0.1	10	No	-	-	-	-
	31680 (children)		0.2		No	-	-	-	-

Table 5.2: Predicted Dinonyl Phthalate Process Contributions at Sensitive Receptors

Averaging period	Receptor						Max	Max PC as % of EAL
	Caswell Farm	Blackbridge Farm 1	Blackbridge Farm 2	The Wilds	Manor Cottage	The Gables		
24-hour (maximum)	2.79	1.94	1.57	0.84	0.53	1.37	2.79	0.1
1 hour (maximum)	12.83	8.66	7.89	4.03	2.28	6.54	12.83	<0.05

5.4 The results presented in Table 5.1 and Table 5.2 show that the predicted PC is below 10% of the relevant short-term EAL and below 1% of the long-term EAL for adults. When comparing the PC against the short-term EAL for children, the PC exceeds 1% of the EAL however, when the long-term PC is added to the background AC, the PEC is well below 100% of the EAL. Therefore, the impacts are not considered significant.

5.5 Table 5.3 summarises the maximum predicted PC across the modelled grid to ground-level concentrations and predicted concentrations for Chlorobenzene. Where the PC cannot be screened out as insignificant, the resulting PECs have been calculated by adding the PC to the background AC.

5.6 Table 5.4 summarises the predicted PCs at sensitive receptors for Chlorobenzene.

Table 5.3: Maximum Predicted Chlorobenzene Process Contributions across the Grid

Averaging period	EAL ($\mu g.m^{-3}$)	Max PC ($\mu g.m^{-3}$)	Max PC as % of EAL	Criteria (%)	PC is Potentially Significant?	AC ($\mu g.m^{-3}$)	PEC ($\mu g.m^{-3}$)	PEC as % of EAL	PEC is Potentially Significant?
Annual mean	5	0.10	2.0	1	Yes	0.43 (benzene)	0.53	10.6	No
24 hour (maximum)	30	0.61	2.0	10	No	-	-	-	-

Table 5.4: Predicted Chlorobenzene Process Contributions at Sensitive Receptors

Averaging period	Receptor						Max	Max PC as % of EAL
	Caswell Farm	Blackbridge Farm 1	Blackbridge Farm 2	The Wilds	Manor Cottage	The Gables		
Annual mean	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.2
24 hour (maximum)	0.09	0.04	0.03	0.02	0.01	0.04	0.09	0.3

5.7 The results presented in Table 5.3 show that the predicted PC is below 10% of the relevant short-term EAL and the short-term impacts are not considered significant. When comparing the chlorobenzene PC against the long-term EAL for benzene, the PC exceeds 1% of the EAL however, when the long-term PC is added to the background AC, the PEC is well below 100% of the EAL. Therefore, the impacts are not considered significant. This is conservative because the predicted concentrations are likely overestimations due to treating the total emissions as a single pollutant.

5.8 A contour plot of each averaging period for dinonyl phthalate and chlorobenzene are shown in Figure 3, Figure 4, Figure 5 and Figure 6. The contours are for the year with the maximum PC across the grid.

Significance of Effects

5.9 It is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

5.10 Using professional judgement, the resulting air quality effect is considered to be 'not significant' overall.

Sensitivity and Uncertainty

5.11 As set out in Section 3, it is generally considered good practice that, where possible, an assessment should communicate effects both numerically and descriptively. Professional judgement by a competent, suitably qualified professional is required to establish the significance associated with the consequence of the impacts.

5.12 Based on the predicted concentrations, the effects are deemed to be not significant, with no predicted exceedances of any objectives or standards with relevant exposure across the modelled grid.

6.0 Mitigation

6.1 Predicted concentrations of pollutants have been demonstrated by the assessment to meet all relevant air quality standards, objectives and EALs. On that basis, no mitigation is proposed.

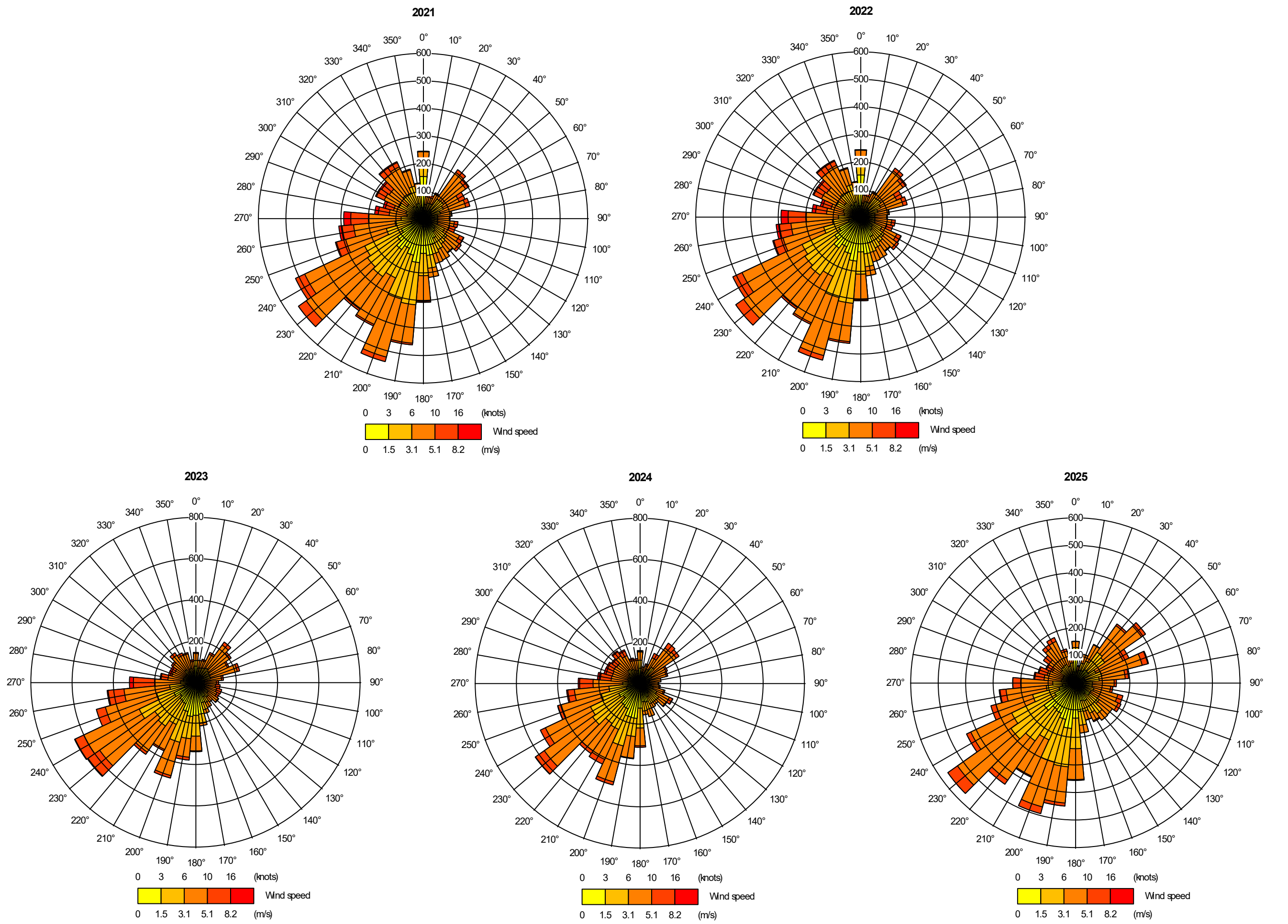
7.0 Conclusions

7.1 This assessment has considered the air quality impacts during the operational phase of for Lumentum Technology UK Limited’s site at Caswell Science and Technology Park.

7.2 Emissions from the facility has been assessed through detailed dispersion modelling using best practice approaches. The assessment has been undertaken based on a number of conservative assumptions. This is likely to result in an over-estimate of the contributions that will arise in practice from the facility. The operational impact on receptors in the local area is predicted to be ‘negligible’ taking into account the changes in pollutant concentrations and the absolute levels. Using the criteria adopted for the assessment, together with professional judgement, the effects are not considered significant.

7.3 Overall, the effects of the facility are not considered to be significant.

Figures



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Project: Caswell Production Facility	
Job Ref: 794-ENV-EPC-21858	
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Figure 1: Wind Roses – Church Lawford

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Figure 2: Stacks, Buildings and Recptors Modelled	

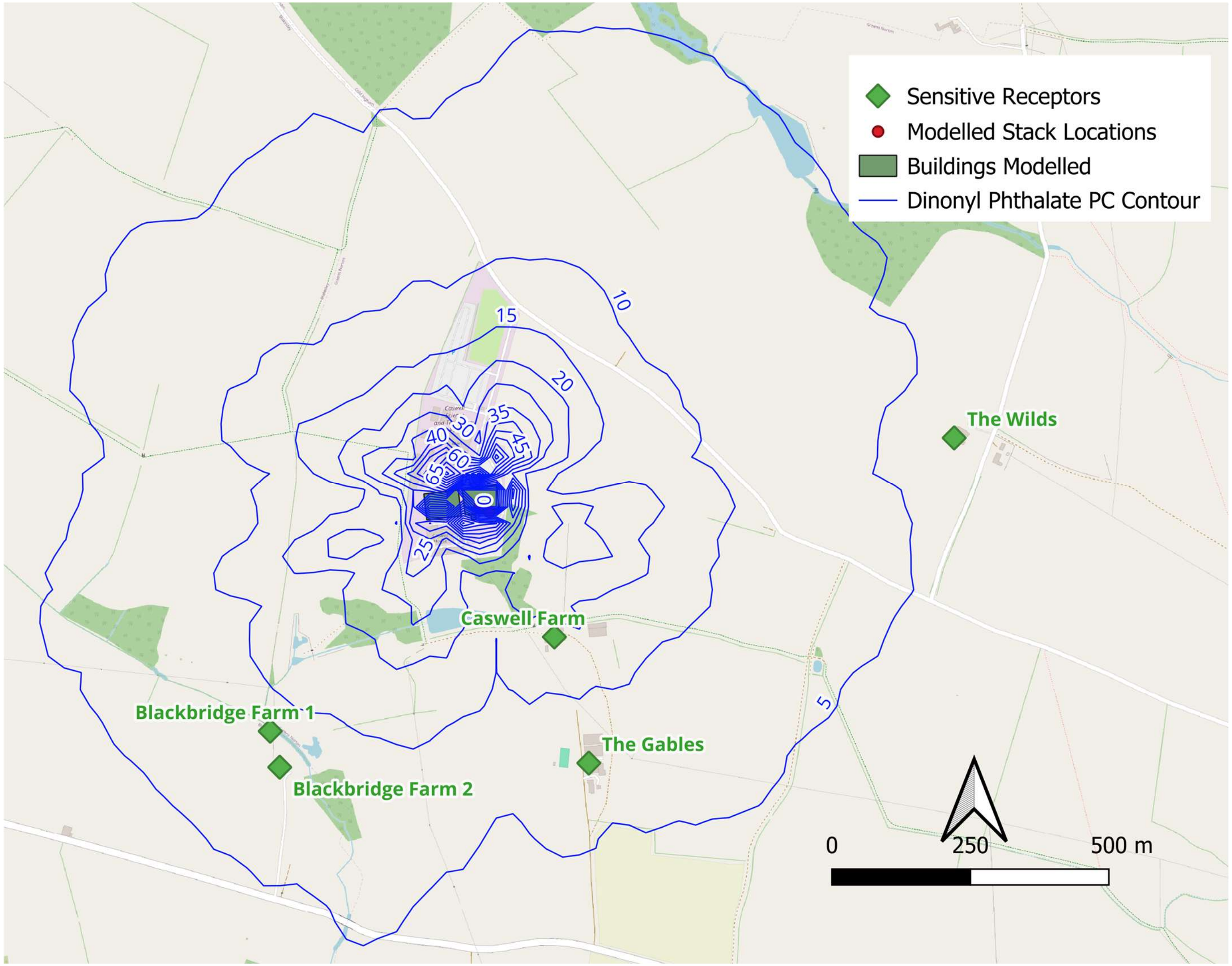

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Figure 3: 1-hour Maximum Dinonyl Phthalate Contour

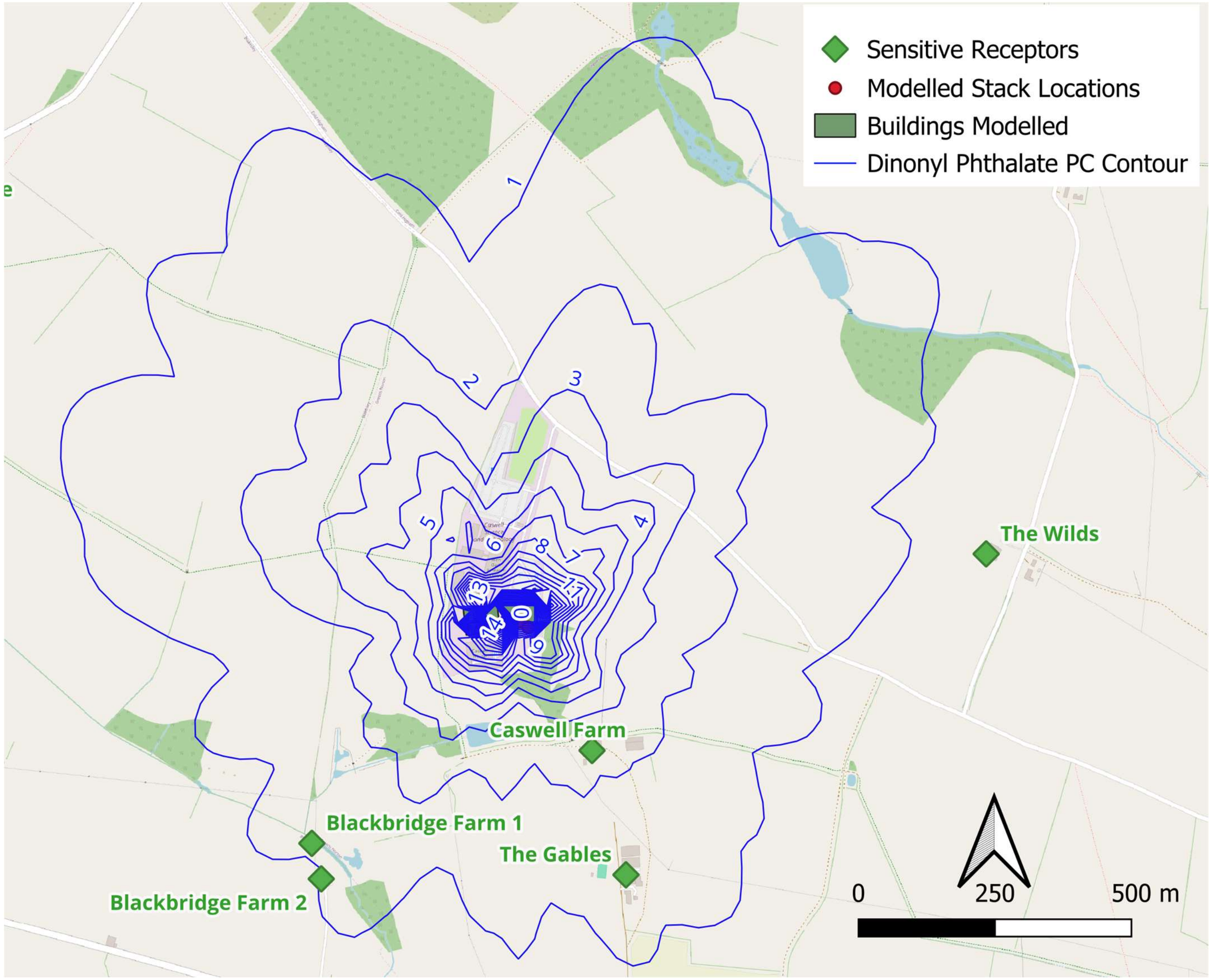

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Figure 4: 24-hour maximum Dinonyl Phthalate

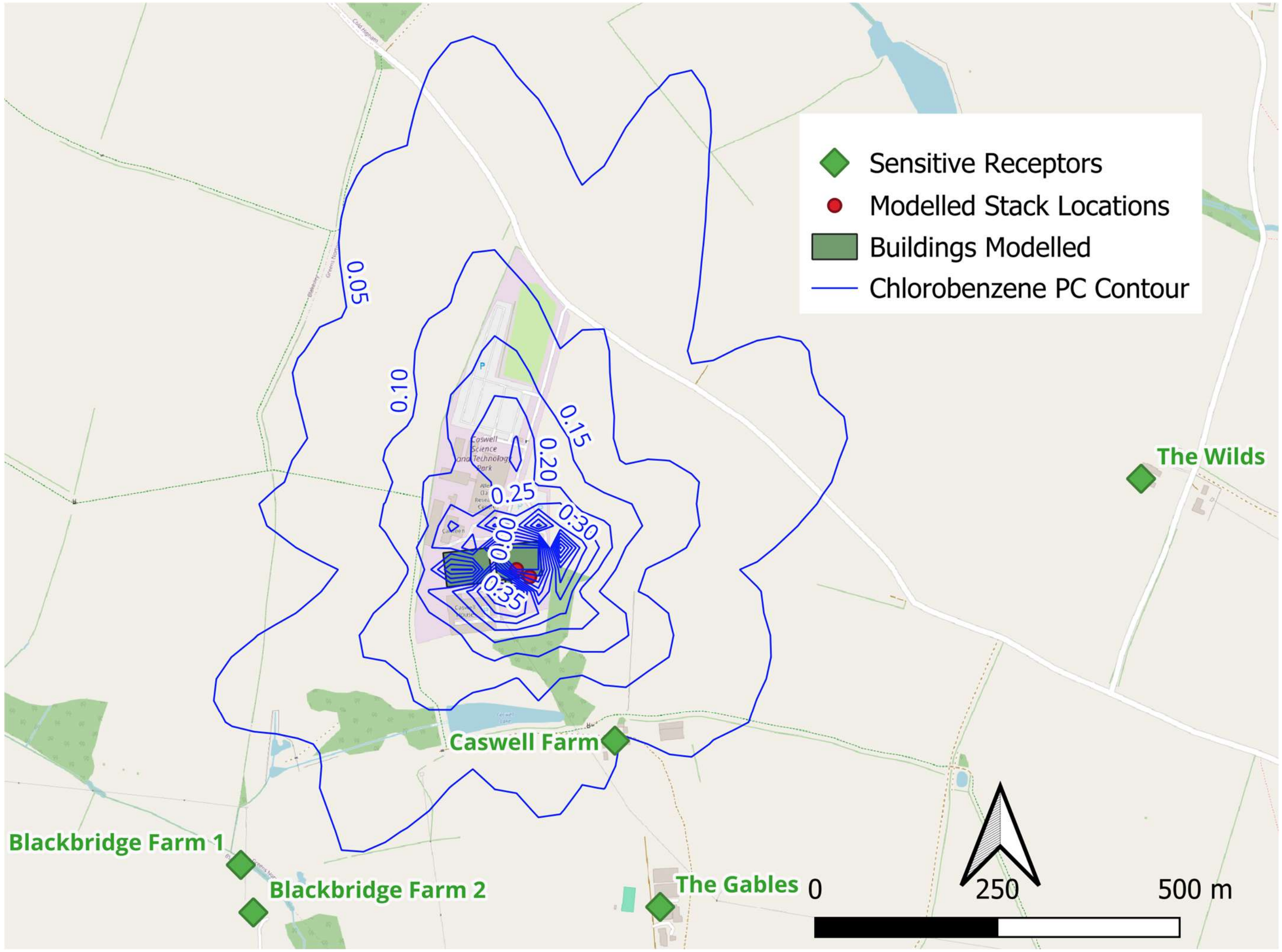

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Figure 5: 24-hour maximum Chlorobenzene

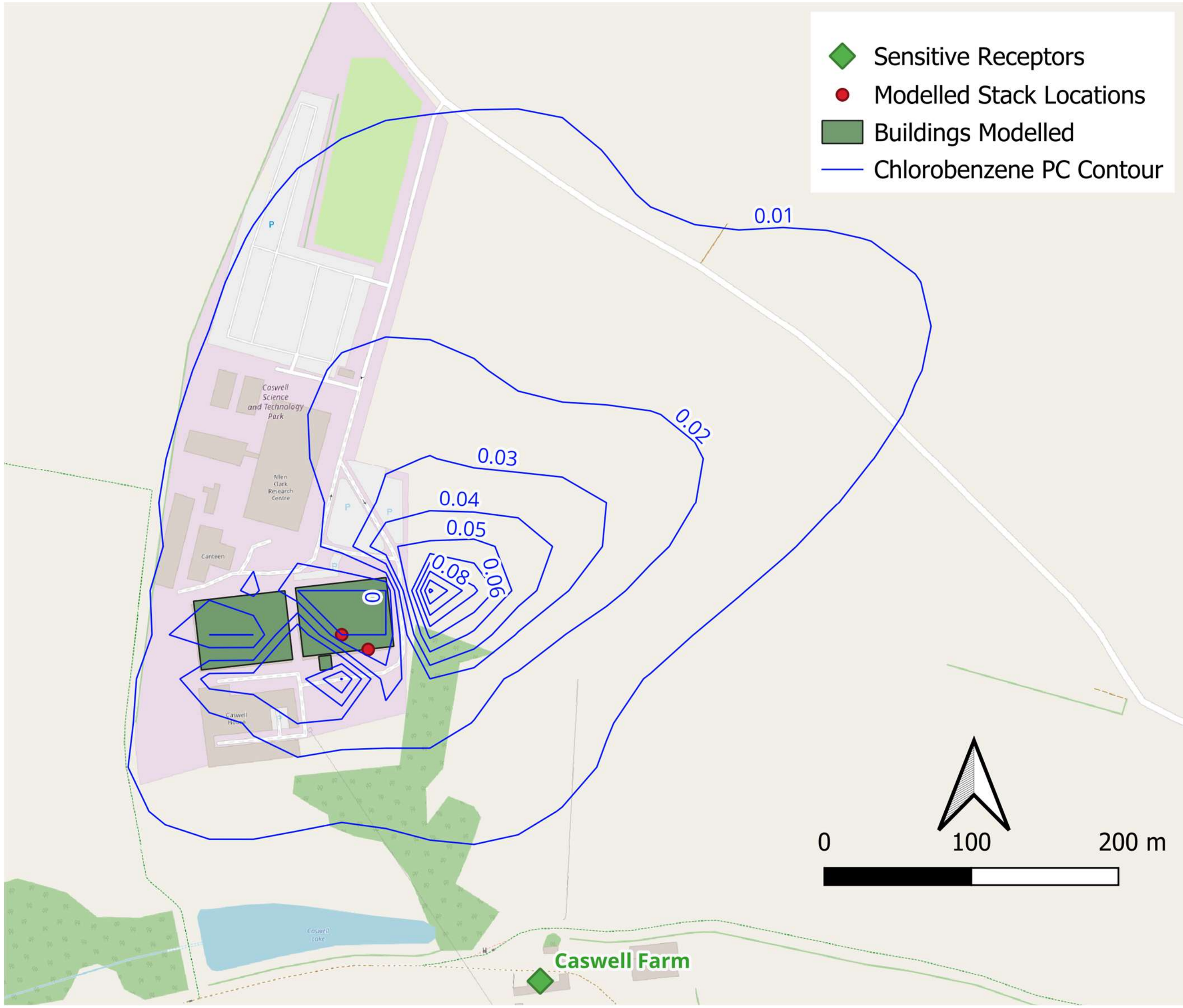

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Figure 6: Annual Mean Chlorobenzene

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