Intended for
Ball Beverage Packaging UK Limited

Date
May 2022

Project Number
1620011745-001

BALL PACKAGING KETTERING SITE ENVIRONMENTAL RISK ASSESSMENT

RAMBOLL

BALL PACKAGING KETTERING SITE
ENVIRONMENTAL RISK ASSESSMENT

Project No.	**1620011745-001**
Issue No.	**01**
Date	16**/05/2022**
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Version Control Log

Revision	Date	Made by	Checked by	Approved by	Description
1	16/05/2022	LB	RW	RW	For client review

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INTRODUCTION

Ramboll Environment and Health UK Limited (Ramboll) was commissioned by Ball Beverage Packaging UK Limited (the 'Client') to prepare an Environmental Risk Assessment (ERA) for its manufacturing facility located at Plot 4b, Segro Park, Kettering Gateway (the 'Facility' or the 'site'). The ERA shall support the Client's application for an Environmental Permit (EP).

The objective of the ERA is to identify the scenarios where pollution to air, water or land could occur, particularly where there is the likelihood of an accident The Environmental Risk Assessment (ERA) is carried out based on the Environment Agency's (EA) EPR H1 Guidance.

In accordance with the aforementioned guidance, this ERA is structured as follows:

1. Identification and consideration of risks for the Facility and sources of the risks.
2. Identification of receptors (people, animals, property and anything else that could be affected by the hazard) at risk from the Facility.
3. Identification of possible pathways from the sources of the risks to receptors.
4. Assessment of the risks relevant to the specific activities carried out at the site and consideration of which risks can be screened out as negligible.
5. Description of measures to control identified risks.

1. IDENTIFICATION OF ENVIRONMENTAL RISKS

1.1 Source-Pathway-Receptor Concept

In order for pollution to have an impact on the environment, a pollution linkage must be present which relies on the Source-Pathway-Receptor concept, where all three factors must be present and linked for a potential risk to exist.

A "pollution linkage" requires the following:

i) A "source" is a substance which is in, on or under the land and which has the potential to cause significant harm to a relevant receptor, or to cause significant pollution of controlled waters;

ii) A "receptor" is something that could be adversely affected by a contaminant, for example a person, an organism, an ecosystem, property, or controlled waters; and

iii) A "pathway" is a route by which a receptor is or might be affected by a contaminant.

Identification of the source, pathway and receptor enables management interventions to be made to manage the environmental risks and avoid pollution reaching the receptor.

In this section the potential sources (environmental risks) of pollution at the Facility are identified and screened for their significance, and the potential pathways and receptors are identified.

1.2 Environmental Risks

The Operator is required to identify the environmental risks (sources of potential contamination) which could occur during the operation of the Facility, including any risks which may arise from accidents. The EA online guidance[1] stipulates that the Operator must consider the following potential risks:

- any discharge (e.g. sewage or trade effluent to surface water or groundwater);
- accidents;
- odour;
- noise and vibration;
- uncontrolled and unintended ('fugitive') emissions (for which risks include dust, litter, pests; and pollutants that shouldn't be in the discharge); and
- visible emissions (e.g. smoke or visible plumes).

In considering the risk, the Operator can determine that a potential risk is not considered to be significant in terms of its potential impact on the environment; however, a justification must be provided for any risk which is 'screened out'.

Based on the guidance summarised above the potential environmental risks at the Facility have been identified and have been determined either significant or not significant based on the potential environmental impact arising from the risk. A summary of these risks is presented in the table below which also provides justifications where risks are considered to be insignificant. The risks which have been identified as significant have been included in the risk assessment in Section 5 of this report.

[1] https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit#risks-from-your-site

Table 1.1: Screening of Environmental Risks

Environmental Risk	Applicability	Justification
Controlled discharges to surface waters	Applicable	There are no controlled discharges to surface water from the Facility. This risk has not been considered for further assessment.
Controlled discharges to Groundwater	Not Applicable	There are no controlled discharges to groundwater from the Facility. This risk has not been considered for further assessment.
Accidents	Applicable	Plant or Equipment Failure: Large quantities of equipment are proposed to be in-use across the Facility. The failure of plant or equipment may result in an incident occurring which could potentially impact on the environment. Materials Handling: Raw materials and wastes are proposed to be stored on site in bulk and will be transported across the Facility via pipework and in IBCs on fork lift trucks. There is the potential for accidents (e.g. spills, leaks etc.) to occur during the filling of bulk storage vessels and the movement of materials, which may result in contaminated run-off. Vandalism: The Facility is located in a relatively rural area and may be a target for vandalism and theft. Operator Error: Whilst the majority of the processing plant is automated, the potential for operator error cannot be ruled out.
Odour	Applicable	Emissions from the Installation have the potential to be odorous. In addition, odours may be produced at the on-site wastewater treatment plant and from the storage of waste.
Noise & Vibration	Applicable	Operations at the Installation have the potential to produce noise, in particularly the movement of Heavy Goods Vehicles making deliveries to and collections from the site.
Visual Impact	Not Applicable	The Facility is bordered by the A14 to the north and by the A6 to the south, in a mixed light industrial and agricultural area. Visible emissions from the Facility will be limited to steam/ water vapour from the evaporative condensers and cooling towers and permitted releases from the boiler stack and regenerative thermal oxidiser. These emissions are not considered to be significant in terms of visual impact. Based on this, visual impact has not been considered to be significant and has not been included for further assessment.
Fugitive Emissions to air and water	Applicable	Emissions to air: The facility includes a Local Exhaust Ventilation (LEV) system to maintain appropriate indoor air quality requirements. Extraction to atmosphere has the potential to generate fugitive emissions. Surface Water: potential for blocked/ damaged drains or misconnections in the drainage system to result in an uncontrolled release of process wastewater to ground or surface water.

Environmental Risk	Applicability	Justification
		Storm water discharges: storm water run-off from the site roofs and yard areas is directed via an integrated wastewater and storm water drainage system flowing towards the west of the site. A StormTech attenuation system will be present to the west of the building, and a rainwater harvesting tank will be present in the south-west of the building. Three petrol interceptors will be present in the west, south-west and south of the site.
Controlled releases to air	Applicable	Emissions to air from the installation will principally comprise VOCs from the use of organic solvents. Combustion gases arising from the operation of the gas-fired boiler and regenerative thermal oxidiser (RTO) will also be generated.
Global Warming Potential	Applicable	Both direct and indirect greenhouse gas emissions arise from the operation of the Facility. Direct emissions arise from the burning of gas in the on-site boilers, operation of the chiller and cooling systems (which use regulated greenhouse gases) and the operation of the RTO. Indirect emissions arise from the use of electricity, and water. There are also other indirect impacts from both in the production and supply process.
Facility Waste	Applicable	Hazardous and non-hazardous wastes will be produced at the Facility as a result of the production processes, maintenance and administrative functions.

2. IDENTIFICATION OF RECEPTORS

A receptor is defined as something that could be adversely affected by a pollutant. Based on desk-based research, information provided by the client and the information relating to its environmental setting (provided in the SCR) Ramboll has identified the receptors within the vicinity of the site. A summary of the identified receptors is provided in Table 2.1 below.

Table 2.1: Summary of Identified Receptors

Receptor	Location
Groundwater: The site is underlain by a Secondary A Aquifer; however, it is not in a Groundwater Source Protection Zone. There are two groundwater abstractions within a 2km radius of the site. These are located 950m south and 1.01km north-west for general farming and domestic purposes.	On-site and in the immediate vicinity.
Surface Water: The nearest identified surface watercourse is an unnamed stream approximately 400m north of the site. The nearest larger watercourse is the River Ise approximately 1.94km south-west. The EA currently classifies the River Ise as being of 'poor' ecological quality and 'good' chemical quality under the Water Framework Directive classification scheme. According to an independent, third-party environmental database, there is one licensed surface water abstraction within a 2km radius of the site. This is located approximately 1.83km south-west for "general use relating to secondary category – low loss" from a spring at Burton Latimer.	On-site and in the immediate vicinity.
Ground: British Geological Survey mapping indicates that the site is site is directly underlain by bedrock of the Northampton Sand Formation (ironstone, ooidal). This is further underlain by the Whitby Mudstone Formation. The most recent site investigation undertaken at the site in 2021 identified the following ground conditions at the site: • Engineered fill in the north and north-west to depths of between 0.5-3.1m below ground level (bgl) (average thickness of 1.7m) comprising sandy gravelly clay. The remainder of the site had been subject to 'cut' operations and fill was absent. • Northampton Sand Formation was encountered in all locations, comprising sandy gravelly clay or gravelly sandy clay to depth of between 0.4m and proven to 4m bgl. • Where encountered, the underlying Whitby Mudstone Formation was present at the surface at one location in the south-west or underlying the Northampton Sand Formation and comprising firm to stiff clay becoming a mudstone with limestone bands.	On-site and in the immediate vicinity
Atmosphere: Emissions to air from the installation will principally comprise VOCs from the use of organic solvents. Combustion gases arising from the operation of the gas-fired boiler and regenerative thermal oxidiser (RTO) will also be generated. Combustion gases from the operation of the RTO will be emitted to air via one stack immediately south of the facility. The stack height is 14.5 m above ground level with a diameter of approximately 1,600mm. A 15m/s exit	Across the entirety of the Facility and in the immediate vicinity of the Facility

Receptor	Location
velocity is anticipated for the six line unit. Exhaust air volume is anticipated to be a maximum of 84,500 Nm^3/hr.	
Designated Ecological Sites: Two statutory designated ecologically sensitive sites are located within 2km of the site. The closest is Cranford St John 1.4km east which is a Site of Special Scientific Interest.	Nearest 1.4km east
Human Occupation: Facility workers and visitors are anticipated to be present across the internal and external areas of the site. The nearest residential dwellings are located approximately 120m north-west of the site. A farm (Blackbridge Farm) is located adjacent to the north-east of the site, and a light industrial warehouse is present immediately west of the site.	On-site and directly adjacent

3. POTENTIAL POLLUTION PATHWAYS

3.1 Identification of Possible Pathways from the Sources of the Risks to Receptors

The potential pollution pathways between the sources identified in Section 1 (excluding those which have been screened out) and the receptors identified in Section 2 are summarised in the table below.

Table 3.1: Potential Pollution Pathways

Source	Potential Pathway	Receptor
Odour: arising from the printing process and waste materials.	Through the air.	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Facility.
Visual emissions: arising from combustion activities; cooling towers and evaporative condensers.	Through the air.	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Facility.
Noise and Vibration: arising from vehicle movements; site operations and process machinery.	Transmitted through the air and through ground vibration.	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Facility.
Accidents: including plant or equipment failure; materials handling; vandalism; operator error; fire; and flooding.	Over site surfaces; through site drainage systems; and through the air.	*Surface water; Groundwater; Ground; Atmosphere, and Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Facility.
Fugitive Emissions: including dust; litter; and surface water run-off.	Through the air; windblown; over Facility surfaces; through Facility drainage systems.	*Surface water; groundwater; ground; atmosphere, and humans including:* facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the site.
Controlled release to air: from point sources.	Through the air; windblown.	*Atmosphere, and humans including:* Facility workers/visitors; workers on adjacent premises; local

Source	Potential Pathway	Receptor
		residents; intermittent presence on pedestrian routes / roadways surrounding the site.
Global Warming Potential: from direct and indirect use of fossil fuels.	Through the air.	*Atmosphere.*
Installation Waste: hazardous and non-hazardous wastes arising as a result of production processes; maintenance; and administrative functions undertaken at the Facility.	Windblown over ground; surface water run-off.	*Groundwater; surface water; ground; and atmosphere.*

4. RISK ASSESSMENT METHODOLOGY

The risk assessment provides a simple representation of the hypothesised relationships between contaminants, pathways and receptors. This allows the identification of potential contamination linkages and, therefore, an interpretation of the potential for pollution to occur at the Facility or within the vicinity of the site as a result of the activities at the Facility.

The potential for pollution to occur at the site is determined by assessing the likelihood of an identified receptor being exposed to pollution emanating from a source at the Facility and the resultant consequences of any such exposure. In determining the likelihood and the consequence of a pollution exposure the risk management techniques which are used at the Facility, and the effect on any such exposure are considered. Where the risk management techniques are considered to have a mitigating impact, the resultant overall likelihood of the pollution exposure occurring and its consequences on a receptor are lowered.

4.1 Assessing Likelihood and Consequence

Within the risk assessment, each hypothesised relationship between contaminants, pathways and receptors is assessed to determine the likelihood of the receptor being exposed to pollution and the consequences of exposure using the rankings listed in the tables below.

Table 4.1: Likelihood Rankings

Very Low	Low	Medium	High
Exposure to pollution is considered to be *highly unlikely*.	Exposure is considered to be *unlikely*.	Exposure is considered to be *likely*.	Exposure is considered to be *highly likely* to occur.

Table 4.2: Consequence Rankings

Very Low	Low	Medium	High
No impact or imperceptible impact on the receptor.	Low level impact easily and quickly mitigated or may not require any intervention to rectify any impact.	Moderate impact which will not be rectified without some mitigation / intervention.	High impact requiring significant intervention / mitigation and may have caused irreparable damage to the receptor.

4.2 Assessment of Risk

Following the determination of the likelihood and consequence rankings for the hypothesised relationships developed using the source-pathway-receptor concept, the matrix in the table below is used to determine the overall risk of the pollution exposure occurring.

Table 4.3 Risk Matrix

		Likelihood			
		Very Low	**Low**	**Medium**	**High**
Consequence	**High**	Low	Medium	High	High
	Medium	Low	Medium	Medium	High
	Low	Low	Low	Medium	Medium
	Very Low	Very Low	Low	Low	Low

5. RISK ASSESSMENT

5.1 Odour

The potential sources of odour at the Facility have been identified and used to develop the risk assessment for odour (see Table 5.1 below).

Table 5.1: Odour

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Odour: printing process	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the Facility.	Fugitive emissions to air from building openings / air handling units	• Fugitive emissions from buildings are minimised by fast-acting doors, keeping them closed whenever they are not needed for access. • Solvent-containing materials are kept in sealed containers where possible to minimise losses to atmosphere. • Extraction units are located in areas where use of solvent-containing materials is high, with extracted air directed to the RTO for thermal treatment.	Medium	Low	**Low**
Odour: waste materials		Fugitive emissions to outdoor air	• Wastes produced at the site include general, mixed recycling, wood, cardboard and hazardous wastes. These wastes are stored in designated covered containers and skips, and are considered to be at low risk of becoming malodorous. • Solvent-contaminated wastes e.g. rags are stored in sealed drums to prevent vapourisation. • The wastes are stored at a centralised 'Recycling Area', reducing the risk of odour from any waste reaching the site boundary. • Frequent collections of wastes are scheduled.	Low	Low	**Low**

5.2 Noise

The potential sources of noise at the Facility have been identified and used to develop the risk assessment for noise (see Table 5.2 below). There is the potential for noise to arise through the transport and receipt of raw materials and through the collection and distribution of finished products and wastes by heavy goods vehicles. Forklift trucks will also be used to transport goods on-site. Production processes including the boilers and RTO are also potential sources of noise on the site. The risk assessment for individual noise sources is provided in the table below. A detailed assessment of noise is provided separately in the Noise Impact Assessment report (VC-103500-EN-RP-0001, July 2021), provided in Appendix 2.

Table 5.2: Noise

Source-Pathway-Receptor Hypothetical Model			**Risk Management Techniques**	**Assessing the Risk**		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Noise: arising from the movement of heavy goods vehicles (HGVs) & forklift trucks across the Facility, and engine noise / alarms from other vehicles working on, and visiting the site.	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory	Through the air and ground vibration	• A site speed limit of 10 miles per hour is in operation across the Facility to minimise engine noise. • The car park for operatives and visitors is located next to the site entrance minimising the movements of traffic on the site.	Low	Low	**Low**
Noise and vibration: arising from the operation of ancillary plant (comprising boiler, air compressors, chillers, RTO).			• The boilers and other process equipment is contained within buildings with fast-acting doors, minimising noise to the external environment. • All plant at the site is maintained in accordance with manufacturers' specifications and managed through a Planned Preventative Maintenance schedule to minimise excessive noise from poor performance. • Fans fitted with attenuators	Low	Low	**Low**
Noise and Vibration: arising from the internal handling of raw materials and production equipment.			• All production processes are undertaken within buildings with acoustic dampening cladding. • Fast-acting building doors are kept closed whenever they are not needed for access. • All plant is maintained periodically in accordance with manufacturers' specifications to minimise excessive noise from poor performance.	Low	Low	**Low**

5.3 Accidents

The risk assessment for accidents at the site is included in table 5.3 below.

Table 5.3: Accidents

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Accident: Failure in containment of solvent storage tank (or other bulk storage) and associated equipment (valves, pipes etc.). Overfilling of tank or other spillage / operator error during filling or decanting from tank.	*Ground*	Over Installation surfaces; and, through Installation drainage systems.	• The Facility will maintain a register of bulk storage tanks/ containers and their contents. All bulk storage will be provided with secondary bunding, and this will be regularly checked and maintained. • The Facility will hold a spillage emergency response procedure in place which will be detailed in the EMS and the Accident Management Plan. • A containment area for two tank trucks will be present and the area will follow a slope into an ACO type drain trench which will be installed around the containment area. The trench drain will be sloped to a retention sump equipped with a cover hatch, and between the retention sump and the connection to the main foul water drainage pipe shall be an electro-valve, which will be closed during loading operations.	Very low	Medium	**Low**
	Groundwater					
	Surface Water					
Accident: Failure in containment of effluent storage: various tanks, sumps and associated equipment (valves, pipes etc.).	*Ground*	Over surfaces & through drainage systems	• In the event of containment failure, liquid will be stored in a retention sump. Retention sumps will be provided at all individual storage areas (i.e. flammable store, bulk hydrocarbon store and chemical store) to ensure incompatible material are kept separate. A sump will also be provided externally where chemicals are unloaded from trucks. Sumps will be sized appropriately to contain 110% of the largest container in any given area. • Cut-off valves will be provided at strategic locations to enable leaks and spills from any tanks, pipework or other storage containers to be effectively contained. • In the event that the capacity of the sump and other tanks is reached, the facility would cease operations until the problem is resolved. • In the event of pump failure, most pumps have a back-up that would be automatically engaged.	Very Low	Medium	**Low**
	Groundwater			Very Low	Medium	**Low**
Accident: Spillage / Release of raw materials during internal handling and storage	*Ground*	Through Facility drainage systems	• All internal areas of the Facility feature impermeable surfaces and a sealed drainage system. • Interceptors will be present across the site and will be inspected regularly. • Spill kits will be available in key risk areas. • A spill response procedure will be defined in the site's Accident Management Plan.	Very Low	Low	**Low**
	Groundwater			Very Low	Low	**Low**
	Surface Water			Very Low	Low	**Low**
Accidents (Vandalism): Damage / theft of externally located equipment / tanks	*Ground*	Over Facility surfaces; and, through drainage systems.	• CCTV will cover the site, which will be secured by fencing and with authorised access only. • The Facility will be operational 24/7, 365 days a year, so is manned at all times.	Very Low	Low	**Low**
	Groundwater			Very Low	Low	**Low**
	Surface Water			Very Low	Low	**Low**
Accidents (Fire): Fire and arson attacks	*Ground*	Over Facility surfaces; through the air;	• A Site Emergency Evacuation Plan will be in place along with departmental fire plans and fire risk assessments. • Fire alarm systems will be subject to monthly maintenance.	Very Low	High	**Low**

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
	Groundwater	and, through Installation drainage systems.	• Trained Fire Marshals will be in place to respond to alarms. • Firefighting equipment will be available on site for handling small fires. • Site drainage shut-off valve to prevent escape of firewater from site	Very Low	High	**Low**
	Surface Water			Very Low	High	**Low**
	Atmosphere			Very Low	High	**Low**
Accidents: Explosion	*Ground*	Over Facility surfaces; through the air; and, through Installation drainage systems.	• Areas at risk of explosion will be identified in the Accident Management Plan.	Very Low	Medium	**Low**
	Groundwater			Very Low	Medium	**Low**
	Surface Water			Very Low	Medium	**Low**
	Atmosphere			Very Low	Medium	**Low**

5.4 Fugitive Emissions

The risk assessment for fugitive emissions is presented in the table below.

Table 5.4: Fugitive Emissions

Source-Pathway-Receptor Hypothetical Model			**Risk Management Techniques**	**Assessing the Risk**		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Fugitive Emissions: solvents and odour from production areas	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory.	Through the air	• Solvent-containing materials are stored in sealed containers to minimise fugitive releases. • Extraction systems in place for areas using & handling solvents, either directed to the RTO for thermal treatment or vented at roof level by the LEV system dependent upon the potential solvent loading.	Low	Medium	**Medium**
	A*tmosphere*			Low	Low	**Low**
Fugitive Emissions: contaminated surface water run-off from external areas.	*Surface Water* *Ground water*	Through drainage systems	• Storm water run-off from the site roofs and yard areas is directed via an integrated wastewater and storm water drainage system flowing towards the west of the site. A StormTech attenuation system will be present to the west of the building, and a rainwater harvesting tank will be present in the south-west of the building. Three petrol interceptors will be present in the west, south-west and south of the site as well as shut-off valves located both on the plant and at strategic locations within the drainage system.	Low	Medium	**Medium**

5.5 Controlled Releases to Air

The risk assessment for controlled releases to air is presented in the table below. A detailed Air Quality Impact Assessment covering the point source and fugitive emissions from the installation is presented in Appendix 1.

Table 5.5: Controlled Releases to Air

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Controlled Releases to Air: Boiler Stack and RTO Emissions	*Atmosphere* *Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory	Through the air	• The Facility will operate one boiler with a thermal input below 1 MW. The boiler will be maintained under a Planned Preventative Maintenance schedule, and operated and monitored in compliance with the Facility's Environmental Permit. • Combustion gases from the operation of the RTO will be emitted to air via one stack immediately south of the facility. The stack height is 14.5 m above ground level with a diameter of approximately 1,600mm. A 15m/s exit velocity is anticipated for the six line unit. Exhaust air volume is anticipated to be a maximum of 84,500 Nm^3/hr.	Low	Medium	**Medium**
Controlled Releases to Air: water vapour from cooling towers and evaporative condensers	*Atmosphere* *Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory	Through the air	• The emissions from these point sources comprises water vapour only.	Low	Low	**Low**

5.6 Global Warming Potential

Table 5.6: Global Warming Potential

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Global Warming Potential: Combustion of natural gas within boiler to support production processes resulting in direct emissions of greenhouse gasses	*Atmosphere*	Through the air	• The Facility will operate 1 gas-fired boiler with a thermal input below 1MW. The boiler will be maintained under a Planned Preventative Maintenance schedule to ensure energy efficient operation. • Combustion gases from the operation of the RTO will be emitted to air via one stack immediately south of the facility. The RTO will be regularly maintained under a Planned Preventative Maintenance schedule to ensure energy efficient operation.	High	Low	**Medium**
Global Warming Potential: Use of grid-sourced electricity to support production processes resulting in in-direct emissions of greenhouse gasses.	*Atmosphere*	Through the air	• Energy consumption will be monitored, recorded, and reported on a monthly basis.	High	Very Low	**Low**

5.7 Installation Waste

Table 5.7: Installation Waste

Source-Pathway-Receptor Hypothetical Model			Risk Management Techniques	Assessing the Risk		
Source of Pollution	**Receptor**	**Pathway**		**Likelihood of Exposure**	**Consequence of Exposure**	**Overall Risk**
Facility Waste: Wastes which arise from production and administrative activities at the site comprising: mixed recyclables; general waste; wood, cardboard and hazardous waste.	*Humans including:* Facility workers/visitors; workers on adjacent premises; local residents; intermittent presence on pedestrian routes / roadways surrounding the factory	Through the air	• All wastes produced at the Facility will be segregated and provided with suitable containment. • All wastes will be stored within a dedicated recycling and waste area. • Wastes will be stored either in a container skip, in sealable containers (e.g. drums) or will be baled ready for collection. • Hazardous waste will be stored internally in locked, bunded containment. • Wastes produced at the Facility are unlikely to produce significant quantities of leachate. • The management of waste will be contracted to a suitable waste carrier, who will manage storage and arrange collections on behalf of the Facility. • All wastes removed from the Facility will be recovered / disposed of at permitted facilities.	Low	Low	**Low**
	Surface Water	Over Facility surfaces; and through drainage systems		Low	Low	**Low**
	Groundwater			Low	Low	**Low**
	Ground			Low	Low	**Low**

6. ERA CONCLUSION

Ramboll has identified potential environmental risks at the Facility and determined the potential environmental impact arising from each risk. The assessment has demonstrated that with the appropriate management controls in place, risks identified are acceptable, i.e. low to medium.

APPENDIX 1
VANGUARDIA AIR QUALITY ASSESSMENT

KETTERING 4B

AIR QUALITY ASSESSMENT

VC-103500-AQ-RP-0001
R01

JUNE 2021

VANGUARDIA

DOCUMENT CONTROL			
DOCUMENT TITLE	AIR QUALITY ASSESSMENT	**REVISION**	R01
DOCUMENT NUMBER	VC-103500-AQ-RP-0001	**ISSUE DATE**	22 JUNE 2021
PROJECT NUMBER	103500	**AUTHOR**	CW
STATUS	ISSUE	**CHECKED**	SG
ISSUED TO	CLIENT	**PASSED**	SG

REVISION HISTORY		
REVISION	**NOTES**	**DATE ISSUED**
01	INTERNAL COMMENTS	06/07/2021

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1. INTRODUCTION

1.1. Vanguardia has been commissioned by Segro to undertake an air quality assessment to support a reserve matters planning application to discharge planning condition no.14, associated with planning approval (planning ref: KET/2018/0774) for Plot 4B at Segro Park, Kettering Gateway, A14 Junction.

1.2. The original approved planning permission is for the:

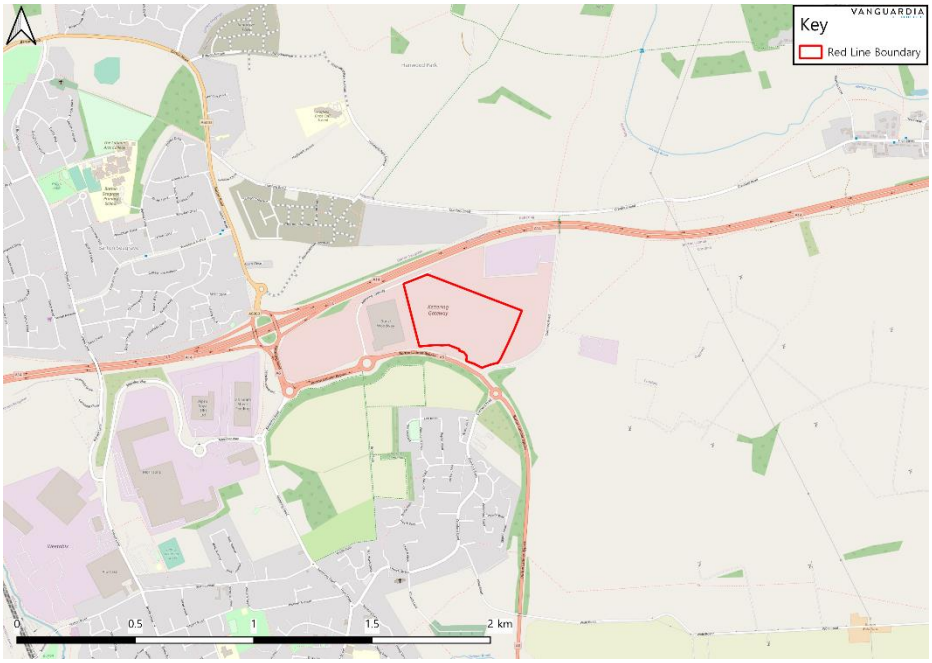
"Development of site for industrial/ distribution uses (use class B1 (c), B2 and B8) including ancillary offices together with roadside uses (petrol filling station and A3/A5 restaurant/cafe) and associated car parking, highway infrastructure and landscaping. All matters reserved for the development plots. Approval sought for matters related to access, the built highway infrastructure works and associated landscaping."

1.3. Planning condition no.14, which this air quality assessment is associated with, states:

"Prior to the first occupation of any of the buildings within the site for any purpose falling within use class B2 (general industry) or notwithstanding the provisions of the Town and Country Planning (Use Classes Order) 1987 (as amended) or any order amending, reinstating or replacing that order, any subsequent change within that use class, details of expected noise and/or emissions along with identified mitigation measures shall be submitted for the written approval of the Local Planning Authority and thereafter the measures shall be undertaken for the lifetime of that use."

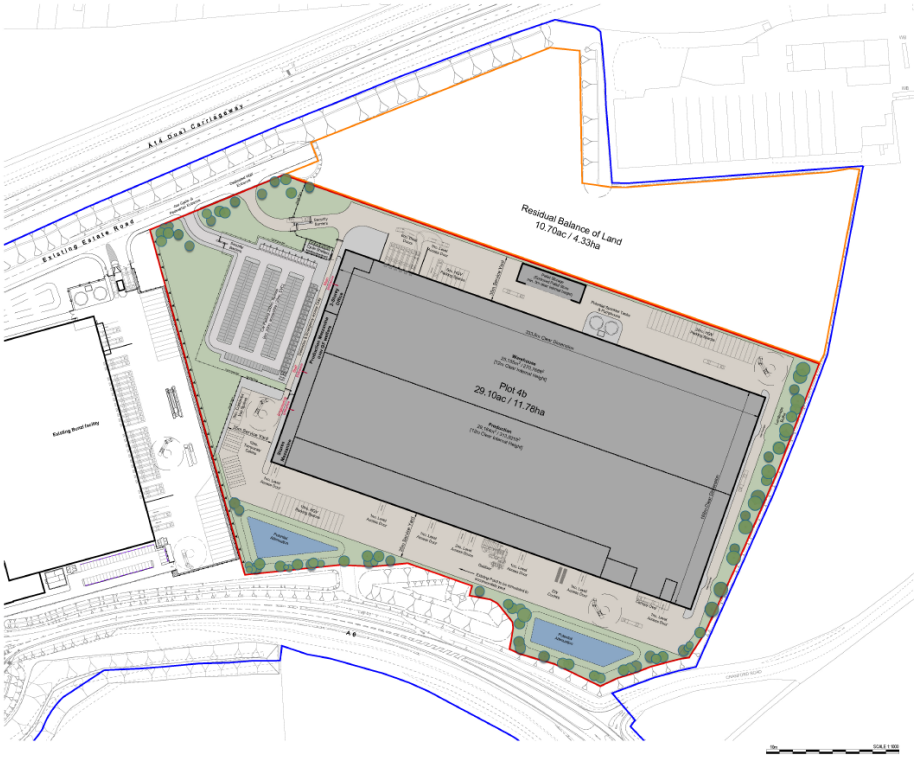
1.4. The Plot 4B site is located on an industrial park. The site is bounded to the north by the A14 with residential dwellings beyond, and to the east by Cranford Road, to the south by the A6 and to the west by a newly built industrial warehouse. The National Grid Reference for the centre of the site is SP 90566 76141 (British National Grid co-ordinates E: 490556, N: 276141. The location of the site is shown in Figure 1.

Figure 1 Site Location



1.5. Within Plot 4B a manufacturing process is proposed, which involves the surface coating of materials, which will release volatile organic carbon compounds (VOCs) to the air. It is planned that the VOC emissions will be minimised by treating them in a Regenerative Thermal Oxidiser (RTO). This will give rise to emissions of nitrogen oxides (NO_x). There will also be fugitive releases to air of VOCs from the manufacturing shopfloor. The proposed development will be subject to planning consent and an appropriate environmental permit. The proposed site layout is set out in Figure 2.

Figure 2 Proposed Site Layout



1.6. This assessment has been undertaken to assess the significance of the impacts from the operational phase of the development on human health receptors as a result of pollutant concentrations associated with stack and fugitive emissions.

KEY POLLUTANTS

NITROGEN DIOXIDE

1.7. NO_2 and nitric oxide (NO) are collectively referred to as oxides of nitrogen (NO_x). During fuel combustion, atmospheric nitrogen combines with oxygen to form NO, which is not considered harmful. Through a chemical reaction with ozone (O_3), NO further combines with oxygen to create NO_2 which can be harmful to human health and vegetation.

1.8. The foremost sources of NO_2 in the UK are combustion activities, mainly road transport and power generation. According to the National Atmospheric Emissions Inventory (NAEI), road transport is now the largest single UK source of NO_x, accounting for almost one third of UK emissions.

VOLATILE ORGANIC COMPOUNDS (VOCS)

1.9. Volatile organic compounds are a loose grouping of a large group of carbon-based compounds emitted to air from man-made and natural sources, due to their relatively low boiling points. Typically in use as liquids, significant man-made sources include petrol vapours from transport and solvents used in manufacturing and coating processes. Two VOCs in the UK are regulated air pollutants, 1,3-butadiene and benzene. VOCs contribute to local air pollution through their reactions with other air pollutants such as nitrogen oxides giving rise to ground-level ozone. Individual compounds are assessed for their impact on human health.

2. LEGISLATION AND POLICY CONTEXT

EUROPEAN LEGISLATION

2.1. The following text is taken from the leglislation.gov.uk[1] website and sets out how EU Legislation will be retained in the United Kingdom after the Brexit transition.

"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)."

2.2. 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.

2.3. 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.

NATIONAL LEGISLATION

2.4. Part IV of the Environment Act 1995[2] 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.

2.5. The purpose of the Air Quality Strategy was to identify areas where air quality was unlikely to meet the objectives prescribed in the regulations. The strategy was reviewed in 2000 and the

[1] EU legislation and UK law. Accessible at: https://www.legislation.gov.uk/eu-legislation-and-uk-law

[2] Department for Environment, Food and Rural Affairs (1995) The Environment Act. HMSO, London.

amended Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2000) was published. This was followed by an Addendum in February 2003 and in July 2007, when an updated Air Quality Strategy was published.

2.6. 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. The Air Quality Standards Regulations (2016)[3] impose duties on the Secretary of State relating to achieving of the limit values set out within the regulations.

RELEVANT AIR QUALITY STANDARDS AND ENVIRONMENTAL ASSESSMENT LEVELS

2.7. A summary of the relevant Air Quality Objectives (AQO) and Environment Assessment Levels (EAL) for human health and environmental receptors are presented in Table 1.

Table 1 Air Quality Standards

Pollutant	Average Period	Objective	Percentile Equivalent	Objectives Should Apply
Nitrogen Dioxide (NO_2)	Annual Mean	40 µg/m^3		All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.
	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year	99.8th	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, 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 where members of the public might reasonably have expected to spend one hour or longer.
Volatile Organic Compounds (VOCs) as Xylene	Annual Mean	4,410 µg/m^3		All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.

[3]The Air Quality Standards Regulations (Amendments), 2016.

	1-hour Mean	66,200 µg/m^3		All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, 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 where members of the public might reasonably have expected to spend one hour or longer.

STATUTORY NUISANCE

2.8. It is recognised that the planning system presents a way of protecting amenity. However, in cases where planning conditions are not applicable to a development/installation, the requirements of the Environmental Protection Act 1990 still apply. Under Part III of the Environmental Protection Act 1990, local authorities have a statutory duty to investigate any complaints of:

- *"any premises in such a state as to be prejudicial to health or a nuisance*
- *smoke emitted from premises so as to be prejudicial to health or a nuisance*
- *fumes or gases emitted from premises so as to be prejudicial to health or a nuisance*
- *any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance*
- *any accumulation or deposit which is prejudicial to health or a nuisance"*

2.9. Where the local authority establishes that any one of these issues constitutes a statutory nuisance and believes it to be unreasonably interfering with the use or enjoyment of someone's premises and/or is prejudicial to health, an abatement notice will be served on the person responsible for the offence or the owner / occupier. Failure to comply with the notice could lead to a prosecution. It is however considered as a defence if the best practicable means to prevent or to counteract the effects of the nuisance are employed.

PLANNING POLICY

NATIONAL POLICIES

2.10. A revised National Planning Policy Framework (NPPF) was published in July 2018 and updated in February 2019. The NPPF (2019)[4] sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

2.11. Paragraph 103 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 170 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 improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans.

[..]"

2.13. Paragraph 180 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 181 states:

[4] Department of Communities and Local Government (2019). National Planning Policy Framework. HMSO, London.

"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 183 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 is supported by Planning Practice Guidance (PPG) (DCLG, 2019)[5], which includes guiding principles on how planning can take account of the impacts of new development on air quality.

2.17. 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)*

[5] Department for Communities and Local Government (2019). National Planning Policy Guidance. HMSO, http://planningguidance.planningportal.gov.uk/

"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."

2.18. 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:

- *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."*

3. ASSESSMENT APPROACH

INTRODUCTION

3.1. This section sets out the approach taken to assess the potential impact on air quality during the operation of the proposed development.

SCOPE OF ASSESSMENT

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

- **Spatial -** The assessment considers the impact of emissions from the site (from the operation's stack and fugitive emissions) on local air quality; and
- **Temporal -** The operational phase impacts resulting from the proposed development have been considered for the earliest possible year of operation (2021).

OPERATIONAL PHASE

STACK EMISSIONS

3.3. The operation of the facility has the potential to generate NO_x and VOC emissions from the stack. VOCs will be abated by destruction in a RTO. This combustion process will emit NO_x. The VOC mixture is understood to contain xylene as a principal component and therefore emissions are assessed as xylene. The assessment is of the predicted impact of these emissions on local air quality in the vicinity of the facility.

FUGITIVE EMISSIONS

3.4. The operation of the facility has the potential to generate VOC emissions from the ventilation extraction from the building. The assessment is of the predicted impact of these emissions on local air quality in the vicinity of the facility.

DISPERSION MODEL

3.5. Dispersion modelling was undertaken using ADMS-5.2 (v5.2.2.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-5 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 proposed development.

3.6. The model typically requires the following input data:

- Extend of the modelling area;
- Locations and dimensions of all sources and nearby structures;
- Output grid and 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.

MODELLED SCENARIO

3.7. In order to provide a conservative estimate of the impact, this assessment assumes that the proposed development runs continuously i.e. 8,760 hours per year.

3.8. Two different configurations for the development are being considered: a 4-line facility and a 6-line facility. All operational scenarios have been considered for 2021, providing a conservative assessment of possible impacts. Therefore, two operational scenarios have been modelled:

- 4-line facility 2021; and
- 6-line facility 2021.

3.9. The model outputs have been set up for the:

- long-term (annual mean) NO_x concentration;

- short-term (1-hour mean) 99.79th percentile NO_x concentration;
- long-term (annual mean) VOC (as Xylene) concentration; and
- short-term (max 1-hour) VOC (as Xylene) concentration.

3.10. Further details on the NO_x to NO_2 relationship and conversion rates are in paragraph 3.24. Further details on modelling VOCs as Xylene can be found in paragraph 3.13 below.

SITE LAYOUT (BUILDING AND STRUCTURAL EFFECTS)

3.11. 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.

3.12. The grid references and the size dimensions of all buildings included in the dispersion model are set out below in Table 2.

Table 2 Modelled Building Dimensions

Name	Shape	X (m)	Y (m)	Height (m)	Length (m)	Width	Angle (°)
Building 4a	Rectangular	490218	276100	17.6	113.0	174.7	75.1
Building 4b	Rectangular	490567	276104	16.2	169.5	334.3	199.6

Figure 3 Modelled Buildings

SOURCE AND EMISSION PARAMETERS

3.13. The proposed development has two sources of emission: a proposed stack at the south of the development emitting NO_x and VOCs, and fugitive VOC emissions emitted from vents on the roof. The stack emissions for both model scenarios have been modelled as a point source, with fugitive emissions modelled as a volume source.

3.14. The source parameters and emissions data included in the model are summarised in Table 3, Table 4, Table 5 and Table 6.

Table 3 Stack Parameters

Parameter (unit)	Stack	
	4-Line	6-Line
Internal Stack Diameter (m)	1.41	
Stack Height (m)	14.5	
Stack area (m^2)	1.56	
Stack Position (m)	490549.01, 276006.02	
Temperature of release (^oC)	150	
Volume flow (Nm^3/s)	15.64	23.46
Emission Velocity at Stack Exit (m/s)	10	15

Table 4 Stack Emissions Data

Pollutant	Emission Rate (g/s)	
	4-Line	6-Line
NO_x	0.7819	1.1729
VOC (as xylene)	0.3454	0.5180

Table 5 Fugitive Source Parameters

Parameter (unit)	Volume Source	
	4-Line	6-Line
Volume source height (m)	16.2	
Volume source area (m^2)	17341.5	
Volume source L1 (m)	1	
Volume source volume (m^3)	17341.5	

Table 6 Fugitive Source Emissions Data

Pollutant	Emission Rate (g/s)	
	4-Line	6-Line
VOC (as xylene)	1.2575E-05	1.7924E-05

Figure 4 Modelled Sources

3.15. Further details of source parameter and emissions calculations are presented in Appendix A.

METEOROLOGICAL DATA

3.16. 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 taken into account.

3.17. 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.

3.18. Based upon the above, a suitably representative meteorological monitoring station identified is Bedford meteorological station, which is located approximately 22 km southeast of the subject site.

3.19. 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 2016 to 2018.

TOPOGRAPHY

3.20. 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.

3.21. Guidance for the use of the ADMS-5 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

3.22. The dispersion site surface roughness length (z0) was set to 0.3 m (agricultural areas max) for the dispersion site and 0.2 m (agricultural areas min) for the meteorological site.

MINIMUM MONIN-OBUKHOV LENGTH

3.23. The Minimum Monin-Obukhov Length (MMOL) provides a measure of the stability of the atmosphere. An MMOL value of 10 m (small towns < 50,000) was used in the dispersion model to describe both the modelling area; an MMOL value of 1 m was used in the dispersion model to describe both the meteorological site. These values are considered representative of the respective surrounding areas.

NO_X TO NO_2 RELATIONSHIP

3.24. As discussed in Section 1, emissions of NO_x will comprise contributions from both NO and NO_2. Typically, air quality assessments are made against the concentrations of NO_2 as it is more toxic than NO. However, combustion flue gases comprise 90-95% NO which, in time, will oxidise in the atmosphere into NO_2.

3.25. As NO_2 emissions from the operation are only one constituent of the total NO_x emissions, an allowance of the NO_2 proportion of NO_x needs to be made. The exact proportion of NO_2 in NO_x emissions from the development is unknown.

3.26. Empirical estimates have been made by Janssen *et al*[6], which are based on a comprehensive study of observations within power station plumes. This method, which is considered to be more realistic, suggests that the conversion would be in the order of 10 – 20% within 1 – 2 km of the release point.

3.27. In accordance with guidance provided by the Environment Agency Air Quality Modelling and Assessment[7] Unit1 it is assumed that 70% of the total NO_x emissions from the plant will be converted into NO_2 over the long-term period, with 35% of the of the total NO_x emissions from the plant will be converted into NO_2 over the short-term period. This is a 'worst case' approach when compared to other research and has been used in this assessment.

MODELLED GRID EXTENT

3.28. The assessment area was defined based upon the source location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors. The modelled grid parameters are defined in Table 7 below with respect to the British National Grid.

Table 7 Modelled Grid Parameters

Parameter	Min	Max
X (m)	490304.01	490794.01
Y (m)	275806.02	276296.02
Z (m)	1.5	

SENSITIVE RECEPTORS

3.29. This assessment includes the nearest residential receptors identified using aerial photography mapping. Nearby workplace receptors are also included. Table 8 presents the receptors specified for assessment.

[6] L.H.J.M. Janssen, J.H.A. Van Wakeren, H. Van Duuren and A.J. Elshout, A Classification of NO Oxidation Rates in Power Plant Plumes Based on Atmospheric Conditions, Atmospheric Environment Vol. 22, No. 1, pp. 43 – 53. 1988.
[7] Environment Agency: Air Quality Modelling and Assessment Unit, Conversion rates for NO_x and NO_2. http://webarchive.nationalarchives.gov.uk/20140328232919/http:/www.environmentagency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf

Table 8 Specified Receptors

Receptor ID	Description	X (m)	Y (m)	Z (m)
R1	Resi Woodland Dr	490364.75	275749.06	1.5
R2	Resi Woodland Dr	490394.91	275748.53	1.5
R3	Resi Cranford Rd	490584.34	275734.25	1.5
R4	Windmill Cottages	490907.66	276002.53	1.5
R5	Blackbridge Farm	490912.97	276383.53	1.5
R6	Hawkes Group	490644.88	276305.34	1.5
R7	Resi Cranford Rd	490668.69	276526.53	1.5
R8	Resi Cranford Rd	490433.75	276545.59	1.5
R9	Building 4a	490271.56	276119.12	1.5
R10	Building 4a	490296.03	276029.88	1.5

Figure 5 Specified Receptors

SCREENING CRITERIA

3.30. The EA risk assessment guidance[8] provides criteria for assessing the significance of emissions with respect to the background air quality and air quality standards.

Stage 1: Criteria for screening out insignificant Process Contributions (PCs)

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

- PC long-term < 1% of the long-term air quality standard; and
- PC short-term < 10% of the short-term air quality standard.

3.32. If both of these criteria are met, no further assessment of the pollutant in question is required. If one or both of the criteria are not met then further screening criteria are applied, outlined below in stage 2.

Stage 2: Criteria for screening out insignificant Predicted Environmental Concentrations (PECs)

3.33. The PEC is the combination of the PC and the background concentration of the pollutant. Detailed dispersion modelling can be screened out if both of the below criteria are met:

- PEC long-term < 70% of the long-term air quality standard; and
- PC short-term < 20% of the short-term air quality standard minus twice the long-term background concentration.

3.34. Any emissions which don't meet the screening criteria for stage 2 require further detailed modelling.

3.35. Detailed modelling is also required if:

- Emissions affect an AQMA; or
- Restrictions apply for any substance emitted in this area.

3.36. The results of the detailed modelling are assessed for the resulting PECs against the relevant AQO. Significance criteria are used to inform the assessment, and are discussed in the next section.

IMPACT / SIGNIFICANCE CRITERIA

[8] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit

3.37. Currently there is no formal guidance on the absolute magnitude and significance criteria for the assessment of air quality impacts. However, the IAQM & EPUK (2017) document have published recommendations for describing the impact at individual receptor locations as set out in Table 9 and utilised to determine the description of any impact.

Table 9 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*)			
	1	2-5	6-10	>10
75% of less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

*AQAL are considered to be the objective levels

3.38. The IAQM & EPUK (2017) document provides guidance 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.

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

MODELLING ASSUMPTIONS, UNCERTAINTIES AND EXCLUSIONS

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

- The development will operate for 24 hours a day throughout the year; and
- Emission data and source parameters has been obtained from the client's stack monitoring data.

3.41. 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.

3.42. 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-5 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 data provided by the client. As such, they are considered to be representative of potential releases during normal operation;
- Receptor locations - A Cartesian Grid was included in the model in order to provide suitable data for contour plotting as well as specified receptors;
- 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 3-year modelling period, so represent the worst case.

4. BASELINE CONDITIONS

INTRODUCTION

4.1. The following section sets out the baseline conditions in relation to air quality at the subject site. For the purpose of this assessment, evidence has been obtained from the Defra air quality resource website[9]. Local air quality was managed by Kettering Borough Council until April 2021, when the council was merged into the new North Northamptonshire Council. The council has not published a recent Annual Status Report for local air quality management.

4.2. The air quality in this area in Northamptonshire is affected by emissions from the major trunk roads the A14 and A6.

BACKGROUND CONCENTRATIONS

4.3. Defra provides background pollution concentration estimates to assist local authorities with undertaking their 'Review and Assessment' work. This data is available to download from the Defra air quality resource website for NO_x, NO_2, PM_{10} and $PM_{2.5}$ for every 1 km X 1 km grid square for all local authorities. The current dataset is based on 2018 background data and the future year projections are available for 2018 to 2030.

AIR QUALITY MANAGEMENT AREAS (AQMAS)

4.4. NNC does not currently have any AQMAs declared within its jurisdiction.

NO_2

4.5. The maximum Defra background NO_2 annual mean concentrations for the modelled grid extent is 11.67 µg/m^3, comfortably below the relevant AQO. This is considered a reasonable baseline given the information published.

VOC

4.6. A limited amount of monitoring for Non-Methane VOCs is carried out by Defra, which includes the compound xylene, as o, m and p isomers. The most representative site is at Chilbolton

[9] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

Observatory in England. The annual average measurement for the sum of the isomers in 2020 is 0.38 µg/m^3. The London Marylebone roadside site (one of the most polluted in the UK) reported an annual average of 1.90 µg/m^3.

BASELINE SUMMARY

4.7. A summary of the annual mean background concentrations used for the purpose of this assessment are presented below in Table 10.

Table 10 Summary of DEFRA Background NO_2 and VOCs as Xylene Concentrations

Source	Site Type	Averaging Period	2021
NO_2 (µg/m^3)			
Defra	Background	Annual Mean	11.67
		1-Hour Mean	23.35
VOCs (as Xylene) (µg/m^3)			
Defra	Background	Annual Mean	0.38
		1-Hour Mean	0.76

5. OPERATIONAL PHASE IMPACT ASSESSMENT

MODELLED 4-LINE SCENARIO

5.1. As discussed in Section 3, there are impacts on local air quality that will arise from the operation of the proposed development. The potential impact of air quality on human health is discussed below for the 4-line operation.

Nitrogen Dioxide (NO_2)

5.2. The impact on air quality from the proposed development with 4 lines operating for the pollutant NO_2 for both averaging periods are detailed below in Table 11 and Table 12.

5.3. Table 11 sets out the maximum PC and PECs for the modelled grid extent, as well as comparison against the relevant AQS. All results presented in Table 11 are the maximum concentrations from a temporal 3-year modelling period across a spatial grid, so represent the worst case. As such, these values are conservative and likely only to occur close to the emission source.

Table 11 Maximum PC and PEC Across the Modelled Grid Extent

	NO_2				
Averaging Period	**AQS (µg/m³)**	**Max PC (µg/m³)**	**Max PC (% AQS)**	**Max PEC (µg/m³)**	**Max PEC (% AQS)**
Annual Mean	40	19.7	49.3	31.4	78.5
1-Hour Mean	200	72.6	36.3	93.9	47.0

5.4. Table 11 shows that all relevant AQSs are met for the PECs for NO_2 for both averaging periods.

5.5. Table 12 assesses the max PCs and PECs for the modelled grid extent for NO_2 and averaging period against the EA screening criteria outlined in Section 3.

Table 12 Assessment of pollutants against EA screening criteria

	NO_2		
Averaging Period	**Scoped out at Stage 1?**	**Scoped out at Stage 2?**	**Detailed Assessment Required?**
Annual Mean	**No**	No	Yes

1-Hour Mean	No	No	Yes

5.6. Table 12 shows that the Predicted Environmental Concentrations of NO_2 cannot be scoped out using the EA screening criteria, requiring detailed assessment. Figure 6 and Figure 7 below present contour plots for both the NO_2 annual and 1-hour means showing the results of the detailed assessment carried out.

Figure 6 4 Line – Predicted Environmental Concentration of Annual Average (µg/m³)

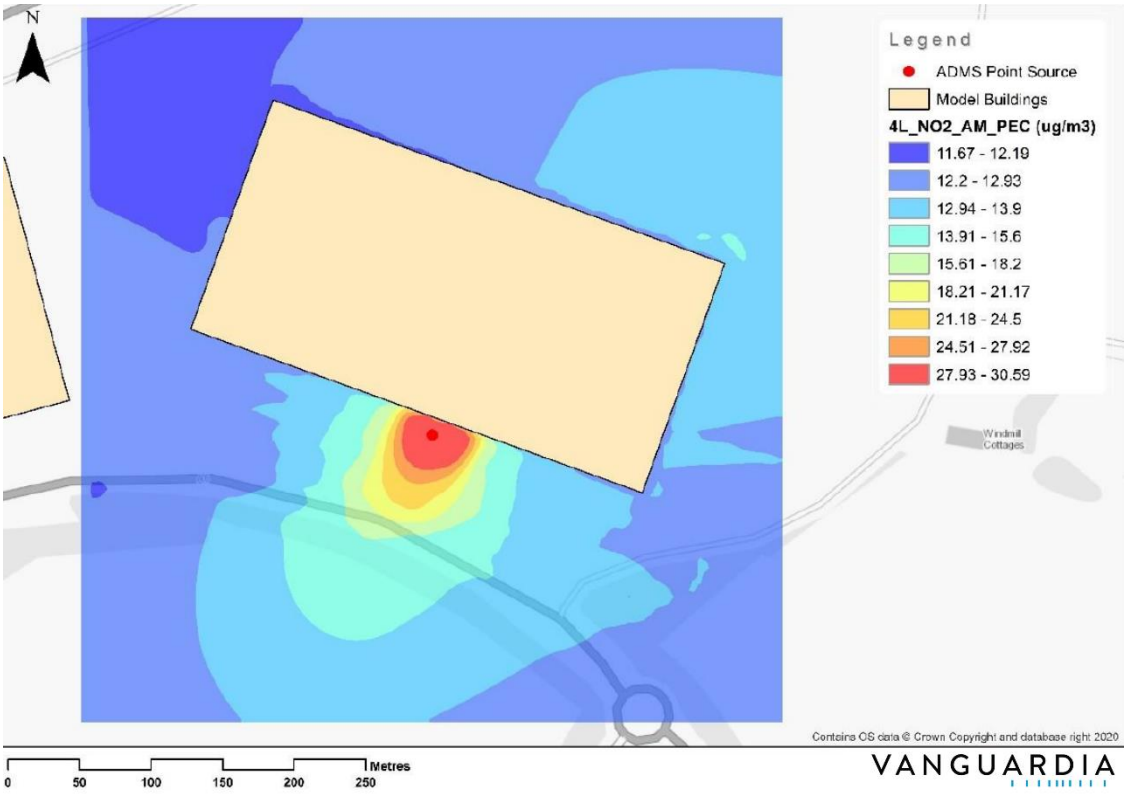
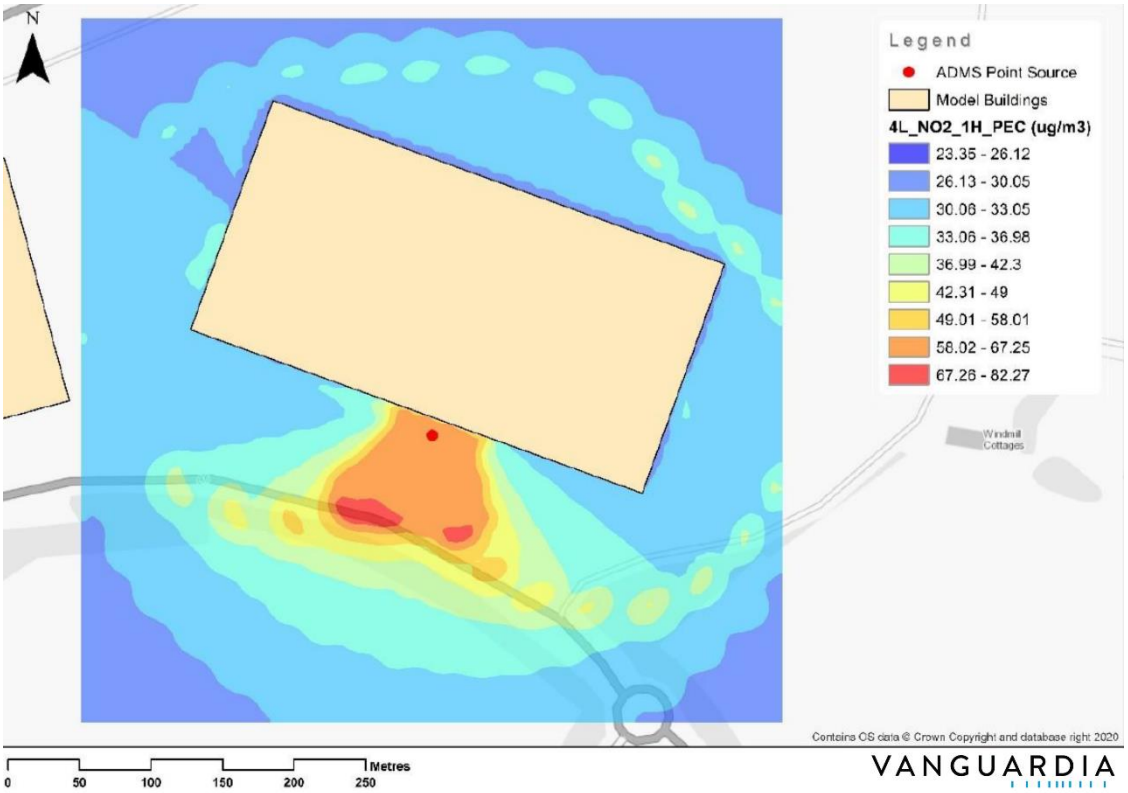


Figure 7 Predicted Environmental Concentration of 99.79th Percentile 1-Hour NO_2 (µg/m³)



5.7. Table 13 shows the maximum predicted annual mean NO_2 concentrations at the receptors. The impacts are assessed as negligible for all receptors.

Table 13 IAQM/EPUK Impact/Significance Criteria (Annual Mean NO_2 µg/m³)

Receptor	Predicted Annual Mean NO_2 Concentration 2021 (µg/m³)	Long Term Average Concentration at Receptor in Assessment Year 2021	Pollutant Concentration Change 2021 (µg/m³)	% Change Relative To AQAL in 2021	2021 Impact Descriptor
1	11.5	75% or less of AQAL	0.81	2-5%	Negligible
2	11.5	75% or less of AQAL	0.90	2-5%	Negligible
3	11.3	75% or less of AQAL	0.71	2-5%	Negligible
4	12.5	75% or less of AQAL	0.80	2-5%	Negligible
5	12.4	75% or less of AQAL	0.72	2-5%	Negligible
6	12.6	75% or less of AQAL	0.89	2-5%	Negligible
7	12.1	75% or less of AQAL	0.39	1%	Negligible

8	11.9	75% or less of AQAL	0.25	1%	Negligible
9	12.2	75% or less of AQAL	0.55	1%	Negligible
10	12.3	75% or less of AQAL	0.62	2-5%	Negligible

VOCs (as Xylene)

5.8. The impact on air quality from the proposed development for the pollutant VOCs for both averaging periods are detailed below in Table 14 and Table 15.

5.9. Table 14 sets out the maximum PC and PECs for the modelled grid extent, as well as comparison against the relevant EAL. All results presented in Table 14 are the maximum concentrations from a temporal 3-year modelling period across a spatial grid, so represent the worst case. As such, these values are conservative and likely only to occur close to the emission source.

Table 14 Maximum PC and PEC Across the Modelled Grid Extent

	Xylene				
Averaging Period	**EAL (µg/m³)**	**Max PC (µg/m³)**	**Max PC (% EAL)**	**Max PEC (µg/m³)**	**Max PEC (% EAL)**
Annual Mean	4410	13.6	0.3	14.0	0.3
1-Hour Mean	66200	337.3	0.5	338.0	0.5

5.10. Table 14 shows that all relevant EALs are met for the PECs for VOCs for both averaging periods.

5.11. Table 15 assesses the max PCs and PECs for the modelled grid extent for VOCs and averaging period against the EA screening criteria outlined in Section 3.

Table 15 Assessment of Pollutants Against EA Screening Criteria

	Xylene		
Averaging Period	**Scoped out at Stage 1?**	**Scoped out at Stage 2?**	**Detailed Assessment Required?**
Annual Mean	**Yes**	-	No
1-Hour Mean	Yes	-	No

5.12. Table 15 shows that VOC emissions can be scoped out of further assessment as Stage 1 of the EAs screening criteria. For completeness however, Figure 8 and Figure 9 below present contour plots for both the VOC annual and maximum 1-hour means.

Figure 8 4 Line – Predicted Environmental Concentration for VOCs as Xylene (Annual Mean µg/m³)

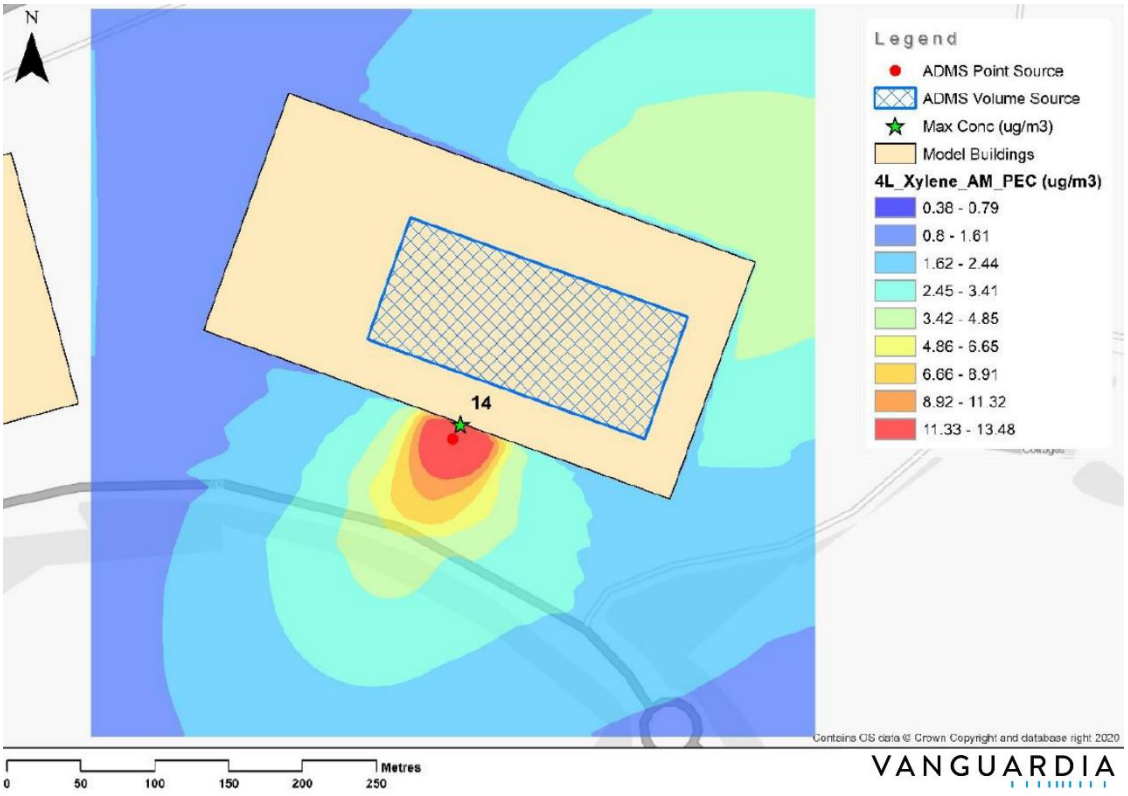
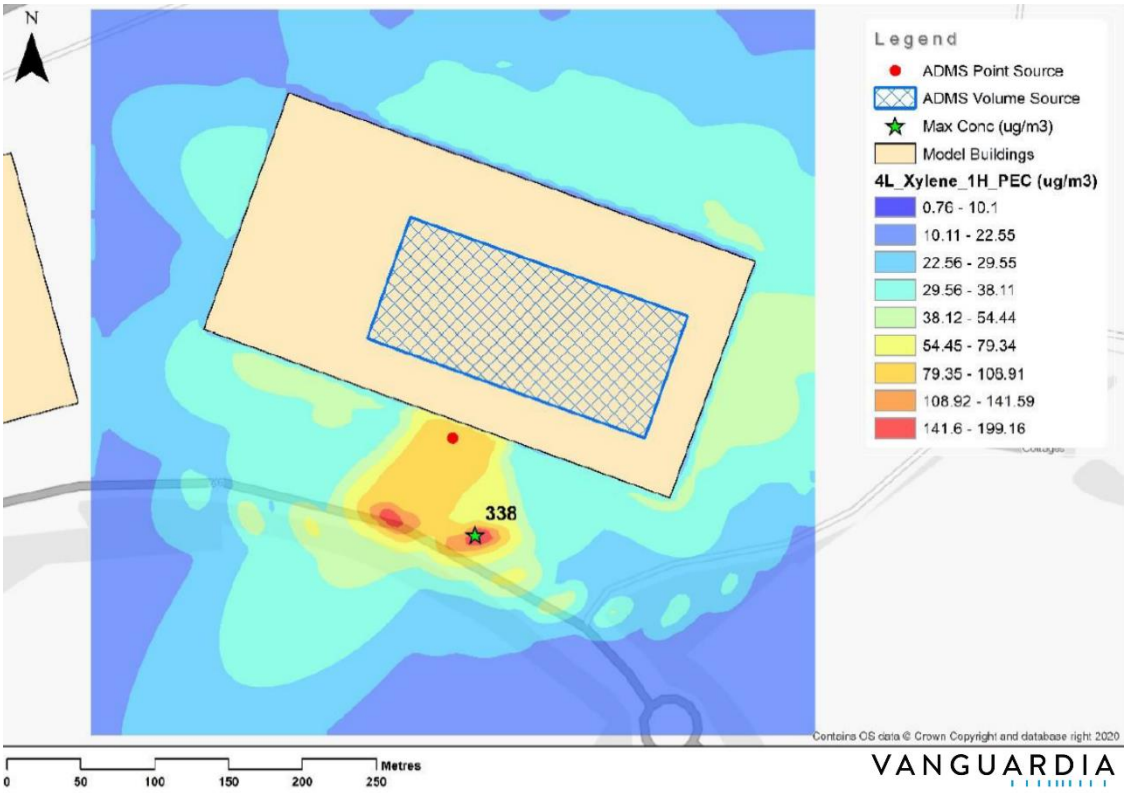


Figure 9 4 Line – Predicted Environmental Concentration for VOCs as Xylene (Maximum 1-Hour Mean µg/m³)



5.13. Table 16 shows the maximum predicted annual mean VOC concentrations at the receptors. The impacts are assessed as negligible for all receptors.

Table 16 IAQM/EPUK Impact/Significance Criteria (Xylene, µg/m³)

Receptor	Predicted Annual Mean Xylene Concentration 2021 (µg/m³)	Long Term Average Concentration at Receptor in Assessment Year 2021	Pollutant Concentration Change 2021 (µg/m³)	% Change Relative To AQAL in 2021	2021 Impact Descriptor
1	1.1	75% or less of AQAL	0.68	0%	Negligible
2	1.2	75% or less of AQAL	0.77	0%	Negligible
3	0.9	75% or less of AQAL	0.57	0%	Negligible
4	1.4	75% or less of AQAL	0.97	0%	Negligible
5	1.5	75% or less of AQAL	1.13	0%	Negligible
6	1.7	75% or less of AQAL	1.30	0%	Negligible
7	0.7	75% or less of AQAL	0.33	0%	Negligible
8	0.5	75% or less of AQAL	0.09	0%	Negligible
9	0.6	75% or less of AQAL	0.17	0%	Negligible
10	0.7	75% or less of AQAL	0.30	0%	Negligible

MODELLED 6-LINE SCENARIO

5.14. As discussed in Section 3, there are impacts on local air quality that will arise from the operation of the proposed development. The potential impact of air quality on human health is discussed below for the 6-line operation.

Nitrogen Dioxide (NO_2)

5.15. The impact on air quality from the proposed development with 6 lines operating for the pollutant NO_2 for both averaging periods are detailed below in Table 17 and Table 18.

5.16. Table 17 sets out the maximum PC and PECs for the modelled grid extent, as well as comparison against the relevant AQS. All results presented in Table 17 are the maximum concentrations from a temporal 3-year modelling period across a spatial grid, so represent the worst case. As such, these values are conservative and likely only to occur close to the emission source.

Table 17 Maximum PC and PEC Across the Modelled Grid Extent

	NO_2				
Averaging Period	**AQS (µg/m³)**	**Max PC (µg/m³)**	**Max PC (% AQS)**	**Max PEC (µg/m³)**	**Max PEC (% AQS)**
Annual Mean	40	20.6	51.5	32.3	80.7
1-Hour Mean	200	64.0	32.0	85.3	42.7

5.17. Table 17 shows that all relevant AQSs are met for the PECs for NO_2 for both averaging periods.

5.18. Table 18 assesses the max PCs and PECs for the modelled grid extent for NO_2 and averaging period against the EA screening criteria outlined in Section 3.

Table 18 Assessment of Pollutant Against EA Screening Criteria

	NO_2		
Averaging Period	**Scoped out at Stage 1?**	**Scoped out at Stage 2?**	**Detailed Assessment Required?**
Annual Mean	No	No	Yes
1-Hour Mean	No	No	Yes

5.19. Table 18 shows that the Predicted Environmental Concentrations of NO_2 cannot be scoped out using the EA screening criteria, requiring detailed assessment. Figure 10 and Figure 11 below present contour plots for both the NO_2 annual and 1-hour means showing the results of the detailed assessment carried out.

Figure 10 Predicted Environmental Concentrations of Annual Average NO_2 µg/m³

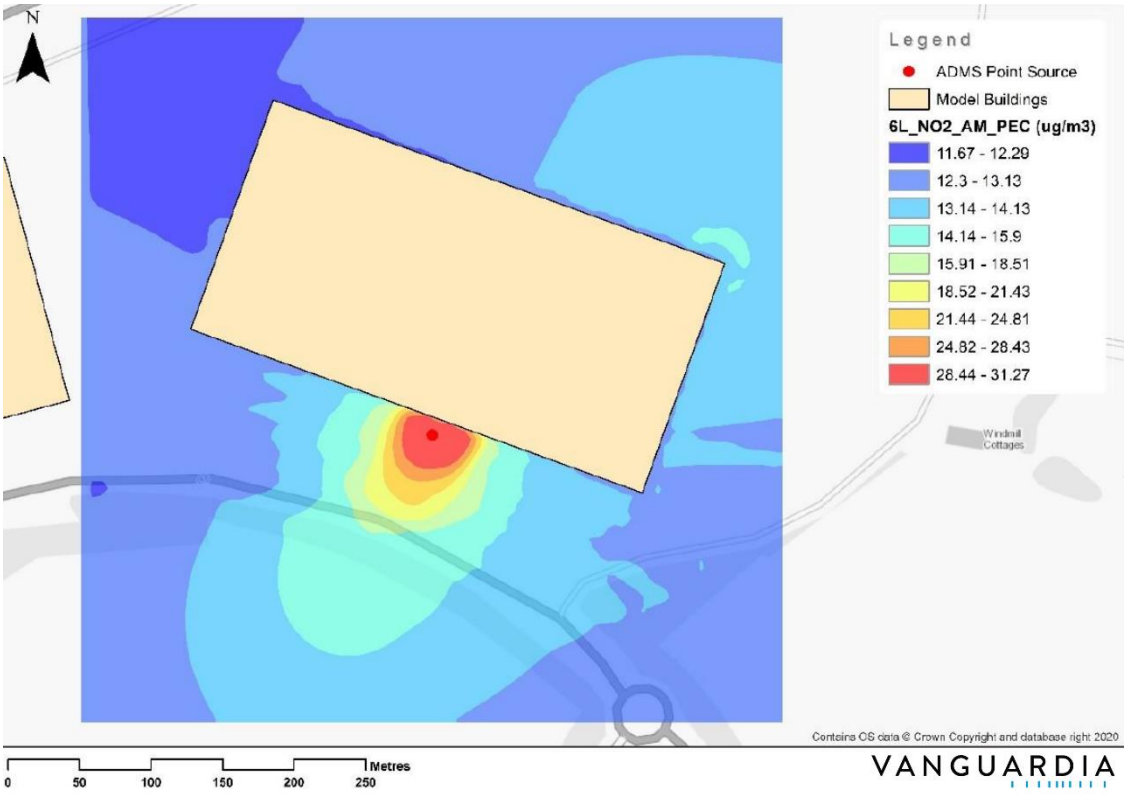
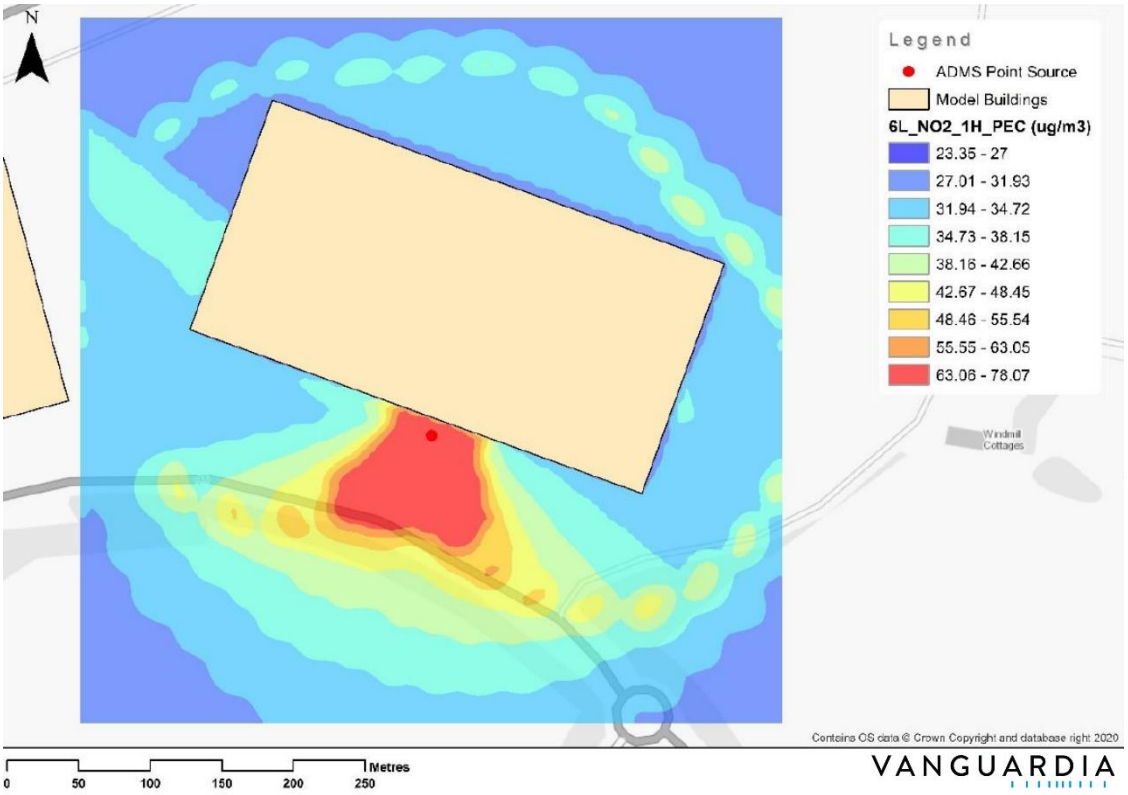


Figure 11 Predicted Environmental Concentration of 99.79th Percentile 1-Hour NO_2 µg/m³



5.20. Table 19 sets out annual mean NO_2 concentrations at the modelled receptors and the impact descriptor.

Table 19 IAQM/EPUK Impact/Significance Criteria (NO_2, µg/m³)

Receptor	Predicted Annual Mean NO_2 Concentration 2021 (µg/m³)	Long Term Average Concentration at Receptor in Assessment Year 2021	Pollutant Concentration Change 2021 (µg/m³)	% Change Relative To AQAL in 2021	2021 Impact Descriptor
1	11.7	75% or less of AQAL	1.04	2-5%	Negligible
2	11.8	75% or less of AQAL	1.15	2-5%	Negligible
3	11.5	75% or less of AQAL	0.89	2-5%	Negligible
4	12.6	75% or less of AQAL	0.97	2-5%	Negligible
5	12.6	75% or less of AQAL	0.88	2-5%	Negligible
6	12.8	75% or less of AQAL	1.09	2-5%	Negligible

7	12.2	75% or less of AQAL	0.50	1%	Negligible
8	11.0	75% or less of AQAL	0.30	1%	Negligible
9	12.3	75% or less of AQAL	0.64	2-5%	Negligible
10	12.4	75% or less of AQAL	0.73	2-5%	Negligible

5.21. Table 19 shows the maximum predicted annual mean NO_2 concentrations at the receptors. The impacts are assessed as negligible for all receptors.

VOCs (as Xylene)

5.22. The impact on air quality from the proposed development for the pollutant VOCs for both averaging periods are detailed below in Table 20 and Table 21.

5.23. Table 20 sets out the maximum PC and PECs for the modelled grid extent, as well as comparison against the relevant EAL. All results presented in Table 20 are the maximum concentrations from a temporal 3-year modelling period across a spatial grid, so represent the worst case. As such, these values are conservative and likely only to occur close to the emission source.

Table 20 Maximum PC and PEC Across the Modelled Grid Extent

	Xylene				
Averaging Period	**EAL (µg/m³)**	**Max PC (µg/m³)**	**Max PC (% EAL)**	**Max PEC (µg/m³)**	**Max PEC (% EAL)**
Annual Mean	4410	14.6	0.3	15.0	0.3
1-Hour Mean	66200	574.1	0.9	574.9	0.9

5.24. Table 20 shows that all relevant EALs are met for the PECs for VOCs for both averaging periods.

5.25. Table 21 assesses the max PCs and PECs for the modelled grid extent for VOCs and averaging period against the EA screening criteria outlined in Section 3.

Table 21 Assessment of Pollutants Against EA Screening Criteria

	Xylene		
Averaging Period	**Scoped out at Stage 1?**	**Scoped out at Stage 2?**	**Detailed Assessment Required?**
Annual Mean	Yes	-	No
1-Hour Mean	Yes	-	No

5.26. Table 21 shows that VOC emissions can be scoped out of further assessment as Stage 1 of the EAs screening criteria. For completeness however, Figure 12 and Figure 13 below present contour plots for both the VOC annual and maximum 1-hour means.

Figure 12 6 Line – Predicted Environmental Concentration for VOCs as Xylene (Annual Mean, µg/m³)

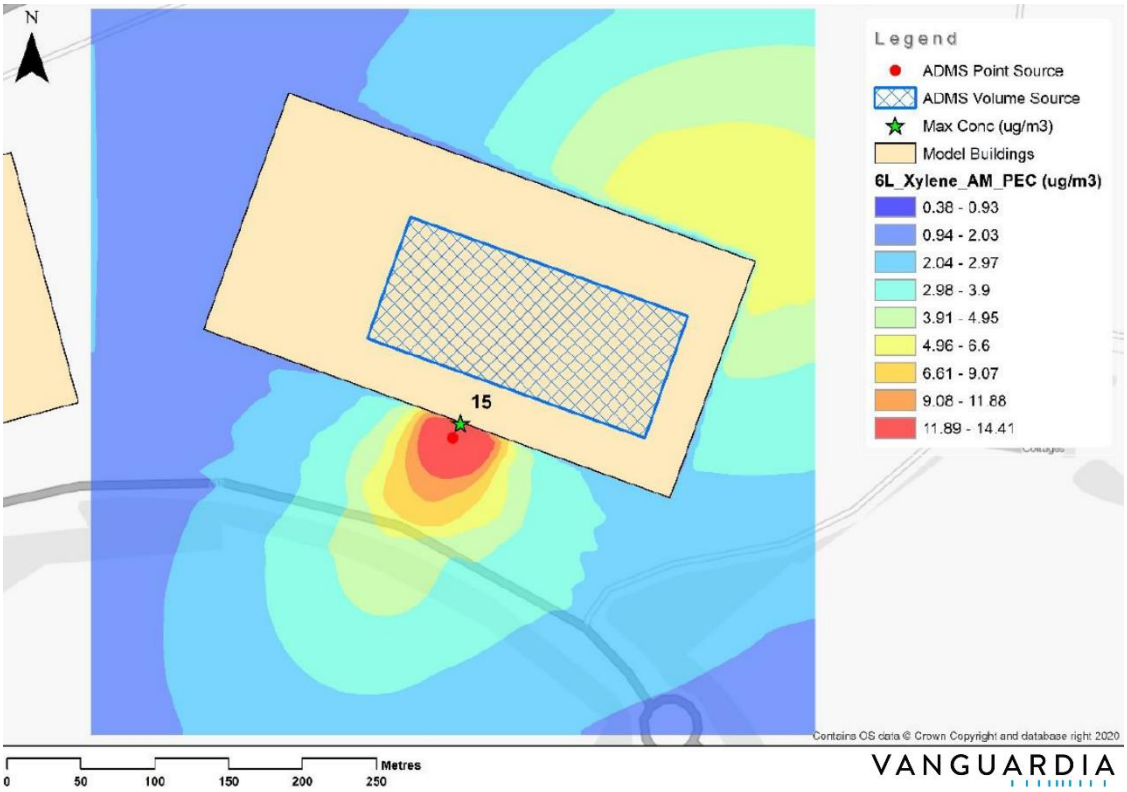
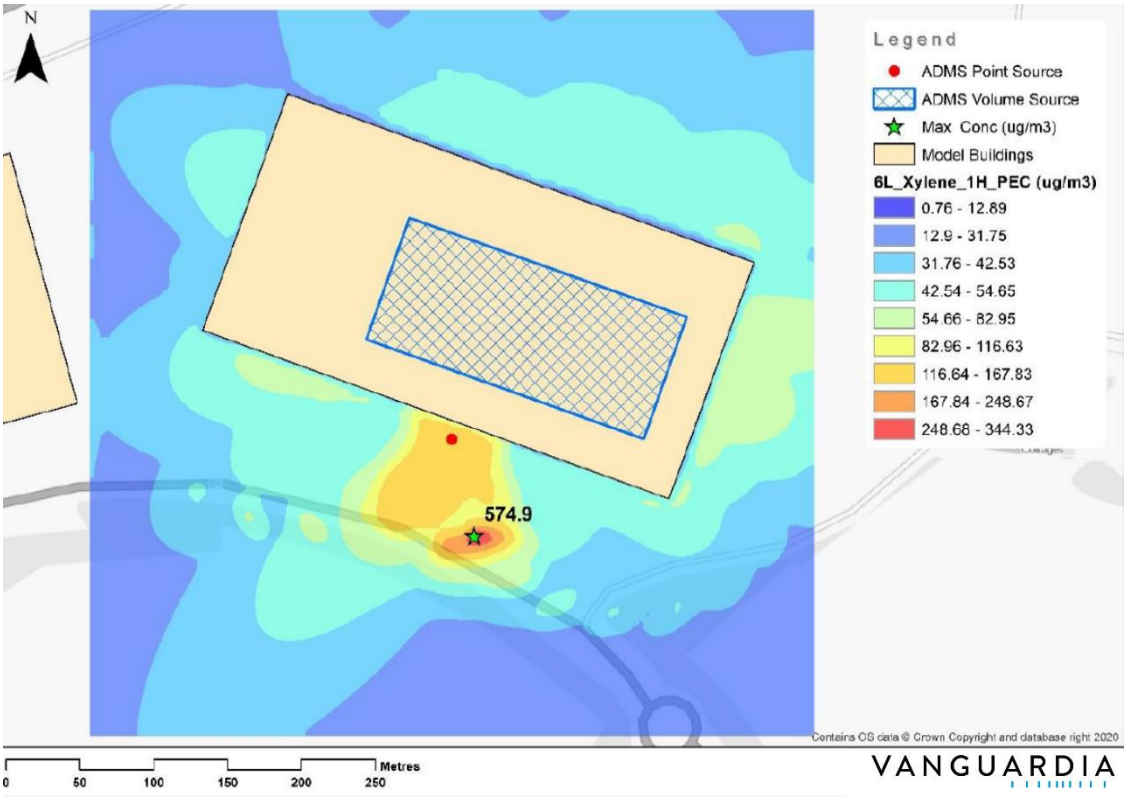


Figure 13 6 Line – Predicted Environmental Concentration for VOCs as Xylene (1 Hour Maximum, µg/m³)



5.27. Table 22 shows the maximum predicted annual mean VOC concentrations at the receptors. The impacts are assessed as negligible for all receptors.

Table 22 IAQM/EPUK Impact/Significance Criteria (Xylene, µg/m³)

Receptor	Predicted Annual Mean Xylene Concentration 2021 (µg/m³)	Long Term Average Concentration at Receptor in Assessment Year 2021	Pollutant Concentration Change 2021 (µg/m³)	% Change Relative To AQAL in 2021	2021 Impact Descriptor
1	1.4	75% or less of AQAL	1.05	0%	Negligible
2	1.6	75% or less of AQAL	1.18	0%	Negligible
3	1.3	75% or less of AQAL	0.90	0%	Negligible
4	1.8	75% or less of AQAL	1.44	0%	Negligible
5	2.1	75% or less of AQAL	1.67	0%	Negligible
6	2.3	75% or less of AQAL	1.90	0%	Negligible
7	1.0	75% or less of AQAL	0.60	0%	Negligible

8	0.6	75% or less of AQAL	0.26	0%	Negligible
9	0.7	75% or less of AQAL	0.34	0%	Negligible
10	0.9	75% or less of AQAL	0.51	0%	Negligible

6. CONCLUSIONS

6.1. This report provides an assessment of the impacts associated with the operation of the proposed development on local air quality.

6.2. This report has assessed the significance of the impacts from the operation of the proposed development on human health receptors as a result of pollutant concentrations arising from stack and fugitive emissions.

6.3. Modelling was undertaken using emissions information provided by the client, and a series of conservative assumptions:

- The proposed development was modelled to operate continuously; and
- All results presented are the maximum concentrations from a 3-year modelling period, so represent the worst case.

6.4. The results of the dispersion modelling show that at all modelled human health receptors and locations where the relevant air quality objectives are applicable, no exceedances will be caused by the proposed development. The impacts are assessed as negligible.

6.5. It can therefore be concluded that the proposed development does not give rise to any significant air quality impacts on human health receptors and is fully compliant with national, regional and local planning guidance.

APPENDIX A – SOURCE PARAMETER AND EMISSIONS CALCULATIONS

STACK PARAMETERS

Table A1 - 4-Line

Stack parameters	Value	Comment
Height (m)	14.5	Agreed by client and to be confirmed by modelling.
Volume flow (Nm^3/s)	15.64	Dürr Systems AG report section 3.5.4. Agreed by client.
Stack diameter (m)	1.41	Diameter calculated based upon a velocity of 10 m/s.
Velocity (m/s)	10	From client.
Temperature (°C)	150	Dürr Systems AG report section 3.5.4. Agreed by client.

Table A2 - 6-Line

Stack parameters	Value	Comment
Height (m)	14.5	As for 4-line model
Volume flow (Nm^3/s)	23.46	Increase of 50 % on 4-line model. Agreed with client.
Stack diameter (m)	1.41	As for 4-line model.
Velocity (m/s)	15	Calculated from volume flow and stack diameter.
Temperature (°C)	150	As for 4-line model.

STACK EMISSIONS

Table A3 - 4-Line

Emission Parameters	Value	Comment
NO_x concentration (mg/Nm^3)	50	Dürr Systems AG report section 2.2. Agreed by client.
NO_x concentration ($\mu g/Nm^3$)	0.05	Unit conversion
NO_x emission (g/s)	0.7819	Calculated from 4-line volume flow.
VOC (as Carbon) concentration (mgC/Nm^3)	20	Dürr Systems AG report section 2.2. Agreed by client.
VOC (as Carbon) emission (g/s)	0.3128	Calculated from 4-line volume flow.

Xylene/Carbon mass ratio	1.1042	Ratio of Xylene to Carbon atomic mass (106/96)
VOC (as Xylene) emission (g/s)	0.3454	Calculated from 4-line volume flow.

Table A4 - 6-Line

Emission Parameters	Value	Comment
NO_x concentration (mg/Nm³)	50	Dürr Systems AG report section 2.2. Agreed by client.
NO_x concentration (µg/Nm³)	0.05	Unit conversion
NO_x emission (g/s)	1.1729	Calculated from 6-line volume flow.
VOC (as Carbon) concentration (mgC/Nm³)	20	Dürr Systems AG report section 2.2. Agreed by client.
VOC (as Carbon) emission (g/s)	0.4692	Calculated from 6-line volume flow.
Xylene/Carbon mass ratio	1.1042	Ratio of Xylene to Carbon atomic mass (106/96)
VOC (as Xylene) emission (g/s)	0.5180	Calculated from 6-line volume flow.

FUGITIVE EMISSIONS : VOLUME SOURCE PARAMETERS

Table A5 - Volume Source Parameters

Volume Source Parameter	Value	Comment
Height (m)	16.2	Height of modelled building 4b
Area (m²)	17341.5	Calculated in GIS from designs supplied by client.
L1 (m)	1	Vanguardia assumption
Volume (m³)	17341.5	Calculated based on area and L1

FUGITIVE EMISSIONS : VOLUME EMISSION PARAMETERS

Table A6 – 4-Line

Emission Parameters	Value	Comment
Production Area area (m²)	22592.7	Calculated in GIS from drawing supplied by client
Production Area height (m)	14.85	From drawings supplied by client.
Production Area volume (m³)	335501.6	Calculated from Production Area area and height.
Ventilation rate (m³/s)	559.2	Calculated from Production Area volume and an air replacement rate of 6 x volume per hour.

VOC (as Xylene) concentration (mg/m³)	0.39	From RPS report OEM record form 3. Xylene not monitored for so took highest concentration of any VOC monitored. Assumed concentration for whole production Area volume so very conservative estimate.
VOC (as Xylene) emission (g/s)	0.2181	VOC emission calculated from concentration in µg/m³ multiplied by ventilation rate.
VOC (as Xylene) emission (g/m³/s)	1.2575E-05	VOC emissions divided by volume source volume.

Table A7 – 6-Line

Emission Parameters	Value	Comment
Production Area area (m²)	32202.2	Calculated in GIS from drawing supplied by client
Production Area height (m)	14.85	From drawings supplied by client.
Production Area volume (m³)	478202.7	Calculated from Production Area area and height.
Ventilation rate (m³/s)	797.0	Calculated from Production Area volume and an air replacement rate of 6 x volume per hour.
VOC (as Xylene) concentration (mg/m³)	0.39	From RPS report OEM record form 3. Xylene not monitored for so took highest concentration of any VOC monitored. Assumed concentration for whole production Area volume so very conservative estimate.
VOC (as Xylene) emission (g/s)	0.3108	VOC emission calculated from concentration in µg/m³ multiplied by ventilation rate.
VOC (as Xylene) emission (g/m³/s)	1.7924E-05	VOC emissions divided by volume source volume.

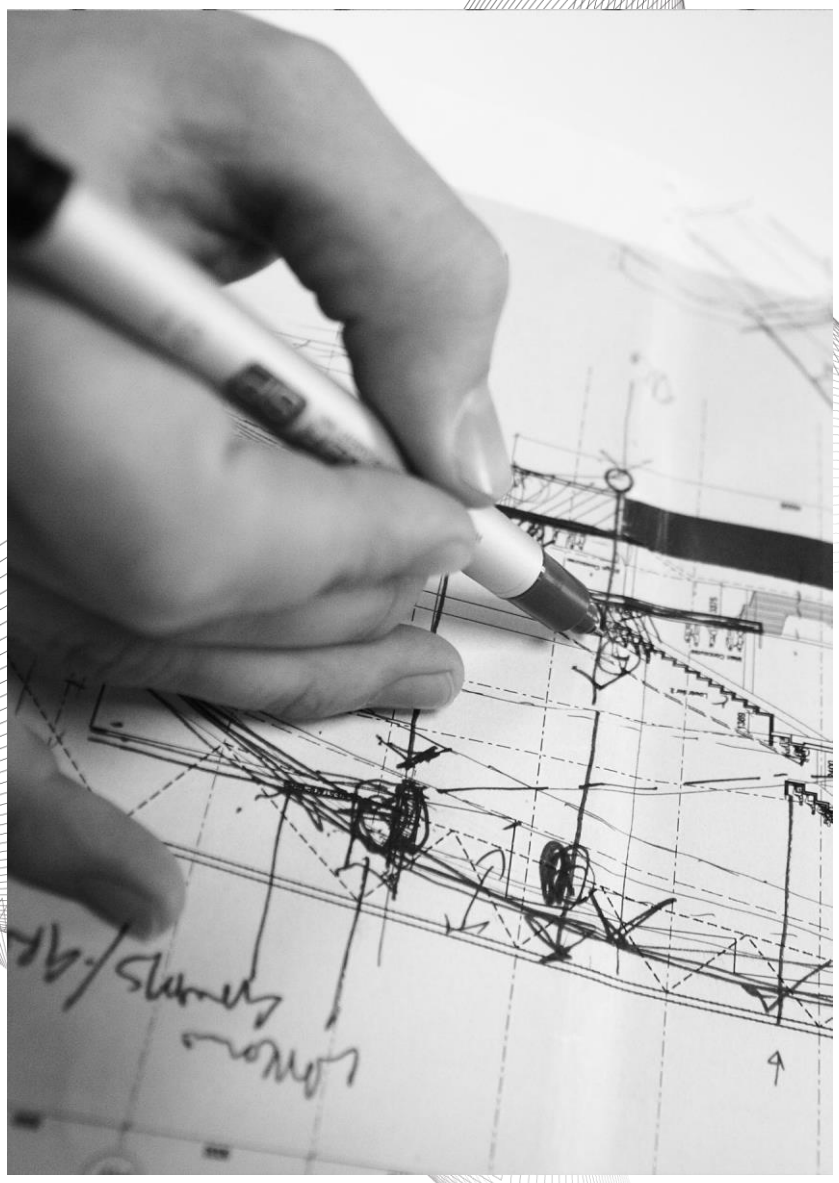
APPENDIX 2
VANGUARDIA NOISE IMPACT ASSESSMENT

KETTERING GATEWAY PLOT 4B

NOISE IMPACT ASSESSMENT TO SUPPORT THE DISCHARGE OF CONDITION 14

VC-103500-EN-RP-0001
R02

1 JULY 2021



VANGUARDIA

DOCUMENT CONTROL			
DOCUMENT TITLE	NOISE IMPACT ASSESSMENT TO SUPPORT THE DISCHARGE OF CONDITION 14	**REVISION**	02
DOCUMENT NUMBER	VC-103500-EN-RP-0001	**ISSUE DATE**	1 JULY 2021
PROJECT NUMBER	103500	**AUTHOR**	AT
STATUS	DRAFT	**CHECKED**	RD
ISSUED TO	CLIENT	**PASSED**	JS

REVISION HISTORY		
REVISION	**NOTES**	**DATE ISSUED**
R01	DRY COOLERS ROTATED THROUGH 90 DEGREES	28/6/21
R02	SLIGHT REVISIONS IN RESPONSE TO COMMENTS FROM RAMBOLL	1/7/21

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1. INTRODUCTION

1.1. Vanguardia has been appointed by SEGRO to undertake an assessment of the likely noise emission from the proposed development at Plot 4B of Kettering Gateway. The proposed development is for a large warehouse of approximately 5700 m^2 which will be used for the manufacture and distribution of aluminium drinks cans. To assist with the understanding of this report a glossary of acoustic terms is provided in Appendix A.

1.2. Kettering Gateway is located to the south-east of Kettering, immediately south of the A14 and east of the A6. The proposed site layout is shown in Appendix B. The proposals include warehousing (which will contain both production and distribution elements) and offices. The onward distribution of goods will occur from the northern side of the warehouse, while the south side will receive the raw materials to manufacture the cans. There are also service yards on the northern and southern warehouse façades.

1.3. Outline planning permission for the site was granted in December 2018 (KET/2018/0774). Condition 14 of the outline planning permission relates to noise and states that;

> *Prior to the first occupation of any of the buildings within the site for any purpose falling within use class B2 (general industry) or notwithstanding the provisions of the Town and Country Planning (Use Classes Order) 1987 (as amended) or any order amending, reinstating or replacing that order, any subsequent change within that use class, details of expected noise and/or emissions along with identified mitigation measures shall be submitted for the written approval of the Local Planning Authority and thereafter the measures shall be undertaken for the lifetime of that use.*
>
> *REASON: In the interests of pollution and noise control and the amenity of the other occupied units in accordance with policy 8 of the North Northamptonshire Joint Core Strategy.*

1.4. This report provides an assessment of the expected operational noise associated with the proposed development at Plot 4B to support the discharge of the noise related elements of Condition 14.

1.5. The assessment has been undertaken using information supplied by the proposed occupier about the nature of their operations and the plant and equipment that will be installed at the proposed development.

2. PLANNING POLICY CONTEXT & RELEVANT GUIDANCE

POLICY

NATIONAL PLANNING POLICY FRAMEWORK 2019

2.1. The National Planning Policy Framework (NPPF), last amended in June 2019, sets out the government planning policy for England. At its heart is an intention to promote more sustainable development.

2.2. The relevant paragraphs concerning noise in the NPPF are:

- Paragraph 170e: Specifies that new and existing development should be prevented from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution and, wherever possible, should help to improve local environmental conditions.
- Paragraph 180: "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. In doing so they should:
  a) *mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*"

2.3. The NPPF makes direct reference to the Noise Policy Statement for England for advice on the achievement of these policy aims.

NOISE POLICY STATEMENT FOR ENGLAND 2010

2.4. The Noise Policy Statement for England (NPSE) sets out the government's overall policy on noise management. It aims to promote good health and a good quality of life through the effective management of noise in the context of government policy on sustainable development.

2.5. It uses the previously established concepts of No Observed Effect Level (NOEL) and Lowest Observed Adverse Effect Level (LOAEL), and extends these concepts by introducing Significant Observed Adverse Effect Level (SOAEL). This is the level above which significant

adverse effects on health and quality of life are likely to occur. However, the explanatory note to the NPSE states that it is not possible to identify a single objective value to define SOAEL that is applicable to all sources of noise in all situations. It is likely to be different for different noise sources, for different receptors and at different times.

2.6. The NPSE sets out the following long-term vision of noise policy and supporting aims in paragraphs 1.6 and 1.7:

> *"Noise Policy Vision*
>
> *Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.*
>
> *Noise Policy Aims*
>
> *Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*
>
> *Avoid significant adverse impacts on health and quality of life;*
>
> *Mitigate and minimise adverse impacts on health and quality of life; and*
>
> *Where possible, contribute to the improvement of health and quality of life."*

2.7. The second aim of the NPSE refers to noise impacts that lie somewhere between LOAEL and SOAEL; while these may be considered as adverse effects, they are not considered as significant.

2.8. The NPSE asserts that, while all reasonable steps should be taken to mitigate and minimise adverse effects, this does not mean that such adverse effects cannot occur.

PLANNING PRACTICE GUIDANCE: NOISE (2019)

2.9. Further government guidance on the consideration of noise for planning has been published as the Planning Practice Guidance for Noise (PPG:N), last revised in July 2019. The PPG:N supports the NPPF by providing a range of advice and includes a noise exposure hierarchy table, and again makes reference to the NPSE.

2.10. The hierarchy table (replicated in Table 1 below), provides descriptive (i.e. non-numerical) guidance on the potential effects of noise exposure at levels corresponding to the NOEL, LOAEL and SOAEL as described in the NPSE, and confirms that adverse effects (between LOAEL and SOAEL) should be mitigated and reduced to a minimum, and significant adverse effects (above SOAEL) should be avoided, taking account of the economic and social benefit of the activity causing or affected by the noise.

Table 1 PPG:N Noise Exposure Hierarchy

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

CONSULTATION

2.11. Consultation regarding the approach to the assessment was undertaken in April 2021 with Environmental Protection Officers at North Northamptonshire Council.

2.12. During this consultation it was agreed;

- to undertake an assessment following the principles of BS 4142:2014+A1:2019;
- initially aim to achieve a rating level which does not exceed the background sound level at the noise sensitive receptors;
- however, in accordance with the guidance in BS 4142 the assessment will also consider the context in drawing a conclusion about the likely impact of the proposed development;
- the noise sensitive receptors and background sound levels would be those set out in the ES/noise & vibration report which accompanied the outline application ref. KET/2018/0774.

RELEVANT GUIDANCE

BS4142:2014+A1:2019 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND.

2.13. The assessment of the potential impacts arising from operational sound associated with the Proposed Development is based on the principles of BS 4142:2014+A1:2019. This methodology provides an initial estimate of impact based on the difference between the sound from the source being assessed (the specific level) and the existing background sound level at the measurement location.

2.14. Regarding the background sound level, the standard states that the value used should be representative of what occurs at the receptor locations during the assessment periods and that the objective is not simply to identify the lowest level. Typical background sound levels are usually identified using statistical analysis; see the Baseline Conditions section below for further information.

2.15. The standard also states that certain characteristics, if perceptible at the receptor location, can increase the extent of the impact over that expected from a simple difference in noise levels. These characteristics include tonality, impulsivity and intermittency as well as “other sound characteristics” which is used when the sound might be readily distinctive against the residual acoustic environment but is not considered to have any of the other three features.

The standard describes various options for taking any such features into account and for determining what is described in the standard as a 'rating level'.

2.16. The standard states that the extent of the impact can be determined by subtracting the typical background sound level from the rating level. The greater the difference the greater the magnitude of the initial impact estimate. The standard states that:

> *'Typically, the greater this difference, the greater the magnitude of the impact.*
>
> *A difference of around + 10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
>
> *A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.*
>
> *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.'*

2.17. The standard states that while the difference between the rating level and the background sound level provides an initial estimate of impact, other factors should be considered in terms of context, such as the absolute noise levels and how the character and level of the source relates to the existing sound environment. Regarding the absolute noise levels, relevant guideline values are presented in Table 2.

Table 2 Summary of Guideline Values from BS 8233:2014

Location (activity)	Time period	Desirable Sound Level not to be exceeded
Inside bedrooms and living rooms (resting)	Day (07:00-23:00)	**35 - 40 dB $L_{Aeq,T}$**
Inside bedrooms (sleeping)	Night (23:00-07:00)	**30 - 35 dB $L_{Aeq,T}$**
Inside Dining Room/area (dining)	Day (07:00 – 23:00)	**40 - 45 dB $L_{Aeq,T}$**
External Amenity Space	Day (07:00-23:00)*	**50-55 dB $L_{Aeq,T}$**

*Time period not defined but assumed to be day.

2.18. The lower values presented in the table are generally regarded as the LOAEL for steady external sound, i.e. no adverse effect due to the impact of the sound would be expected. If the sound has certain characteristics at the receptor location, it could be appropriate to consider a lower value as the LOAEL.

3. BASELINE CONDITIONS & NOISE SENSITIVE RECEPTORS

NOISE SENSITIVE RECEPTORS

3.1. Consideration has been given to the area surrounding the A14 Business Park and the nearest noise sensitive receptors, which may potentially be adversely affected by the site once operations have commenced.

3.2. The locations of the nearest noise sensitive receptors (as identified in Figure 1 of Appendix 8.1 to the 2018 Environmental Statement[1]) are illustrated in Appendix C. To the north-east the nearest noise sensitive receptors are the residential dwellings at Blackbridge Farm and to the east are Windmill Cottages, both located on Cranford Road.

3.3. To the south of the A6, there is a cluster of dwellings on Elm Road, Woodland Drive and The Crescent. To the west, beyond Kettering Road there are a number of existing commercial premises which are part of an existing business park.

3.4. To the north, the nearest noise sensitive receivers are located on Cranford Road, north of the A14.

BASELINE CONDITIONS

3.5. A baseline noise survey was undertaken by Hoare Lea in February 2013 for the ES. Monitoring was conducted at six locations surrounding the site to establish the existing residual and background noise levels. The survey locations were selected to obtain a representative sample of the existing baseline noise climate at nearby noise-sensitive receptors that have the potential to be altered by the proposed development. Unattended long-term surveys were carried out over a weekday and weekend period by Hoare Lea.

3.6. The noise measurement locations comprised:

- Location 1 – Recycling plant and Residential Property at Blackbridge Farm
- Location 2 – Field adjacent to Windmill Cottages
- Location 3 – Boundary of properties to the south of Cranford Rd
- Location 4 – Field adjacent to industrial unit on Kettering Rd
- Location 5 – Field adjacent to A14 Junction 10 (within site boundary)

[1] P_1004806_PJ_20130924_1.TechnicalAppendixNoise.0774.2018.KET.041018

- Location 6 – Field boundary of properties to the north of Cranford Rd

3.7. The background noise climate is characterised by road traffic from the A14, A6 and industrial activities. Table 3 below provides daytime and night-time levels for the measurement locations.

3.8. The weather during the survey was dry with light showers on occasions, but mostly dry with breaks of sunny periods. Full details of the survey can be found in the Chapter 8 of the 2018 Environmental Statement[2].

3.9. The noise levels presented in Table 3 show the average ambient $L_{Aeq,16\ hour}$ from the survey period, the average ambient $L_{Aeq,8\ hour}$ from the survey period, and the typical background noise levels derived from a statistical analysis of the most commonly occurring levels. The analysis of these data can be found in Appendix D, with the selected typical levels indicated in blue.

3.10. It is noted that this data reflects the background noise environment at the time of measurement, and it is likely that the levels will have increased since that time, so this is considered a robust basis for the assessment.

3.11. Locations 4 and 5 do not have any associated noise sensitive properties for consideration and have therefore been excluded from the assessment. Location 7 was not included in the original baseline assessment but has been added due to its closer proximity to the proposed development site than Location 6. It has been assumed to have the same noise climate as Location 6, although in reality may be subject to marginally higher noise levels.

Table 3 Baseline levels for Assessment

Location	Averaged Ambient Noise Levels dB		Typical Background Noise levels dB	
	Daytime ($L_{Aeq,16\ hour}$)	Night-time ($L_{Aeq,8\ hr}$)	Daytime ($L_{A90,1\ hour}$)	Night-time ($L_{A90,5\ min}$)
Location 1	57	53	52	42
Location 2	59	53	54	42
Location 3	57	52	52	40
Location 6	58	52	49	42
Location 7	58	52	49	42

[2] 0661.2013.KET.ES Chapter 8.Noise and Vibration

4. OPERATIONAL SOUND LEVELS

4.1. The primary sources of operational noise associated with the proposed development are:

- Noise from HGV manoeuvres in the service yard areas;
- Noise from plant associated with the proposed development (locations provided in Appendix E) which includes:
  - typical mechanical services plant to provide heating and cooling to office spaces;
  - specialist plant associated with the production and coating of aluminium drinks cans (i.e., an oxidiser, two dry air coolers, and a substantial quantity of roof-top mechanical plant to provide ventilation to the production area);
- Noise break-out from the internal production area.

4.2. It is proposed that initially the plant will operate 4 production lines, but that in future it could expand the production area within the warehouse to operate 6 production lines. Therefore, the predictions have been undertaken for both 4-line and 6-line operation.

4.3. In accordance with the relevant British standard for predicting and assessing this type of noise (BS4142:2014+A1:2019), the likely noise levels arising from operational activities at Plot 4B have been considered during the 1-hour daytime assessment period and 15-minute night-time assessment period.

4.4. The noise sources included in the model and their associated noise emission are discussed in turn below.

HGV MANOEUVRES

4.5. The proposed occupier has provided information regarding the level of HGV activity associated with the proposed Plot 4B development.

4.6. The unloading of raw materials will occur on the southern side of the warehouse between the hours of 07:00 – 18:00 hours. This activity will be concentrated in the south-east corner of the service yard and is understood to take approximately 30 minutes per vehicle. There is not proposed to be any HGV manoeuvring at night on this side of the warehouse.

4.7. A summary of the number of lorries per day (07:00 - 18:00 hours) and the number in the peak hour are presented in Table 4 below. This indicates the number of lorries there would be

under the initial 4 production line scenario and how many under the 6 production line scenario.

Table 4 No. of HGVs manoeuvring – southern service yard

	Daytime (07:00 – 18:00)		Night-time (23:00 – 07:00)	
Lines	**4 lines**	**6 lines**	**4 lines**	**6 lines**
Number (whole period)	20	30	0	0
Peak number per hour	2	3	0	0

4.8. The distribution of manufactured cans will take place from the northern side of the warehouse. This will be a 24-hour operation and loading is anticipated to occur for approximately 20 minutes per HGV.

4.9. A summary of the number of lorries in the daytime (07:00 – 23:00 hours) and the number in the peak 15 minutes at night (23:00 – 07:00 hours) is presented in Table 5. This indicates the number of lorries there would be under the initial 4 production line scenario and how many under the 6 production line scenario.

Table 5 No. of HGVs manoeuvring – northern service yard

	Peak Hour Daytime (07:00 – 23:00)		Peak 15 mins of Peak Hour Night-time (23:00 – 07:00)	
Lines	**4 lines**	**6 lines**	**4 lines**	**6 lines**
Number	4	8	1	2

4.10. In accordance with BS 4142:2014 the daytime assessment period is 1 hour. It is assumed therefore that during the peak hour of the day each HGV associated with the development arrives, reverses up to the unit, loads/unloads for 30 minutes and then starts the engine and pulls away.

4.11. The night-time assessment period is 15 minutes. It is unlikely that an HGV will complete all of its loading/unloading and manoeuvring within 15 minutes, so it is assumed that during the assessment period, the HGV either reverses or pulls away and that loading/unloading occurs for the rest of the assessment period.

4.12. As the vehicles arriving and departing the site may be from different distribution companies, it is not possible to guarantee the use of broadband reversing alarms on these third-party

vehicles. It has therefore been assumed, in order to present a worst-case assessment, that all reversing alarms will be narrowband.

4.13. Based on measurements taken at other distribution parks, the source spectra used for each activity are presented in Table 6.

Table 6 Source Terms for Typical HGV Activities

Activity	Sound Power Level Lw (dB) in each Octave Band (Hz)								LwA (dB)
	63	125	250	500	1000	2000	4000	8000	
HGV Reverse	102	95	95	92	94	95	85	79	99
HGV Start-up & Pull Away	107	101	98	97	97	94	87	78	101
HGV Load / Unload	88	87	88	88	85	83	79	74	91

4.14. The calculations assume that there is no mitigation other than the screening provided by the proposed ground works, buildings and contouring which are inherent in the design of the Proposed Development.

PLANT NOISE

Office HVAC

4.15. The office heating and cooling plant is located in four main compounds on the roof of the warehouse as indicated in Appendix E (Figure 3) below. The compounds and number of units in each compound are set out below:

- Compound 1 (north-west roof): 3 No. VRV/VRF Condensers and 3 No. AHUs.
- Compound 2 (south-west roof): 3 No. VRV/VRF Condensers and 3 No. AHUs.
- Compound 3 (south roof): 3 No. VRV/VRF Condensers and 3 No. AHUs.
- Compound 4 (south-east roof): 1 No. VRV/VRF Condensers and 1 No. AHU.

4.16. The sound power levels of the VRV/VRF and AHU condensers are set out in Table 7. These were modelled at 1 m back from the edge of the roof with a source height of 1 m above the roof.

Table 7 Sound Power Level of Office HVAC

Equipment	Sound Power Level (dB) in each Octave Band (Hz)								LwA (dB)	LpA (dB at 1m)
	63	125	250	500	1000	2000	4000	8000		
VRV/VRF condenser	85.5	81.0	79.5	76.5	71.5	67.5	63.0	59.0	78	70
Comms Room AHU condensers	80.5	76.0	74.5	71.5	66.5	62.5	58.0	54.0	73	65

Oxidiser and Dry Air Cooler

4.17. The oxidiser and two dry air coolers are located externally close to the southern façade of the building as can be seen in the close-up of the location presented in Appendix E (Figure 4) below.

4.18. The oxidiser has been modelled as 5 No. point sources (1 to represent each fan on the oxidiser) each at a height of 2 meters. The oxidiser has been specified to achieve a sound pressure level of 75 dB(A) at 10 m from each fan. The sound power level for the oxidiser fans is presented in Table 8.

Table 8 Oxidiser Fans Sound Power Level

Sound Power Level (dB) in each One Third Octave Band (Hz)																
16	20	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630
85.9	86.7	85	83.2	84	85.4	78.9	76.7	84.5	77.9	76.1	77	75.4	76	74.1	71.9	72.7

Sound Power Level (dB) in each One Third Octave Band (Hz)												
800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500
70.7	70.5	72	73.5	71.1	71	71	71.8	65.1	63	62.4	57.8	55.5

4.19. The 2 No. dry air coolers have each been modelled as 14 separate point sources. Each point source has been modelled at a height of 2m above ground level and with a sound power level of 80.5 dB. The sound power level spectrum, derived from manufacturer data (Model FVN91145B5BM D P2.1 EC QE RE OS HY) is set out in 0 below.

Table 9 Dry Air Cooler Fans Sound Power Level

Equipment	Sound Power Level (dB) in Octave Band (Hz)							L_{WA} (dB)
	125	250	500	1000	2000	4000	8000	
Dry Air Cooler (Per Fan)	81.7	80.1	76.8	75.3	72.5	69.4	62.8	80.5

Production Cooling Plant

4.20. There are multiple fans located on the roof of the production area which provide ventilation and cooling to the production area as indicated in Appendix E (Figure 5) below. Table 10 provides the sound power level of this equipment and the number of units of each type that would operate with 4 production lines and 6 production lines. All fans have been assumed to be located at 0.5 m above the roof except the spot cooling units, which are assumed to be at 1 m above the roof.

Table 10 Sound Power Level for Production Mechanical Services Plant

Equipment	Sound Power Level (dB) in Octave Band (Hz)								LwA (dB)	No of units	
	63	125	250	500	1000	2000	4000	8000		4 lines	6 lines
Extract/Exhaust Fan	85	92	88	87	85	82	79	76	90	25	37
Supply fans	91	92	100	93	91	88	85	82	97	27	40
Make-up air fan	91	92	100	93	91	88	85	82	97	6	9
Spot cooling	88	83	812	79	74	70	65	61	80	12	18

4.21. The exhaust, supply and make-up air fans will all be fitted with attenuators which will achieve as a minimum the insertion loss specified in Table 11.

Table 11 Exhaust, Supply and Make Up Fan Attenuator Insertion Loss

Equipment	Insertion Loss (dB) in Octave Band (Hz)							
	63	125	250	500	1k	2k	4k	8k
Attenuation	5	10	18	28	36	28	24	14

4.22. It has been assumed that there is no significant break out noise from penetrations through the roof structure associated with this plant. This will be addressed during detailed design by the occupier's acoustic consultant.

NOISE BREAKOUT FROM THE BUILDING ENVELOPE

4.23. Based on data provided by the occupier from measurements undertaken at a similar facility, the sound pressure level at the ground floor of the production area is expected not to exceed 95 dB(A). The assumed sound pressure level spectrum is set out in Table 12.

Table 12 Assumed Internal Sound Pressure Level Spectrum in Production Area

Octave Band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Sound pressure level in each octave band	84	90	90	91	90	88	86	85	95

4.24. For 6 production lines, operations are assumed over a proportionally larger floor area than for 4 production lines, with a commensurate increase in the relative façade and roof areas.

4.25. The predictions consider the break-out from the roof over the production area, the eastern façade and the southern façade. It is noted that due to the presence of various technical rooms on the southern façade there would not be break out from the whole façade area. The northern and western façades of the building are not considered to have any significant noise break out due to the offices and internal fire wall separating the offices and distribution area from the production area.

4.26. The warehouse cladding system will be a combination of Euroclad Elite 51 panels (applied vertically) and Euroclad Elite 55 panels (applied horizontally) to the walls, and Euroclad Elite 1 Panels covering the roof. Vertical wall panels will cover approximately 2/3 of the height of the building, with horizontal panels covering most of the remainder up to the top of the parapet. An indicative detail is provided at Appendix F.

4.27. The sound reduction performance of these panels is presented in 0 to Table 15. As can be seen from the tables, the in-situ performance has been estimated by subtracting 5 dB from the laboratory performance.

Table 13 Sound Reduction Index – EuroClad Elite 1

Performance	Sound Reduction Index (dB) in Octave Band (Hz)							Rw
	63	125	250	500	1k	2k	4k	
Laboratory	13	21	31	39	45	51	56	40
In-situ	8	16	26	34	40	46	51	35

Table 14 Sound Reduction Index – EuroClad Elite 51

Performance	Sound Reduction Index (dB) in Octave Band (Hz)							Rw
	63	125	250	500	1k	2k	4k	
Laboratory	12	17	31	39	45	50	53	12
In-situ	7	12	26	34	40	45	48	7

Table 15 Sound Reduction Index – EuroClad Elite 55

Performance	Sound Reduction Index (dB) in Octave Band (Hz)							Rw
	63	125	250	500	1k	2k	4k	
Laboratory	10	20	31	38	45	53	60	40
In-situ	5	15	26	33	40	48	55	35

4.28. It has been assumed that the internal sound pressure level would be reduced by 3 dB at the points at which it breaks out from the roof and from the horizontally clad façades of the building.

PREDICTION METHODOLOGIES

4.29. Predictions have been undertaken using a 3D model of the proposed development and surrounding area, including topography, created using the software package IMMI.

4.30. Point-source (for HGV and plant sources) and area source (for façade breakout) propagation have been calculated using the methodologies described in ISO 9613-2:1996[3].

4.31. Ground-floor level is taken to be 1.5 m above local ground. First-floor level is taken to be 4.5 m above local ground.

[3] ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of calculation, ISO (1996)

5. ASSESSMENT

HGV MANOEUVRES

5.1. Predicted noise levels at the closest noise sensitive receivers are presented in Table 16.

Table 16 Predicted contributions from HGV Manoeuvres

Receptor	HGV Noise Levels dB(A)			
	4 Lines		6 Lines	
	Day	Night	Day	Night
R1 GF	28	28	32	31
R1 FF	29	29	33	32
R2 GF	28	14	30	17
R2 FF	30	13	32	17
R3 GF	33	7	34	10
R3 FF	31	7	32	10
R6 GF	31	30	35	35
R6 FF	31	30	35	35
R7 GF	24	23	27	26
R7 FF	24	23	27	26

PLANT NOISE

Constant Sources

5.2. Contributions from constant sources which are not affected by the number of production lines (Office HVAC, Oxidiser and Dry Air Coolers) have been grouped as shown in Table 17. Levels are expected to be steady and continuous.

Table 17 Predicted contributions from constant plant sources

Receptor	Constant Sources dB(A)			Combined Constant Plant Noise dB(A)
	Office HVAC	Dry Air Coolers	Oxidiser	
R1 GF	21	10	3	22
R1 FF	22	10	2	22
R2 GF	24	15	10	24
R2 FF	24	14	10	25
R3 GF	24	28	31	34
R3 FF	24	28	29	32
R6 GF	23	8	3	23
R6 FF	23	8	3	23
R7 GF	18	17	16	22
R7 FF	18	17	16	22

Production Cooling Plant

5.3. The number of fans active will depend on whether there are 4 or 6 production lines running. Levels are expected to be steady and continuous. The predicted contribution from each scenario is presented in Table 18.

Table 18 Predicted contributions from rooftop production plant

Receptor	Production Cooling Plant dB(A)	
	4 Lines	6 Lines
R1 GF	29	31
R1 FF	30	32
R2 GF	31	33
R2 FF	32	33
R3 GF	30	32
R3 FF	30	32
R6 GF	27	29
R6 FF	27	29
R7 GF	24	26
R7 FF	24	26

BUILDING ENVELOPE BREAKOUT

5.4. Predicted contributions from production noise breakout through the building envelope are presented in Table 19. Levels are expected to be steady and continuous.

Table 19 Predicted contributions from building envelope breakout

Receptor	Building Envelope Breakout dB(A)	
	4 Lines	6 Lines
R1 GF	30	31
R1 FF	29	31
R2 GF	35	37
R2 FF	37	38
R3 GF	34	34
R3 FF	33	34
R6 GF	25	26
R6 FF	25	26
R7 GF	25	26
R7 FF	25	26

CUMULATIVE LEVELS

5.5. The total predicted cumulative levels from all sources are presented in Table 20.

Table 20 Predicted cumulative contribution from all sources

Receptor	4 Lines		6 Lines	
	Day (dB $L_{Aeq,1\ hour}$)	Night (dB $L_{Aeq,15\ min}$)	Day (dB $L_{Aeq,1\ hour}$)	Night (dB $L_{Aeq,15\ min}$)
R1 GF	34	34	36	36
R1 FF	34	34	37	36
R2 GF	37	37	39	38
R2 FF	39	38	40	40
R3 GF	39	38	39	38
R3 FF	38	37	39	37
R6 GF	34	33	36	36
R6 FF	34	33	36	36
R7 GF	30	30	32	31
R7 FF	30	30	32	31

RATING LEVELS

5.6. None of the noise sources was considered likely to have any audible impulsivity, intermittency or tonality at the receptors. Where the specific noise level is relatively high compared to the background noise level, however, it is possible that it may be identifiable against the residual soundscape.

5.7. A cautionary +3 dB acoustic feature correction was applied to any specific noise level which was predicted to be within 5 dB of the typical background noise level from Table 3. The Rating levels thus derived are presented in Table 21, along with the background noise levels for comparison.

5.8. Where the predicted rating level exceeds the typical background noise level, this is indicated by red shading.

Table 21 Rating level compared with Background Noise Level

Receptor	Background Noise Level		4 Lines		6 Lines	
	Day (dB $L_{A90,1\ hour}$)	Night (dB $L_{A90,15\ min}$)	Day (dB $L_{Aeq,1\ hour}$)	Night (dB $L_{Aeq,15\ min}$)	Day (dB $L_{Aeq,1\ hour}$)	Night (dB $L_{Aeq,15\ min}$)
R1 GF	52	42	34	34	36	36
R1 FF	52	42	34	34	37	36
R2 GF	54	42	37	40	39	41
R2 FF	54	42	39	41	40	43
R3 GF	52	40	39	41	39	41

Receptor	Background Noise Level		4 Lines		6 Lines	
	Day (dB $L_{A90,1\ hour}$)	Night (dB $L_{A90,15\ min}$)	Day (dB $L_{Aeq,1\ hour}$)	Night (dB $L_{Aeq,15\ min}$)	Day (dB $L_{Aeq,1\ hour}$)	Night (dB $L_{Aeq,15\ min}$)
R3 FF	52	40	38	40	39	40
R6 GF	49	42	34	33	36	36
R6 FF	49	42	34	33	36	36
R7 GF	49	42	30	30	32	31
R7 FF	49	42	30	30	32	31

5.9. It is evident from Table 21 that rating level is predicted to exceed the typical background noise level at only one location, R2 (night-time, first-floor level).

5.10. When considering the context of this exceedance, the following must be taken into consideration:

- The predicted rating level exceeds the background by only 1 dB, which would not be considered a subjectively discernible difference, and includes a cautionary +3 dB acoustic feature correction.
- An exceedance of +5 dB would be considered significant under BS4142.
- The measured average night-time residual sound level at this location is 53 dB $L_{Aeq,8\ hour}$, and the noise climate is characterised by road traffic from the A14, the A6, and nearby existing industrial activities, so it is extremely unlikely that this exceedance will be noticeable.
- The predicted level is unlikely to exceed the BS8233 guideline desirable level inside a bedroom of 30 - 35 dB $L_{Aeq,T}$ with a window partially open for ventilation.

6. CONCLUSION

6.1. Noise level contributions from all identified sources have been predicted at the closest potentially noise sensitive residences.

6.2. The cumulative predicted noise level at each receptor has been corrected as appropriate for acoustic features to determine the BS4142 rating level, which has been compared with the typical background noise level at that location.

6.3. At all but one location the rating level was predicted to be no louder than the typical background noise level.

6.4. At R2 the exceedance was predicted to be 1 dB but given the context (in terms of the absolute level, the acoustic environment and the magnitude of the exceedance) was not considered significant.

6.5. No significant adverse impact is predicted as a result of the proposed development, and the requirements of Condition 14 are thereby considered to be discharged.

APPENDIX A – ACOUSTIC GLOSSARY

DECIBELS DB

Noise is commonly defined as unwanted sound. The range of audible sound is from 0 dB to 140 dB, which is taken to be the threshold of pain. The sound pressure detected by the human ear covers an extremely wide range. The decibel (dB) is used to condense this range into a manageable scale by taking the logarithm of the ratio of the sound pressure and a reference sound pressure.

'A' WEIGHTED DECIBELS DB(A)

6.7. The frequency response of the ear is usually taken to be about 18Hz (number of oscillations per second) to 18,000Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than at the lower and higher frequencies, and because of this, the low and high frequency component of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most used and which correlates best with the subjective response to noise, including that of music, is the dB(A) weighting. This electronic filter matches the variation in the frequency sensitivity of the meter to that of the human ear. This is an internationally accepted standard for noise measurements.

EQUIVALENT CONTINUOUS SOUND LEVEL LAEQ

The subjective response to a noise is dependent not only upon the sound pressure level and its frequency, but also its intermittency. Various indices have been developed to try and correlate annoyances with the noise level and its fluctuations. The parameter used for this measure is the Equivalent Continuous Sound Pressure Level (L_{Aeq}). The A-weighted sound pressure level of a steady sound that has, over a given period, the same energy as the fluctuating sound under investigation. In essence, the L_{Aeq} provides a single value to express the average sound energy over the measurement period and is the most widely used indicator for environmental noise.

The decibel scale is logarithmic and therefore when two noise sources are present together, they have to be combined logarithmically. Therefore, when two sound sources of the same sound pressure level are combined the resultant level is 3 dB(A) higher than the single source. However, in subjective terms the ear can distinguish a difference in 'loudness' between two simple noises sources when there is a 3 dB(A) difference between them.

Loudness, not a measure of annoyance. Again for simple sources, when two sounds differ by 10 dB(A) one is said to be twice as loud as the other.

OTHER NOISE UNITS:

$L_{A90,T}$: This is the 'A' weighted noise level exceeded for 90% of the measurement period,T. This is normally used to describe the background noise.

Façade Level: The sound level at a position 1 m in front of a reflecting façade of a building. The façade noise level is assumed to be 3 dB(A) higher than the level measured or predicted at an equivalent position away from the noise reflected from the building façade i.e. in the free-field.

Free-field Level: The sound level in an open area well away from any buildings or other sound reflecting surfaces other than the ground. Generally the minimum distance from building facades for free-field measurements is taken to be 3.5 m.

BS414:2014 TERMINOLOGY

Background Noise Level: The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval. Expressed as LA90,T and generally considered to be the average minimum noise level.

Ambient Noise Level: Totally encompassing sound in a given situation at any given time interval and usually composed of sound from many sources near and far. Usually expressed in terms of LAeq,T

Residual Noise Level: The ambient noise remaining at a given position in a given situation where the specific noise source is suppressed to such a degree that it does not contribute to the ambient noise. Expressed in terms of LAeq,T

Specific Noise Level: The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source (source being assessed) over a given reference time interval (LAeq,Tr)

Rating Noise Level: The specific noise level plus any adjustment for the characteristic features of the noise. Expressed in terms of LAr,Tr. The standard indicates that a correction should be added to the noise if it was tonal, impulsive or irregular enough to attract attention.

OBSERVED EFFECTS

The Noise Policy Statement for England (2010) defines several key terms in relation to the observed effects of noise. The three key terms are defined below;

No Observed Effect Level (NOEL): This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

Lowest Observed Adverse Effect Level (LOAEL): This is the level above which adverse effects on health and quality of life can be detected.

Significant Observed Adverse Effect Level (SOAEL): This is the level above which significant adverse effects on health and quality of life occur.

APPENDIX B – PROPOSED SITE LAYOUT

Figure 1 Site plan

APPENDIX C – NOISE SURVEY LOCATIONS

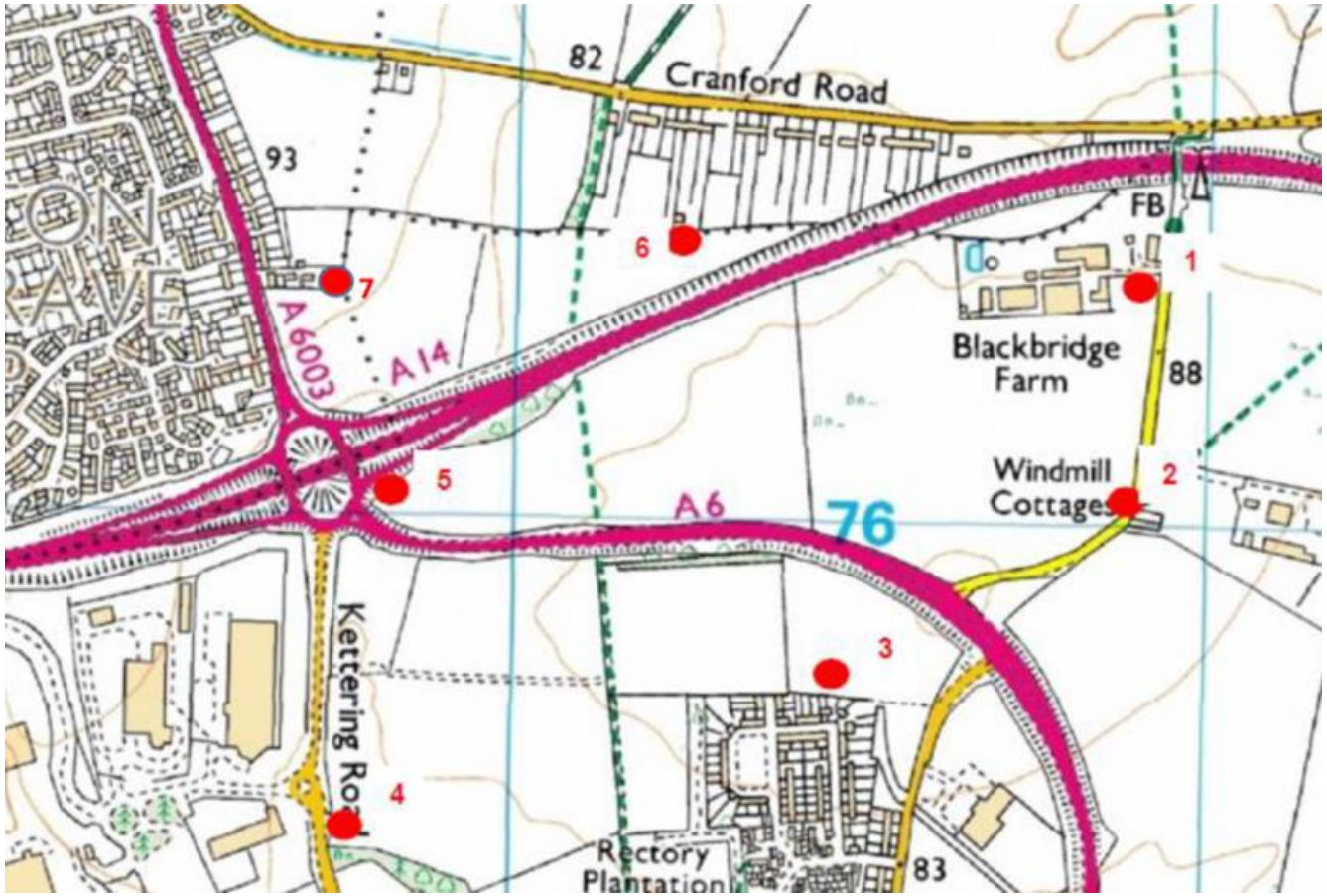
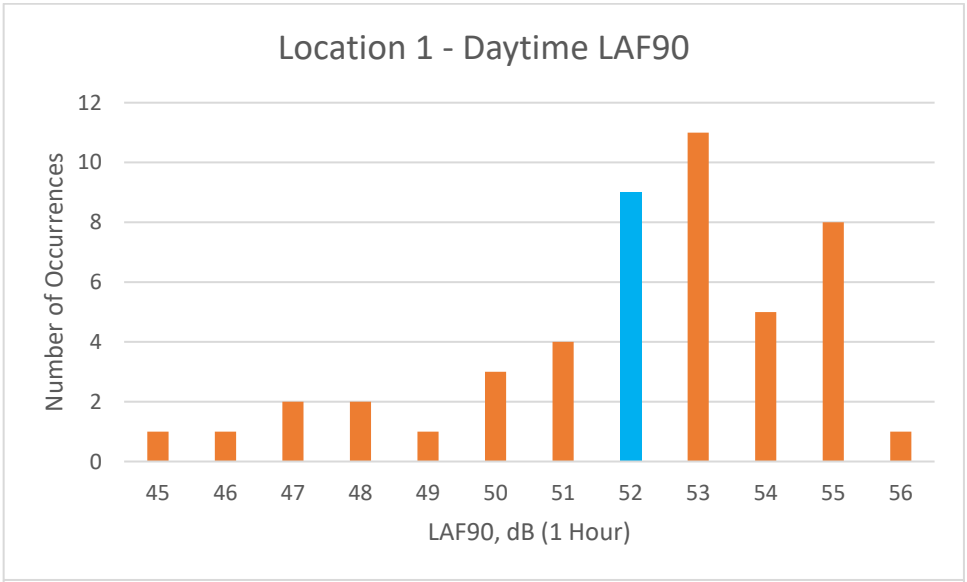


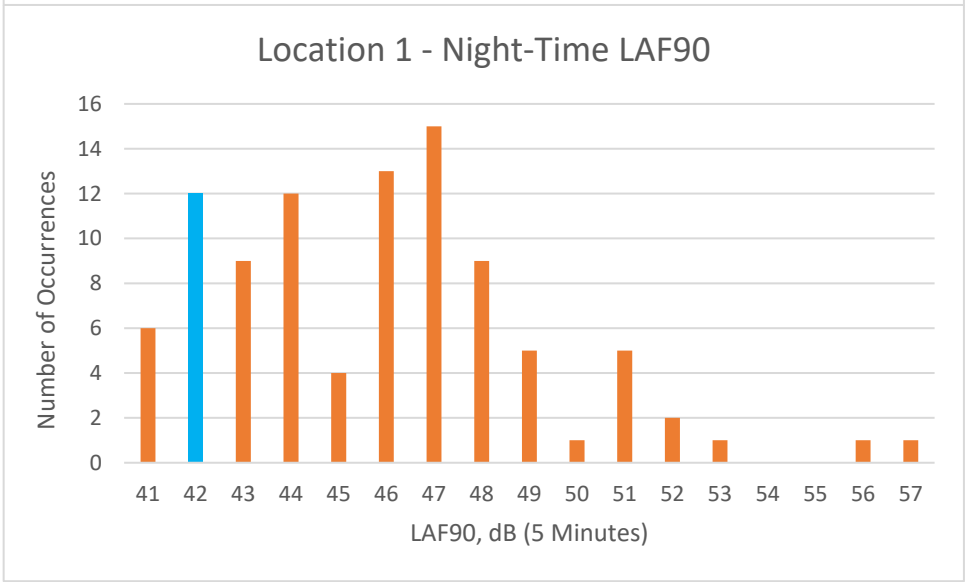
Figure 2 Noise survey locations

APPENDIX D – BACKGROUND NOISE LEVEL SELECTION

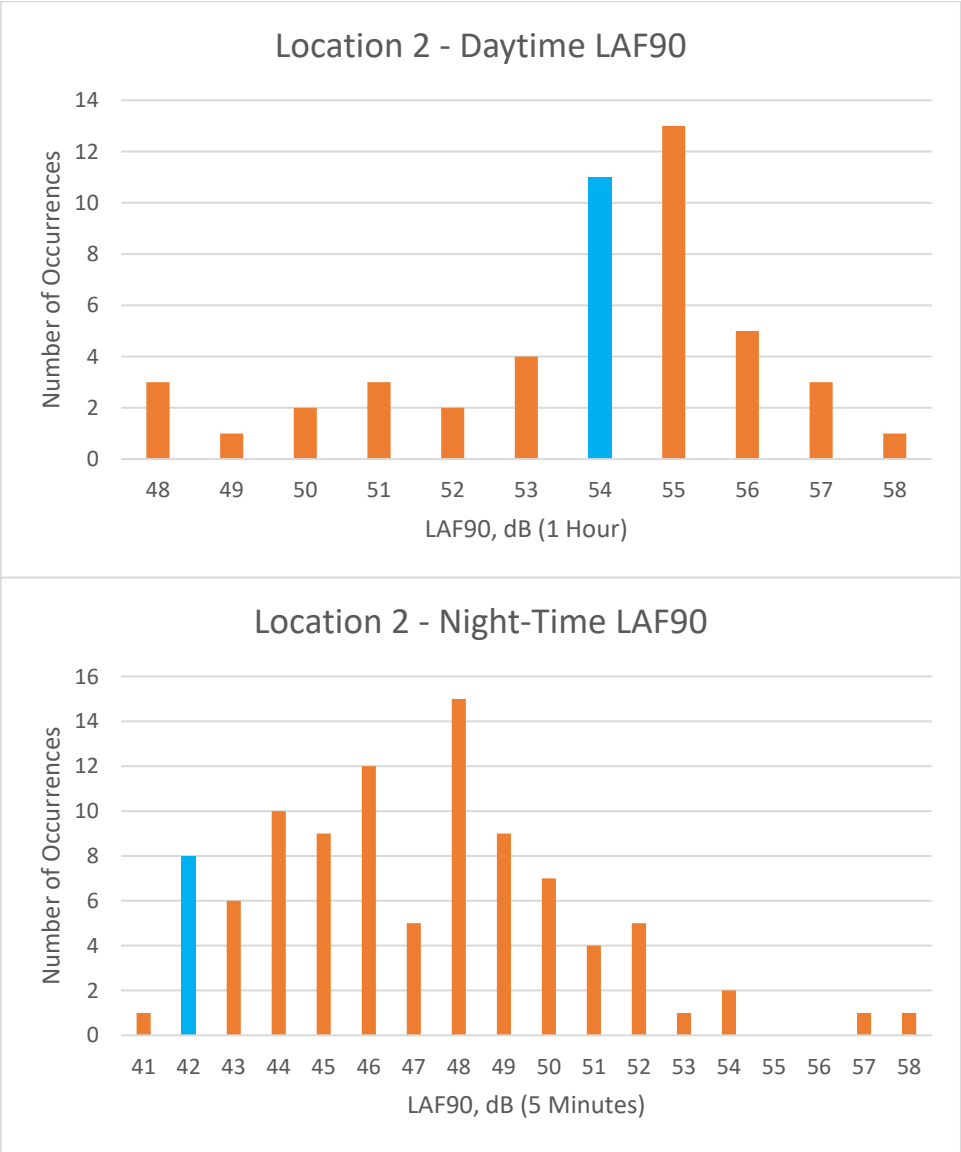
Data taken from the ES baseline assessment undertaken by Hoare Lea in 2013.

LOCATION 1

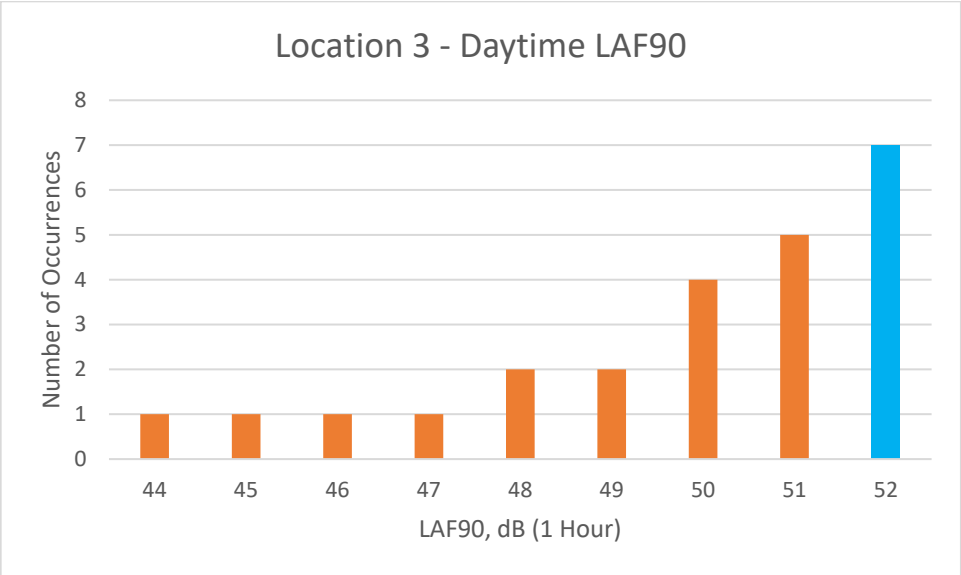


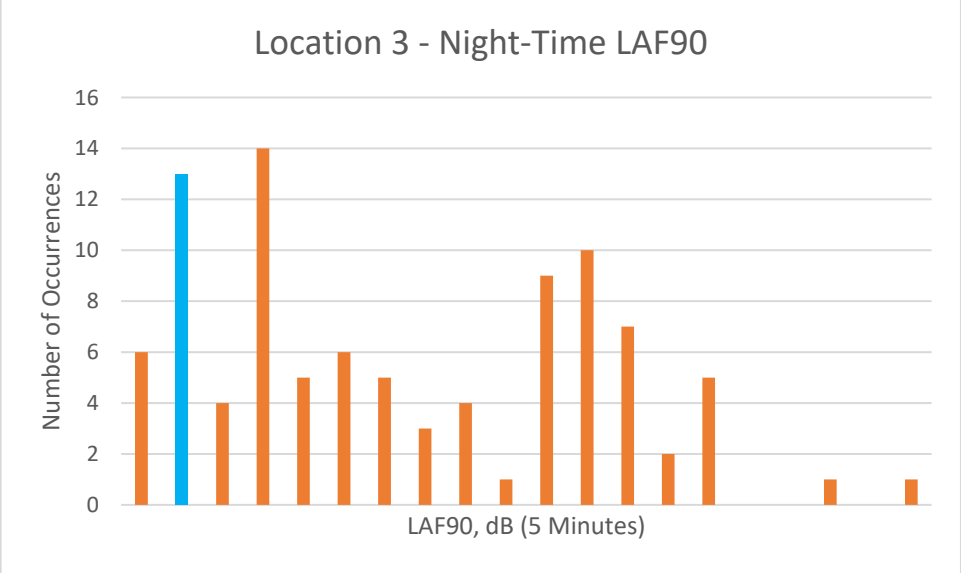


LOCATION 2

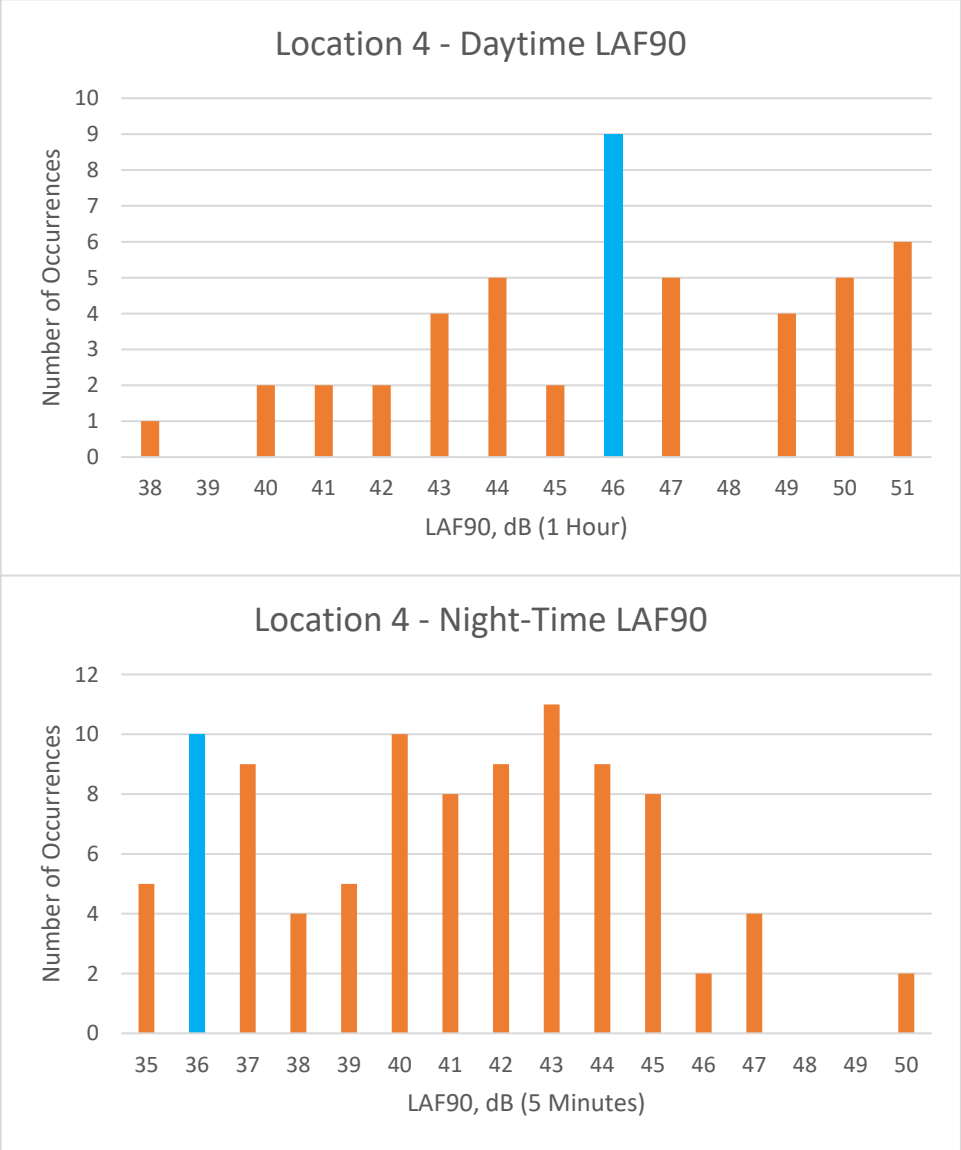

Location 2 - Daytime LAF90
Number of Occurrences
0
2
4
6
8
10
12
14
48
49
50
51
52
53
54
55
56
57
58
LAF90, dB (1 Hour)
Location 2 - Night-Time LAF90
Number of Occurrences
0
2
4
6
8
10
12
14
16
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
LAF90, dB (5 Minutes)

LOCATION 3

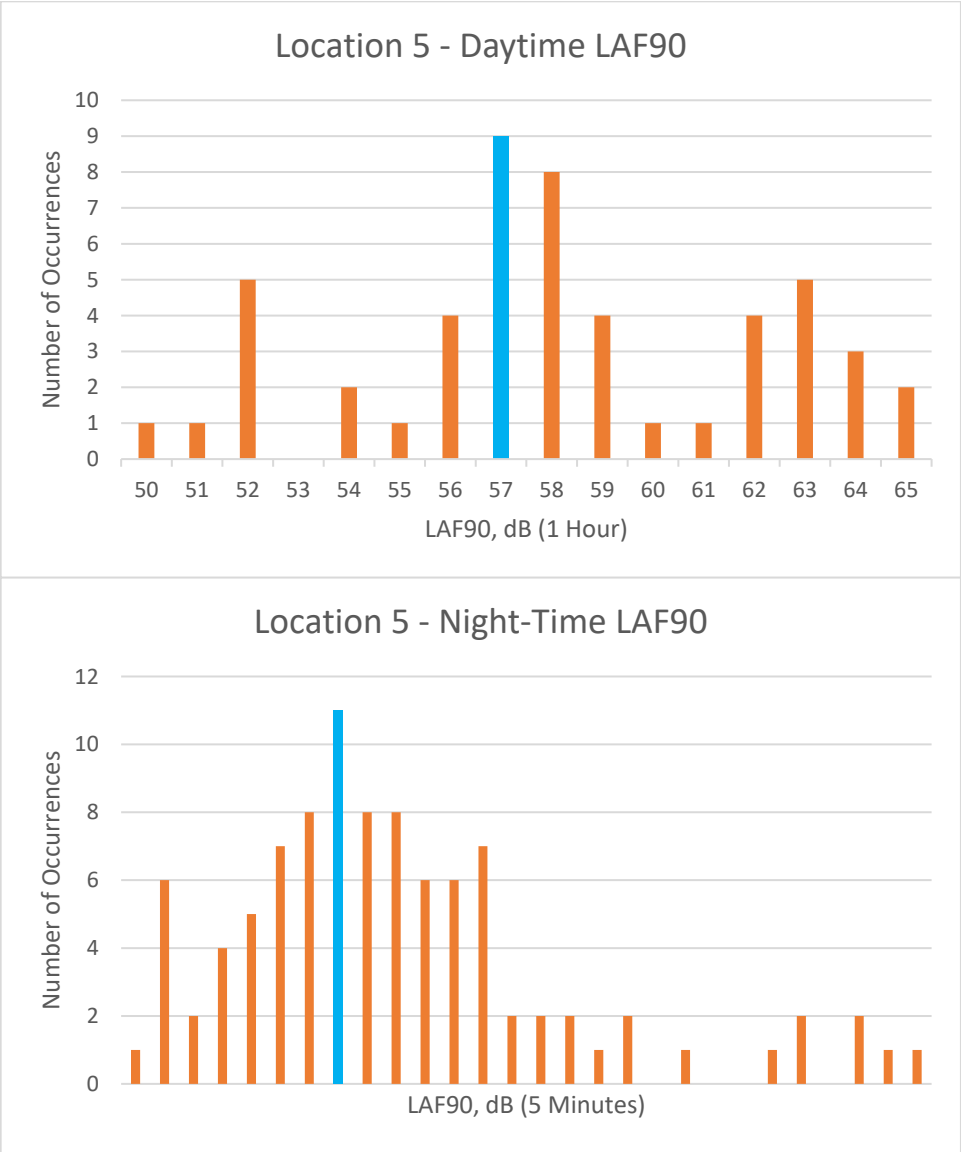

Location 3 - Daytime LAF90
Number of Occurrences
0
1
2
3
4
5
6
7
8
44
45
46
47
48
49
50
51
52
LAF90, dB (1 Hour)


Location 3 - Night-Time LAF90
Number of Occurrences
0
2
4
6
8
10
12
14
16
LAF90, dB (5 Minutes)

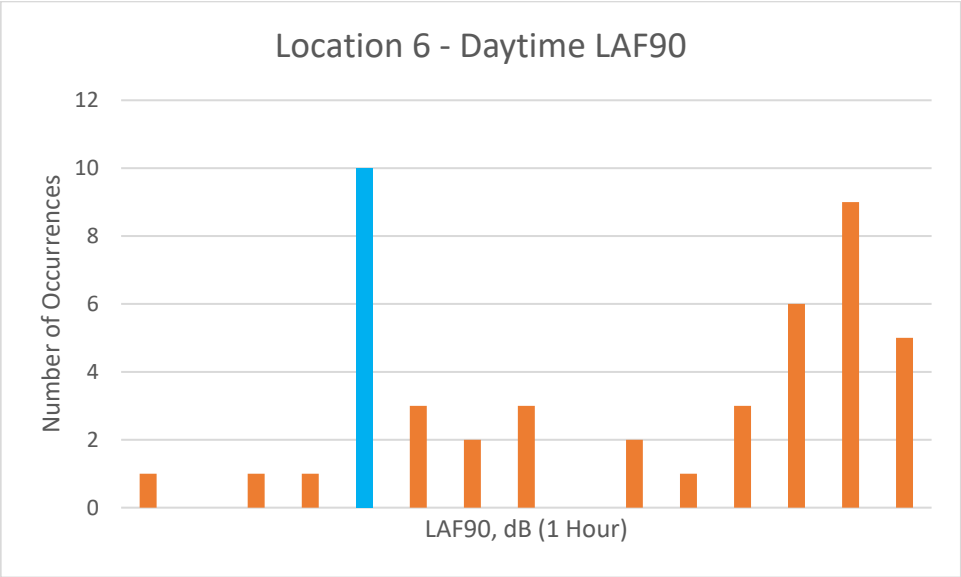
LOCATION 4

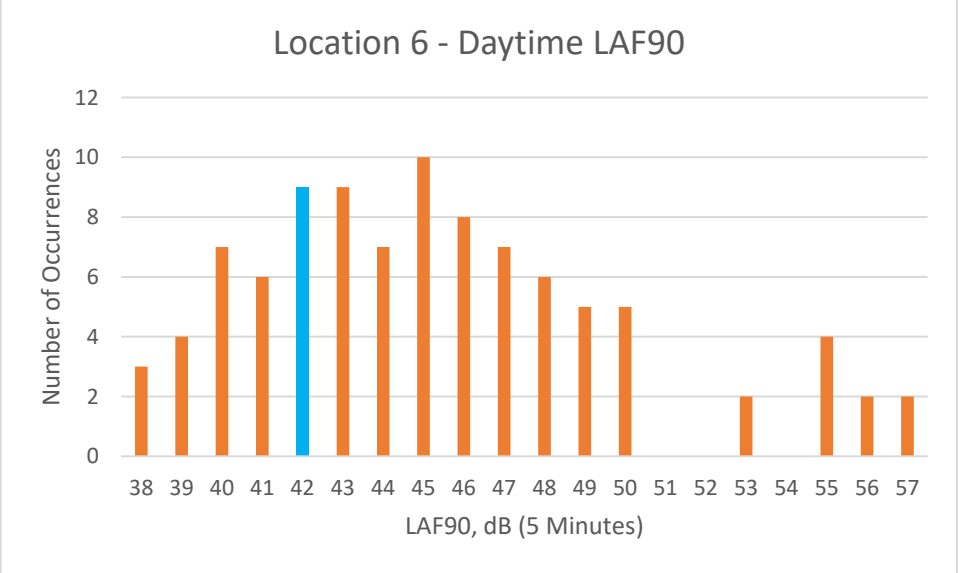

Location 4 - Daytime LAF90
Number of Occurrences
0
1
2
3
4
5
6
7
8
9
10
38
39
40
41
42
43
44
45
46
47
48
49
50
51
LAF90, dB (1 Hour)
Location 4 - Night-Time LAF90
Number of Occurrences
0
2
4
6
8
10
12
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
LAF90, dB (5 Minutes)

LOCATION 5


Location 5 - Daytime LAF90
Number of Occurrences
0
1
2
3
4
5
6
7
8
9
10
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
LAF90, dB (1 Hour)
Location 5 - Night-Time LAF90
Number of Occurrences
0
2
4
6
8
10
12
LAF90, dB (5 Minutes)

LOCATION 6


Location 6 - Daytime LAF90
Number of Occurrences
0
2
4
6
8
10
12
LAF90, dB (1 Hour)


Location 6 - Daytime LAF90
Number of Occurrences
0
2
4
6
8
10
12
38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57
LAF90, dB (5 Minutes)

APPENDIX E – PLANT LOCATIONS

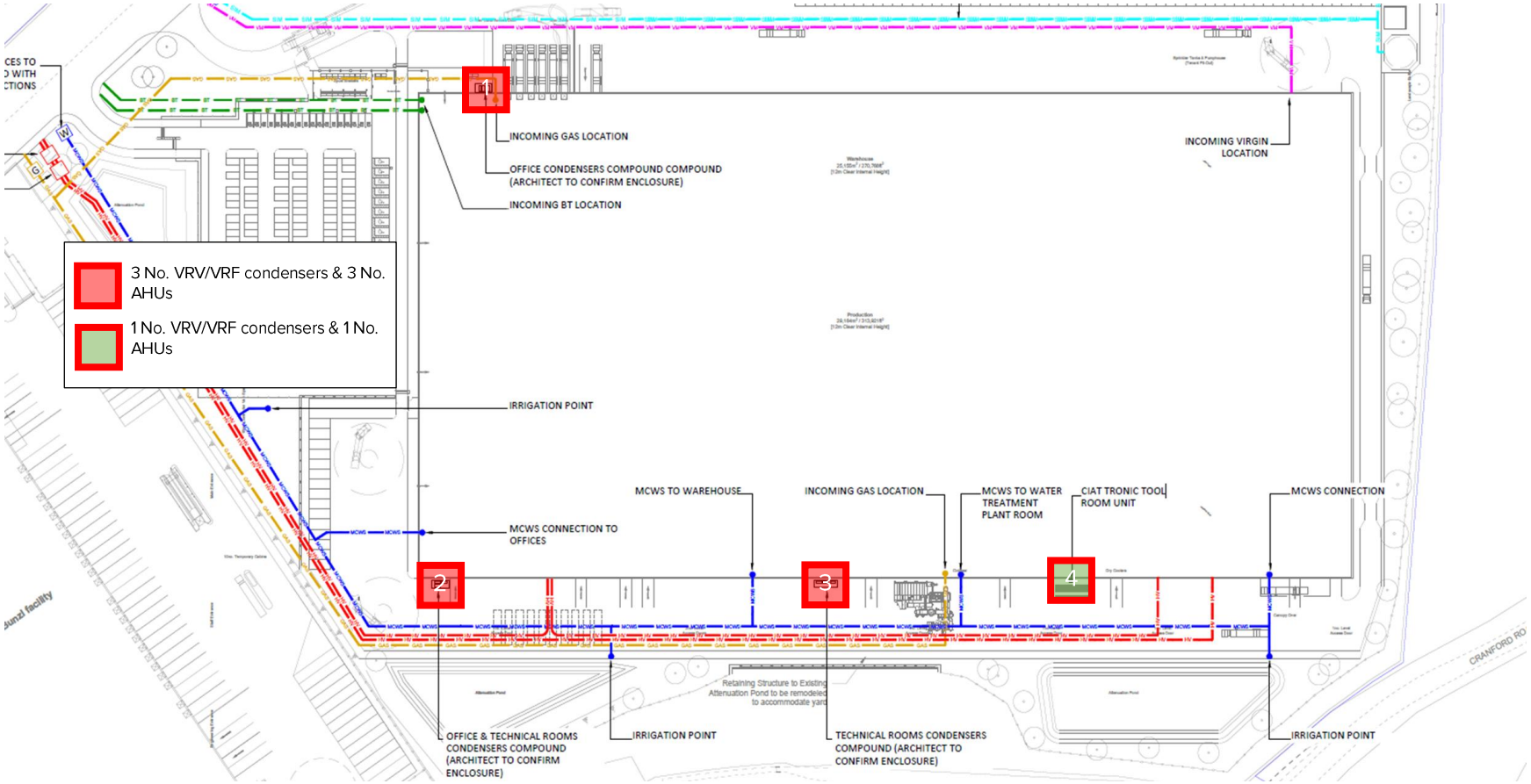


Figure 3 Office cooling plant locations

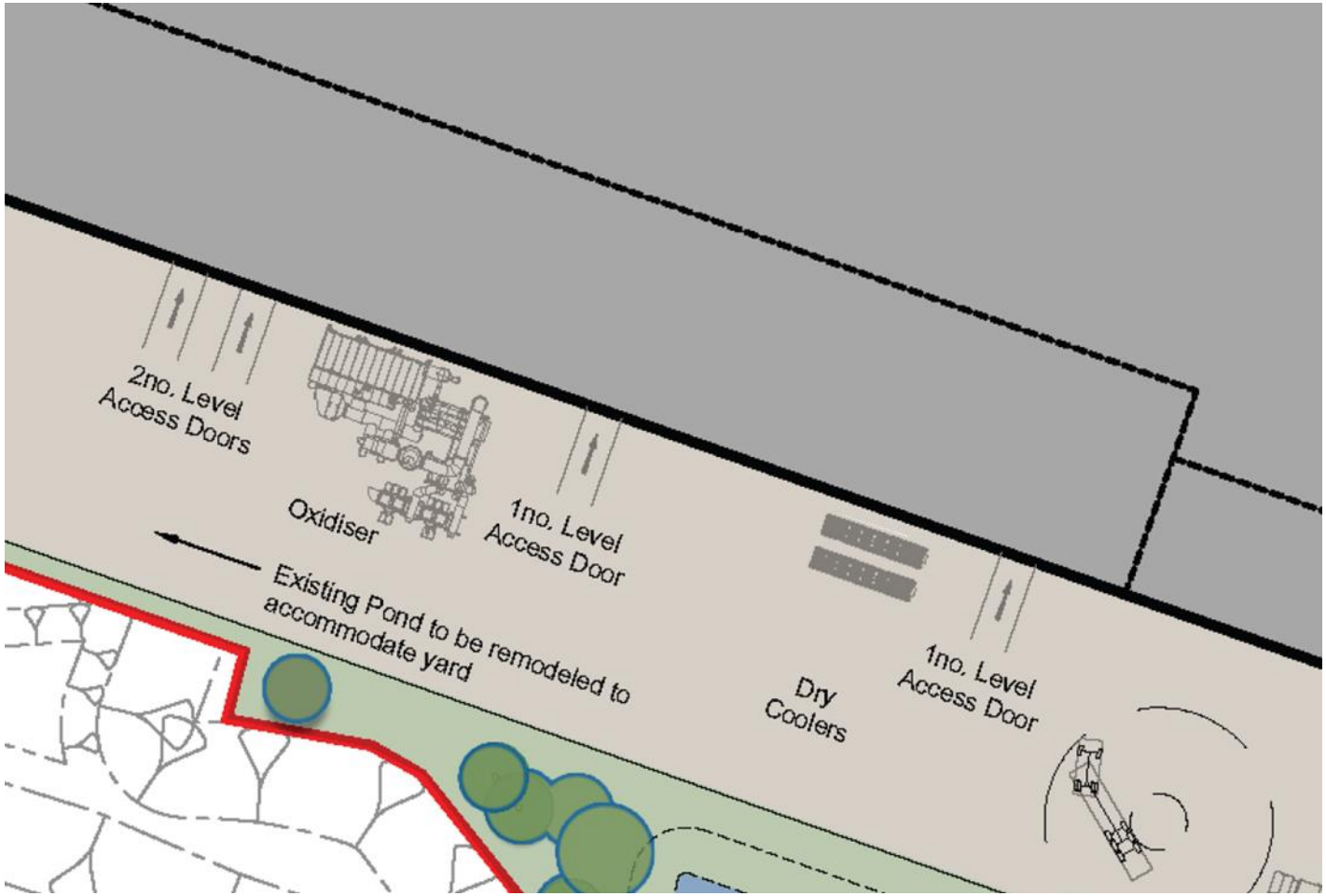


Figure 4 Oxidiser and Dry Cooler locations

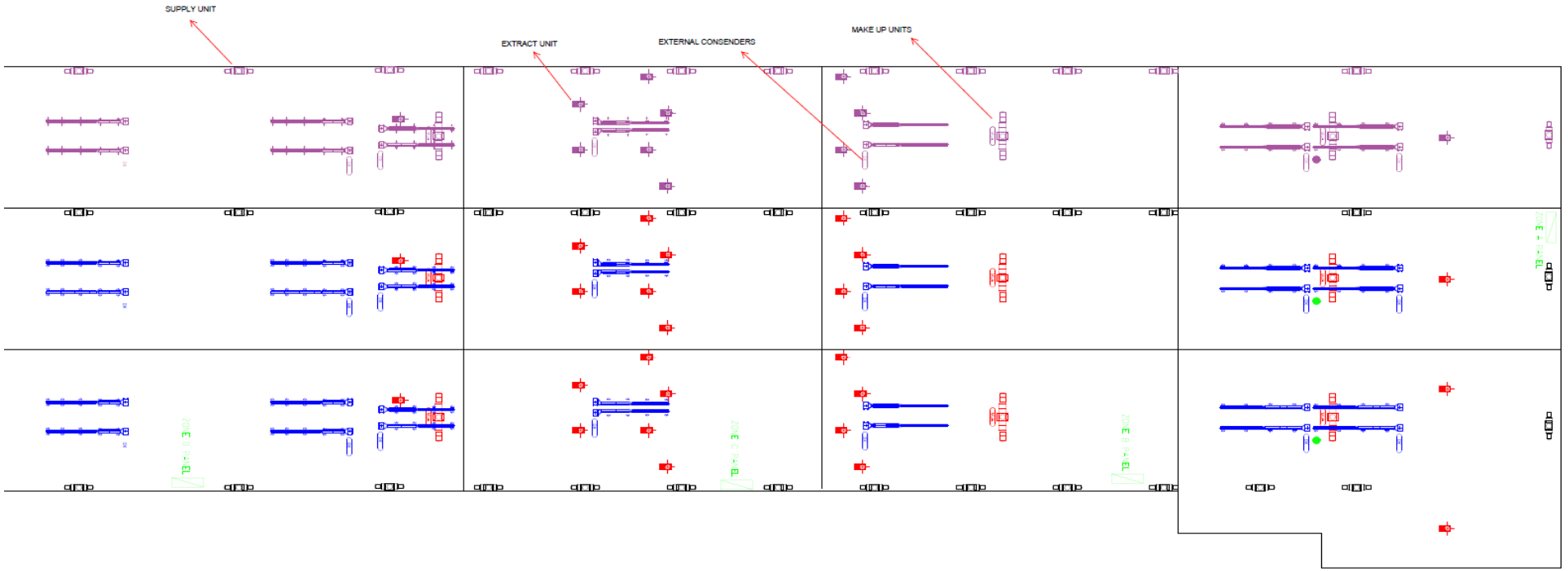


Figure 5 Cooling plant locations above the Production Area (Blue represents 4-line operation; purple represents additional plant for 6-line operation)

APPENDIX F – CLADDING DISTRIBUTION

Figure 6 Indicative Building Elevation Detail

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