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Consulting Engineers Limited



Chirk Particleboard Facility

Kronospan

Dispersion Modelling Assessment

ENGINEERING + CONSULTING

Document approval

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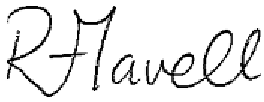
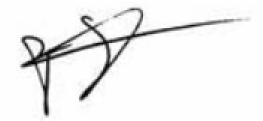
Prepared by:	Rosalind Flavell		Senior Environmental Consultant	15/12/2021
Checked by:	James Sturman		Lead Environmental Consultant	15/12/2021

Document revision record

Revision no	Date	Details of revisions	Prepared by	Checked by
0	30/07/2021	Consolidated AQA	RSF	JRS
1	10/09/2021	Updated following initial review by NRW	RSF	JRS
2	15/12/2021	Updated tables of Critical Loads	RSF	JRS

Contents

1 Introduction

1.1 Background

Kronospan Limited (Kronospan) operates a panel board manufacturing facility at its site in Chirk, North Wales (the Facility). The panel board manufacturing process is operated in accordance with an Environmental Permit (EP) which was granted by Wrexham Borough Council (WCBC) (Ref: WCBC/IPPC/03/KR(V2)). In addition to the EP granted by WCBC, the Formalin plant and combustion processes which supply power and heat to support the manufacturing process is operated in accordance with an EP which is regulated by Natural Resources Wales (NRW) (Ref: EA/EPR/BW9999IG/V004). NRW is determining an application from Kronospan to transfer all of the activities regulated within the WCBC EP to be regulated by NRW.

The modelling that has been undertaken to support the EP application demonstrates normal operating conditions (the likely case), and also with the plant operating at the worst-case emissions (the worst case). In terms of the latter scenario these are unlikely to be achievable given the integrated nature of the combustion plant and board manufacturing processes. In the situation where there is no production, heat demand is minimal and electricity demand is reduced which would lead to a progressive shutdown of operations.

1.2 Structure of the report

This report has the following structure:

- A description of the emission points to atmosphere is provided in Section 2.
- A description of the operating and emissions scenarios to be considered in this dispersion modelling assessment is provided in Section 3.
- National and international air quality legislation and guidance, and local planning policies which relate to air quality, are considered in Section 4.
- Section 5 highlights residential properties and ecological receptors in the vicinity of the Facility sensitive to changes in air quality associated with the proposals.
- The current levels of ambient air quality are described in Section 6.
- The inputs used for the dispersion model are contained within Section 7.
- Section 8 to Section 9 present and discuss the results of the dispersion modelling.
- The conclusions are presented in Section 10.
- All figures, model input data, and results tables are provided in the Appendices.

2 Emission Points to Atmosphere

For the purpose of this analysis it is worth splitting the sources into two groups. Those related to the combustion plant which provide heat and power to the manufacturing process and those directly related to the panel board manufacturing process. The combustion plant are set out in Table 1, the panel board manufacturing process plant in Table 2. These tables set out the use of each combustion plant and where the emissions from the plant are released to atmosphere.

As shown in Table 1, there are a number of combustion plants at the Facility. Under normal operations the hot exhaust gases from the combustion plant are used as a source of heat within the driers and released to atmosphere via the cyclones.

Table 1: Combustion Sources

Combustion plant	Fuel	Thermal capacity (MW)	Status	Use	Vents to atmosphere via
Natural Gas Heaters					
K1	Gas	2.25	Primary heat source	Kronoplus single daylight press plus space heating.	Dedicated stack only
K5	Gas	14.1	Standby for K7	Rawboard thermal oil to contiroll presses.	Dedicated stack only
K6	Gas	16.5	Standby for K7 & K8	Rawboard thermal oil to contiroll presses.	Dedicated stack only
Biomass Boilers					
K7	Biomass Gas	38	Primary heat source	Grate based combustion system producing steam and heating thermal oil for the Particle Board and MDF processes. Residual heat from the stack fed into MDF Drier 2.	MDF 1 or MDF 2 cyclone or dedicated stack
K8	Biomass	32	Primary heat source	Grate based combustion system producing steam and heating thermal oil for the Particle Board and MDF processes. Residual heat from the stack fed into the MDF Drier 1.	MDF 1 or MDF 2 cyclone or dedicated stack
Gas Engines					
Engine 1	Gas	21.28	Primary electricity, heat and steam source for the manufacturing process.	Electricity supplied to the Site. Steam production for MDF 1 & 2 process. Heat to the MDF Driers (MDF 1 and MDF 2).	MDF 1 or MDF 2 cyclone or dedicated stack
Engine 2	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack
Engine 3	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack

Combustion plant	Fuel	Thermal capacity (MW)	Status	Use	Vents to atmosphere via
Engine 4	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack
Engine 5	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack
Gas Turbines					
GT1	Gas	20.5	Standby in the event that a gas engine is offline.	Heat to MDF1 drier during gas engine maintenance. Back-up electricity supply to site.	MDF 1 cyclone or dedicated stack
GT2	Gas	20.5	Standby in the event that a gas engine is offline.	Heat to MDF2 drier during gas engine maintenance. Back-up electricity supply to site.	MDF 2 cyclone or dedicated stack
Process driers – combustion plant					
MDF1	Gas	15	Standby for K8/GT1	MDF1 drier. Direct drier. Back-up.	MDF 1 cyclone only
MDF2	Gas	32	Standby for K7/GT2	MDF2 drier. Direct drier. Back-up.	MDF 2 cyclone only
Chip dryer	Wood Dust/Gas	45	Primary heat source	Chip drier. Direct drier.	WESP 21

Table 2: Process Plant

Unit	Use	Vents to atmosphere via
A1	Exhaust from the emissions control – formaldehyde plant	Dedicated stack only
A5	Exhaust from the wet scrubber on the Resin VITS 2,3 and 5 paper impregnation lines	Dedicated stack only
A6	Exhaust from the wet scrubber on the Resin VITS 4 paper impregnation line	Dedicated stack only
MDF1 cyclone	Abatement for emissions from the MDF 1 drier	MDF 1 Cyclone
MDF2 cyclone	Abatement for emissions from the MDF 1 drier	MDF 2 Cyclone
WESP	Abatement for emissions from press abatement system	WESP 32
Press abatement system (existing)	Press abatement system on the MDF 1, MDF 2 and particleboard Contiroll (3 lines)	WESP 32
Chip dryer	Chip dryer fuelled by gas and dust (not yet contained in a permit but allowed as part of this consolidation as currently being operated)	WESP 21

3 Operating Scenarios

The combustion plant at the Facility are configured so that in the event that a particular combustion plant is not available, other combustion plant can provide the heat and power required for the board manufacturing process. For all other sources it has been assumed that these are in continuous operation. Within this section we have detailed the operating scenarios and associated emission sources in both normal operations, and in the event that certain board manufacturing plant or combustion plant are offline. These represent the full suite of operating scenarios which have been considered within this assessment.

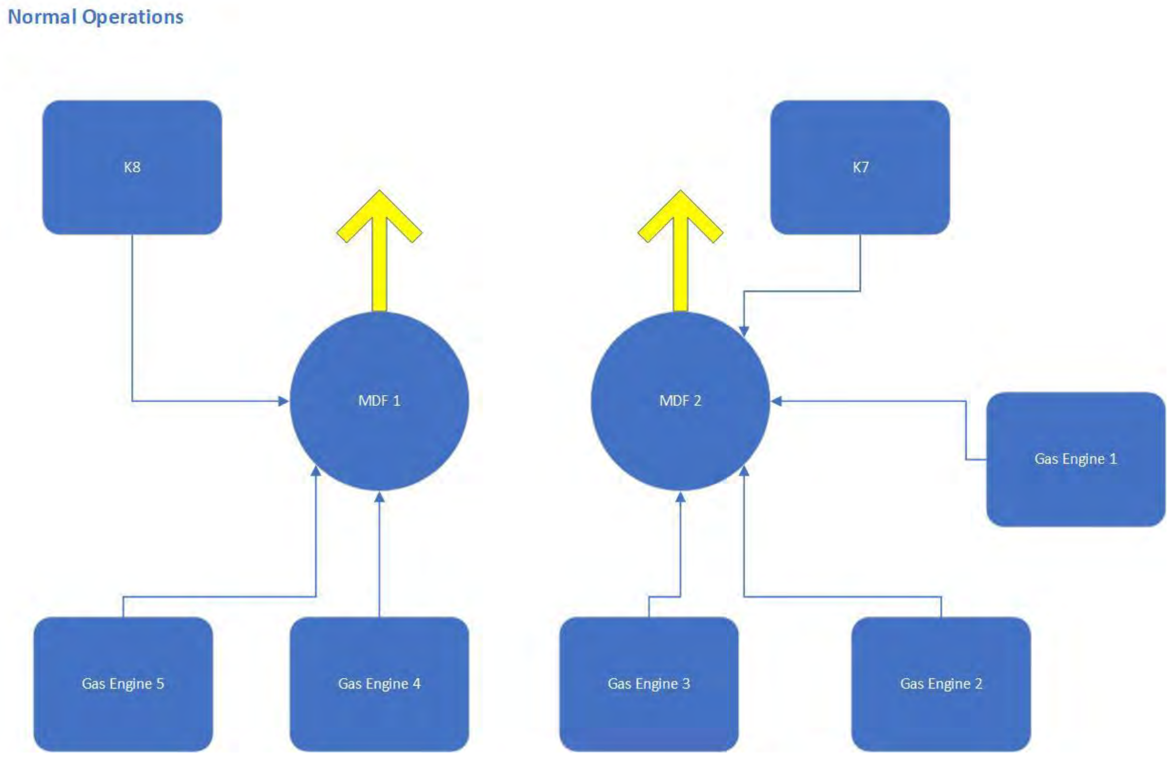
3.1 Normal operations

Under normal operating conditions point source emissions to atmosphere from the Facility are from the following sources:

1. K1 boiler;
2. the MDF 1 and MDF 2 cyclones;
3. the WESP 32
4. the WESP 21;
5. the emissions control system from the Formalin Plant (A1);
6. the wet scrubbers on the paper impregnation plant (A5 and A6); and
7. the dust filter units.

The arrangements for the release of emissions from the MDF 1 and MDF 2 cyclones is presented in Figure 1, and the point sources are explained in more detail in sections 3.1.1 to 3.1.7.

Figure 1: Normal Operations



3.1.1 K1 boiler

K1 is a 2.25MW gas heater providing heating. While the thermal capacity of the plant falls below the threshold in the IED the existing EP includes an ELV for oxides of nitrogen (NOx), K1 is included in the modelling to correctly define the impact of the installation. The reference conditions for the boiler is specified in the existing EP as mg/m^3 with no correction for oxygen, moisture or temperature. However, it is proposed that this is aligned with the other gas combustion plant (i.e. sources K5, K6, and the gas engines) and the ELV be expressed as mg/Nm^3 (273.15 K, 101.3 kPa, dry air, 3 % oxygen content by volume).

3.1.2 MDF 1 cyclone

MDF 1 cyclone is fed from the MDF 1 drier which is a direct heat drier. The existing WCBC EP includes ELVs from MDF 1 cyclone for total dust (PM), condensable volatile organic compounds (CVOCs) and formaldehyde (CH_2O) but does not include an emission limit for NOx. The Best Available Techniques (BAT) Reference Document for the Production of Wood-based Panels[1] (the BREF) includes BAT AELs for direct heat driers of 250 mg/Nm^3 (273.15 K, 101.3 kPa, dry air, with no correction for oxygen content). However, monitoring from the cyclone has shown that emissions are typically around 100 mg/Nm^3 (273.15 K, 101.3 kPa, dry air, with no correction for oxygen content). As part of this EP application, it is proposed to include an ELV for NOx on the MDF 1 cyclone as set out in the BREF.

Under normal operations emissions from MDF 1 cyclone consist of exhaust gases from the K8 biomass plant and two gas engines. The existing WCBC permit includes an ELVs for the full suite of pollutants listed in Annex VI of the IED for co-incineration plants, and the existing NRW permit includes an ELV for NOx from the gas engines. This application is seeking to keep the ELVs set in the existing WCBC. As the K8 biomass plant would be regulated as a waste-wood co-incineration plant half-hourly ELVs do not apply, and this assessment only considers the operation of the K8 biomass plant operating at the daily ELV. For modelling purposes when determining the impact of pollutants other than those for which an ELV has been set for the MDF 1 cyclone, it has been assumed that the release rate from the K8 biomass plant vents to atmosphere via the MDF 1 cyclone under normal operations.

3.1.3 MDF 2 cyclone

MDF 2 cyclone is fed from the MDF 1 drier which is a direct heat drier. The existing WCBC permit includes ELVs for NOx, carbon monoxide (CO), PM, CVOCs, sulphur dioxide (SO_2), hydrogen chloride (HCl) and hydrogen fluoride (HF). These had been included in the WCBC permit to account for the emissions from the K7 biomass plant which feed the MDF 2 drier. As part of this EP application, it is proposed to vary the ELVs from the MDF 2 cyclone to align with the BREF. This would mean there would be ELVs set at the MDF 2 cyclone for NOx, PM, CVOC and CH_2O, which would be expressed as 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content.

Under normal operations emissions from the MDF 2 cyclone consists of exhaust gases from the K7 biomass plant and three gas engines. The existing permits do not include any ELVs for the K7 biomass plant, but the NRW permit does include ELVs for the gas engines. As part of this application, it is proposed to introduce ELVs for the K7 biomass plant based on those set out in Process Guidance Note 1/02(12) Statutorily Guidance for Boilers and Furnaces 20-50MW thermal input. This will mean that there will be ELVs set for the K7 for NOx, CO, PM and SO_2 prior to the MDF 2 drier. For

[1] Best Available Techniques (BAT) Reference Document for the Production of Wood-based Panels, Industrial Emissions Directive 2010/75/EU 2016

modelling purposes it has been assumed that the release rate of CO and SO_2 from the K7 biomass plant vents to atmosphere via the MDF 2 cyclone under normal operations.

3.1.4 WESP 32

In the existing configuration the WESP 32 includes emissions from three existing presses (the MDF 1 and 2 presses and the Particleboard Press) after the press abatement system. The existing WCBC Permit includes ELVs for two former pieces of plant (Bab 2 and Bab 3 driers) at their emission point to atmosphere which was the WESP 32. However, these driers have been decommissioned and as such the only emissions from the WESP 32 are only those from the press abatement system. The existing WCBC permit includes ELVs to air for PM, CVOCs, total aldehydes, and CH_2O, for the three presses combined (referred to as the Contriroll combined in the existing WCBC permit). As per the existing permit it is proposed that the ELVs are expressed as 273.15 K, 101.3 kPa, with no correction for moisture or oxygen.

This is monitored prior to release to atmosphere via the WESP 32. Historically these emissions vented to atmosphere via a separate stack but this was changed to vent via the WESP 32 to aid dispersion in mid 2016. The BREF does not include any limit for total aldehydes. Therefore, it is proposed to remove the ELVs set for total aldehydes as part of the EP application.

3.1.5 Formalin plant

The Formalin Plant includes an emission control system, which vents to atmosphere via a dedicated stack (A1). The existing NRW permit includes an ELV for CH_2O. It is not proposed to change this ELV as part of the EP application. The ELV is expressed as 273.15 K, 101.3 kPa, with no correction for moisture or oxygen.

3.1.6 Paper impregnation plant

The paper impregnation plant includes two wet scrubbers (A5 and A6). Both are covered under the existing NRW permit. The permit includes ELVs for CH_2O and total volatile organic compounds (TVOCs). It is not proposed to change these ELVs as part of the EP application. These ELVs are expressed as 273.15 K, 101.3 kPa, with no correction for moisture or oxygen.

3.1.7 WESP 21

The site benefits from planning permission for a new chip preparation plant and associated drier and WESP (referred to as the WESP 21). This process is not currently permitted but there is an agreement in place to operate this plant providing that it was included in this permit variation. As part of this EP application it has been agreed to include this process. It is proposed to apply for the ELVs for the WESP 21 based on the BAT AELS set in the BREF. ELVs are proposed for NOx, PM, TVOC and CH_2O. The WESP 21 used to abate the emissions from the directly heated drier. The BREF states that the ELVs are expressed as 273.15 K, 101.3 kPa and a dry basis with varying reference oxygen content depending upon the process. The reference conditions for directly heated PB or directly heated OSB driers alone or combined with the press is 18% oxygen by volume. Where PB is defined as "panel material manufactured under pressure and heat from particles of wood (wood flakes, chips, shavings….". Therefore, in accordance with the BREF, the reference oxygen content applicable for the emissions from the WESP 21 should be expressed as 273.15 K, 101.3 kPa, dry, 18% oxygen content by volume.

The WESP 21 includes a single drier fan. For compliance purposes monitoring is carried out after the drier fan close to the top of WESP 21. Monitoring can only be undertaken on the WESP 21 when the drier / drier fan is near to full load (min 80% loading). The flue gas parameters have been determined based on the monitoring of the operation of the WESP 21.

3.2 Non standard operating scenarios

3.2.1 WESP 32 or WESP 21 Offline

Condition 2.1.15 of the existing WCBC permit (ref: WCBC/IPPC/03/KR(v3)), states:

"any malfunction of the SEKA WESP unit and associated plant, or any other circumstance which results in the discharge of particleboard drier emissions from the drier stacks shall be treated as an emergency. The particleboard drier operations shall be terminated as soon as is reasonably practicable, but within a period not exceeding 1-hour, until such time as normal operations of the SEKA WESP unit can be restored."

Noting that the SEKA WESP referenced in the existing WCBC EP is the same emission point as WESP 32 referred to in the EP application.

This is imposed to ensure that the drier and can be effectively shut down in the event that the WESP cannot be restored. It is proposed to retain this requirement but with it being imposed on WESP 21 which is the abatement system for the chip drier. As required by the current EP, Kronospan is required to notify WCBC in the event of this occurring, and it has a record of all of these historical events. The reports show that, in most cases, the WESP 32 recovers and that discharge to the chip drier emergency stack only lasts for a short period with the drier still operational and in compliance with Condition 2.1.15 of the existing WCBC permit.

Therefore, releasing the exhaust gases from the chip drier emergency stack is considered to be an emergency scenario if the WESP 21 is offline. This has been considered in the dispersion modelling as an emergency case.

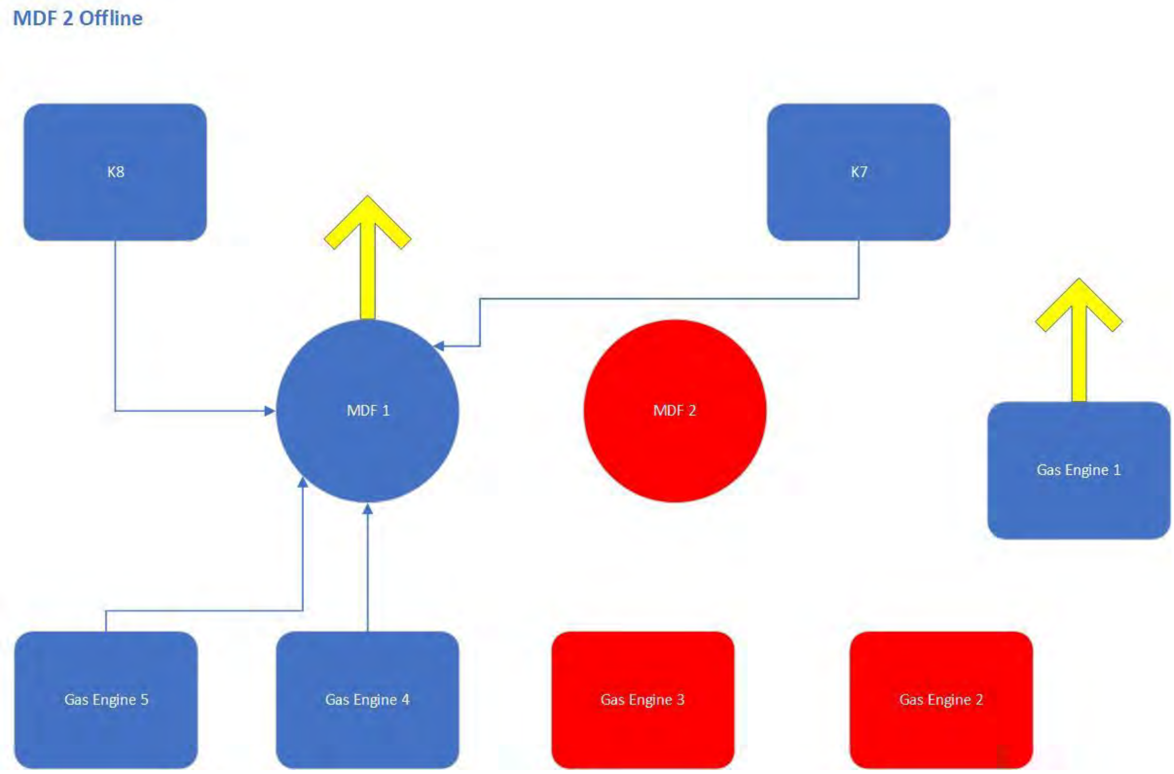
WESP 32 is not used for the abatement of emissions from the press abatement system but will allow emission to be released at height to assist with dispersion of emissions.

3.2.2 MDF 1 or MDF 2 Cyclone offline

The MDF 1 and 2 driers are fed by exhaust gases from a mixture of the K7 biomass plant, the K8 biomass plant, Gas Engines, and Gas Turbines (if gas engine is unavailable).

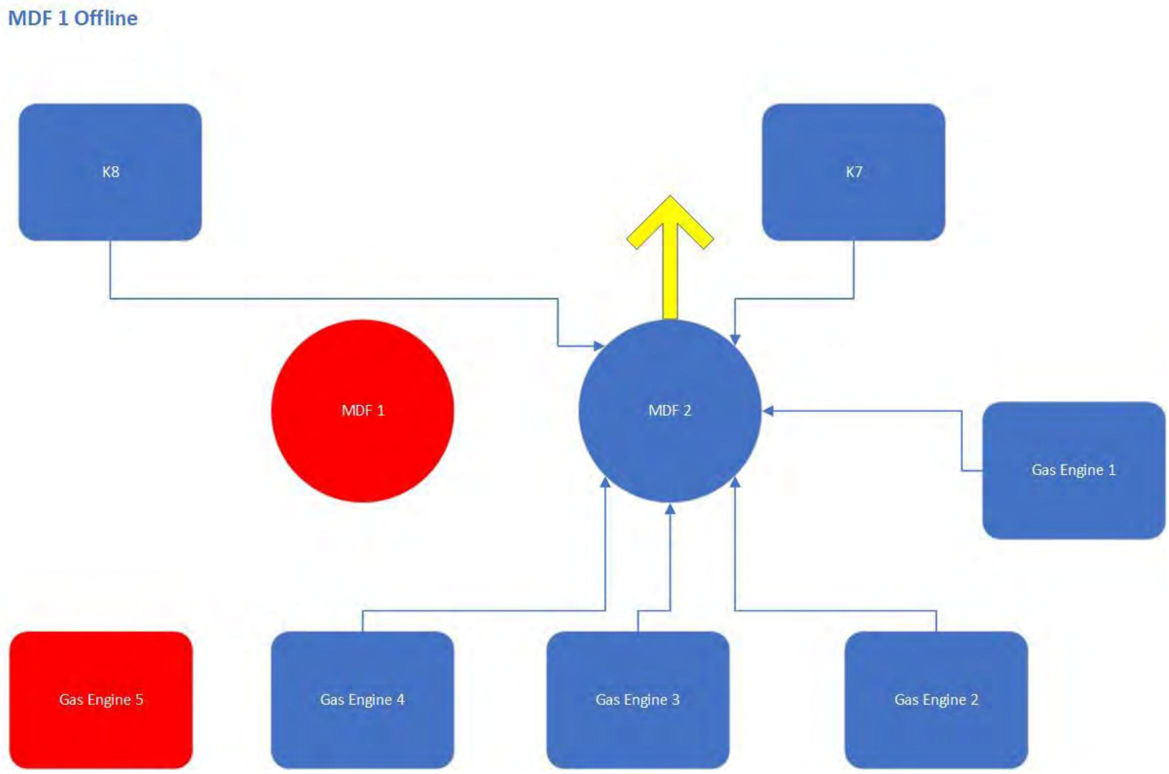
MDF 1 drier normally takes the exhaust gases from K8 biomass plant and two gas engines. However, if MDF 2 cyclone is offline MDF 1 drier can take the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to two gas engines. If the MDF 2 cyclone is offline the electricity demand for the site is reduced and only three gas engines are needed. In this instance the exhaust gases from two gas engines will be used in the MDF 1 drier, but one of the gas engines will need to exhaust via its own dedicated stack. This is presented in a graphical format in Figure 2.

Figure 2: Emissions Sources - MDF 2 Offline



MDF 2 drier is the larger drier and normally takes the exhaust gases from K7 biomass plant and three gas engines. However, if MDF 1 cyclone is offline MDF 2 drier can take the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to four gas engines. If the MDF 1 cyclone is offline the electricity demand for the site is reduced and only four gas engines are needed. In this instance the exhaust gases from all the operating gas engines can be used in the MDF 2 drier. This is presented in a graphical format in Figure 3.

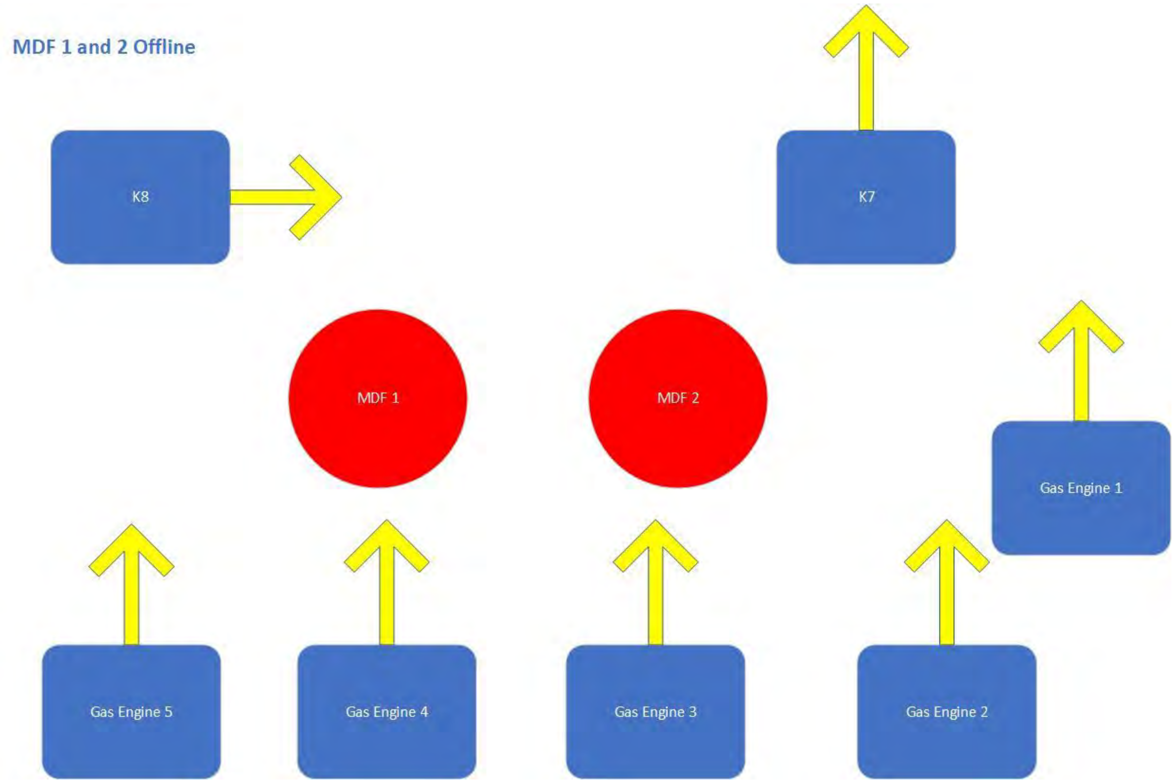
Figure 3: Emissions Sources - MDF 1 Offline



3.2.3 MDF 1 and 2 Cyclone offline

If MDF 1 and 2 cyclones are offline for a short period, the sources feeding the drier are required to release to atmosphere via their own dedicated stacks. This would only occur for extremely short and rare periods as the electricity and heat generated would not be able to be used by the manufacturing process. In this scenario emissions from both the K7 and K8 biomass plants and up to five gas engines would vent to atmosphere via their dedicated stacks. In this scenario there would not be any releases from the MDF 1 or MDF 2 cyclones. This is presented in a graphical format in Figure 4.

Figure 4: Emissions Sources - MDF 1 and 2 Offline



3.2.4 K7 or K8 Biomass Plant offline

K7 and K8 biomass plant provide steam for the MDF manufacturing process; heat to the thermal oil for the contiroll presses; and residual heat from the exhaust gases is used in the MDF driers. If either of these are offline, the heat for the driers will be provided by the burners in the driers and gas heaters K5 and / or K6 will be used to heat the oil for the contiroll presses. In this scenario the MDF 1 and MDF 2 cyclones would still be operating together with either K5 or K6, which will always vent to atmosphere via their dedicated stacks.

For the dispersion modelling if the K7 and K8 biomass plants are offline, it has been assumed that the MDF driers continue to operate but K5 and K6 will also operate to supply heat to the thermal oil for the contiroll presses.

3.2.5 Gas engine unavailable

Gas turbines will be used as a back-up to the gas engines. Gas Turbine 1 is linked to MDF 1 drier and Gas Turbine 2 is linked to MDF 2 drier. This would not change the emissions from the driers. These sources are already permitted within the existing NRW permit. Kronospan is committed to decommissioning the turbines when the two new gas engines (4 and 5) are installed. The only time the gas turbines would vent via their own stack would be to carry out quarterly emissions monitoring.

Table 3: Operating Scenarios – Combustion Sources

Source	Normal Ops	MDF 1 Only Offline	MDF 2 Only Offline	WESP 32 Only Offline	MDF 1 and MDF 2 Offline[(1)]	MDF 1, MDF 2 and WESP 32 Offline[(1)]	K7 and K8 offline
K1	K1	K1	K1	K1	K1	K1	K1
K5	-	-	-	-	-	-	K5
K6	-	-	-	-	-	-	K6
K7	MDF 2	MDF 2	MDF 1	MDF 2	K7	K7	-
K8	MDF 1	MDF 2	MDF 1	MDF 1	K8	K8	-
Chip drier	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21
Gas Engine 1	MDF 1	-	MDF 1	MDF 1	Gas Engine Stack	Gas Engine Stack	MDF 1
Gas Engine 2	MDF 1	MDF 2	MDF 1	MDF 1	Gas Engine Stack	Gas Engine Stack	MDF 1
Gas Engine 3	MDF 2	MDF 2	Gas Engine Stack	MDF 2	Gas Engine Stack	Gas Engine Stack	MDF 2
Gas Engine 4	MDF 2	MDF 2	-	MDF 2	Gas Engine Stack	Gas Engine Stack	MDF 2
Gas Engine 5	MDF 2	MDF 2	-	MDF 2	Gas Engine Stack	Gas Engine Stack	MDF 2
MDF 1 burner	-	-	-	-	-	-	MDF 1
MDF 2 burner	-	-	-	-	-	-	MDF 2
Gas Turbine 1	Only if 1 or more Gas Engines are offline – a single Gas Turbine would replace the operation of a single Gas Engine.						
Gas Turbine 2							

Notes:
(1) When the driers are offline the electricity demand for the site would be reduced and therefore not all gas engines would be needed. However, for a worst-case assessment it has been assumed that all gas engines could operate at the same time for short periods.

Table 4: Operating Scenarios – Some Gas Engines Offline – Gas Turbines Used as Backup

Source	MDF 2 Only Offline	MDF 1 and MDF 2 Offline – 1 GE Offline(1)	MDF 1 and MDF 2 Offline – 2 GE Offline(1)	MDF 1, MDF 2 and WESP 32 Offline – 1 GE Offline(1)	MDF 1, MDF 2 and WESP 32 Offline – 2 GE Offline(1)	MDF 1, MDF 2 and WESP 32 Offline – 1 GE Offline(1)	MDF 1, MDF 2 and WESP 32 Offline – 2 GE Offline(1)
K1	K1	K1	K1	K1	K1	K1	K1
K5	-	-	-	-	-	-	-
K6	-	-	-	-	-	-	-
K7	MDF 1	K7	K7	K7	K7	K7	K7
K8	MDF 1	K8	K8	K8	K8	K8	K8
Chip drier	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21	WESP 21
Gas Engine 1	MDF 1	-	-	-	-	-	-
Gas Engine 2	MDF 1	Gas Engine Stack	-	Gas Engine Stack	-	Gas Engine Stack	-
Gas Engine 3		Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack
Gas Engine 4	-	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack
Gas Engine 5	-	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack	Gas Engine Stack
MDF 1 burner	-	-	-	-	-	-	-
MDF 2 burner	-	-	-	-	-	-	-
Gas Turbine 1	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack	Gas Turbine Stack
Gas Turbine 2	-	-	Gas Turbine Stack	-	Gas Turbine Stack	-	Gas Turbine Stack

Notes:

Only those scenarios where the Gas Turbine would vent via its own stack are listed above.

(1) When the driers are offline the electricity demand for the site would be reduced and therefore not all gas engines would be needed. However, for a worst-case assessment it has been assumed that all gas engines could operate at the same time for short periods.

3.3 Emissions scenarios

The BREF includes BAT AELs for NOx for direct heat driers such as the MDF 1 and MDF 2 cyclones and the chip drier. This is 250 mg/Nm^3 (273.15 K, 101.3 kPa, dry air, 18% reference oxygen content). However, monitoring from the existing driers has shown that emissions are typically around 100mg/Nm^3 (273.15 K, 101.3 kPa, dry air, 18% reference oxygen content)

The assumption that these direct heat driers operate at the BAT AEL is therefore considered very conservative.

To account for this the following emissions scenarios have been considered for each operating scenario when considering the impact of emissions of NOx:

- Likely case – driers emitting NOx calculated from typical emissions, all other sources emitting at the relevant ELVs.
- Worst case - driers emitting NOx calculated from BAT AEL, all other sources emitting at the relevant ELVs.

3.4 WESP 32

In the existing configuration WESP 32 includes emissions from three existing presses (the MDF 1 and 2 presses and the Particleboard Press) after the press abatement system. The existing WCBC Permit includes ELVs for two former pieces of plant (Bab 2 and Bab 3 driers) at their emission point to atmosphere which was WESP 32. However, these driers have been decommissioned and as such the only emissions from WESP 32 are only those from the press abatement system. This volume of air is ducted to WESP 32. The velocity is a function of the volume of exhaust gases, the temperature, and the stack diameter of WESP 32. As a result, the velocity of the emissions from WESP 32 with only the emissions from the press abatement system is fairly low (5.1 m/s). However, as shown in section 8.3.4 the routing of the press abatement emissions to the WESP 32 enhances dispersion, resulting in a lower impact on air quality.

4 Legislation Framework and Policy

4.1 Air quality assessment levels

European air quality legislation is consolidated under the Ambient Air Quality Directive (Directive 2008/50/EC), which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides Ambient Air Directive (AAD) Limit Values for sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, lead and particulate matter with a diameter of less than 10µm (PM_{10}) and a new AAD Target Value and Limit Value for fine particulates (those with a diameter of less than 2.5µm ($PM_{2.5}$). The fourth daughter Directive - 2004/107/EC - was not included within the consolidation. It sets health-based Target Values for polycyclic aromatic hydrocarbons (PAHs), cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable. Directives 2008/50/EC and 2004/107/EC are transposed under UK Law into the Air Quality Standards Regulations (2010). The regulations also extend powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to local authorities for the implementation of these Directives.

The UK Government and the devolved administrations are required under the Environment Act (1995) to produce a national air quality strategy. This was last reviewed and published in 2007. The Air Quality Strategy (AQS) sets out the UK's air quality objectives and recognises that action at national, regional and local level may be needed, depending on the scale and nature of the air quality problem. This is the method of the implementation of the AADT Limits and Targets. This includes additional targets and limits for 15-minute sulphur dioxide and 1,3-butadiene and more stringent requirements for benzene and PAHs, known as AQS Objectives.

The Air Quality Strategy defines “standards” and “objectives” in paragraph 17:

“For the purposes of the strategy:

- *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems; and*
- *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedances, within a specified timescale.”*

The status of the objectives is clarified in paragraph 22, which also emphasises the importance of European Directives:

“The air quality objectives in the Air Quality Strategy are a statement of policy intentions or policy targets. As such, there is no legal requirement to meet these objectives except in as far as these mirror any equivalent legally binding limit values in EU legislation. Where UK standards or objectives are the sole consideration, there is no legal obligation upon regulators, to set Emission Limit Values (ELVs) any more stringent than the emission levels associated with the use of Best Available Techniques (BAT) in issuing permits under the PPC Regulations. This aspect is dealt with fully in the PPC Practical Guides.”

In 2019 the UK Government published the Clean Air Strategy (CAS). This sets out methods by which air pollution from all sectors will be reduced. The CAS has not introduced any new air quality limits. However, the CAS sets out the actions required across all parks of the government to meet legally binding targets to reduce five key pollutants (primary particulate matter (PM2.5), ammonia (NH3), nitrogen oxides (NOx), sulphur dioxide (SO2) and non-methane volatile organic compounds (NMVOCs)) by 2020 and 2030 and secure health public health benefits. The CAS also makes a commitment to bring forward primary legislation on clean air as outlined in the Environmental Bill.

The Environment Bill introduces a duty on the government to set a legally binding target for PM2.5s. To date this has not yet been set. The Department for the Environment Food and Rural Affairs (Defra) fact sheet[2] sets out that:

"The government is committed to evidence-based policy making, and will consider the WHO's annual mean guideline level for $PM_{2.5}$ when setting the target, alongside independent expert advice, evidence and analysis on a diversity of factors – from the health benefits of reducing $PM_{2.5}$, to the practical feasibility and economic viability of taking different actions.

It would be irresponsible to set a target without giving consideration to its achievability and the measures required to deliver on that target.

The target level and achievement date will be developed during the target setting process and will follow in secondary legislation."

The WHO annual mean PM guidelines values are as follows:

- Fine particulate matter ($PM_{2.5}$) – 10 µg/m^3 as an annual mean, and 25 µg/m^3 as a daily mean
- Course particulate matter (PM_{10}) – 20 µg/m^3 as an annual mean, and 50 µg/m^3 as a daily mean

For other pollutants the EA set Environmental Assessment Levels (EALs) in the environmental management guidance document 'Air Emissions Risk Assessment for your Environmental Permit'[3] (Air Emissions Guidance). The long-term and short-term EALs from this document have been used when the AQS does not contain relevant objectives. Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within the Air Emissions Guidance and the Air Pollution Information System (APIS[4]).

AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups. For the remainder of this report these are collectively referred to as Air Quality Assessment Levels (AQALs). Table 5, Table 6 and Table 7 summarise the air quality objectives and guidelines used in this assessment.

Table 5: Air Quality Assessment Levels (AQALs)

Pollutant	Limit Value (µg/m^3)	Averaging Period	Frequency of Exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AQS Objective
	40	Annual	-	AQS Objective
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)	AQS Objective
	350	1 hour	24 times per year (99.73rd percentile)	AQS Objective

[2] DEEFRA Policy paper 10 March 2020: Air quality factsheet (part 4) - https://www.gov.uk/government/publications/environment-bill-2020/10-march-2020-air-quality-factsheet-part-4

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

[4] http://www.apis.ac.uk

Pollutant	Limit Value (µg/m³)	Averaging Period	Frequency of Exceedances	Source
	125	24 hours	3 times per year (99.18th percentile)	AQS Objective
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AQS Objective
	50	24 hours	-	WHO Guideline
	40	Annual	-	AQS Objective
Particulate matter ($PM_{2.5}$)	25	Annual	-	AQS Target Value
	25	24 hours	-	WHO Guideline
	10	Annual	-	WHO Guideline
Carbon monoxide	10,000	8 hours, running	-	AQS Objective
	30,000	1 hour	-	Air Emissions Guidance
Hydrogen chloride	750	1 hour	-	Air Emissions Guidance
Hydrogen fluoride	160	1 hour	-	Air Emissions Guidance
	16	Annual	-	Air Emissions Guidance
Ammonia	2,500	1 hour	-	Air Emissions Guidance
	180	Annual	-	Air Emissions Guidance
Lead	0.25	Annual	-	AQS Objective
Benzene	5.00	Annual	-	AQS Objective
	195	1 hour	-	Air Emissions Guidance
1,3-butadiene	2.25	Annual, running	-	AQS Objective
Formaldehyde	5	Annual	-	Air Emissions Guidance
	100	1 hour	-	Air Emissions Guidance
PCBs	6	1-hour	-	Air Emissions Guidance
	0.2	Annual	-	Air Emissions Guidance
PAHs	0.00025	Annual	-	AQS Objective

As shown in Table 5, lead is the only metal included in the AQS. The AQS includes objectives to limit the annual mean to 0.5 µg/m³ by the end of 2004 and to 0.25 µg/m³ by the end of 2008. Only the first objective is included in the Air Quality Directive.

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, these values are the same as, or lower than, those included in the Air Emissions Guidance. Therefore, the Environmental Assessment Levels (EALs) from the Air Emissions Guidance shown in Table 6 have been used in this assessment.

Table 6: Environmental Assessment Levels (EALs) for Metals

Metal	Daughter Directive Target Level (μg/m³)	EALs (μg/m³)	
		Long-term	Short-term
Arsenic	0.006	0.006	-
Antimony	-	5	150
Cadmium	0.005	0.005	-
Chromium (II & III)	-	5	150
Chromium (VI)	-	0.0002	-
Cobalt	-	-	-
Copper	-	10	200
Lead	-	0.25	-
Manganese	-	0.15	1500
Mercury	-	0.25	7.5
Nickel	0.020	0.020	-
Thallium	-	-	-
Vanadium	-	5	1

Table 7: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	Concentration (μg/m³)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75 / 200*	Daily mean	Air Emissions Guidance / WHO
	30	Annual mean	AQS Objective
Sulphur dioxide	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity	Air Emissions Guidance
	20	Annual mean for all higher plants	AQS Objective
Hydrogen fluoride	5	Daily mean	Air Emissions Guidance
	0.5	Weekly mean	Air Emissions Guidance

Pollutant	Concentration ($\mu g/m^3$)	Measured as	Source
Ammonia	1	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity	Air Emissions Guidance
	3	Annual mean For all higher plants	Air Emissions Guidance
Note: ** the Institute of Air Quality Management (IAQM) consider it most appropriate to use 200 µg/m³ as the short term Critical Level.*			

The WHO Guidelines include a short term (24-hour) average NOx Critical Level of 75 $\mu g/m^3$. However, the CD Rom version of the guidelines[5] expands upon the justification for this level. This shows that experimental evidence exists that the Critical Level reduces from around 200 to 75 $\mu g/m^3$ when in combination with ozone or sulphur dioxide above their Critical Levels. Given the low ozone and sulphur dioxide levels in the UK the IAQM consider it most appropriate to use 200 $\mu g/m^3$ as the short-term Critical Level. As such when carrying out this assessment the daily Critical Level of 75 $\mu g/m^3$ has been used as an initial screening level, and consideration has also been made of the impact with reference to the much higher Critical Level of 200 $\mu g/m^3$.

In addition to the Critical Levels set out in the table above, provides habitat specific Critical Loads for nitrogen and acid deposition. Full details of the habitat specific Critical Loads can be found in Appendix C.

4.2 Areas of relevant exposure

The AQALs apply only at areas of exposure relevant to the assessment level. The following table extracted from Local Authority Air Quality Technical Guidance (TG16) (2021) (LAQM.TG(16)) explains where the AQALs apply.

Table 8: Guidance on Where AQALs Apply

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or

[5] WHO Guidelines CD Rom version

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
		any other location where public exposure is expected to be short-term.
24-hour mean and 8-hour mean	All locations where the annual mean AQAL would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean AQALs 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 be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15-minutes or longer.	

Source: Box 1.1 LAQM.TG(16)

4.3 Industrial pollution regulation

Atmospheric emissions from industrial processes are controlled in England through the Environmental Permitting Regulations (2012) (and subsequent amendments). The Facility currently has an EP to operate. The EP includes conditions to ensure that the environmental impact of the operations is minimised. This includes conditions to prevent fugitive emissions of dust and odour beyond the boundary of the permitted activity, and limits on emissions to air.

4.4 Local air quality management

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to periodically review and assess air quality within their area of jurisdiction, under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves assessing present and likely future ambient pollutant concentrations against AQALs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, then the local authority is required to declare an

AQMA. For each AQMA, the local authority is required to produce an AQAP, the objective of which is to reduce pollutant levels in pursuit of the relevant AQALs.

5 Sensitive Receptors

5.1 Human sensitive receptors

The general approach to the assessment is to evaluate the highest predicted process contribution to ground level concentrations. In addition, the predicted process contribution across the modelling domain has been analysed to determine the impact at all areas of relevant exposure.

For completeness analysis has also been carried out at the specific receptor locations stated in Table 9 and presented Figure 6 within Appendix A.

Table 9: Human Sensitive Receptors

ID	Name	Location		Distance from Installation Boundary (m)
		X (m)	Y (m)	
R1	Afron Bradley Farm	328394	339485	550
R2	Lodge Farm	329168	339548	670
R3	Lodgefield Park	329049	339262	360
R4	Rhosywaun	328993	338676	85
R5	Chirk Community Hospital	329358	338975	460
R6	Chirk Infant School	329158	338426	160
R7	Highfield Farm	329747	338667	760
R8	Maes-y-Waun	329074	338157	53
R9	Colliery Road	329069	337877	290
R10	St Mary's Church	330303	337785	1,300
R11	Station Avenue	328876	337733	390
R12	Llwyn-y-cil	327984	338086	430
R13	New Hall	327596	338890	890
R14	Chirk Court	329045	338274	30

The receptors stated in Table 9 is not an exhaustive list of; as such reference has also been made to the distribution of emissions where areas of public exposure may not be captured by the stated receptors.

5.2 Ecological sensitive receptors

A study was undertaken to identify the following sites of ecological importance in accordance with Air Emissions Guidance criteria:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the Facility;
- Sites of Special Scientific Interest (SSSIs) within 2 km of the Facility; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), Local Wildlife Sites and ancient woodlands within 2 km of the Facility.

The sensitive ecological receptors identified are stated in Table 10 and presented in Figure 7 and Figure 8 within Appendix A. A review of the citation for ecological receptor has been undertaken to determine if lichens are an important part of the ecosystem's integrity for the purposes of determining the relevant Critical Level for the habitat.

Table 10: Sensitive Ecological Receptors

Site	Location		Distance from Installation boundary at closest point (km)	Lichens identified as present within citation
	X (m)	Y (m)		
European and UK designated sites				
River Dee and Bala Lake SAC, SSSI	Various points		1.0	No
Johnstown Newt Sites SAC	330614	345069	6.3	No
Berwyn and South Clwyd Mountains SAC	324820	342829	5.4	Yes
Berwyn SPA	324820	342829	5.4	Yes
Chirk Castle SSSI	Various points		0.5	Yes
Nant-y-Belan & Prynella Woods	Various points		2.4	Yes
Locally designated sites				
Barracks Field	Various points		1.1	Yes
Ceod-Y-Canal Wood	Various points		<0.05	Yes
Various Ancient Woodlands	Various points		-	Yes
NOTES: For those sites contained within the modelling domain the maximum impact across any point within the site has been calculated by post processing the model output files				

It has been assumed that lichens or bryophytes are contained in each of the locally designated sites as a precautionary approach. Full details of the habitats present at each ecological receptor and the habitat-specific Critical Loads are presented in Appendix C.

6 Baseline

The Facility is located on land adjacent to Holyhead Road, Chirk and covers a total area of approximately 40 hectares. The Facility comprises a number of large industrial process buildings including air emissions stacks, storage areas for raw materials, warehouse buildings for manufactured products, offices and car parking. The main residential area of Chirk is located to the east of the Facility with residential properties lining the majority of the eastern side of Holyhead Road. Chirk town centre is located approximately 500m to the southeast of the Facility. The wider area beyond the urban settlement of Chirk is dominated by agricultural fields and woodland. Chirk Castle and its grounds are located to the west of the Facility, beyond the Llangollen Canal. In this section, we have reviewed the baseline air quality and defined appropriate baseline concentrations to be used in this assessment.

6.1 Local authority air quality review and assessment

In accordance with Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercise to review air quality within their area of jurisdiction. The Facility is located within Wrexham County Borough Council (WCBC) area.

There are no Air Quality Management Areas (AQMA) which have been declared within 5 km of the Facility. The closest AQMAs to the Facility are in the centre of Shrewsbury and Chester both located over 30 km away. Therefore, emissions from the Facility are not expected to be discernible within any AQMA.

6.2 National modelling – mapped background data

To assist local authorities with their responsibilities under Local Air Quality Management, Defra provides modelled background concentrations of pollutants across the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations have been downloaded for the grid squares containing the Facility and immediate surroundings. In addition, mapped atmospheric concentrations of ammonia are available from DEFRA via the National Environment Research Council (NERC) Centre for Ecology and Hydrology (CEH) throughout the UK on a 5 km by 5 km grid.

The mapped background data is calibrated against monitoring data. For instance, the 2018 mapped background concentrations are based on 2018 meteorological data and are calibrated against monitoring undertaken in 2018. As a conservative approach where mapped background data is used the concentration for the year against which the data was validated has been used. This eliminates any potential uncertainties over anticipated trends in future background concentrations.

Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration from within 5 km of the Facility and the concentration at the Facility, is presented in Table 11.

Table 11: Mapped Background Data

Pollutant	Annual mean concentration (µg/m³)		Dataset
	At Facility	Max within 5 km of Facility	
Nitrogen dioxide	8.10	10.84	DEFRA 2018 dataset
Sulphur dioxide	2.97	3.39	DEFRA 2001 dataset
Particulate matter (as PM_{10})	11.66	15.39	DEFRA 2018 dataset
Particulate matter (as $PM_{2.5}$)	8.01	10.94	DEFRA 2018 dataset
Carbon monoxide	213	224	DEFRA 2001 dataset
Ammonia	2.05	2.05	APIS 2017 – 2019 average

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6.3 AURN and LAQM monitoring

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of Defra. This includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and fine particulate matter. In addition, as part of their commitment local authorities undertake monitoring of nitrogen dioxide, particulate matter, carbon monoxide and sulphur dioxide if deemed necessary.

There are no AURN monitoring stations within 10 km of the Facility. The closest AURN monitoring station to the Facility is in Wrexham, an urban traffic site located approximately 12 km to the north. Monitoring at traffic sites is only representative of the immediate area and do not represent concentrations in the general area in the way a background analyser does. In addition, at this distance, the data from this analyser is not representative of concentrations in the vicinity of the Facility. Therefore, data from this site has not been considered further in this analysis.

WCBC undertake non-automatic (diffusion tube) monitoring for nitrogen dioxide at four monitoring sites within Chirk. The locations of the monitoring are shown in Figure 9 within Appendix A. A summary of monitoring data from these sites is provided in Table 12. Data has been taken from the North Wales Authorities Collaborative Project 2019 Air Quality Progress Report which is the most recent report published at the time of writing this assessment.

Table 12: Summary of Non-Automatic Nitrogen Dioxide Monitoring

Site Name	Type	2018 Mapped Bg (µg/m³)	Annual mean concentration (µg/m³)				
			2014	2015	2016	2017	2018
Ceriog School	Suburban	8.9	13.1	12.2	13.2	12.5	11.8
Holyhead Rd	Intermediate	6.1	17.3	16.4	16.3	15.9	15.7
Chapel Lane	Roadside	6.1	-	-	21.2	24.6	36.5(1)

Site Name	Type	2018 Mapped Bg (µg/m³)	Annual mean concentration (µg/m³)				
			2014	2015	2016	2017	2018
Church Street	Roadside	5.1	-	-	-	-	18.3
NOTE: *(1) Data capture was only for 8% and as such the concentration presented is the period mean rather than an annualised concentration.*							

Source: North Wales Authorities Collaborative Project 2019 Air Quality Progress Report and © Crown 2021 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

Due to their proximity, all of these monitoring sites will include a contribution from the Facility, and they demonstrate that levels of nitrogen dioxide are relatively low in the area.

All non-automatic monitoring sites have recorded nitrogen dioxide to be higher than the mapped background data for their locations which is expected as they are roadside and including a contribution from the Facility. However, as shown the concentrations remain low and are well within the AQAL. As the contribution from the Facility is being explicitly modelled the background concentration has been taken as the maximum mapped background concentration within 5 km of the Facility as presented in Table 11. Noting that this also includes a contribution from the Facility albeit it an average concentration for the grid square. In addition, consideration has been made to the spatially varying baseline levels of nitrogen dioxide within this assessment.

6.4 Other national monitoring networks

6.4.1 Hydrogen chloride

Hydrogen chloride was measured until the end of 2015 on behalf of Defra as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). Monitoring of hydrogen chloride ceased at the end of 2015 and none of the historic sites were located within 10 km of the Facility. Prior to the cessation of the monitoring concentrations were fairly constant.

The maximum annual average monitored within the UK between 2011 and 2015 was 0.71 µg/m³. In lieu of any recent representative monitoring this has been used as the baseline concentration for this assessment as a conservative estimate.

6.4.2 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are not measured locally or nationally, since these are not generally of concern in terms of local air quality. However, the EPAQS report 'Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects' contains some estimates of baseline levels, reporting that measured concentrations have been in the range of 0.036 µg/m³ to 2.35 µg/m³.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been used for the purpose of this assessment as a conservative estimate.

6.4.3 Ammonia

Ammonia is also measured as part of the UKEAP project at rural background locations. There are no UKEAP monitoring locations within 10 km of the Facility. The nearest monitoring site is Llynclys Common. In lieu of any local UKEAP monitoring, the maximum mapped background value from APIS within 5 km of the Facility has been used for the purpose of this assessment as set out in Table 11. This value is 2.05 µg/m³.

6.4.4 Volatile Organic Compounds - formaldehyde

Formaldehyde is not routinely monitored in the UK. In 2004 WCBC carried out two rounds of passive ambient monitoring for formaldehyde in Chirk. Following this in 2005 the Environment Agency's Air Quality Modelling Assessment Unit (AQMAU) undertook a modelling exercise to determine the contribution of the Kronospan Facility to the background levels. A summary of this exercise is set out in the WCBC 2005 Updating and Screening Assessment. This states that the background concentration 4 µg/m³ and the contribution from the Kronospan Facility was 0.7µg/m³. It appears that this background concentration was extracted from the WHO document "guidelines for indoor air quality" which states that mean ambient air background concentrations range from 1 to 4 µg/m³. In 2016 some additional monitoring was undertaken by WCBC at a number of sites in Chirk and at the Wrexham AURN. This was only undertaken for a two week period but showed that concentrations at the AURN were 1 µg/m³, with concentrations in Chirk ranging from 0.6 to 1.2 µg/m³. The concentrations monitored in Chirk included a contribution from the point sources at the Facility which have been modelled as part of this assessment. Therefore, for the purpose of this assessment the monitored concentration at the AURN has been used - 1µg/m³.

6.4.5 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). There are no metals monitoring locations within 10 km of the Facility. The nearest monitoring site is Runcorn Western Point, an urban industrial site 48 km to the north. Due to its more industrial nature and distance from the Facility, it is not considered representative of the conditions at the Facility.

A summary of the maximum annual data across all UK rural background monitoring sites is presented in the following table. It is considered appropriate to use the rural background concentration as the baseline as there is very little industry in the local area and the contribution from the Facility is being explicitly modelled.

Table 13: Metals Monitoring Maximum of all Rural Background Sites

Substance	Annual mean concentration (ng/m³)						Max (as % of AQAL)
	AQAL	2016	2017	2018	2019	2020	
Cadmium	5	0.07	0.08	0.08	0.08	0.08	1.6%
Mercury	250	2.50	2.70	2.80	-	-	1.1%
Arsenic	3	0.46	0.46	0.50	0.48	0.48	8.3%
Chromium	5,000	1.41	1.06	1.06	0.88	0.50	0.03%
Cobalt	-	0.03	0.05	0.06	0.04	0.03	-
Copper	10,000	1.95	1.88	2.03	2.03	1.60	0.02%
Lead	20	3.25	2.92	3.43	2.83	2.39	1.4%

Substance	Annual mean concentration (ng/m³)						Max (as % of AQAL)
	AQAL	2016	2017	2018	2019	2020	
Manganese	150	1.79	1.86	2.24	2.14	2.06	1.5%
Nickel	20	0.52	0.47	0.49	0.44	0.33	2.6%
Vanadium	5,000	0.50	0.58	0.64	0.62	0.56	0.01%

NOTES:

(1) Monitoring of mercury in the vapour phase ceased at the end of 2018 and was not monitored at rural sites, therefore the concentration presented is that from urban background sites.

(2) Monitoring of antimony across the UK ceased at the end of 2013. The maximum monitored at any UK site in 2014 was 1.3 ng/m³, which will be used as the baseline concentration. This value is only 0.026% of the annual mean AQAL of 5,000 ng/m³.

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As shown, the concentrations monitored between 2016 and 2020 were significantly lower than the AQALs at all monitoring sites considered. Monitoring of antimony across the UK ceased at the end of 2013. The maximum monitored at any UK site in 2014 was 1.3 ng/m³, which will be used as the baseline concentration. This value is only 0.026% of the annual mean AQAL of 5,000 ng/m³.

6.4.6 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PBCs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 14 and Table 15. There are no monitoring locations within 10 km of the Facility, and the closest monitoring site is located at Manchester Law Courts.

Monitoring data for dioxins and furans is only available up to the end of 2016 from the UK-Air website, and monitoring data for PCBs data is only available up to the end of 2018 from the UK-Air website.

Table 14:TOMPS – Dioxin and Furans Monitoring

Site	Annual mean concentration (fgTEQ/m³)				
	2012	2013	2014	2015	2016
Auchencorth Moss	0.13	0.86	0.01	0.01	0.13
Hazelrigg	8.75	2.02	2.61	5.27	4.59
High Muffles	4.32	0.6	1.07	0.54	2.73
London Nobel House	15.42	3.47	2.89	4.34	21.27
Manchester Law Courts	32.99	10.19	16.52	5.94	12.23
Weybourne	9.3	2.34	1.61	1.42	16.32

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Table 15:TOMPS – PCB Monitoring

Site	Annual mean concentration (pg/m³)				
	2014	2015	2016	2017	2018
Auchencorth Moss	23.23	24.27	25.32	19.09	12.31
Hazelrigg	25.84	41.68	52.58	33.15	22.22
High Muffles	26.11	33.43	37.76	31.63	8.86
London Nobel House	107.49	121.39	110.46	121.87	46.63
Manchester Law Courts	128.93	97.99	92.6	97.27	40.1
Weybourne	17	20.95	38.61	32.26	11.23

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As shown, the concentrations vary significantly between sites and years. As there are not and monitoring sites located within close proximity of the Facility or mapped background datasets, the maximum monitored concentration from the past 5 years has been used as the background concentration within this assessment. These values are 32.99 fg/TEQ/m³ for dioxins and furans and 128.93 pg/m³ for PCBs.

6.4.7 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored at a number of stations in the UK as part of the PAH network. There are no monitoring locations within 10 km of the Facility, and the closest site is in Speke, Liverpool.

For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQAL has been set. A summary of benzo(a)pyrene concentrations from all urban background monitoring sites within the UK is presented in Table 16.

Table 16: National Monitoring - Benzo(a)pyrene

Site Type	Quantity	AQAL (ng/m³)	Annual mean concentration (ng/m³)				
			2016	2017	2018	2019	2020
All Urban Background	Min	0.25	0.12	0.13	0.05	0.08	0.08
	Max		0.65	0.98	0.70	0.55	0.70
	Average		0.29	0.36	0.24	0.23	0.29

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As shown, the monitored concentration exceeds the AQAL at a number of urban background sites. The AQAL goes beyond the requirement of the European Directive (Commission Decision 2004/107/EC) which sets a target value of 1 ng/m³. None of the background sites exceed this value. In lieu of any local monitoring of PAHs or mapped background datasets, the maximum of the UK average concentration from any urban background site has been used (0.98 ng/m³ – 2017). In the event that the process contribution is greater than 1% of the AQAL, in accordance with the assessment methodology, further consideration of this background concentration will be undertaken.

6.5 Baseline conditions at ecological sites

The Air Pollution Information System (APIS) database sets out the baseline concentrations on a grid across the UK. Atmospheric concentrations of oxides of nitrogen and sulphur dioxide are provided on a 1km x 1km grid whilst ammonia concentrations, nitrogen deposition and sulphur deposition are provided on a 5 km x 5 km grid. Data is provided for the maximum across the ecological site. This data is the from 2017 to 2019 average presented on APIS.

Table 17: APIS Data for Ecological Sites

ID	Site	Maximum concentration (µg/m³)		
		Oxides of nitrogen	Sulphur dioxide	Ammonia
Annual mean Critical Level		**30**	**10 / 20**	**1 / 3**
R1	River Dee and Bala Lake SAC, SSSI	10.68	0.79	2.05
R2	Johnstown Newt Sites SAC	12.69	1.55	2.99
R3	Berwyn and South Clwyd Mountains SAC	7.72	0.76	1.39
R4	Berwyn SPA	7.72	0.76	1.39
R5	Chirk Castle SSSI	7.18	0.79	2.05
R6	Nant-y-Belan and Prynela Woods SSSI	12.20	1.29	1.95
R7	Barracks Field	12.11	0.79	2.05
R8	Ceod-Y-Canal Wood	13.81	0.79	2.05
R9	Various Ancient Woodlands	13.81	0.79	2.05

Source: APIS

As shown, the baseline data presented in APIS shows that concentrations of oxides of nitrogen and sulphur dioxide are below the critical level at all sites. Concentrations of ammonia exceed the lower critical level applicable for lichen sensitive communities at all sites.

Table 18: APIS data for Ecological Sites - Deposition

ID	Site	N deposition	Acid N deposition	Acid S deposition
		kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
Grassland deposition velocity				
R1	River Dee and Bala Lake SAC, SSSI	22.4	1.60	0.19
R2	Johnstown Newt Sites SAC	24.5	1.75	0.19
R3	Berwyn and South Clwyd Mountains SAC	21.14	1.51	0.21
R4	Berwyn SPA	21.14	1.51	0.21
R5	Chirk Castle SSSI	22.4	1.60	0.19
R6	Nant-y-Belan and Prynela Woods SSSI	-	-	-
R7	Barracks Field	22.4	1.60	0.19

ID	Site	N deposition	Acid N deposition	Acid S deposition
		kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
R8	Ceod-Y-Canal Wood	-	-	-
R9	Various Ancient Woodlands	-	-	-
Woodland deposition velocity				
R1	River Dee and Bala Lake SAC, SSSI	-	-	-
R2	Johnstown Newt Sites SAC	-	-	-
R3	Berwyn and South Clwyd Mountains SAC	31.36	2.24	0.26
R4	Berwyn SPA	-	-	-
R5	Chirk Castle SSSI	35	2.50	0.22
R6	Nant-y-Belan and Prynela Woods SSSI	33.6	2.40	0.25
R7	Barracks Field	-	-	-
R8	Ceod-Y-Canal Wood	35.0	2.50	0.22
R9	Various Ancient Woodlands	35.0	2.50	0.22

Source: APIS

The values presented in the Table 17 and Table 18are grid square averaged values provided as a rolling 3-year mean and derived from a mixture of interpolation from measured data, and modelled data as set out in APIS. The APIS website explains that the use of a 3-year mean has been demonstrated to be a suitable time period to smooth out some of the inter-annual variations in deposition which occur due to the natural variability in annual weather patterns.

6.6 Summary of baseline concentrations used in assessment

Sections 6.1 to 6.5have provided a review of the local and national monitoring data and national modelled background concentrations. This review has shown that there a number of nitrogen dioxide monitoring sites in the local area but each of these include a contribution from the Facility as it has been operating for a number of years. Monitoring of other pollutants is limited. As the contribution from the Facility is being explicitly modelled the background concentration has been taken as the maximum mapped background concentration within 5 km of the Facility. Noting that this also includes a contribution from the Facility albeit it an average concentration for the grid square. For some pollutants there are no mapped background datasets. In these instances, the maximum concentration from national monitoring datasets for sites in a similar setting has been used as the baseline concentration.

Table 19: Summary of Baseline Concentrations

Pollutant	Conc.	Units	Justification
Nitrogen dioxide	10.84	µg/m^3	Maximum mapped background concentration from within 5 km of Facility - Defra 2018 dataset.

Pollutant	Conc.	Units	Justification
Sulphur dioxide	3.39	µg/m^3	Maximum mapped background concentration from within 5 km of Facility - Defra 2001 dataset.
Particulate matter (as PM_{10})	15.39	µg/m^3	Maximum mapped background concentration from within 5 km of Facility - Defra 2018 dataset.
Particulate matter (as $PM_{2.5}$)	10.94	µg/m^3	Maximum mapped background concentration from within 5 km of Facility - Defra 2018 dataset.
Carbon monoxide	224	µg/m^3	Maximum mapped background concentration from within 5 km of Facility - Defra 2001 dataset.
Formaldehyde	1	µg/m^3	Monitored concentration at Wrexham AURN in 2016.
Ammonia	2.05	µg/m^3	Maximum mapped background concentration from within 5 km of Facility – APIS 2017 – 2019 Average.
Hydrogen chloride	0.71	µg/m^3	Maximum monitored concentration across the UK 2012 to 2015
Hydrogen fluoride	2.35	µg/m^3	Maximum measured concentration from EPAQS report
Cadmium	0.08	ng/m^3	Maximum annual concentration averaged across all rural sites across the UK 2016 to 2010, with the exception of - mercury which is the from urban background sites; and - antimony the maximum monitored across the UK in 2014.
Mercury	2.80	ng/m^3	
Antimony	1.30	ng/m^3	
Arsenic	1.3	ng/m^3	
Chromium	1.41	ng/m^3	
Cobalt	0.06	ng/m^3	
Copper	2.03	ng/m^3	
Lead	3.43	ng/m^3	
Manganese	2.24	ng/m^3	
Nickel	0.52	ng/m^3	
Vanadium	0.64	ng/m^3	
Dioxins and Furans	32.99	fgTEQ/m^3	Maximum monitored concentration across all UK sites 2012 to 2016
Dioxin-like PCBs	128.93	pg/m^3	Maximum monitored concentration across all UK sites 2014 to 2018
PaHs	0.98	ng/m^3	Maximum annual concentration averaged across all background sites across the UK 2015 to 2019

7 Dispersion Modelling Methodology

7.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 5.2, developed and supplied by Cambridge Environmental Research Consultants (CERC) This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of the NRW and the EA. An analysis of the variation in model outputs has been undertaken and the maximum predicted concentration for each pollutant and averaging period has been used to determine the significance of any potential impacts.

7.2 Source and emissions data

The principal inputs to the model with respect to the emissions to air from the Facility are presented in Appendix B. When determining the release rate of pollutants in the first instance volumetric flow rate from each item of plant has been multiplied by the proposed ELV. The volumetric flow rate was taken as the maximum flow rate between 2015 and 2017 as per the original submission. However, a comparison has been made with more recent monitoring data to demonstrate that this assumption is valid. These graphs are provided in Appendix B. As shown, the volumetric flow rate varies but the inputs used in the model remain a realistic assumption of flow rates from the plant. Graphs are also provided in Appendix B of emissions as a percentage of the ELV for key items of plant. This shows that assuming each item of plant operates continually at the ELV is extremely conservative. In addition, data has been provided from Kronospan which shows the operational loading for each item of plant. This shows that although the Facility operates on a 24-hour basis the loading of each process varies and none of the processes operate 100% of the time, as conservatively assumed within this modelling.

As set out in section 3.1.4, WESP 32 is currently used to provide height to the releases from the press abatement system. The only flows entering WESP 32 are those from the press abatement system. The emissions from the press abatement system are monitored at source and then this is ducted approximately 185 m to WESP 32. As such the temperature of the release will be lower at the emission point to atmosphere than monitored. Therefore, for the purpose of the modelling the likely reduction in temperature has been calculated (10 °C) and the emission parameters (temperature and velocity) modified to account for the lower temperature of the release and the wider diameter of the stack at the emission point to atmosphere.

As set out in section 3.1.7, WESP 21 serves the new chip preparation plant and associated drier. This process is not currently permitted but there is an agreement in place to operate this plant providing that it was included in this permit variation. The source parameters have been taken from monitoring data for the WESP 21 as per the other sources on site. However, as with all other sources the emission rates have been determined by calculating the emission rate when operating at the proposed ELV.

7.3 Other Inputs

Modelling has been undertaken over a grid of 3.3 km x 3.3 km, with a spacing of 33 m. Reference should be made to Figure 10 of Appendix A for a graphical representation of the modelling domain.

Table 20: Modelling Domain

Parameter	Value (m)
Grid Spacing (m)	33
Grid Start X	326850
Grid Finish X	330150
Grid Start Y	336750
Grid Finish Y	340050

7.3.1 Meteorological data and surface characteristics

The impact of meteorological data was taken into account by using meteorological data from the RAF Shawbury meteorological recording station for the years 2013 – 2017 sourced from ADM Limited. RAF Shawbury is approximately 30 km to the south-east of the Facility and is the closest and most representative meteorological station available.

The period 2013 – 2017 was chosen as this was the data available at the time of submitting the original application. It is recommended that five years of data are used to take into account inter-annual fluctuations in meteorological conditions. It was agreed with NRW that as the meteorological data covered a period of 5 years and allows for interannual variability it remains appropriate for use. Wind roses for each year can be found in Figure 11 within Appendix A.

The minimum Monin-Obukhov length can be selected in ADMS for both the dispersion site and the meteorological site. This is a measure of the minimum stability of the atmosphere and can be adjusted to account for urban heat island effects which prevent the atmosphere in urban areas from ever becoming completely stable. The minimum Monin-Obukhov length has been set to the default value for the dispersion and meteorological site which is appropriate for the nature of the area surrounding the Facility which is generally rural with the exception of the village of Chirk, and the Shawbury meteorological station.

The surface roughness length can be selected in ADMS for both the dispersion site and the meteorological site. A surface roughness length of 0.5 m has been selected for the dispersion site. This value is appropriate for 'parkland and open suburbia' and is considered appropriate for the area surrounding the Facility. A surface roughness value of 0.2 m has been selected for the meteorological site which is appropriate for the area surrounding the meteorological station.

7.3.2 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The EA recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

The ADMS 5.2 user guide also states that buildings less than one third of the stack height will not have any effect on dispersion.

A review of the site layout has been undertaken and the details of the applicable buildings are presented in Table 21. A site plan showing which buildings have been included in the model is presented in Figure 10 within Appendix A.

Table 21: Building Details

Buildings	Centre Point		Height (m)	Width (m)	Length (m)	Angle (°)
	X (m)	Y (m)				
Dry CHP Silos	328422.40	338354.50	26.0	43.16	8.22	91.29
K7 Boiler	328428.20	338318.10	31.0	22.10	35.59	1.94
MDF Refiner B	328451.80	338409.40	27.0	12.20	14.10	82.50
MDF Refiner C	328465.30	338411.10	36.6	14.60	14.10	82.50
MDF Fibre Cyclones	328471.80	338230.90	46.0	11.70	6.16	81.61
Chip Silos	328464.50	338337.80	26.0	18.00	7.00	82.50
Main Factory C	328499.30	338287.10	11.5	65.00	96.00	82.00
Gas Engines	328506.00	338434.10	18.2	26.00	27.60	82.50
WESP	328404.20	338343.50	65.5	5.00	-	-
Main Factory A	328745.70	338373.10	11.5	426.72	197.63	82.00
Main Factory B	328533.00	338321.40	11.5	11.65	154.70	82.00
Ducting structure	328468.90	338296.30	16.5	7.45	68.40	82.00
Structure B	328428.80	338416.70	20.0	24.21	72.04	98.40
Structure A	328440.50	338336.70	20.0	6.53	8.07	180.00
Biomass A	328499.90	338362.40	30.0	5.70	13.17	81.87
Biomass B	328505.60	338363.30	35.0	3.35	9.10	82.23
Biomass Silos	328512.30	338365.90	30.0	5.11	11.39	81.51
Biomass C	328482.40	338359.10	25.0	17.02	9.40	81.08
New Chip Preparation	328401.60	338432.30	36.0	29.00	120.00	98.40

7.3.3 Terrain

Where gradients within 500 m of the modelling domain are greater than 1 in 10, it is recommended by CERC that, the complex terrain module within ADMS (FLOWSTAR) should be used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling. To account for this the initial modelling has been undertaken excluding the effects of terrain and a comparison has been undertaken including the effects of terrain. The initial results showed that the effect of terrain was minimal and the greatest driver to the dispersion of pollutants in this instance is the building wake effects. The detailed modelling therefore excludes the effects of terrain.

7.4 Chemistry

The Facility will release emissions of nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as NOx. In the atmosphere, nitric oxide will be converted to nitrogen dioxide in a reaction with ozone which is influenced by solar radiation. Since the AQALs are expressed in terms of nitrogen dioxide, it is important to be able to assess the conversion rate of nitric oxide to nitrogen dioxide.

Ground level NOx concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70% conversion from NOx to nitrogen dioxide for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario specified in the EA's guidance for dispersion modelling[6] which is appropriate where the primary nitrogen dioxide to NOx ratio is less than 10%. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

7.5 Baseline concentrations

Background concentrations for the assessment have been derived from monitoring and national mapping as summarised in Table 19. For short term averaging periods of less than 24-hours, the background concentration has been assumed to be twice the long term ambient concentration following the EA recommendation within the Air Emission Guidance. For 24-hour periods the background concentration has been assumed to be the same as the annual mean concentration in line with guidance from LAQM.TG(16).

7.6 Sensitivity study – WESP 32 – stack downwash

In the existing configuration the WESP 32 includes emissions from three existing presses (the MDF 1 and 2 presses and the Particleboard Press) after the press abatement system. These emissions vent to atmosphere via WESP 32 to provide added height for dispersion. The WESP 32 is not used as a form of abatement. The two former pieces of plant (Bab 2 and Bab 3 driers) also emitted to atmosphere via the WESP 32. As such historically the volumetric flow rate had been greater than proposed in this application. At the request of NRW a sensitivity study has been carried out which quantifies the impact of the WESP 32 with and without the stack downwash option in ADMS used. This has shown that there is no difference in the peak 1-hour concentration but a slight reduction in annual mean impacts when the downwash option is switched off. The WESP 32 will induce down wash on the emissions from the particleboard presses and as such this option has been kept on in the model. The differences are only marginal and do not alter the overall impacts of the Facility as these are driven by other sources.

7.7 Sensitivity study – WESP 32 vs Press Abatement Stack

At the request of NRW a sensitivity study has been carried out which quantifies the impact of the visible plume from the WESP 32 and the press abatement system and the impact on air quality. This has shown that the visible plume is predicted to be slightly longer and last visible slightly higher than if the emissions from the press abatement system exit to atmosphere via the press abatement stack. This is attributed to the lower velocity of the release from the WESP 32. However, the ground level concentration is lower owing to the increased height of the release.

[6] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

8 Impact on Human Health

8.1 Screening criteria

The EA's Air Emissions Guidance states that to screen out 'insignificant' process contributions:

- the long-term process contribution must be less than 1% of the long-term environmental standard; and
- the short-term process contribution must be less than 10% of the short-term environmental standard.

Consultation with the EA has confirmed that if the above criteria are achieved, it can be concluded that "it is not likely that emissions would lead to significant environmental impacts" and the process contributions can be screened out.

The long-term 1% process contribution threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% process contribution threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term process contributions are transient and limited in comparison with long-term process contributions; and
- the threshold provides a substantial safety margin to protect health and the environment.

If process contributions cannot be screened out, assessment is to be undertaken for the following:

- the predicted environmental concentration (PEC) at the point of maximum impact – defined as the process contribution plus the baseline concentration; and
- the process contribution and PEC at areas of public exposure.

In these cases, consultation with the Environment Agency has revealed that if the long-term PEC is below 70% of the AQAL, or the short-term process contribution is less than 20% of the headroom[7] it can be concluded that "there is little risk of the PEC exceeding the AQAL", and the impact can be considered to be 'not significant'.

The EA guidance document 'Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016' ('EA metals guidance') states that where the process contribution for any metal exceeds 1% of the long term or 10% of the short-term environmental standard (in this case the AQAL), this is considered to have potential for significant pollution. Where the process contribution exceeds these criteria, the PEC should be compared to the AQAL. The PEC can be screened out if is less than the AQAL. Where the impact is within these parameters it can be concluded that there is no risk of exceeding the AQAL.

8.2 Normal operations

The detailed results tables presented in Appendix D presents the maximum impact using the 5-years of weather data for the proposed normal operations. The results are presented for the maximum outside the site boundary and the impact at the specific receptors identified.

[7] Calculated as the AQAL minus twice the long-term background concentration.

The modelling assumes each item of plant operates at maximum capacity and emissions are at the relevant ELVs, or in the case of oxides of nitrogen the BAT AEL or the more realistic (but still conservative) assumption that emissions from the driers are typically 100 mg/Nm^3. As shown in Appendix B, although the Facility does operate on a 24-hour basis the operational loading of each process is well below 100%, and each source operates below the ELVs, and in some cases by a significant margin. Therefore, these results are considered to be extremely conservative.

As shown the PEC is predicted to be less than 70% of the AQAL for all pollutants and averaging periods, with the exception of annual mean PAHs and particulate matter. The contribution of PAHs from the Facility is extremely small being only 0.3% of the AQAL and can be screened out as insignificant. A detailed analysis for each pollutant is presented in sections 8.2.1 to 8.2.7.

8.2.1 Nitrogen dioxide

The sources of NOX from the Facility, under normal operation are identified in section 3.1. The following table provides a summary of the nitrogen dioxide impacts.

Table 22: Summary Nitrogen Dioxide Impacts - Normal Operations

Quantity	Scenario	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary			
Annual mean	Likely case	14.6%	41.7%
	Worst-case	36.5%	63.6%
99.79%ile of hourly means	Likely case	18.9%	29.7%
	Worst-case	47.2%	58.0%
Maximum at an identified sensitive receptor			
Annual mean	Likely case	9.4%	36.5%
	Worst-case	23.0%	50.1%
99.79%ile of hourly means	Likely case	8.7%	19.5%
	Worst-case	21.7%	32.5%

As shown, although the process contribution cannot be screened out as insignificant as it is greater than 1% of the long term and 10% of the short term AQAL the total PEC is well below the AQAL for both the likely and worst-case emissions scenario. Therefore, the impact of the Facility is "not significant".

The following figures have been produced which show the maximum PC of nitrogen dioxide for the proposed normal operations:

- Figure 13: Annual Mean NO2 - Normal Operations - Likely Case
- Figure 14: 99.79%ile 1hour NO2 - Normal Operations - Likley Case
- Figure 15: Annual Mean NO2 - Normal Operations - Worst-case
- Figure 16: 99.79%ile 1hour NO2 - Normal Operations - Worst-case

This analysis shows that at all areas of relevant exposure the impact is less than the AQAL. This is substantiated by the monitoring data which shows that baseline concentrations which include a contribution from the Facility are relatively low.

8.2.2 Particulate matter

As explained in section 3.1, under normal operations the sources of PM from the site will be the MDF 1 and 2 cyclones, the WESP 32, WESP 21 and dust filter units. The following table provides a summary of the PM impacts.

Table 23: Summary PM Impacts - Normal Operations

Pollutant	Averaging period	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary			
PM_{10}	Annual mean	35.8%	74.3%
	90.41th %ile 24-hour	69.9%	100.7%
$PM_{2.5}$	Annual mean	71.6%	126.3%
Maximum at an identified sensitive receptor			
PM_{10}	Annual mean	15.9%	54.4%
	90.41th %ile 24-hour	30.0%	60.8%
$PM_{2.5}$	Annual mean	31.8%	86.5%

As shown, there are predicted to be exceedednces of the AQALs. However, at the identified sensitive receptors the PEC is well below the AQAL. This conservatively assumes that each item of plant operates continuously at the ELVs and the total dust impact has been compared to the AQAL for PM_{10} and $PM_{2.5}$. Given the conservatism in the modelling and the operations at the Facility form the baseline this is not considered to be a significant impact.

The following figures have been produced which show the maximum PC of PM for the proposed normal operations, these also highlight the areas where the PEC is predicted to exceed the AQAL:

- Figure 17: Annual Mean PM10 - Normal Operations
- Figure 18: 90.41%ile of daily mean PM10 - Normal Operations
- Figure 19: Annual Mean PM2.5 - Normal Operations

As shown, there are small exceedences of the annual mean $PM_{2.5}$ to the west of the Facility. This is not in an area of relevant exposure to the annual mean AQAL. This conservatively assumes that all items of plant (including all the dust units) operate continually at the ELV (or guarantee in the case of the dust units). As set out in Appendix B although the Facility does operate on a 24-hour basis the operational loading of each process is well below 100%, and each source operates below the ELVs, and in some cases by a significant margin. Therefore, these results are considered to be extremely conservative.

As set out in section 4.1 it is likely that the UK Government will set the WHO guideline for $PM_{2.5}$ in legislation. This will reduce the AQAL from 20 µg/m^3, as used in the above analysis, to 10 µg/m^3. The whole area exceeds the WHO guideline value, as the background concentration exceeds this without any modelled contribution from the Facility. It should be recognised that the Facility as applied for in this application forms part of the local baseline and Best Available Techniques are used to control emission from operations including dust.

8.2.3 Formaldehyde

As explained in section 3.1, under normal operations the only sources of formaldehyde from the site will be the MDF 1 and 2 cyclones, the WESP 32, WESP 21, the formaldehyde plant (A1) and the exhausts from the wet scrubbers on the paper impregnation lines (A5 and A6). The following table provides a summary of the formaldehyde impacts.

Table 24: Summary Formaldehyde Impacts - Normal Operations

Quantity	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary		
Annual mean	31.4%	51.4%
Maximum hourly mean	54.5%	56.5%
Maximum at an identified sensitive receptor		
Annual mean	27.8%	47.8%
Maximum hourly mean	22.7%	24.7%

As shown, although the process contribution cannot be screened out as insignificant as it is greater than 1% of the long term and 10% of the short term AQAL the total PEC is well below the AQAL for.

The following figures have been produced which show the maximum PC of formaldehyde for the proposed normal operations:

- Figure 20: Annual Mean CH2O - Normal Operations
- Figure 21: Maximum 1-hour CH2O - Normal Operations

The peak annual mean formaldehyde process contribution from the Facility during normal operations is close to the eastern boundary of the Facility. Although the process contribution cannot be screened out as 'insignificant', there is little risk of the PEC exceeding the AQAL and the annual mean impact is "not significant".

8.2.4 Other VOCs

The EP includes an emission limit for TVOCs. This consists of a wide range of VOCs. The Production of Wood-based Panels BREF states that:

"The main constitutes of the volatile organic fraction in wood are generally not considered in literature as possessing toxic properties. An exception is formaldehyde."

In addition to formaldehyde (which is considered in Section 10.1.3) there are two AQALs set for two other VOCs; benzene and 1,3-butadiene. If either of these species were to be released from the Facility it would be expected that the BREF and the existing EP would also consider these species. The ELVs are set for TVOC and formaldehyde but no other speciation is required. Assuming that the entire TVOC emissions consist of either benzene or 1,3-butadiene is extremely unlikely as if these VOCs were of concern limits would be set in a similar approach to formaldehyde.

8.2.5 Carbon monoxide

As explained in section 3.1, under normal operations the only sources with an ELV for CO from the Facility will be the MDF 1 and 2 cyclones. The CO from MDF 1 cyclone is from the K8 biomass plant and the CO from the MDF 2 cyclone is from the K7 biomass plant. The existing WCBC EP has an emission limit for CO on the MDF 2 cyclone. However, as part of this application it is proposed to remove this ELV and instead set an ELV on the emissions from the K7 biomass plant into the MDF 2 drier. There could be other sources of CO such as the gas engines which have not been included as emissions of CO from these sources are unknown. However, as shown in Appendix D the impact of the sources modelled is only 0.4% of the AQAL. Including additional sources will increase this impact but not to a level which could not be screened out as 'insignificant'. Therefore, the impact of CO emissions can be screened out as 'insignificant'.

8.2.6 Acid gases

For the purpose of this discussion acid gases consist of sulphur dioxide, hydrogen chloride and hydrogen fluoride. As explained in section 3.1, under normal operations the only sources of these acid gases from the Facility will be the MDF 1 and 2 cyclones. The acid gases from MDF 1 cyclone are from the K8 biomass plant and the acid gases from the MDF 2 cyclone are from the K7 biomass plant.

As shown in Appendix D, the maximum predicted process contribution of acid gases from the Facility during normal operations outside the site boundary is less than 1% of the long term and less than 10% of the short term AQAL and can be screened out as 'insignificant'.

8.2.7 Other pollutants

The K8 biomass plant is a co-incinerator and includes ELVs on emissions to air for the full suite of IED pollutants. Emissions of NOx, PM, VOCs, CO and acid gases have been considered in the preceding sections as these are also released from other sources on site. Under normal operations the emissions from the K8 biomass plant are used in the MDF 1 drier and vent to atmosphere via the MDF 1 cyclone stack. The detailed results table provided in Appendix D shows that at the point of maximum impact the peak concentration is less than 1% of the long term and less than 10% of the short-term standard for all other pollutants with the exception of annual mean cadmium impacts. The peak annual mean cadmium impact is 2.3% of the AQAL. However, this assumes that emissions from the K8 biomass plant are at the combined ELV for cadmium and thallium, and these only consist of cadmium. Monitoring from the site has shown that cadmium emissions are typically well below the ELV. Although the process contribution cannot be screened out as 'insignificant', there is little risk of the PEC exceeding the AQAL and the annual mean impact of cadmium is "not significant".

The EP will need to include an ELV for total metals for the K8 biomass plant. However, there are specific AQALs set for individual metals. The Environment Agency guidance document 'Guidance on assessing group 3 metals stack emissions from incinerators – V.4 June 2016' ('Environment Agency metals guidance') has been developed to assist in determine the impact of individual metals and is applicable for use for this application to NRW. The guidance states that where the PC for any metal exceeds 1% of the long term or 10% of the short-term environmental standard (in this case the AQAL), this is considered to have potential for significant pollution. Where the PC exceeds these criteria, the PEC should be compared to the AQAL. The PEC can be screened out where the PEC is less than the AQAL. Where the impact is within these parameters it can be concluded that there is no risk of exceeding the AQAL. The monitoring data presented in the Environment Agency metals guidance has been taken from both incinerators and waste wood co-incinerators and as such is an appropriate source of speciation of metals for the Facility. The detailed tables in Appendix D show that if it is assumed that the entire emissions of metals consist of only one metal, the impact is generally less than 1% of the long term and less than 10% of the short term AQAL, with the exception of annual mean impacts of arsenic, chromium (VI), and nickel. The PEC is only predicted to exceed the long term AQAL for chromium (VI) using this worst-case screening assumption. If it is assumed that the K8 biomass plant would perform no worse than a currently operating co-incinerator, the process contribution is below 1% of the long term and 10% of the short term AQAL for all pollutants, with the exception of arsenic and nickel. However, the PECs for arsenic and nickel are well below the AQALs and therefore it can be concluded that there is no risk of exceeding the AQAL for metals.

8.3 Non-Standard Operations

Section 8.2 has detailed the impact of the Facility under normal operations. However, as detailed in section 3.2, the plant may operate under non-standard conditions if for instance if a drier is offline. A summary of the non-standard operating scenarios is provided below:

1. Scenario 1 - MDF 2 drier offline

   MDF 1 drier can use the exhaust gases from the K7 and K8 biomass plants and three gas engines, the electricity needed on site would be reduced so only three gas engines would be needed; two of which would be used in MDF 1 drier, and one would need to vent to atmosphere via its own dedicated stack. Therefore, this would result in an additional emission point to atmosphere from the gas engine. The impact of this operating scenario has been considered further below.

2. Scenario 2 - MDF 1 drier offline

   MDF 2 drier can use the exhaust gases from the K7 and K8 biomass plants and four gas engines, the electricity needed on site would be reduced so only four gas engines would be needed. Exhaust gases from all four gas engines can be accommodated within the MDF 2 drier. The impact of this operating scenario has been considered further below.

3. Scenario 3 - WESP 32 offline

   The exhaust gases from the continuous press abatement system would need to vent to atmosphere via their own dedicated stack. This is considered an emergency release in the existing permit. The WCBC EP ensures that this is limited to periods of less than 1-hour and any occurrences are reported. It is proposed to keep this condition with the new EP. Therefore, this scenario has not been considered further.

4. Scenario 4 - MDF 1 and MDF 2 drier offline

   If both MDF driers are offline, the exhaust gases from the biomass plants and gas engines would need to vent to atmosphere via their dedicated stacks. If the MDF driers were not online, the power and heat needed for the site would be reduced and these combustion plants would not be needed and would be shut down. Therefore, this operating scenario would only occur for short periods. In this instance there would not be emissions from the MDF cyclones but there would be emissions from the K7, K8 biomass plants, and up to 5 gas engines, the WESP 32 and the WESP 21 as a worst-case. The impact of this operating scenario has been considered further below.

5. Scenario 5 - All driers offline

   If both MDF driers are offline, the emissions would be as scenario (4) above, but emissions would also be released from the Chip drier emergency stack rather than the WESP 21. This is considered an emergency release it is proposed to mirror a condition in the existing WCBC permit that ensures that this is limited to periods of less than 1-hour and any occurrences are reported. It is proposed to keep this condition with the new permit. Therefore, this scenario has not been considered further.

6. Scenario 6 - K7 and K8 biomass plants are offline

   The drying process would still be able to operate but the K5 and K6 gas heaters will be used to heat the thermal oil for the presses. In this case emissions from site would also be from the K5 and K6 gas heaters. The impact of this operating scenario has been considered further below.

In all instances the Gas Turbines would be used as back-up to the Gas Engines. The impact of all scenarios where the one or more Gas Engines are not operating and either one or two Gas Turbines are needed has been analysed. For the worst-case emissions scenario, if a Gas Engine or Gas Turbine exhaust gases are used the mass release of emissions from the cyclones calculated will not change, as this is based on the BAT AEL for the driers. Therefore, the impact of the back-up Gas Turbines has not been considered further in this analysis as effectively these would replace emissions from the Gas Engines and the impact of both scenarios is similar. Kronospan would propose that the EP only allows for that testing of the gas turbines in the event that two engines of the engines are offline.

8.3.1 MDF 2 drier offline – scenario 1

If the MDF 2 drier is offline:

- the MDF 1 drier will use the exhaust gases from the K7 biomass plant and the K8 biomass plant and two gas engines;
- the electricity needed on site would be reduced so only 3 gas engines would be needed; and
- the exhaust gases of two engines would be used in MDF 1 drier, and one of the engines would need to vent to atmosphere via its own dedicated stack.

Therefore, this would result in an additional emission point to atmosphere from the gas engine. The gas engine will only include an ELV for NOx.

Under normal operations exhaust gases from K7 would vent to atmosphere via the MDF 2 drier. However, if this is offline these will vent to atmosphere via the MDF 1 drier. The MDF 1 drier will include an emission limit for NOx, PM and CH_2O and the emissions of other pollutants are based on the release rate from the biomass plants into the drier. The K7 biomass plant will have an emission limit for NOx, CO, PM and SO_2 but as requested it has also been assumed that the K7 biomass plant will have emissions of HCl and HF these have been taken from the large combustion BREF. Emission of NOx and PM are limited at the exit from the MDF drier. For NOx and PM we have assumed that the MDF 1 drier operates at the ELV, and the MDF 1 drier will continue to need to comply with the ELV even if the K7 biomass plant also vented to atmosphere via the MDF 1 drier.

The only potential change to the overall impact of emissions from the facility would be for NOx (due to the gas engine), and CO, SO_2, HCl, HF (as a result of the potential change in dispersion as the release from the K7 biomass plant is vented to atmosphere via the MDF 1 drier), and PM and HC_2O as the MDF 2 drier would no longer be a source of these pollutants. The detailed results tables presented in Appendix E presents the maximum impact using the 5-years of weather data when the MDF 2 drier is offline. The results are presented for the maximum outside the site boundary and the impact at the specific receptors identified.

As shown when the MDF 2 drier is offline the PEC is predicted to be less than 70% of the AQAL for all pollutants and averaging periods, with the exception of annual mean PAHs and particulate matter. The contribution of PAHs from the Facility is extremely small being only 0.3% of the AQAL and can be screened out as insignificant. The impact of acid gases is greater than normal operations as that the acid gases from the K7 biomass plant would be emitting to atmosphere via the MDF 1 drier which has a shorter stack. Emissions of metals etc would be the same as normal operations as the K8 biomass plant which is the source of these would continue to emit to atmosphere via the MDF 1 drier. As such detailed discussion has also been carried out for nitrogen dioxide, PM, formaldehyde and acid gases.

8.3.1.1 Nitrogen dioxide

The following table provides a summary of the nitrogen dioxide impacts when the MDF 2 drier is offline.

Table 25: Summary Nitrogen Dioxide Impacts - MDF 2 Offline

Quantity	Scenario	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary			
Annual mean	Likely case	15.8%	42.9%
	Worst-case	37.5%	64.6%
99.79%ile of hourly means	Likely case	18.6%	29.4%
	Worst-case	42.2%	53.1%
Maximum at an identified sensitive receptor			
Annual mean	Likely case	9.8%	36.9%
	Worst-case	20.7%	47.8%
99.79%ile of hourly means	Likely case	8.8%	19.6%
	Worst-case	20.0%	30.9%

As shown, although the process contribution cannot be screened out as insignificant as it is greater than 1% of the long term and 10% of the short term AQAL the total PEC is well below the AQAL for both the likely and worst-case emissions scenario. Therefore, the impact of the Facility is "not significant".

The following figures have been produced which show the maximum PC of nitrogen dioxide when MDF 2 is offline:

- Figure 22: Annual Mean NO2 - MDF 2 offline - Likley Case
- Figure 23: 99.79%ile 1-hour NO2 - MDF 2 offline - Likley Case
- Figure 24: Annual Mean NO2 - MDF 2 offline - Worst-case
- Figure 25: 99.79%ile 1-hour NO2 - MDF 2 offline - Worst-case

8.3.2 Particulate matter

The following table provides a summary of the PM impacts when the MDF 2 drier is offline.

Table 26: Summary PM Impacts - MDF 2 Offline

Pollutant	Averaging period	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary			
PM_{10}	Annual mean	35.8%	74.3%
	90.41^{th} %ile 24-hour	69.9%	100.7%
$PM_{2.5}$	Annual mean	71.6%	126.4%
Maximum at an identified sensitive receptor			
PM_{10}	Annual mean	15.4%	53.9%
	90.41^{th} %ile 24-hour	28.7%	59.5%
$PM_{2.5}$	Annual mean	30.8%	85.5%

As shown, there are predicted to be exceedences of the AQALs for both PM_{10} and $PM_{2.5}$, but at the identified sensitive receptors the PEC is well below the AQAL. This conservatively assumes that each item of plant operates continuously at the ELVs and the total dust impact has been compared to the AQAL for PM_{10} and $PM_{2.5}$. Given the conservatism in the modelling, and the operations at the Facility form the baseline, this is not considered to be a significant impact. The results are only slightly different to normal operations as the peak contributor at the point of maximum impact is not the MDF 2 drier.

8.3.2.1 Formaldehyde

Table 27 provides a summary of the impact of emission of formaldehyde when the MDF 2 drier is offline.

Table 27: Summary Formaldehyde Impacts - Normal Operations

Quantity	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary		
Annual mean	38.3%	58.3%
Maximum hourly mean	53.6%	55.6%
Maximum at an identified sensitive receptor		
Annual mean	25.1%	45.1%
Maximum hourly mean	21.8%	23.8%

As shown, although the process contribution cannot be screened out as insignificant as it is greater than 1% of the long term and 10% of the short term AQAL the total PEC is well below the AQAL. The impact is lower than normal operations owing to the MDF 2 drier no longer being a source of formaldehyde emissions.

8.3.2.2 Acid gases

The acid gases from the MDF 1 cyclone are produced by the K7 biomass plant and the K8 biomass plant.

As shown in Appendix E, the maximum predicted short term process contribution of SO_2 from the Facility during outside the site boundary is slightly over 10% of the AQAL. However, the PEC is well below the AQAL. This analysis is highly conservative as it assumes that emissions of SO_2 from the K7 and K8 biomass plant are at the ELVs. As such the results presented are considered worst-case and actual impacts are likely to be lower. Given the conservative assumptions in the modelling this is not considered to be a significant impact.

8.3.2.3 Other pollutants

The impact of other pollutants is the same as normal operations as the emissions from K8 biomass plant which are the source of these continue to be emitted via the MDF 2 cyclone.

8.3.3 MDF 1 drier offline – scenario 2

If the MDF 1 drier is offline:

- the MDF 2 drier will use the exhaust gases from the K7 biomass plant and the K8 biomass plant and four gas engines;
- the electricity needed on site would be reduced so only 4 gas engines would be needed.

Therefore, this would not result in an additional emission point to atmosphere. However, the MDF 2 drier will then take the emissions from K8 biomass plant as well as the K7 biomass plant. The MDF 2 is a taller stack then MDF 1 drier as such it is expected that the dispersion of the emissions from the K8 biomass plant would be better when emitted via MDF 1.

Under normal operations exhaust gases from K8 will vent to atmosphere via the MDF 1 drier. However, if this is offline these will vent to atmosphere via the MDF 2 drier. The MDF 2 drier will include an emission limit for NOx, PM and CH_2O and the emissions of other pollutants are based on the release rate from the biomass plants into the drier. The K7 biomass plant (which would also vent via MDF 2 will have an emission limit for NOx, CO, PM and SO_2 but as requested it has also been assumed that the K7 biomass plant will have emissions of HCl and HF these have been taken from the large combustion BREF. The emissions from the K8 biomass plant have been assumed to vent via MDF 1. For NOx and PM it has been assumed that the MDF 2 drier operates at the ELV, and the MDF 2 drier will continue to need to comply with the ELV even if the K7 biomass plant and the K8 biomass plant also vented to atmosphere via the MDF 1 drier.

The only potential change to the overall impact of emissions from the Facility would be for CO, SO_2, HCl, HF, metals and dioxins (as a result of the potential change in dispersion as the release from the K8 biomass plant is vented to atmosphere via the MDF 2 drier), and PM and CH_2O as the MDF 1 drier would no longer be a source of these pollutants. The detailed results tables provided in Appendix F present the maximum impact using the 5-years of weather data when the MDF 1 drier is offline. The results are presented for the maximum outside the site boundary and the impact at the specific receptors identified. As shown, the impact is lower than both normal operations and MDF 2 offline scenario given the greater height of the release.

8.3.4 WESP 32 offline – scenario 3

The exhaust gases from the continuous press abatement system would need to vent to atmosphere via their own dedicated stack. This is considered an emergency release in the existing permit. The WCBC EP ensures that this is limited to periods of less than 1-hour and any occurrences are reported. It is proposed to keep this condition with the new EP.

As requested by NRW the impact of the operation of the continuous press abatement system has been modelled during periods of maintenance. This has assumed this occurs during normal operation. Therefore, the only change from normal operations is that the WESP 32 is not operating but the emissions vent to atmosphere via the press abatement stack. The press abatement system only has emission limits for PM, TVOC and CH_20. As such this analysis has only focussed on short term impacts of PM and CH_2O.

8.3.5 Particulate matter

The following table provides a summary of the PM impacts during normal operations and testing of the continuous press abatement system. Testing would only occur for a few hours, and it would not operate for the full 24-hour period and so comparison with the daily mean AQAL for PM_{10} is overly conservative

Table 28: Summary PM Impacts - Testing of Press Abatement System

Pollutant	Averaging period	PC (as % of AQAL)	
		Testing of Press Abatement System	Normal Operations
Maximum outside installation boundary			
PM_{10}	Annual mean	-	35.8%
	90.41th %ile 24-hour	71.3%	69.9%
$PM_{2.5}$	Annual mean	-	71.6%
Maximum at an identified sensitive receptor			
PM_{10}	Annual mean	-	15.9%
	90.41th %ile 24-hour	30.5%	30.0%
$PM_{2.5}$	Annual mean	-	31.8%

As shown, the change in impact is very slight at the point of maximum impact and at sensitive receptors. Given the conservatism in the modelling that the testing of the press abatement system occurs when all other items of plant are operating at capacity and at the ELVs during the worst-case weather conditions for dispersion, this is not considered to be a significant impact and testing of the press abatement system via its dedicated stack is acceptable.

8.3.5.1 Formaldehyde

Table 27 provides a summary of the impact of emission of formaldehyde during normal operations and testing of the continuous press abatement system.

Table 29: Summary Formaldehyde Impacts - Testing of Press Abatement System

Quantity	PC (as % of AQAL)	
	Testing of Press Abatement System	Normal Operations
Maximum outside installation boundary		
Annual mean	-	31.4%
Maximum hourly mean	74.5%	54.5%
Maximum at an identified sensitive receptor		
Annual mean	-	27.8%
Maximum hourly mean	36.3%	22.7%

As shown, the change in impact from normal operations during the testing of the press abatement system will increase by 20% at the point of maximum impact, and 10% at identified sensitive receptors. However, in all instances the PEC is not predicted to exceed the AQAL. Given the assumed conservatism in the modelling, namely that the testing of the press abatement system occurs when all other items of plant are operating at capacity, at the ELVs, and during the worst-case weather conditions for dispersion, this is not considered to be a significant impact and the impact of the testing of the press abatement system via its dedicated stack will not be significant.

8.3.6 MDF 1 and MDF 2 driers offline – scenario 4

If both MDF driers are offline, the exhaust gases from the biomass plant and gas engines would vent to atmosphere via their dedicated stacks. If the MDF driers were not online, the power and heat needed for the site would be reduced and these combustion plants would not be needed and would be shut down. Kronospan would not operate the combustion plant in power only generation mode for prolonged periods as the board manufacturing process will not have a significant power demand when the MDF 1 and MDF 2 driers are offline. Therefore, this operating scenario would only occur for short periods.

The detailed results tables presented in Appendix G presents the maximum impact using the 5-years of weather data when both the MDF 1 and MDF 2 driers are offline. The results are presented for the maximum outside the installation boundary and the impact at the specific receptors identified. This analysis assumes each item of plant operates at peak capacity. It should be noted that CH_2O and TVOCs is not released from any of the combustion plants. Therefore, when the combustion plant emit to atmosphere via their dedicated stacks there would be no increase in CH_2O and TVOC emissions from the Facility, and these would actually reduce as the MDF driers which are a potential source of these pollutants are no longer operating.

Emissions of acid gases and other pollutants are lower than normal operations as the emergency stack on K8 biomass plant is significantly higher than the driers and the temperature of the release for the K7 biomass plant and the K8 biomass plants is significantly higher than the MDF driers leading to better dispersion.

The only pollutant for which there are greater impacts than any of the other scenarios is nitrogen dioxide. This is attributed to the levels of NOx from the gas engines. A summary of the impact is provided in the following table. As shown even in this scenario the PEC remains well below the AQAL.

Table 30: Summary Nitrogen Dioxide Impacts - MDF 1 and 2 Offline

Quantity	Scenario	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary			
99.79%ile of hourly means	Likely case	36.1%	47.0%
	Worst-case	53.3%	64.1%
Maximum at an identified sensitive receptor			
99.79%ile of hourly means	Likely case	16.5%	27.3%
	Worst-case	25.2%	36.1%

8.3.7 All driers offline – scenario 5

If both MDF driers are offline, the emissions would be as scenario (4) above, but emissions would also be released from the Chip drier emergency stack rather than the WESP 21. This is considered an emergency release it is proposed to mirror a condition in the existing WCBC permit that ensures that this is limited to periods of less than 1-hour and any occurrences are reported. It is proposed to keep this condition with the new permit. Therefore, this scenario has not been considered further.

8.3.8 K7 and K8 biomass plants offline – scenario 6

If either the K7 biomass plant or the K8 biomass plant are offline, the MDF driers would still be able to operate but the K5 or K6 gas heaters will be used to provide heat for the thermal oil for the presses. In this case, NOx emissions from Facility would be released from the K1 boiler, MDF 1 cyclone, MDF 2 cyclone, K5 or K6. The worst-case scenario is that both the K7 and K8 biomass plants are offline, as in this instance both the K5 and K6 gas heaters would be needed to provide heat for the thermal oil for the presses. The K5 and K6 gas heaters only include an ELV for NOx. Therefore, this analysis has only focused on NO_2 impacts. The detailed results tables presented in Appendix H presents the maximum impact using the 5-years of weather data when the K7 and K8 biomass plant are offline and K5 and K6 gas heaters are needed to heat the thermal oil.

A summary of the impact is provided in the following table. As shown even in this scenario the PEC remains well below the AQAL.

Table 31: Summary Nitrogen Dioxide Impacts - K7 and K8 Offline

Quantity	Scenario	PC (as % of AQAL)	PEC (as % of AQAL)
Maximum outside installation boundary			
Annual mean	Likely case	39.6%	66.7%
	Worst-case	17.8%	44.9%
99.79%ile of hourly means	Likely case	49.8%	60.6%
	Worst-case	39.2%	50.0%
Maximum at an identified sensitive receptor			
Annual mean	Likely case	11.6%	38.7%
	Worst-case	25.2%	52.3%
99.79%ile of hourly means	Likely case	9.9%	20.7%
	Worst-case	22.9%	33.7%

8.3.9 Summary

The following table provides a summary of the nitrogen dioxide impact from the Facility for each scenario.

Table 32: Summary All Scenarios

Quantity	Scenario	Nitrogen dioxide PC (as % of AQAL)			
		Normal Ops	MDF 2 Offline	MDF 1&2 Offline	K7 & K8 Offline
Maximum outside installation boundary					
Annual mean	Likely case	14.6%	15.8%	-	39.6%
	Worst-case	36.5%	37.5%	-	17.8%
99.79%ile of hourly means	Likely case	18.9%	18.6%	36.1%	49.8%
	Worst-case	47.2%	42.2%	53.3%	39.2%

Quantity	Scenario	Nitrogen dioxide PC (as % of AQAL)			
		Normal Ops	MDF 2 Offline	MDF 1&2 Offline	K7 & K8 Offline
Maximum at an identified sensitive receptor					
Annual mean	Likely case	9.4%	9.8%	-	11.6%
	Worst-case	23.0%	20.7%	-	25.2%
99.79%ile of hourly means	Likely case	8.7%	8.8%	16.5%	9.9%
	Worst-case	21.7%	20.0%	25.2%	22.9%

As shown, there are slight differences between the impacts of the different operating scenarios. The greatest annual mean impact is predicted to occur when the K7 biomass plant and K8 biomass plant are offline. This is expected as additional sources (K5 and K6) will be needed to provide heat to the thermal oil for the contrioll presses. The greatest short-term impact is predicted to occur when the MDF 1 and MDF 2 driers are offline. The sources feeding the driers are required to release to atmosphere via their own dedicated stacks. This would only occur for extremely short and rare periods as the electricity and heat generated would not be able to be used by the manufacturing process. This modelling has assumed that this event occurs at the same time as the worst-case weather conditions for dispersion. Even with these conservative assumptions the PEC is predicted to be well below the AQAL.

9 Impact at Ecological Receptors

9.1 Screening

The EA has produced Operational Instruction documents which explain how to assess aerial emissions from new or expanding Integrated Pollution Prevention and Control (IPPC) regulated industry applications, issued under the Environmental Permitting Regulations. The process to follow to satisfy the requirements of the Conservation of Habitats and Species Regulations 2010, Countryside and Rights of Way (CRoW) Act 2000, and the EA's wider duties under the Environment Act 1995 and the Natural Environment and Rural Communities Act 2006 (NERC06) are outlined.

Operational Instruction 67_12 "Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation" provides the following risk based screening criteria for nature conservation sites:

Table 33: Ecological Screening Criteria

Threshold	European sites	SSSIs	NNR, LNR, LWS, ancient woodlands
Y (% threshold long-term)	1	1	100
Y (% threshold short-term)	10	10	100
Z (5 threshold)	70	70	100
NOTE: *Short term considered both daily and weekly timescales*			

Source: EA Operational Instruction 67_12

Where:

- Y is the long-term process contribution calculated as a percentage of the relevant Critical Level or Load; and
- Z is the long-term predicted environmental concentration (PEC) calculated as a percentage of the relevant Critical Level or Load.

Operational Instruction 66-12 states:

- If process contribution < Y% Critical Level and Load then emissions from the application are 'not significant', and
- If PEC < Z% Critical Level and Load it can be concluded 'no likely significant effect' (alone and in-combination).

AQTAG 17 – "Guidance on in combination assessments for aerial emissions from EPR permits" states that:

"Where the maximum process contribution (PC) at the European site(s) is less than the Stage 2 de-minimis threshold of the relevant critical level or load, the PC is considered to be inconsequential and there is no potential for an alone or in-combination effects with other plans and projects."

Consultation with the EA has confirmed that the "Stage 2 de-minimis threshold" is the criteria outlined in Operational Instruction 67_12 outlined above. It has been agreed that this guidance is appropriate for use by NRW.

9.2 Methodology

9.2.1 Atmospheric emissions

The impact of emissions from the Facility has been compared to the Critical Levels listed in Table 7. Further assessment would be undertaken where the process contribution of a particular pollutant is greater than 1% of the long term or 10% of the short-term Critical Level for European and UK designated sites, and where the process contribution of a particular pollutant is greater than 100% of the Critical Level for locally-designated sites.

9.2.2 Deposition of emissions

In addition to the Critical Levels for the protection of ecosystems, habitat specific Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication) are outlined in APIS.

An assessment has been made for each habitat feature identified in APIS for the specific site. The site-specific features tool has been used to identify the feature habitats, and then the search by location tool to find the habitat specific Critical Load for the specific points assessed within the designated sites. The relevant Critical Loads are presented in Appendix C.

If the impact of process emissions upon nitrogen or acid deposition is greater than 1% of the Critical Load, further assessment has been undertaken.

APIS does not include site specific Critical Loads for non-designated sites. In lieu of this, the search by location function of APIS has been used. The Critical Loads using this function are based on a broad habitat type and location.

9.2.2.1 Calculation methodology – nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

1. Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.
2. Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 34.
3. Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 35.
4. Compare this result to the nitrogen deposition Critical Load.

Table 34: Deposition Factors

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0

Pollutant	Deposition Velocity (m/s)		Conversion Factor ($\mu g/m^2/s$ to kg/ha/year)
	Grassland	Woodland	
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

9.2.2.2 Calculation methodology – acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the Facility. The steps to determine the acid deposition flux are as follows:

1. Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in Section 9.2.2.
2. Apply the conversion factor for N outlined in Table 34 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.
3. Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.
4. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.
5. Determine the wet deposition rate of HCl in kg/ha/yr by multiplying the model output by the factors presented in Table 35.
6. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the wet keq Cl/ha/year.
7. Add the contribution from S to HCl dry and wet and treat this sum as the total contribution from S.
8. Plot the results against the Critical Load functions.

The March 2014 version of the AQTAG 6 document states that, for installations with an HCl emission, the PC of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H+ from HCl should be added to the S contribution (and treated as S in the APIS tool). This should include the contribution of HCl from wet deposition.

Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purpose of this analysis it has been assumed that wet deposition of HCl is double dry deposition. This approach is also considered appropriate for use by NRW.

Table 35: Conversion Factors

Pollutant	Conversion Factor (kg/ha/year to keq/ha/year)
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

The contribution from the facility has been calculated using the APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

PC as % of CL function = (PC S + N deposition) / CLmaxN

9.3 Operating scenarios

The Critical Levels for protection of ecosystems are set for NOx, SO2, and HF and are expressed as a daily, weekly and annual mean, and acid and nitrogen deposition are expressed as an annual deposition rate. The operating scenarios which occur for periods of 1-hour or less are therefore not considered in this assessment. Of the scenarios identified in Section 3, only the following are expected to occur for periods of more than 1-hour:

1. Normal operations

   MDF1 and MDF2 driers operating. The only relevant emissions from the Facility are from the K1 boiler, MDF 1 cyclone, MDF 2 cyclone, and WESP 21. The impact of this operating scenario has been considered further. Noting that the WESP 32 does not include any emissions of NOx, SO2, HF, NH3 or HCl as this is currently being used to vent emissions from the press abatement system to aid dispersion.

2. Non-standard operations scenario 1 - MDF 2 offline

   MDF 1 drier can use the exhaust gases from the K7 and K8 biomass plants and three gas engines, the electricity needed on site would be reduced so only three gas engines would be needed; two of which would be used in MDF 1 drier, and one would need to vent to atmosphere via its own dedicated stack. Therefore, the only relevant emissions from site would be from the K1 boiler, MDF 1 cyclone, a single gas engine, and the WESP 21. The impact of this operating scenario has been considered further below.

3. Non-standard operations scenario 2- MDF 1 offline

   MDF 2 drier can use the exhaust gases from the K7 and K8 biomass plants and four gas engines, the electricity needed on site would be reduced so only four gas engines would be needed. Exhaust gases from all four gas engines can be accommodated within the MDF 2 drier. Therefore, the only relevant emissions from the Facility would be from the K1 boiler, MDF 2 cyclone, the WESP 21 – i.e. no change from normal operations, albeit emissions of acid gases would differ as the concentration of these would be sourced from both the K7 and K8 biomass plant. The analysis has shown that this would have a lower environmental impact then either the normal operations or MDF 2 offline scenario and as such this scenario has not been considered further.

4. Non-standard operations scenario 6 - K7 and K8 biomass plants are offline

   The drying process would still be able to operate but the K5 and K6 heaters will be used to heat the thermal oil for the presses. In this case relevant emissions from the Facility would be from the K1 boiler, MDF 1 cyclone, MDF 2 cyclone, K5 and K6. This scenario is not expected to occur for extended periods and not for a continuous 24-hour period.

The only scenario in which all the combustion plant on site would be operating concurrently would be if the MDF 1 and MDF 2 driers are unavailable. However, if MDF 1 and MDF 2 driers are unavailable the electricity demand on site would be reduced and not all items of combustion plant would be required. This scenario would only occur for periods of 1 hour or less. Therefore, this scenario has not been considered in relation to the impact on ecological receptors.

9.4 Emissions Scenarios

The assessment of the impact of the Facility in relation to the AQALs for the protection of human health considered a range of emissions scenarios for NOx and concluded that even the likely emissions scenario had a great deal of conservatism applied in modelling. The impact of the emissions on ecological receptors has also considered the likely and worst-case scenario for NOx emissions including the following worst-case assumptions:

1. All items of plant run at peak capacity when operating. In reality, each item of plant is not continually operated at peak capacity as operations are dependent upon production.
2. Emissions from all combustion plant are at the ELVs. Monitoring of the emissions from the existing combustion plant on-site show that these normally operate below the ELVs.
3. Operation of all items of plant occur during the worst-case weather conditions for dispersion. It is unlikely that the non-standard operations would occur at the same time as the adverse conditions for dispersion of emissions occur.
4. The predicted impacts are based on the maximum predicted concentration using 5 years of weather data.

9.5 Results – Critical Level

When determining the impact of the operations in relation to the Critical Level is it appropriate to consider the normal operating and non-standard operating scenarios, noting that both are conservative as they assume all plant continually operates at the ELVs and does not consider periods of reduced operations on site or shutdowns. Detailed results tables for normal operations are provided in Appendix D, and when the MDF 2 drier is offline are provided in Appendix E.

As shown for NOx the impact of normal operations is greater than when the MDF 2 drier is offline. This is as when the MDF 2 drier is offline this is no longer a source of NOx. However, for NH_3, SO_2 and HF the impact is greater when MDF 2 is offline. This is as the SO_2 and HF released from MDF 1 consists of that from the K7 and K8 biomass plants, the increase is attributed to the lower rate of dispersion from the MDF 1 drier stack than MDF 2 drier stack. The maximum impact of either the normal operation of the MDF2 drier offline scenario is presented in section 9.5.1.

9.5.1 Impacts at European and UK designated sites

There are four identified sites of European importance within the screening distances, the detailed results tables show that at Johnstown Newt Site SAC, Berwyn and South Clwyd Mountains SAC, and Berwyn SPA the contribution from the Facility is less than 1% of the long-term and less than 10% of the short-term Critical Levels with the exception of annual mean nitrogen dioxide impact assuming the worst-case emissions scenario. However, even with the worst-case emissions scenario the impact is only 1.5% at each site and the PEC is well below the 70% of the Critical Level. This is not considered to be a significant impact.

The maximum impact has been calculated for the grid points within the modelling domain which are contained in the River Dee and Bala Lake SAC and SSSI. The maximum impact is greater than 1% of the long-term and less than 10% of the short-term Critical Levels but the PEC remains well below 70% of the Critical Level when considering the less stringent daily mean Critical Level for oxides of nitrogen. This is not considered to be a significant impact.

The maximum impact has been calculated for the grid points within the modelling domain which are contained in the Chirk Castle SSSI. The maximum impact is greater than 1% of the long term and less than 10% of the short-term Critical Levels but the PEC remains well below 70% of the Critical

Level, with the exception of ammonia emissions when compared to the lower Critical Level which is appropriate for lichen sensitive communities.

Kronospan has been operating the Facility in Chirk since 1972, and Chirk Castle was granted SSSI status in 2011, i.e. after Kronospan commenced operation of the Facility. Therefore, the contribution from the Facility should be allowed for and this should form the baseline for concentrations at Chirk Castle.

The impact of ammonia assumes that the K8 biomass plant operates at the ELV set in the permit of 15 mg/Nm^3. The K8 biomass plant underwent a significant overhaul in June 2020. From an analysis of the CEMS data whilst there is some variability in the monitored concentrations the average daily monitored concentration between July and November 2020 was 9.9 mg/Nm^3 (expressed at 6% reference oxygen content), i.e. significantly lower than that modelled. Therefore, whilst the impact from the Facility cannot be screened out as insignificant this is based on very conservative modelling and a contribution and this considered to be not significant.

The maximum impact has been calculated for a series of grid points which contain in the Nant-y-Belan and Prynella Woods SSSI. The maximum impact is less than 1% of the long term and less than 10% of the short term Critical Levels for all pollutant except nitrogen dioxide and sulphur dioxide. However, for these the PEC remains well below 70% of the Critical Level. This is considered to be a not significant impact.

For reference the following plot files have been produced:

- Figure 28: Annual Mean NOx - Normal Operations - likely case
- Figure 29: Maximum daily mean NOx - Normal Operations - Likley Case
- Figure 30: Annual Mean NOx - Normal Operations - Worst-case
- Figure 31: Maximum daily mean Nox - Normal Operations - Worst-case

9.5.2 Impacts at locally designated sites

The impact of emissions from the Facility has been calculated for the local wildlife sites by post processing the model files to determine the maximum impact across the site. This has shown that whilst impacts are high the PEC remains below the Critical Level for the likely case emissions scenario when considering the less stringent daily mean Critical Level which is appropriate given the low sulphur dioxide and ozone concentrations in the local area. Therefore, the impact is not considered to be significant.

9.6 Results - Deposition of emissions

When determining the impact of the operations in relation to the Critical Level is it appropriate to consider the normal operating and non-standard operating scenarios, noting that both are conservative as they assume all plant continually operates at the ELVs and does not consider periods of reduced operations on site or shutdowns. Detailed results tables for normal operations are provided in Appendix D, and when the MDF 2 drier is offline are provided in Appendix E.

The maximum impact of either the normal operation of the MDF2 drier offline scenario is presented in section 9.6.1.

9.6.1 Impacts at European and UK designated sites

There are four identified sites of European importance within the screening distances, the detailed results tables show that at the European designated sites the contribution from the Facility is less than 1% of the Critical Loads with the exception of nitrogen and acid deposition impacts for bog habitats at Berwyn and South Clwyd Mountains SAC. However, if the impact of nitrogen deposition is only just over 1% (being 1.1% of the lower Critical Load for nitrogen deposition using the worst-case emissions scenario) and less than 1% for the likely case. The impact of acid deposition is slightly greater being around 2.5% of the lower Critical Load. However, the change from background levels is below 1%. Whilst the total impact of the Facility cannot be screened out as “insignificant” this application is not seeking to significantly change any of the currently permitted activities, and given the conservatism within the modelling, this is considered to be a not significant impact.

The maximum impact has been calculated for the grid points within the modelling domain which are contained in the Chirk Castle SSSI. The maximum impact is greater than 1% of the Critical Loads and the PEC is above 70% of the Critical Loads. As set out previously, Chirk Castle was granted SSSI status in 2011 well after the Kronospan Facility had been operating and as such a contribution from the Facility should be allowed for an this should form the baseline for concentrations at Chirk Castle. Whilst the impact from the Facility cannot be screened out this is based on very conservative modelling.

The maximum impact has been calculated for a series of grid points which contain in the Nant-y-Belan and Prynella Woods SSSI. The maximum impact is greater than 1% of the relevant Critical Loads. However, as this application is not seeking to significantly change any of the currently permitted activities, and given the conservatism in the modelling, this is not considered to be a significant impact.

9.6.2 Impacts at locally designated sites

The impact of emissions from the Facility has been calculated for the local wildlife sites by post processing the model files to determine the maximum impact across the site. This has shown that whilst impacts are high the PC is below the Critical Load. Using the EA Operational Instructions guidance this can be screened out as not significant.

9.7 Other local point sources of emissions

A review of local point source emissions has been undertaken and two additional point sources have been identified which may have an in-combination impact with the Facility. Searches of the local authorities (Wrexham, Denbighshire, Shropshire and Powys) planning registers has been undertaken for the period of 1 January 2018 to 1 November 2020 have been undertaken to identify any ‘additional developments’ which should be considered. The searches included the following criteria:

- Stack;
- CHP;
- Energy;
- Diesel;
- Gas; and
- Engine.

The additional developments have been reviewed to determine whether they would:

1. introduce any significant point source emissions; and
2. be located within 10 km of the installation.

Owing to the fairly rural nature of the local area, and the distance to the nearest adjacent towns, the only development identified from the search of the local authorities planning registers is:

- Shropshire – 18/04510/FUL in Oswestry for which a non-material amendment was granted ref: 20/037222/AMP, here in referred to as the Oswestry gas peaking plant.

In addition to the search of the local authorities planning registers consideration, a list of projects where an application for a permit (EP developments) has been submitted has been provided by NRW.

This list of applications was analysed and the location of each site identified and the distance to statutory designated ecological sites determined. The majority of the EP developments are in Flint and are more than 10 km from of any of the European designated sites listed in Table 10. As such there is little risk of significant cumulative impacts from these EP developments. The projects identified within 10 km of the Facility are

1. Mondelez MCPD application (ref: PAN-008579),
2. Five Fords WwTW gas to grid facility (ref: PAN-002939)
3. Conrad (Hawarden) Limited (ref: PAN-010150).

These projects are shown on Figure 12 of Appendix A with reference to the Facility and the European designated ecological sites. As shown, EP developments 2 and 3 are located approximately 10 km to the east of the Berwyn and South Clwyd Mountains SAC. Based on the wind direction it is unlikely for any significant cumulative impacts with the Facility at this SAC. The River Dee and Bala Lake SAC is 4 km from EP developments 2 and 3. However, the Facility is about 10 km away from this area. Therefore, there is no risk of significant cumulative impacts. EP development No. 1 is just to the south of the Facility. Therefore, further analysis of the cumulative impact of this project has been carried out.

9.7.1 Mondelez MCPD application

The MCPD application at the Mondelez site is to install a new steam raising boiler plant. The existing boilers will be retained at the site but will only operate on a stand-by basis only. As such, only the impact of the new steam raising boiler has been included. The permit application documentation (ref: PAN-008579) includes a detailed Air Quality Assessment which includes all the model inputs for the new steam raising boiler plant.

The Air Quality Assessment includes detailed results tables presenting the impact of NOx at ecological receptors. The maximum annual mean NOx impact at any SAC, SPA or SSSI, was at Chirk Castle SSSI, was predicted to be 0.09 $\mu g/m^3$, or 0.3% of the Critical Level. Furthermore, the maximum daily mean NOx impact was also at Chirk Castle SSSI and was predicted to be 1.01 $\mu g/m^3$. Therefore, the contribution from the Mondelez site was screened out as insignificant. The additional contribution from the Mondelez site would not significantly change the predicted impact of emissions at any of the ecological receptors. However, for completeness the cumulative impact with of emissions from this source has been modelled and included in the detailed results tables in Appendix I. As shown the additional contribution from this source is minimal.

9.7.2 Oswestry gas peaking plant

The Oswestry gas peaking plant is a standby generator comprising of 12 natural gas generators located approximately 8.5 km to the south of the Facility. Planning permission for the peaking plant was granted in October 2020 and we understand an EP application has been submitted to the EA.

The peaking plant is located 8.5 km to the south of the Facility, and more than 10 km from either:

- Berwyn and South Clwyd Mountain SAC;
- Berwyn SPA; and
- Johnstown Newt Site SAC.

Therefore, the cumulative impact of emissions from the Facility and Oswestry gas peaking plant on these features has been screened out for assessment purposes and the analysis within this assessment has only considered the cumulative impact on the River Dee and Bala Lake SAC.

The planning application for the peaking plant was supported by an Air Quality Assessment[8] which explained that the generators would operate for 2,500 hours per year. The planning application did not consider the impact that emissions would have upon ecology. Therefore, it is not possible to qualitatively determine what the cumulative impact of the Facility and the Oswestry gas peaking plant would be. However, the model inputs were set out in Appendix A2 of the Air Quality Assessment.

The model inputs have been used to model the predicted impact of the peaking plant in combination with the Facility and determine the cumulative impact of emissions on the Natura 2000 sites listed in the planning application for the peaking plant. The model inputs for the peaking plant only include emissions of NOx; therefore, this is the only pollutant which has been modelled; however, the analysis has taken into consideration emissions of NOx, nitrogen and acid deposition.

A review of APIS shows that there are no established critical loads for "*riverine habitats and running waters (rivers with floating vegetation often dominated by water-crowfoot)*", Therefore, this analysis has only focussed on impacts of oxides of nitrogen emissions in relation to the critical levels for the protection of habitats.

The maximum annual mean impact of process emissions from the peaking plant is predicted to be 0.11 µg/m^3 at the points used to represent the River Dee and Bala Lake SAC, assuming 100% operation of the peaking plant. However, as stated previously, the Air Quality Assessment states that the peaking plant would only operate for 2,500 hours per year: therefore, the annualised impact would be 0.0302 µg/m^3. This is considered to be an extremely small additional contribution at this feature. Therefore, from a cumulative impact perspective, it would not change the conclusions of the assessment. For completeness the cumulative impact with of emissions from this source has been modelled and included in the detailed results tables in Appendix I. As shown the additional contribution from each of these is sources is minimal.

[8] Air Quality Assessment: Gas Power Generation Facility, Land off A5, Oswestry, Air Quality Consultants, September 2020.

10 Conclusions

This Dispersion Modelling Assessment has been carried out to support the EP variation application for the Kronospan Facility. The Facility is currently permitted by both NRW and WCBC. It is proposed to consolidate the permits into a single permit under the jurisdiction of NRW.

The modelling that has been undertaken to support the EP application demonstrates normal operating conditions (the likely case), and also with the plant operating at the worst-case emissions (the worst case). In terms of the latter scenario these are unlikely to be achievable given the integrated nature of the combustion plant and board manufacturing processes. In the situation where there is no production, heat demand is minimal and electricity demand is reduced which would lead to a progressive shutdown of operations.

The dispersion modelling undertaken has used a number of highly conservative assumptions.

1. All items of plant run at peak capacity when operating.

Each item of plant is not continually operated at peak capacity as operations are dependent upon production.

2. Emissions from all plant are at the BAT AELs or ELVs.

Monitoring of the emissions from the existing combustion plant on-site show that these normally operate below the ELVs. The BAT AELs for the driers are easily achieved. The monitoring from the existing driers has shown that the emissions are well below the BAT AELs therefore a likely and worst case emissions scenario has been considered in relation to NOx.

3. Operation of all items of plant occur during the worst-case weather conditions for dispersion;

It is unlikely that the non-standard operations would occur at the same time as the adverse conditions for dispersion of emissions occur.

4. The predicted impacts are based on the maximum predicted concentration using 5 years of weather data.

With regard the impact on human health, during normal operations, although the predicted process contribution cannot be screened out as 'insignificant' there is little risk of the PEC exceeding any of the AQALs at areas of relevant exposure. The impact of dust emissions is predicted to exceed both the AQALs for $PM_{2.5}$ for a small area. However, it is unlikely that all the dust will consist of these fractions and this assumes that the dust units continually operate at the guarantees. Data from Kronospan has shown that although the Facility runs on a 24-hour basis, the loading of each process varies and none of the processes operate 100% of the time, as conservatively assumed within this modelling.

Additional modelling has been carried out to quantify the impact of non-standard operations which accounts for different items of plant being offline and exhaust gases being used in different processes.

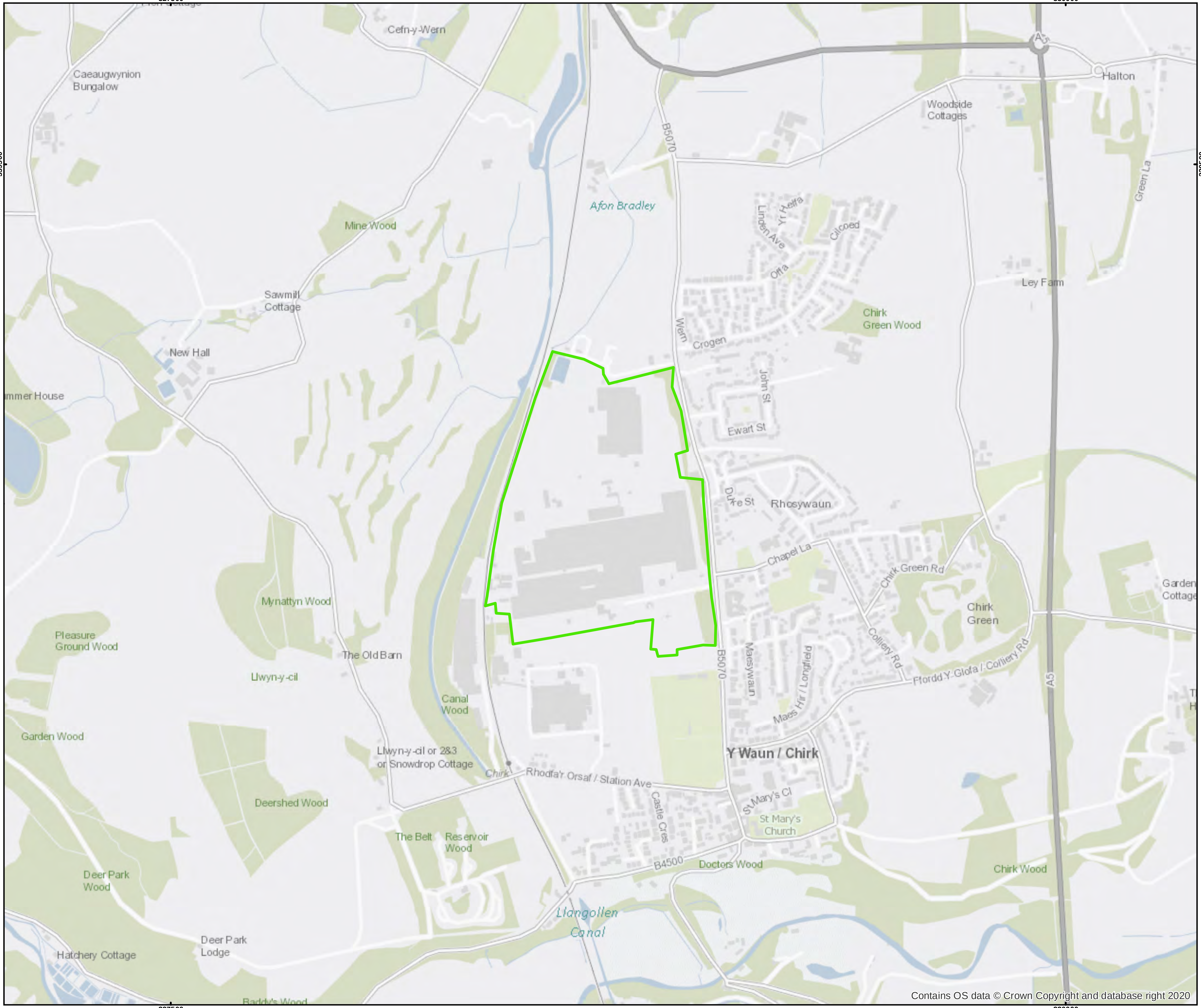
With regard to the impact on ecology, only those operating scenarios which could occur for periods of at least one day have been considered. The results have shown that:

- The contribution that the Facility should be allowed for, and this should form the baseline, especially at Chirk Castle SSSI which was granted SSSI status after Kronospan commenced operation of the Facility.
- At all European Designated sites the impact of process emissions is not significant.
- At SSSIs the impact of process emissions is not significant.
- At locally designated sites whilst impacts are high the impact is considered not significant in line with the EAs Operational Instructions guidance.

Additional consideration has been made to the in combination impact of emissions. This has shown that the inclusion of other identified sources would not have a significant impact.

Appendices

A Figures



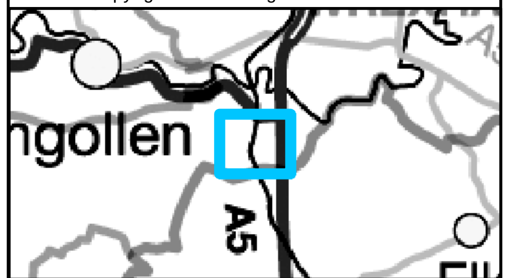
Legend

Installation Boundary

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 5 - Facility Location

Drawn by: Rosalind Flavell	Date: 30/07/2021



0 0.1 0.2 0.4 km

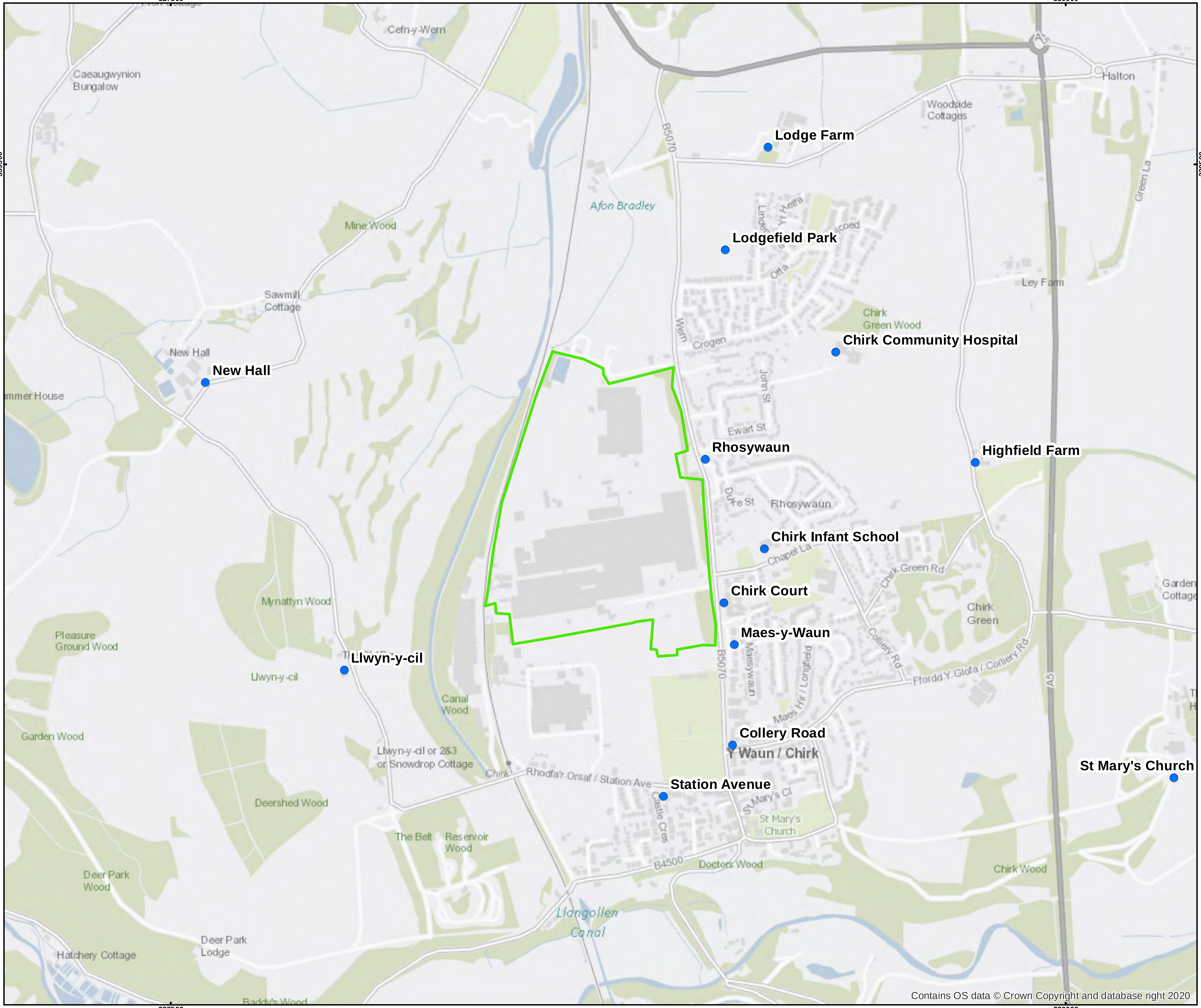
N

Scale: 1:10,000

FICHTNER

Consulting Engineers Limited

Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618



Legend

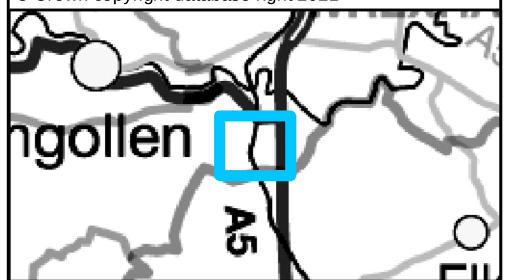
Installation Boundary

Receptors

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 6 - Human Sensitive Receptors

Drawn by: Rosalind Flavell	Date: 09/09/2021



0 0.1 0.2 0.4 km

Scale: 1:10,000

N

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Tel: 0161 476 0032
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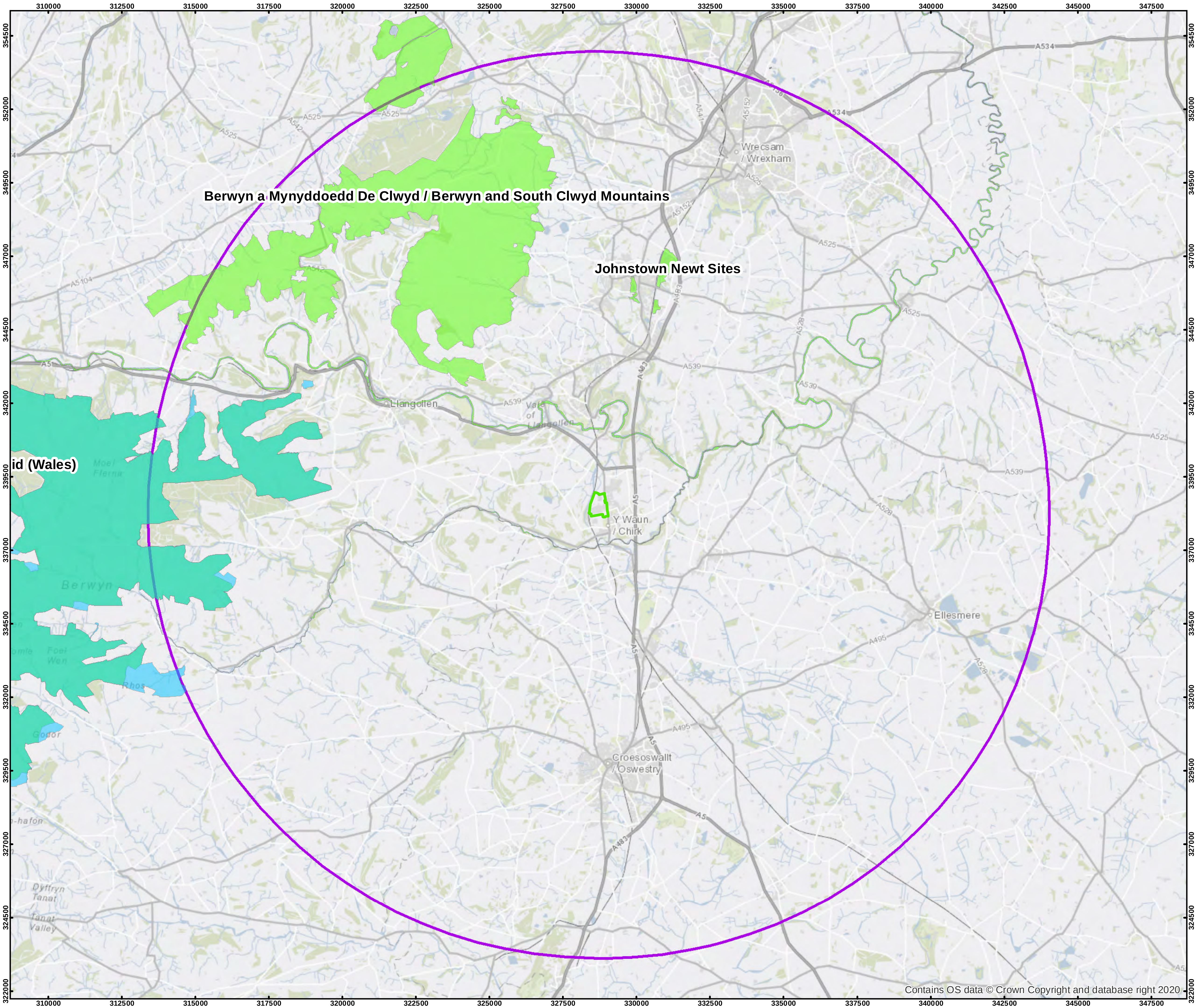

Legend

- Installation Boundary
- SPA
- SAC
- 15km Buffer from Installation

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 7 - Ecological Receptors
Drawn by: Rosalind Flavell	Date: 09/09/2021

0 1.25 2.5 5 km

Scale: 1:120,000

N

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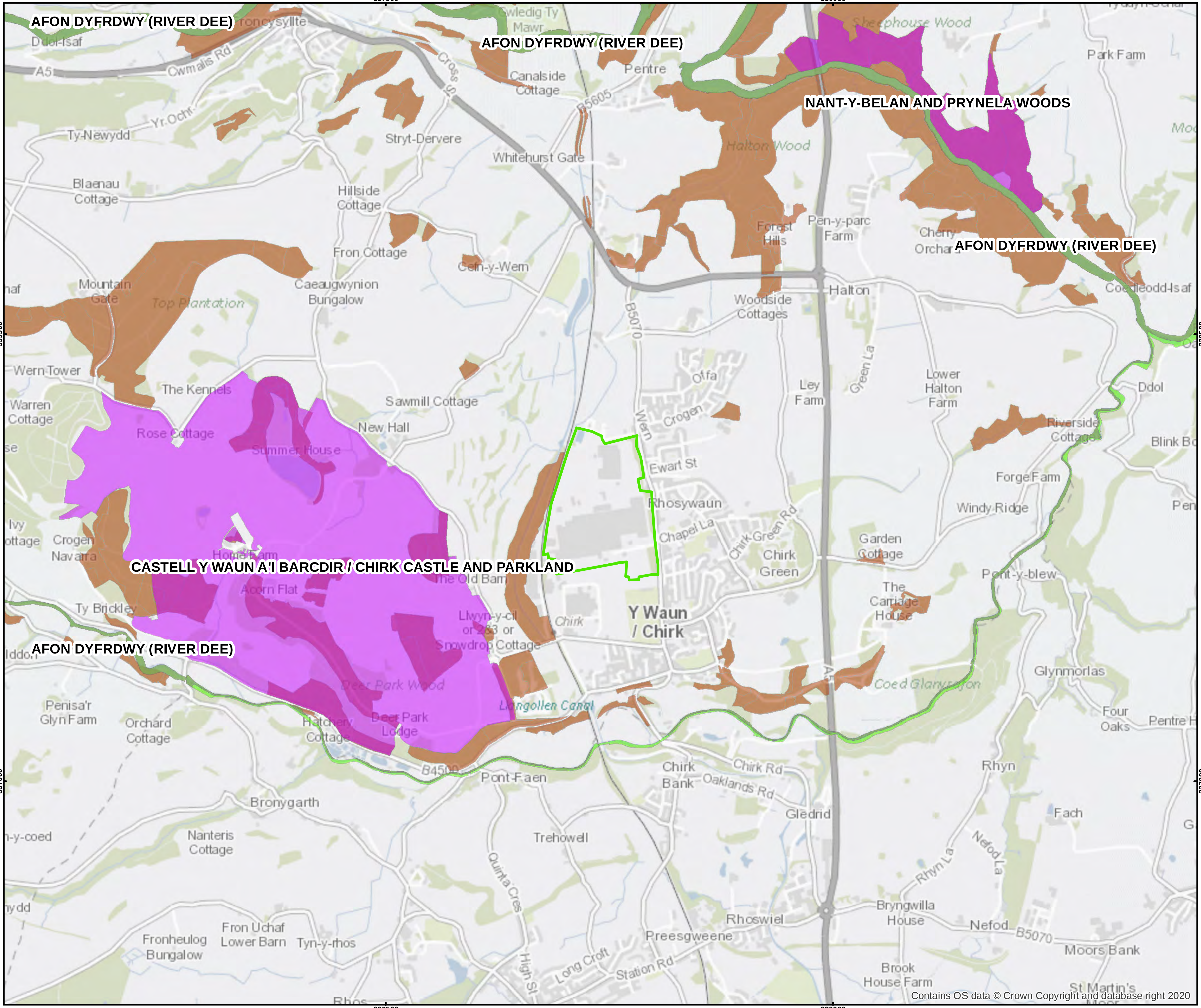


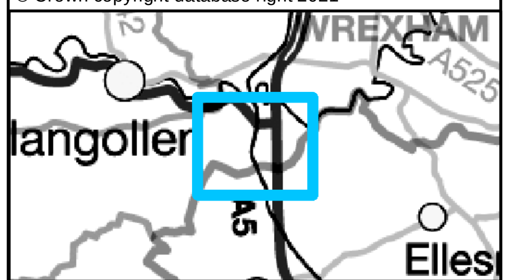
Legend

- Installation Boundary
- SAC
- SSSI
- Ancient Woodlands

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 8 - Ecological Receptors Zoomed

Drawn by: Rosalind Flavell	Date: 30/07/2021



0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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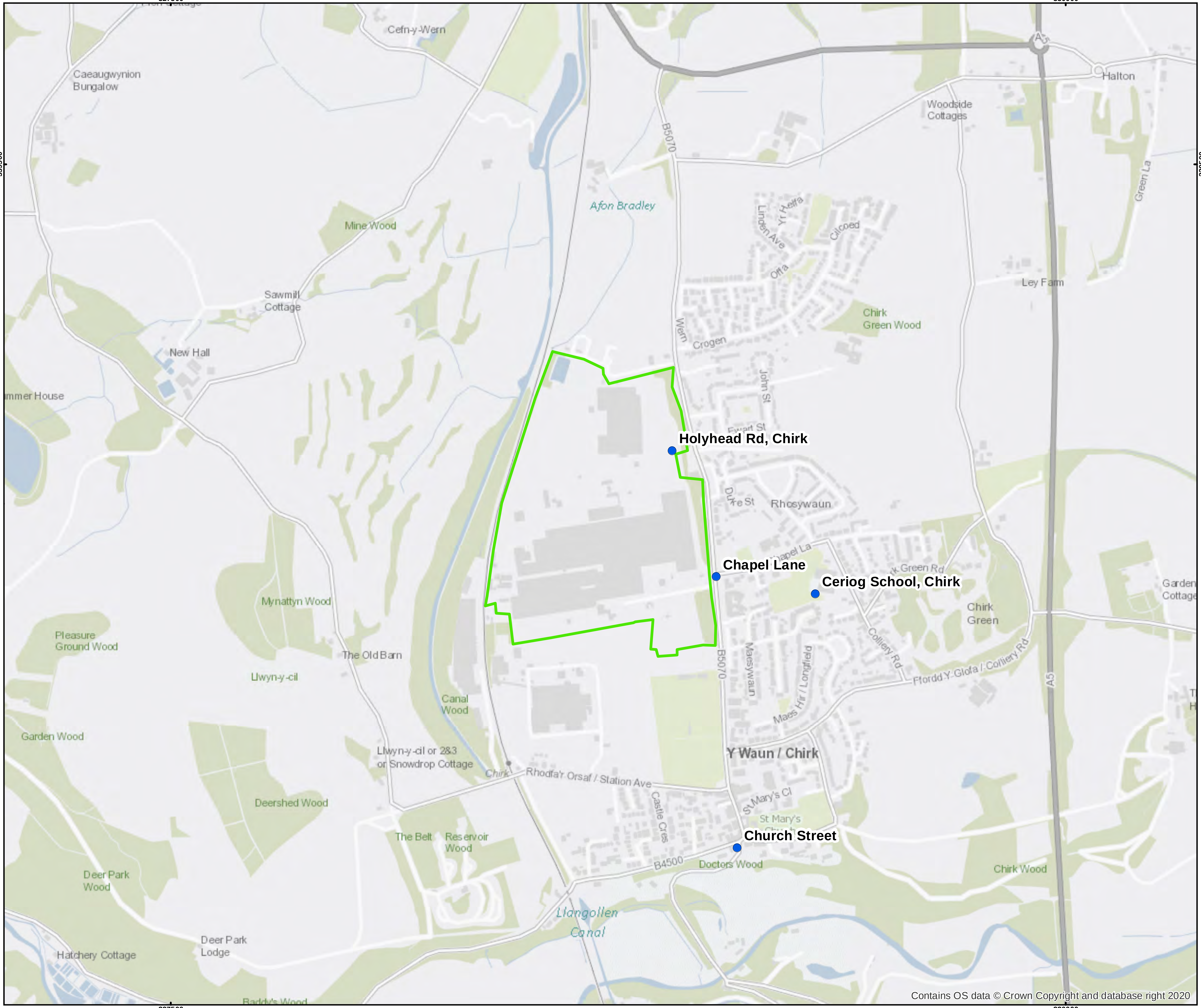
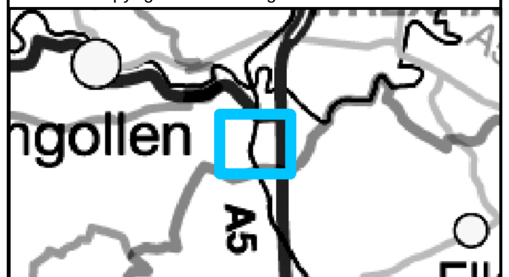


Legend

- Monitoring site
- Installation Boundary

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 9 - Monitoring Locations

Drawn by: Rosalind Flavell | Date: 30/07/2021



0 0.1 0.2 0.4 km

Scale: 1:10,000

N

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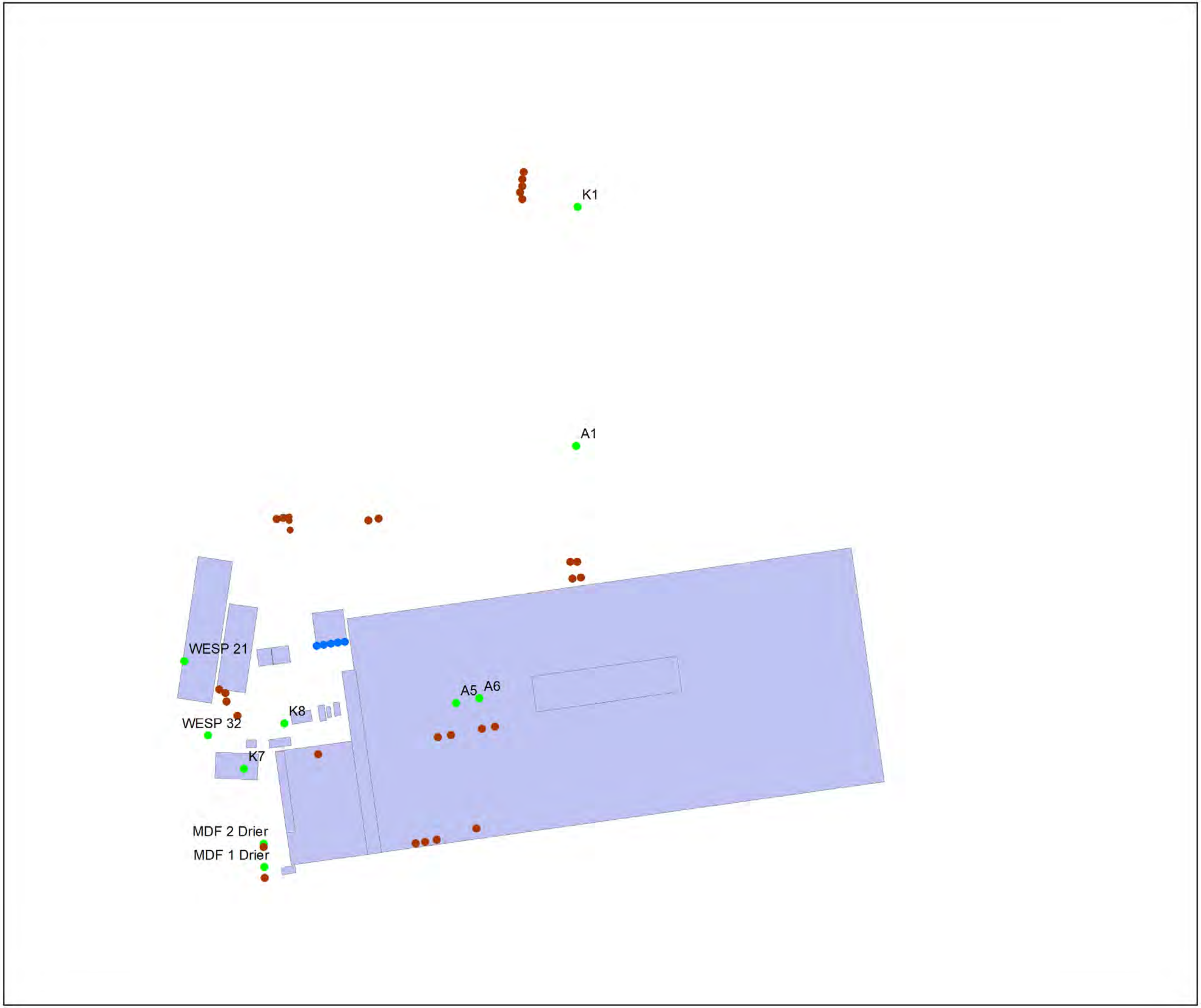
Tel: 0161 476 0032
Fax: 0161 474 0618



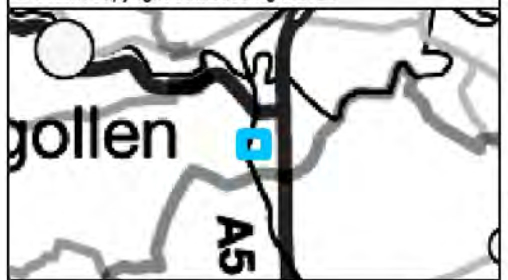
Legend

- Emission sources
- Dust units
- Gas Engines
- Buildings

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 10 - Model Inputs

Drawn by: Rosalind Flavell	Date: 09/09/2021



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Scale: 1:3,000

N

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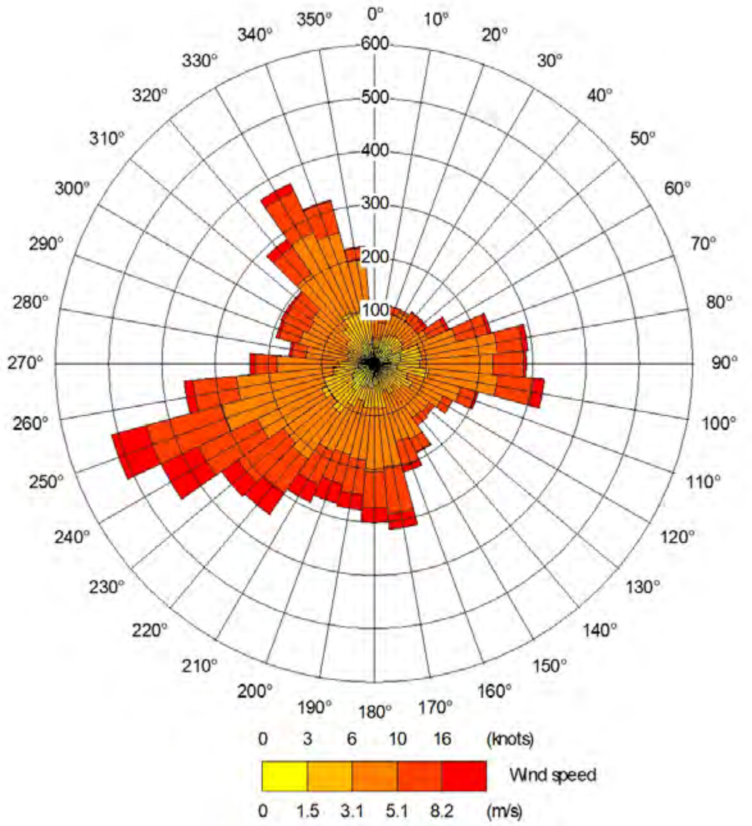
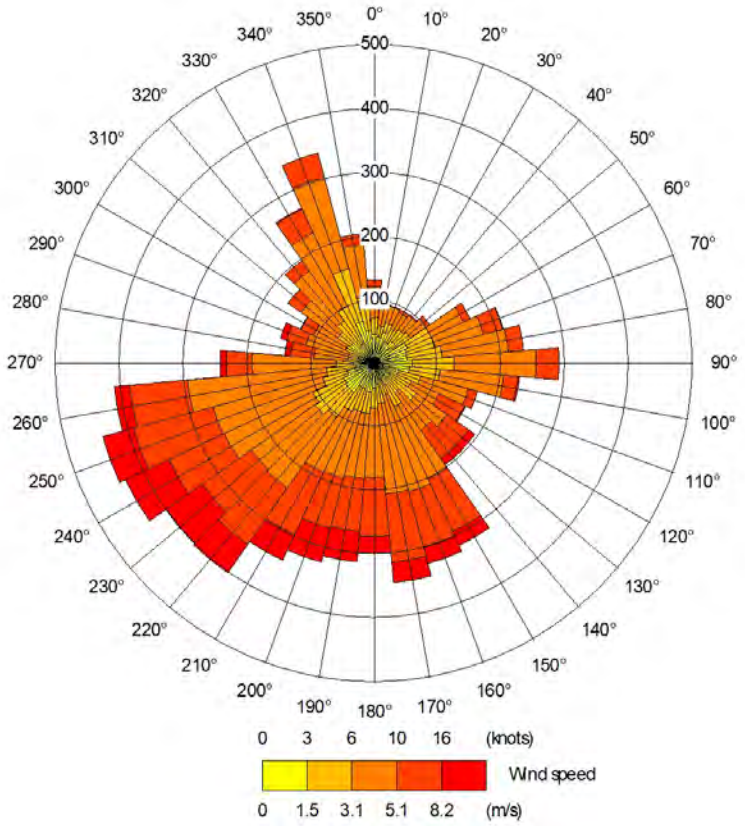
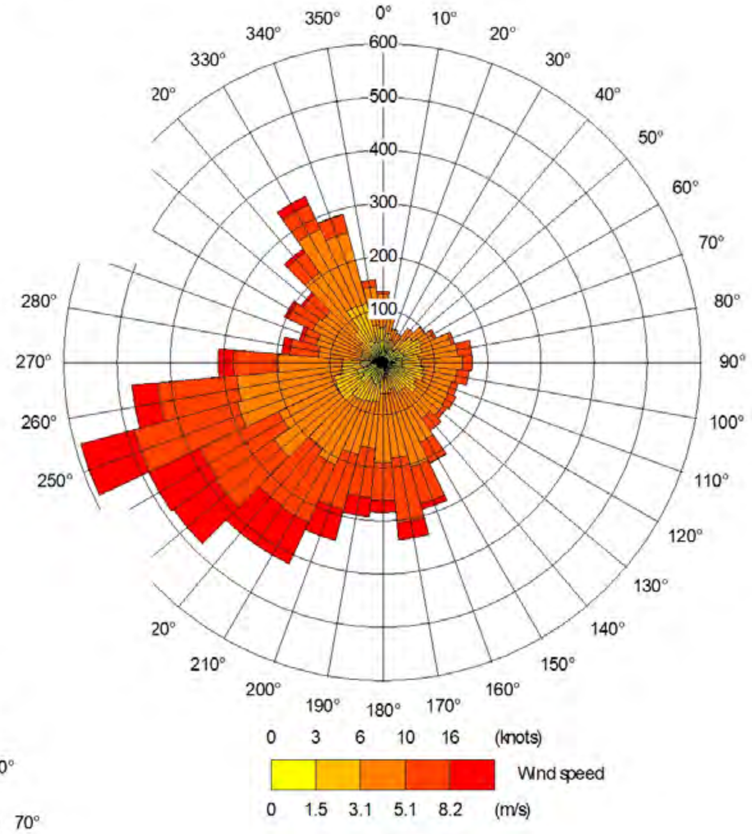
2013



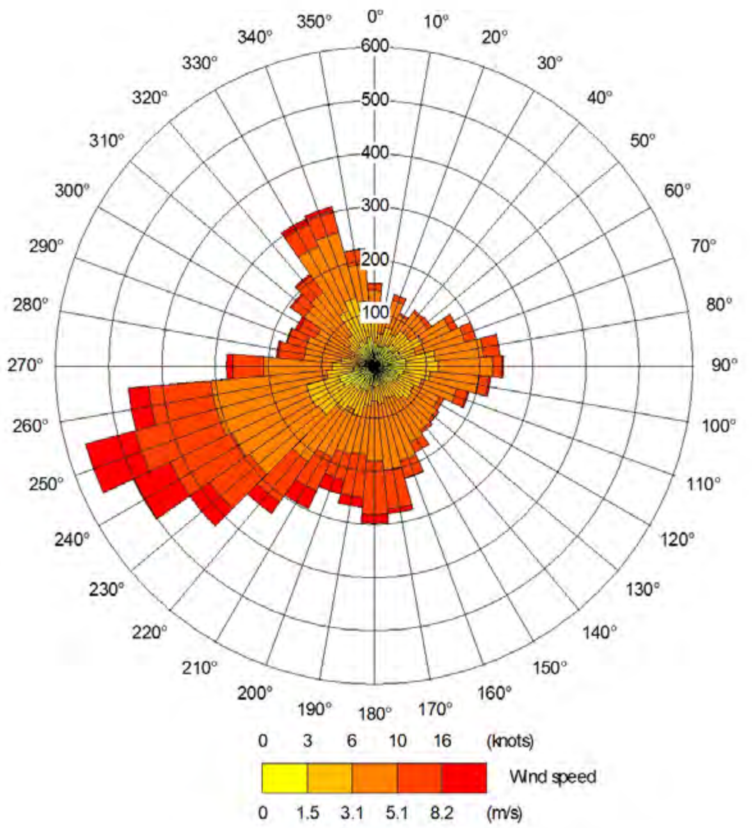
2014



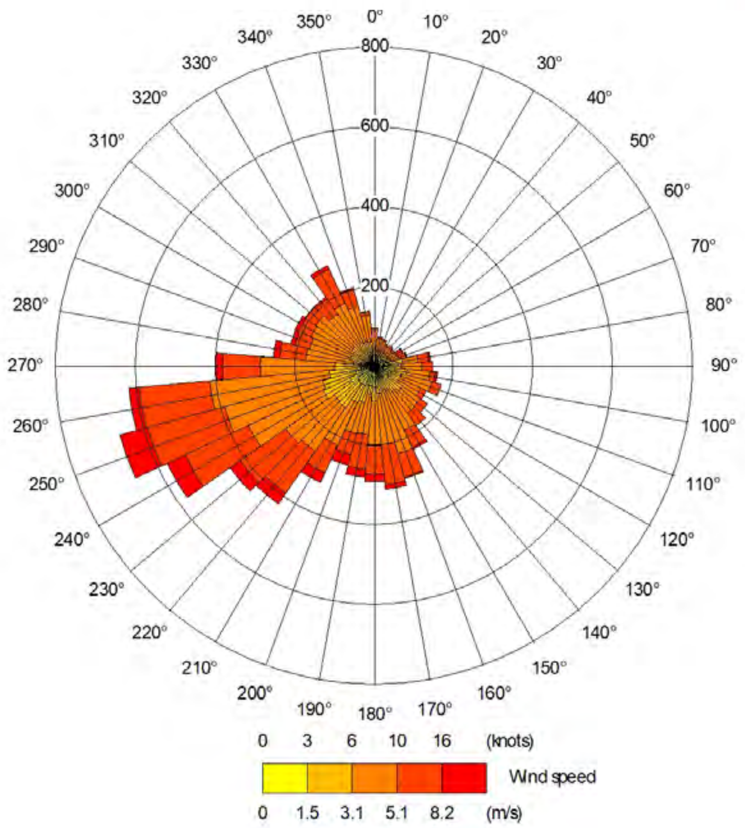
2015



2016



2017



Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 11 - Wind Roses - Shawbury 2013 to 2017
Drawn by: Rosalind Flavell	Date: 31/07/2021

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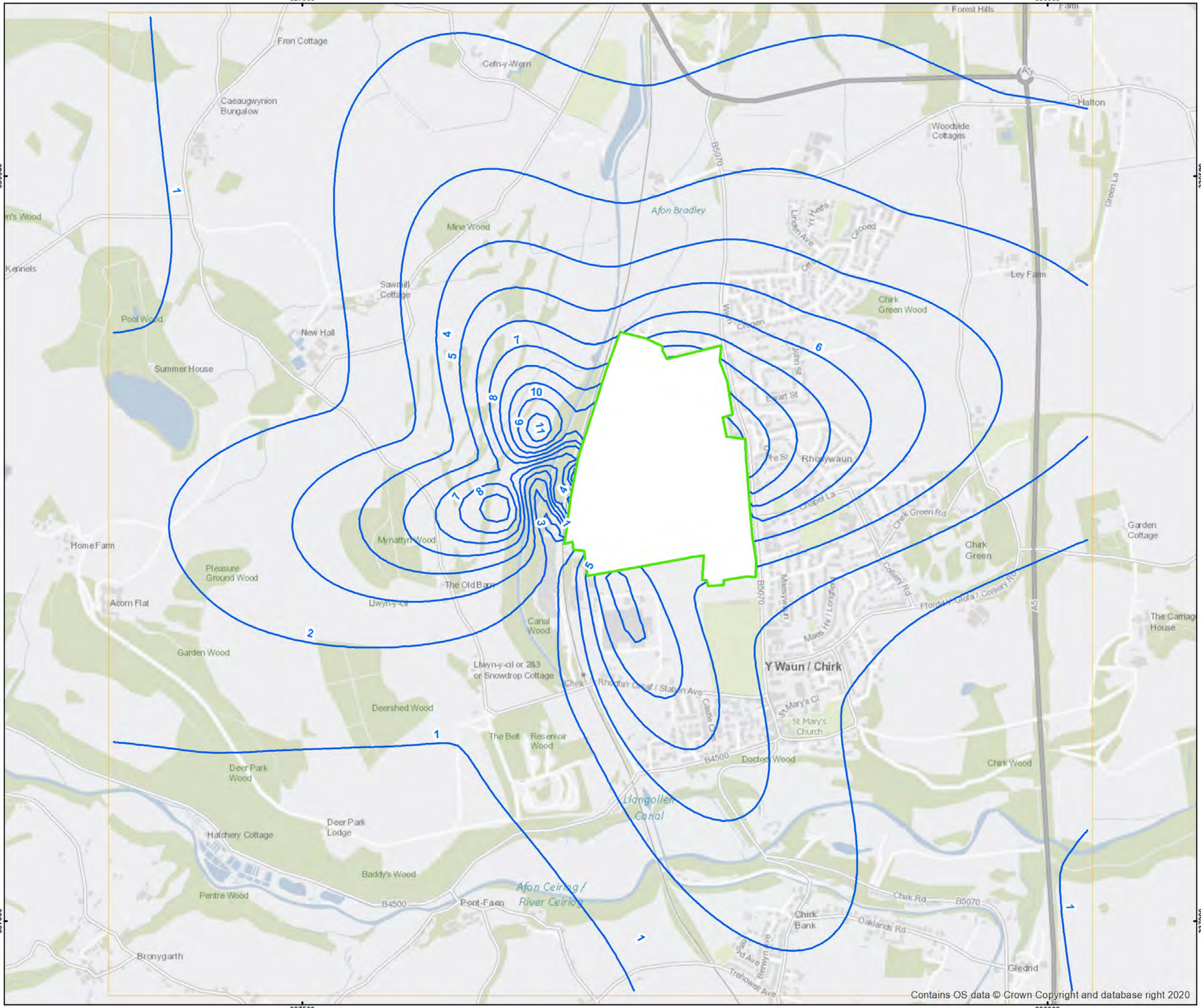

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 13 - Annual mean nitrogen dioxide
- normal operations
- likely emission scenario

Drawn by: Rosalind Flavell | Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

N

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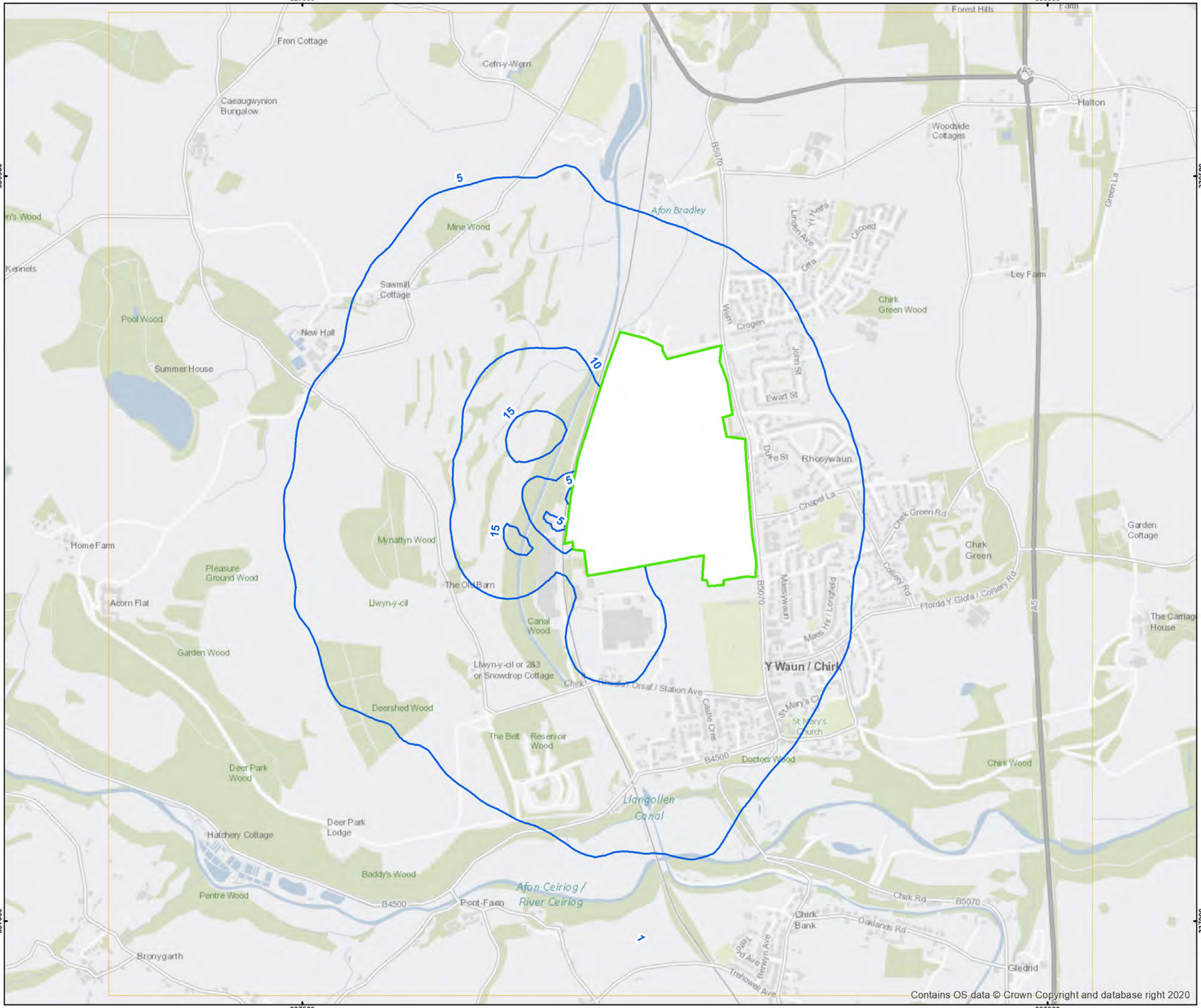

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 14 - 99.79%ile of 1-hour nitrogen dioxide - normal operations - likely emission scenario

Drawn by: Rosalind Flavell Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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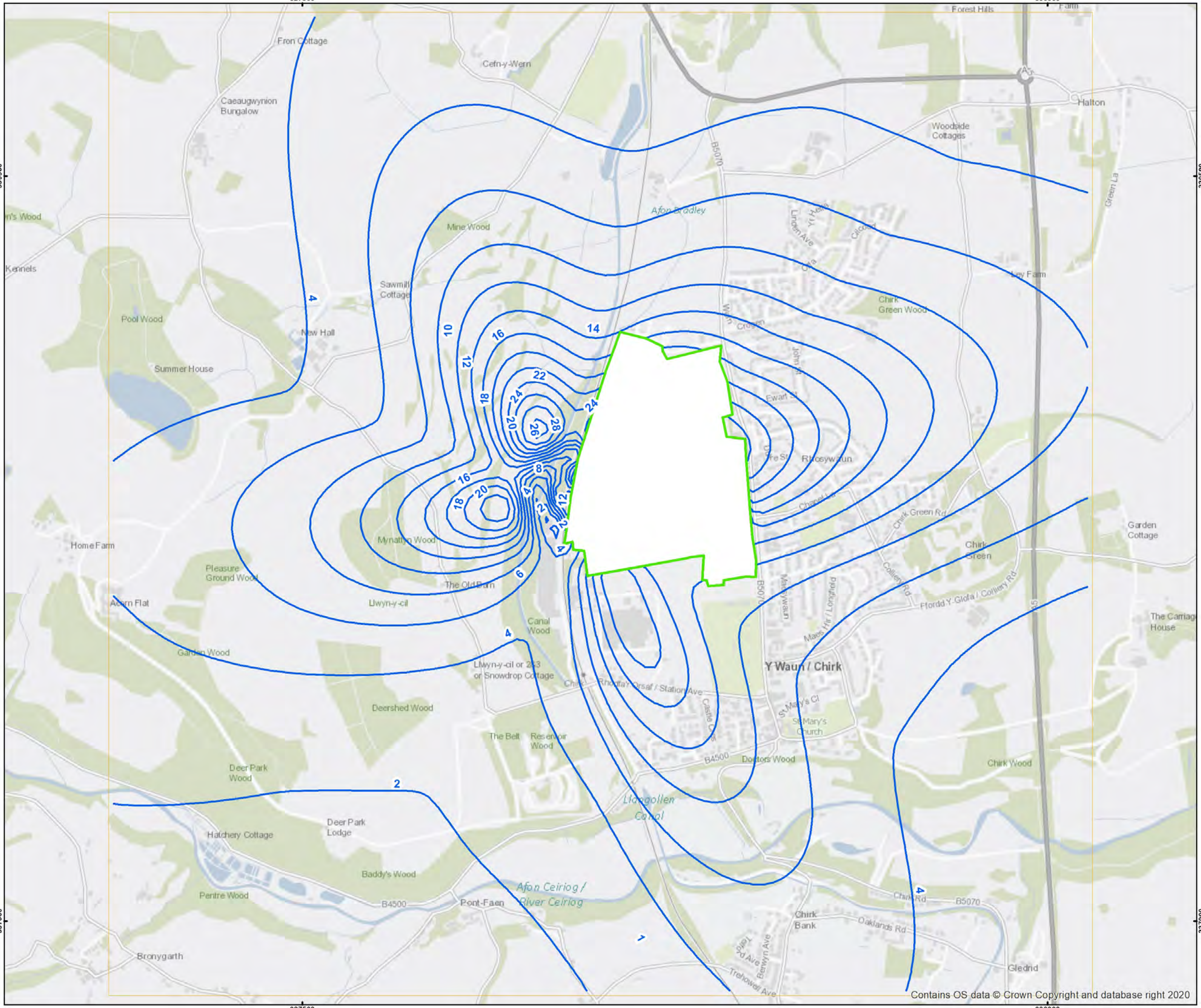

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 15 - Annual mean nitrogen dioxide
- normal operations
- worst case emission scenario

Drawn by: Rosalind Flavell | Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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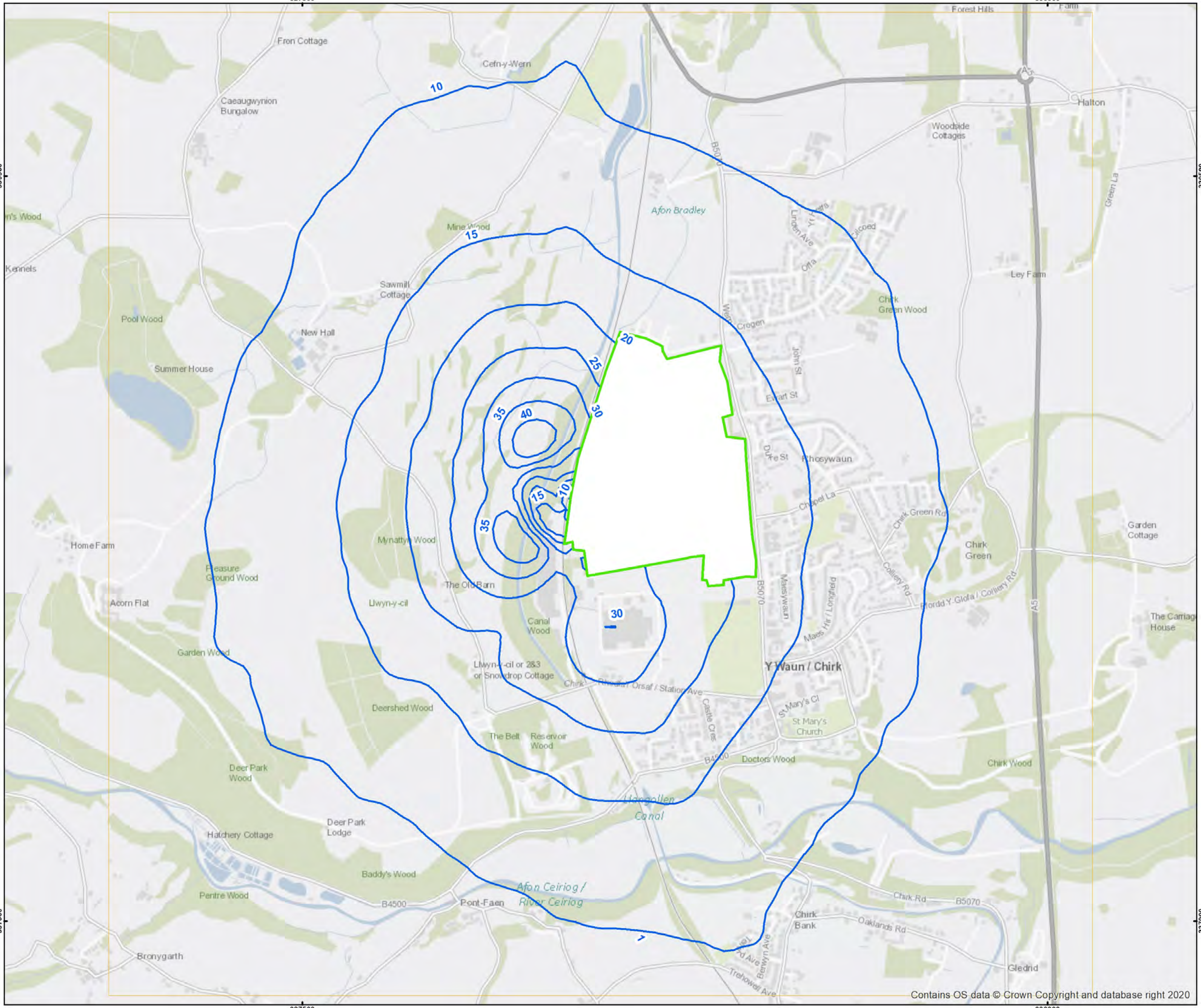

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 16 - 99.79%ile of 1-hour nitrogen dioxide - normal operations - worst case emission scenario

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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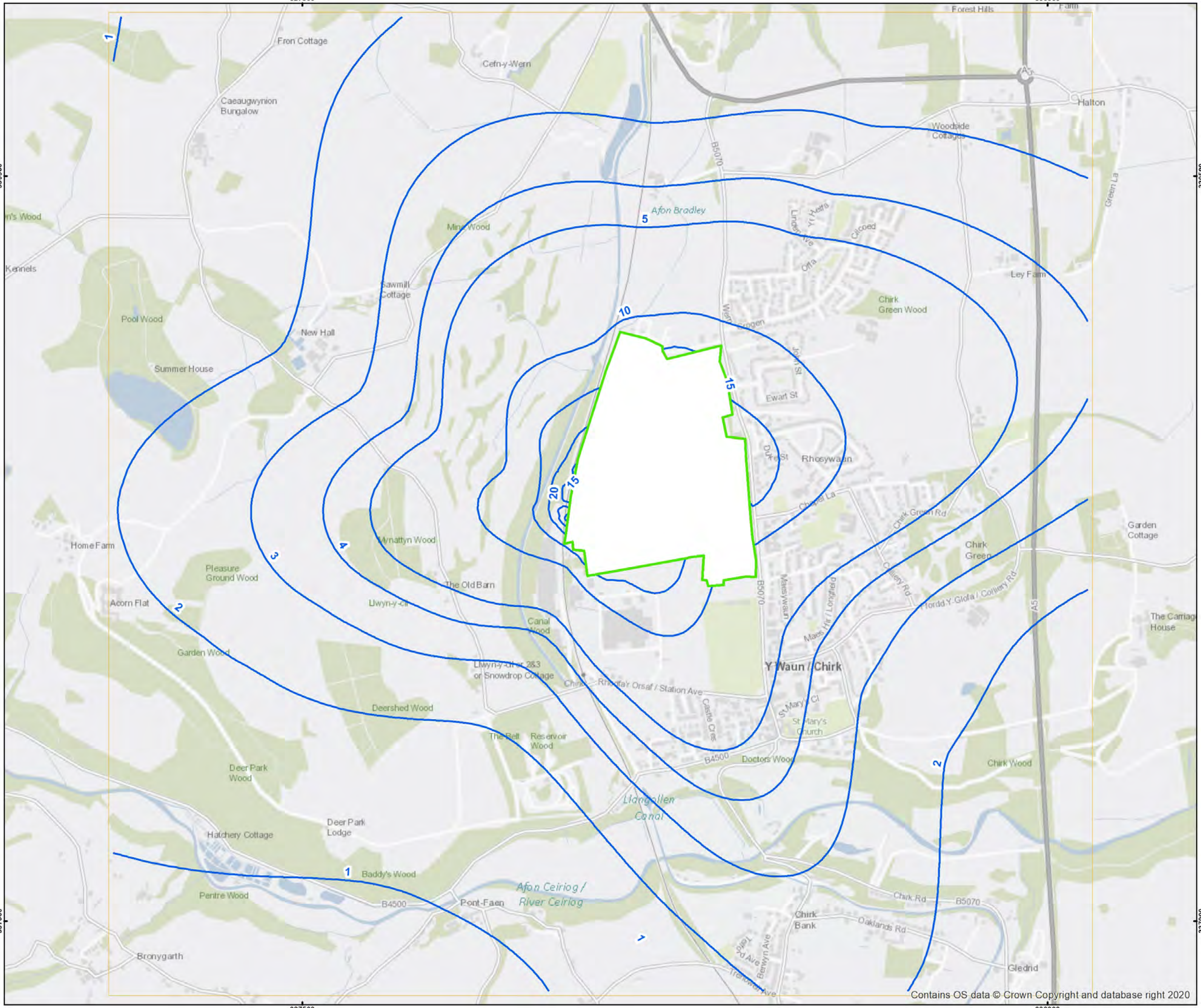

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL
- PEC < 70% of AQAL
- PEC > 70% of AQAL
- PEC > AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 17 - annual mean PM10 - normal operations
Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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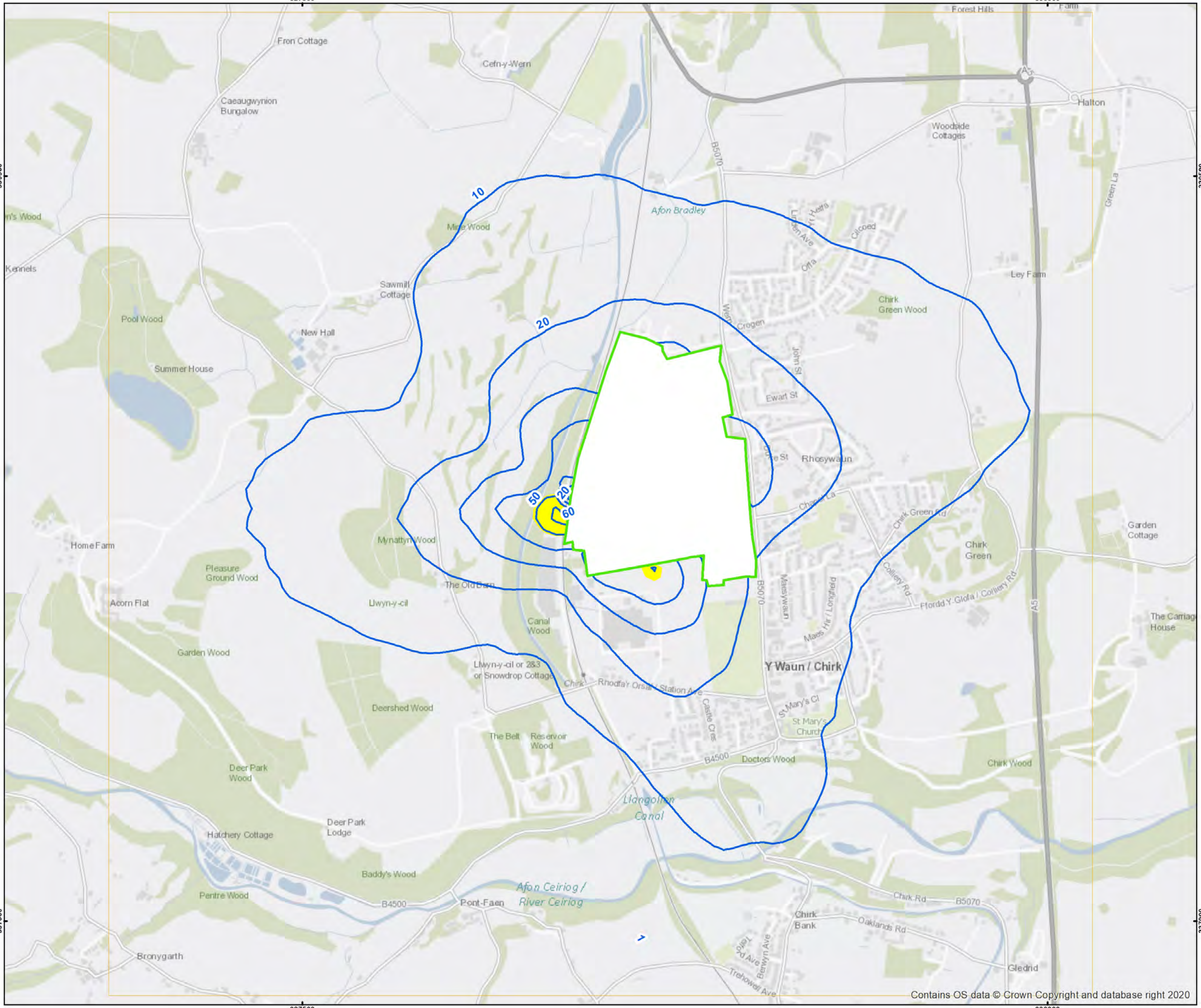

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL
- PEC < 70% of AQAL
- PEC > 70% of AQAL
- PEC > AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 18 - 90.41%ile of daily mean PM10 - normal operations

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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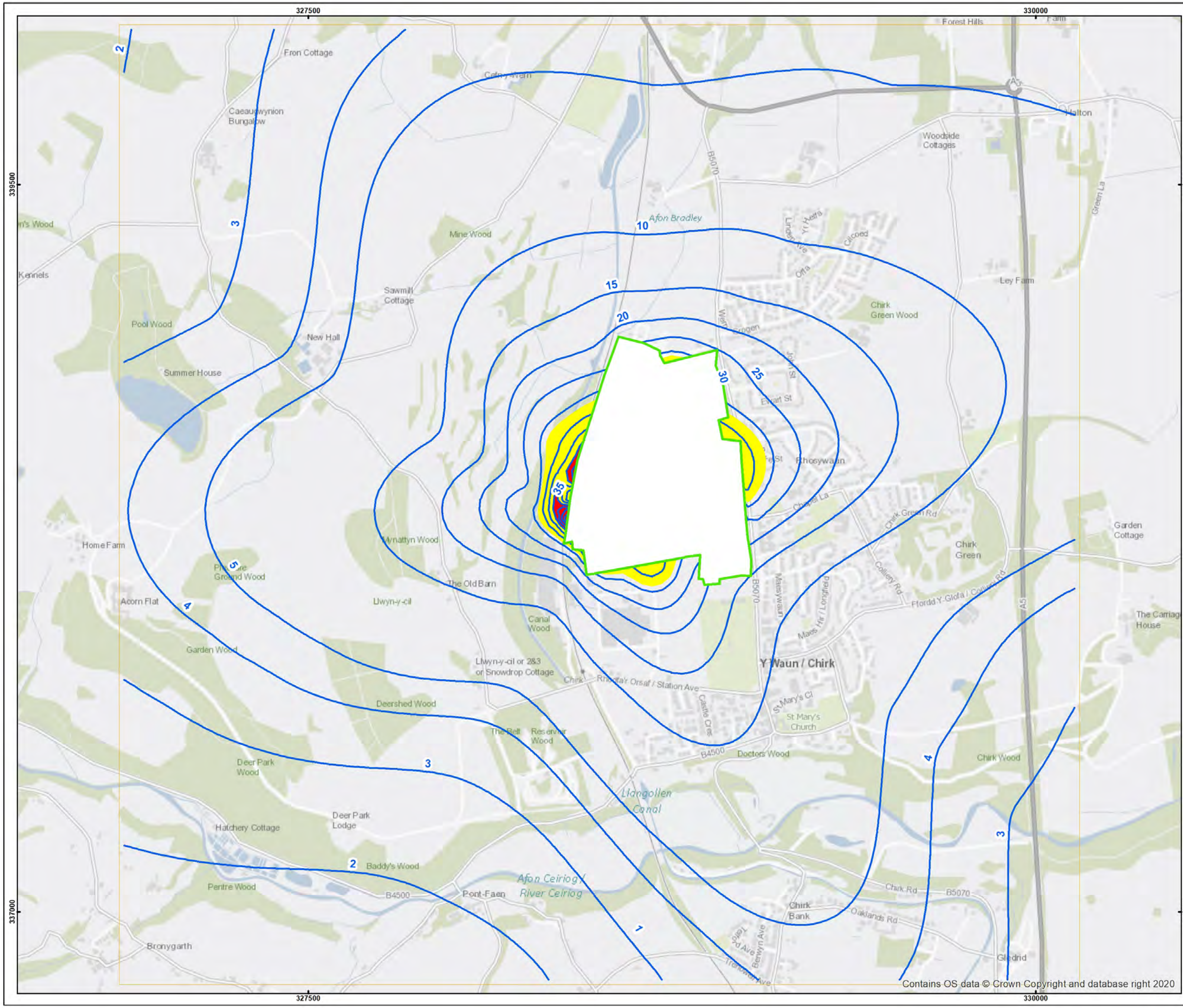

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL
- PEC < 70% of AQAL
- PEC > 70% of AQAL
- PEC > AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 19 - annual mean PM2.5 - normal operations
Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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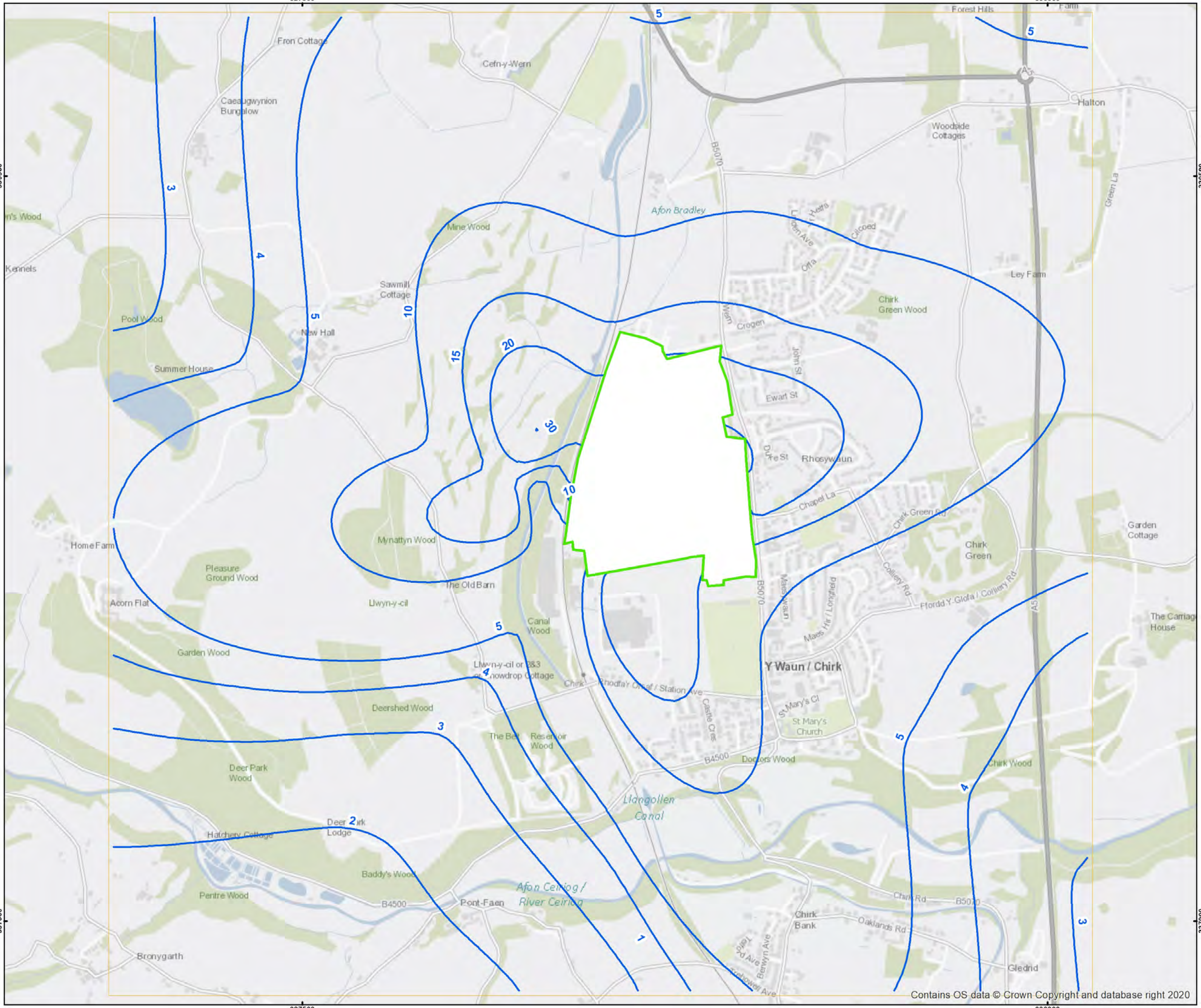

Legend

- Installation Boundary
- Modelling domain
- % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 20 - annual mean formaldehyde - normal operations

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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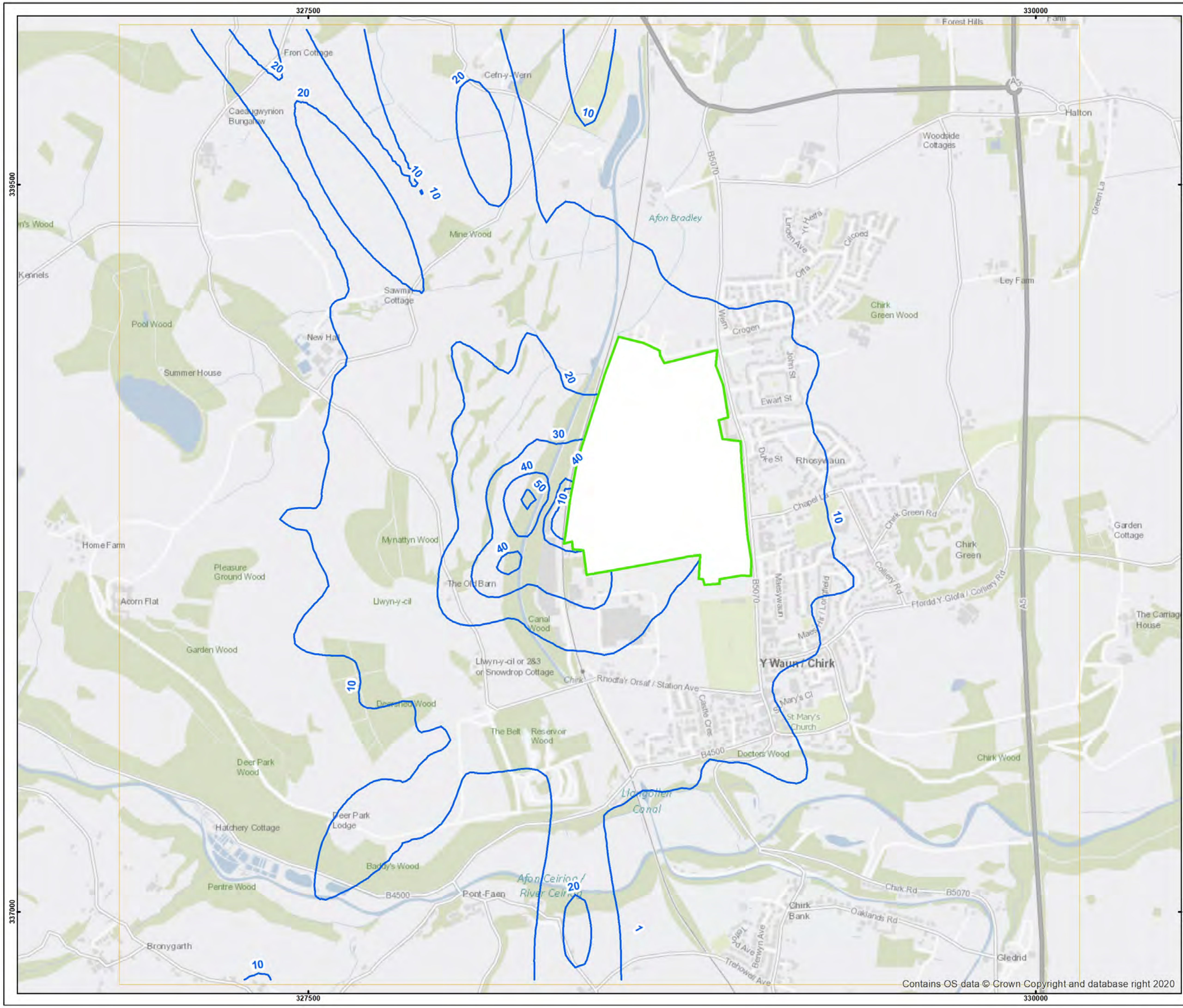

Legend

- Installation Boundary
- Modelling domain
- % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 21 - Maximum hourly mean formaldehyde - normal operations

Drawn by: Rosalind Flavell | Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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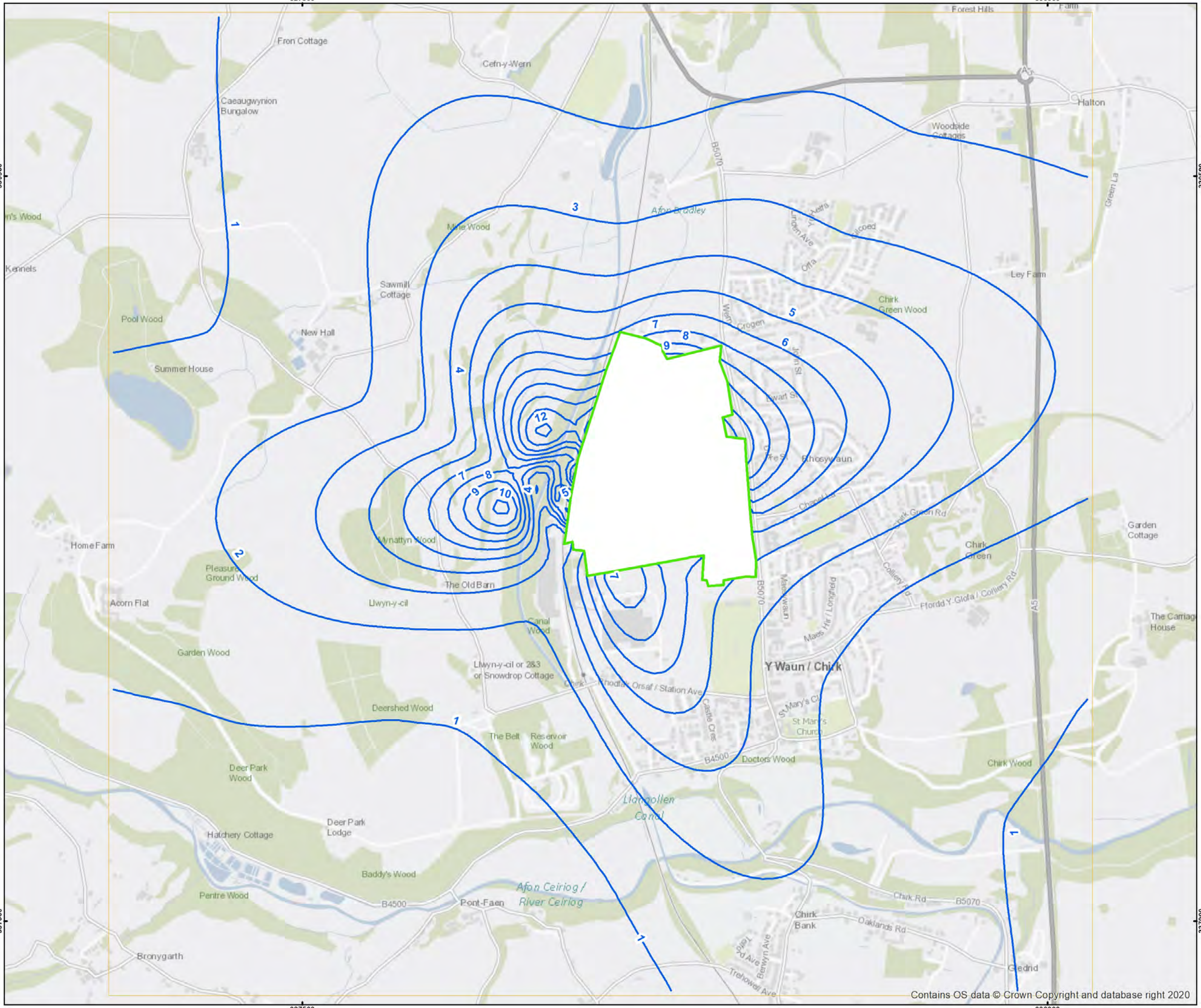

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 22 - Annual mean nitrogen dioxide - MDF 2 Offline - likley emissions scenario
Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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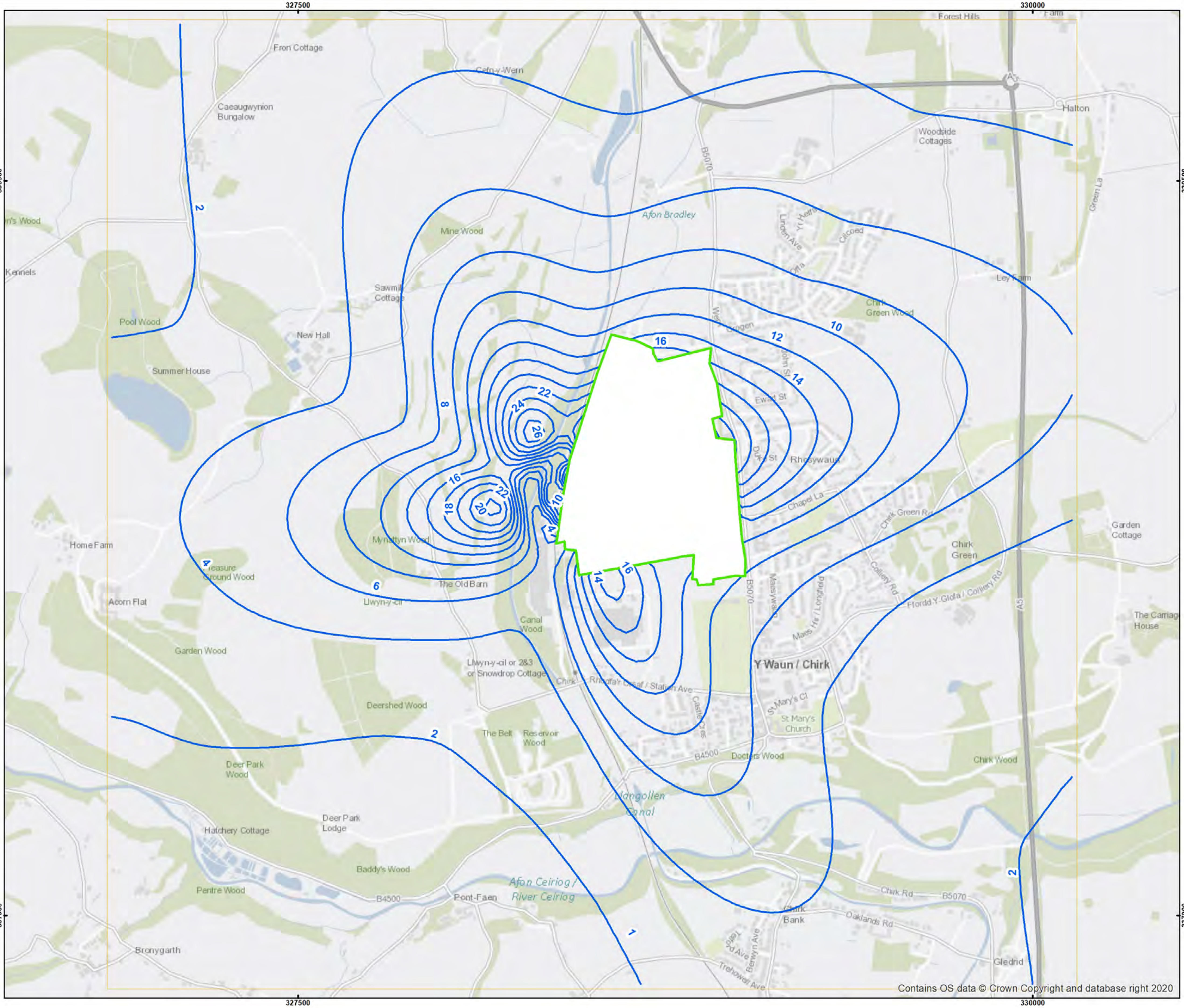

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 24 - Annual mean nitrogen dioxide
- MDF 2 Offline
- worst case emissions scenario

Drawn by: Rosalind Flavell | Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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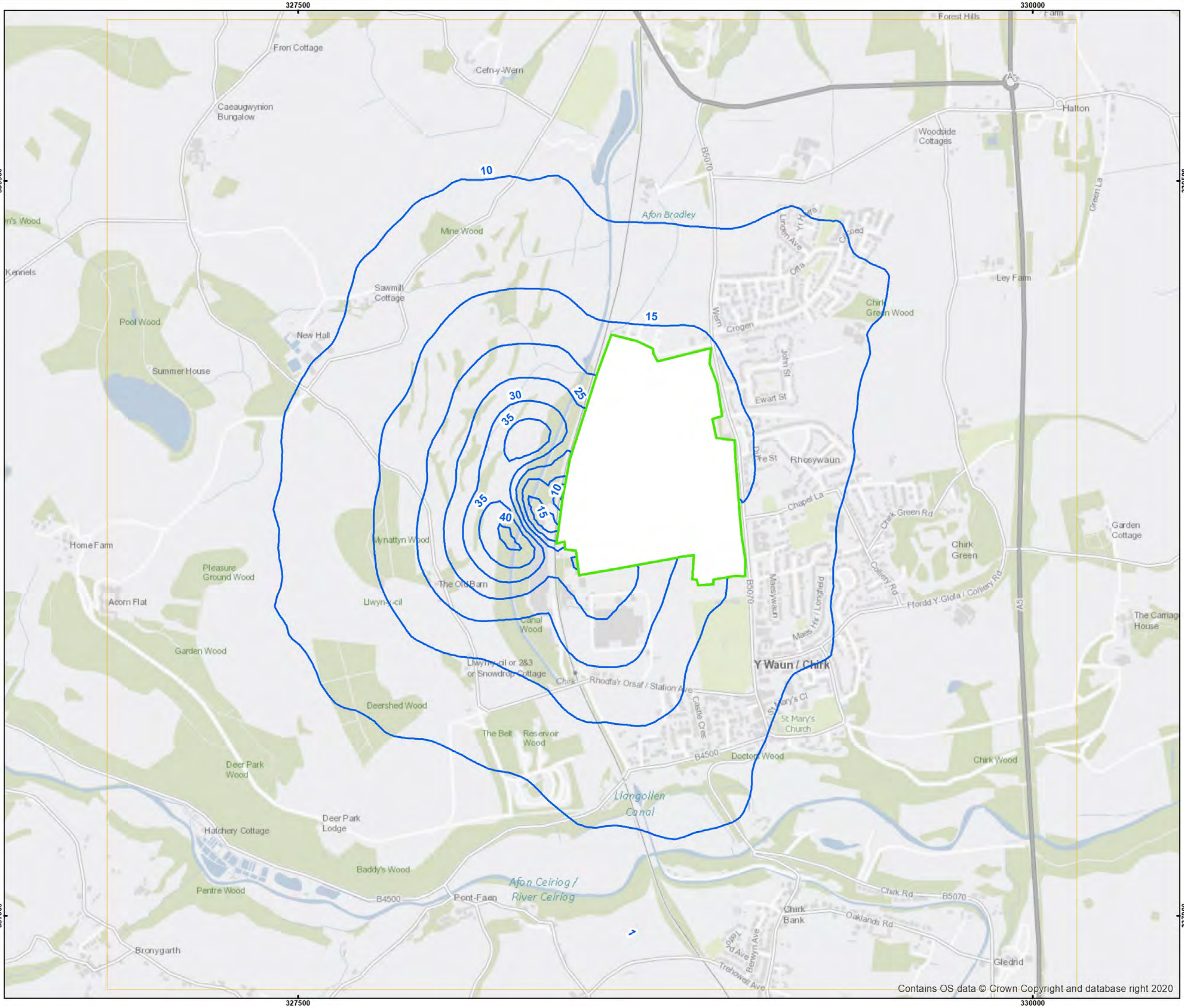

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 25 - 99.79%ile of 1-hour mean nitrogen dioxide - MDF 2 Offline - worst case emissions scenario

Drawn by: Rosalind Flavell | Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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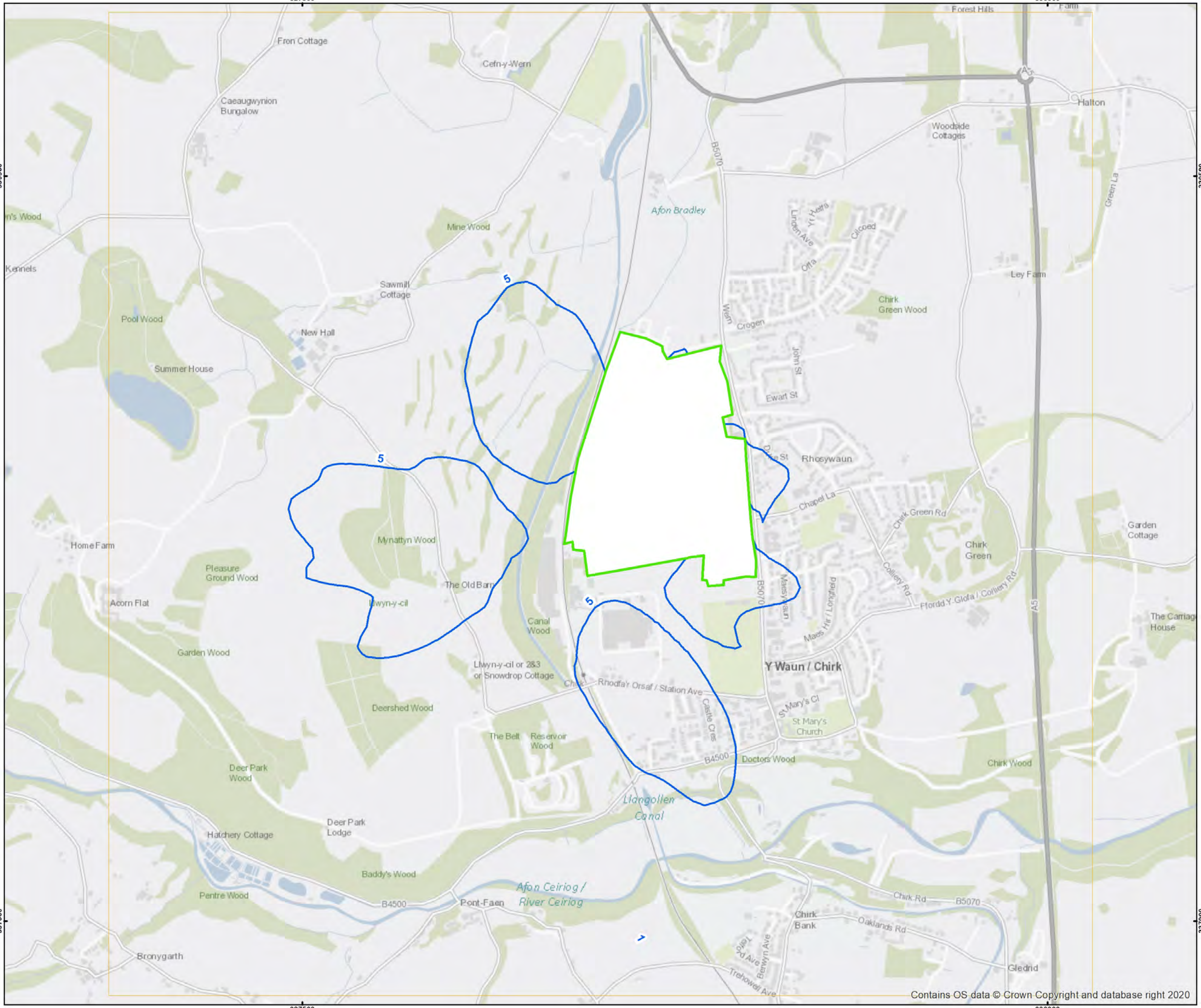

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL
- PC < 10% of AQAL
- PC > 10% of AQAL

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 26 - 99.18%ile of daily mean sulphur dioxide - MDF 2 Offline

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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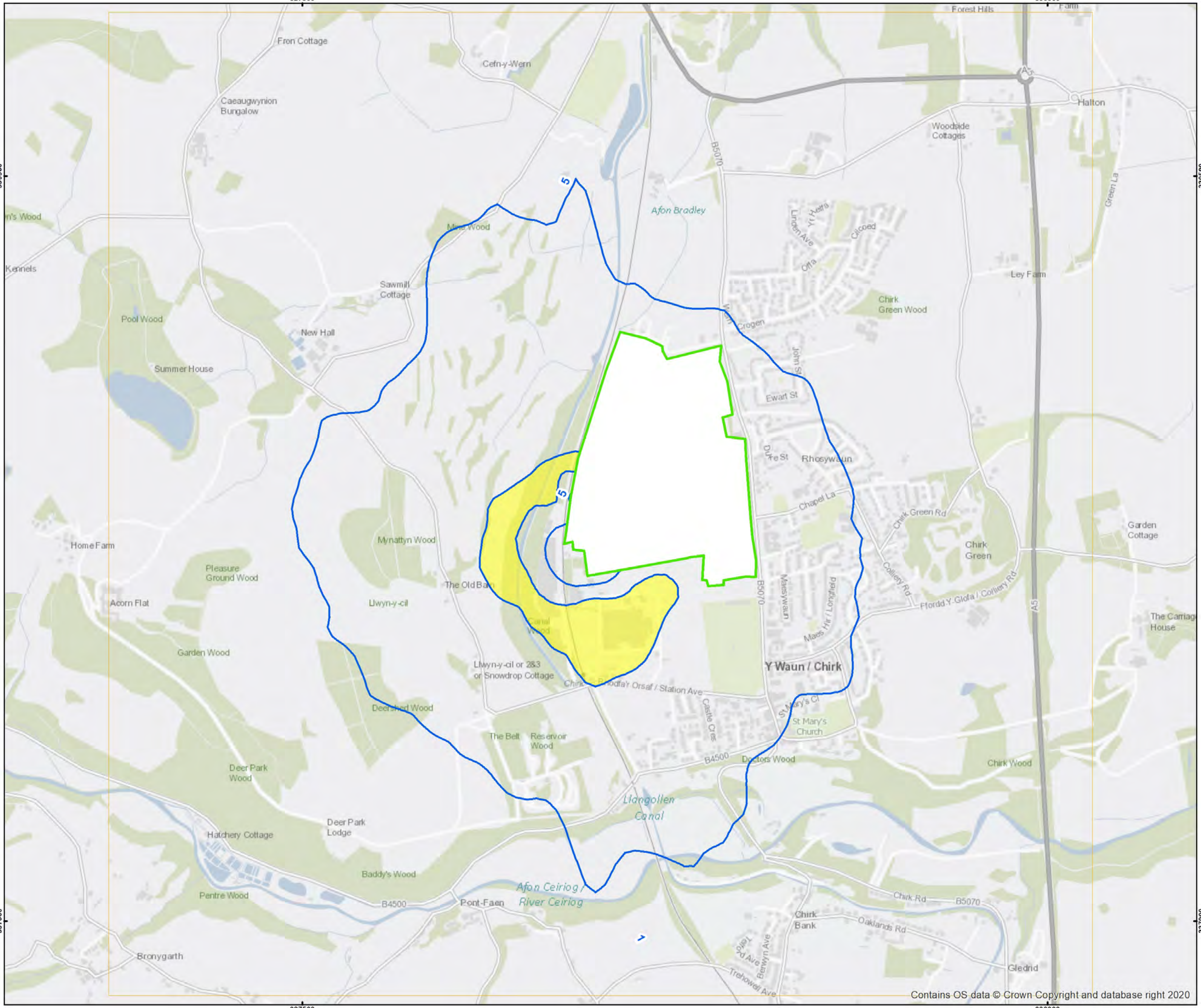

Legend

- Installation Boundary
- Modelling domain
- PC as % of AQAL
- PC < 10%
- PC > 10%

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 27 - 99.9%ile of 15-min mean sulphur dioxide
- MDF 2 Offline

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

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Scale: 1:12,000

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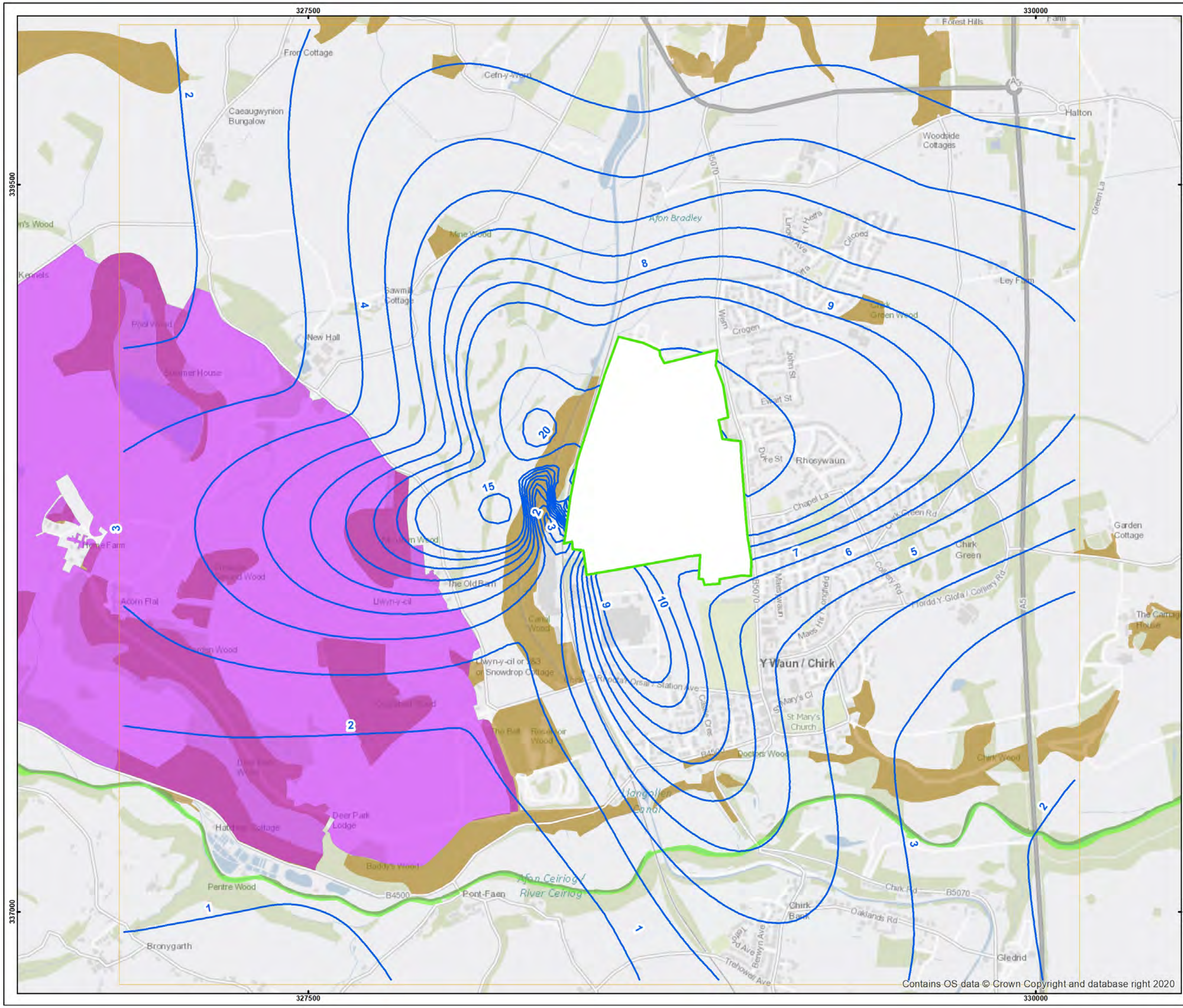

Legend

- Installation Boundary
- Modelling domain
- PC as % of CL
- SAC
- SSSI
- Ancient Woodland

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 28 - Annual mean NOx
- normal operations
- likely emission scenario

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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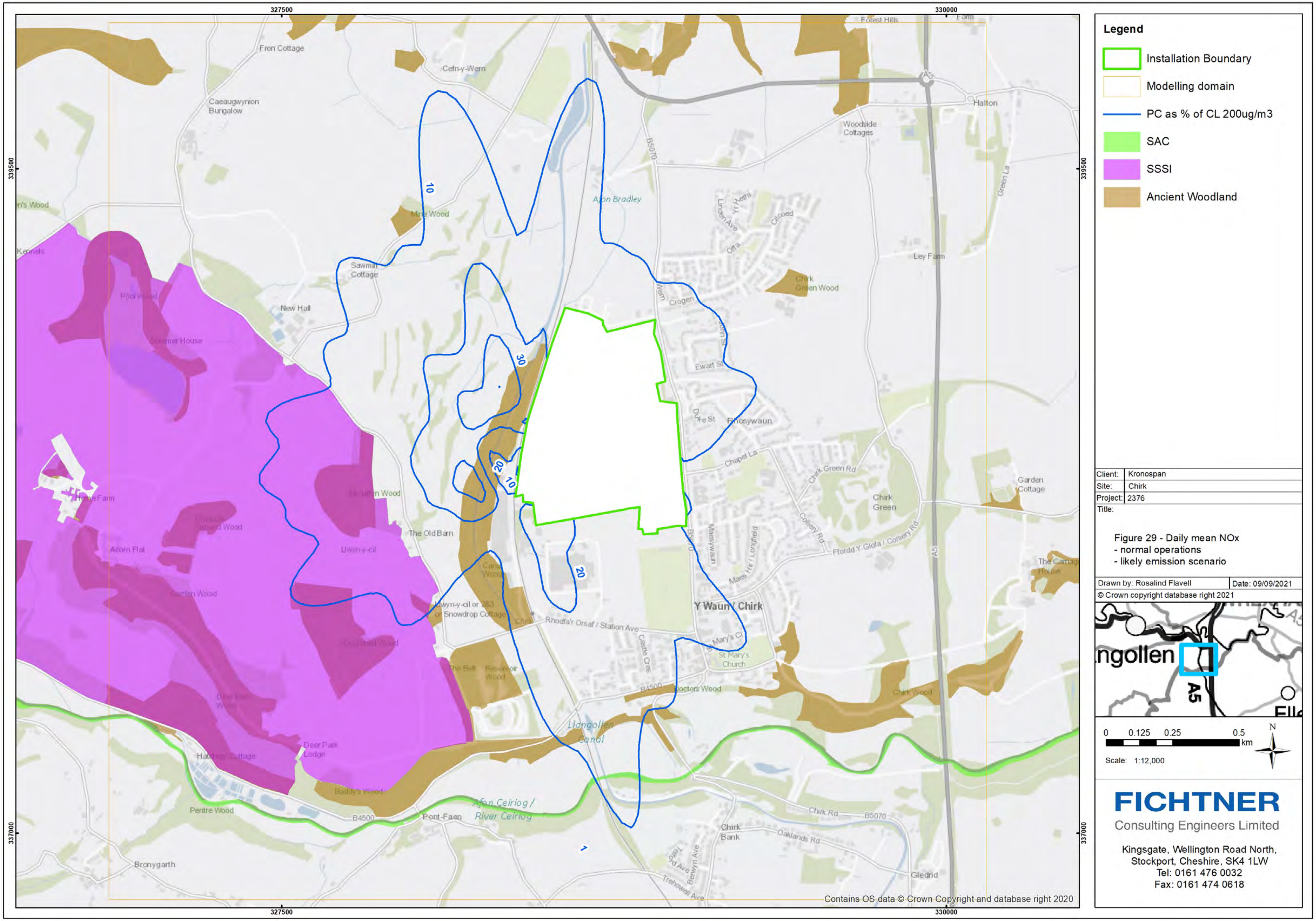

Legend
Installation Boundary
Modelling domain
PC as % of CL 200ug/m3
SAC
SSSI
Ancient Woodland
Client: Kronospan
Site: Chirk
Project: 2376
Title:
Figure 29 - Daily mean NOx
- normal operations
- likely emission scenario
Drawn by: Rosalind Flavell
Date: 09/09/2021
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0 0.125 0.25 0.5 km
Scale: 1:12,000
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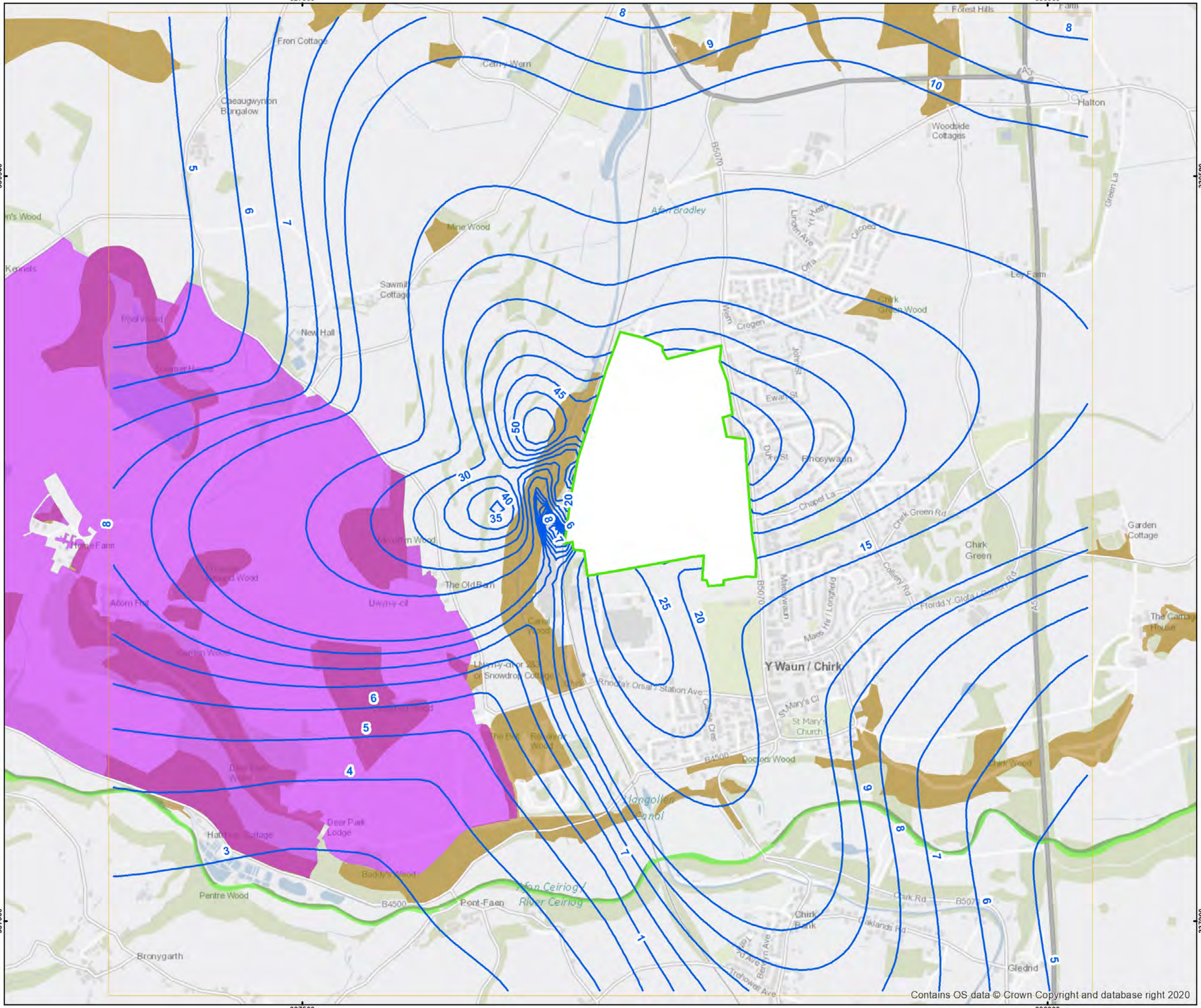

Legend

- Installation Boundary
- Modelling domain
- PC as % of CL
- SAC
- SSSI
- Ancient Woodland

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	

Figure 30 - Annual mean NOx
- normal operations
- worst case emission scenario

Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

Scale: 1:12,000

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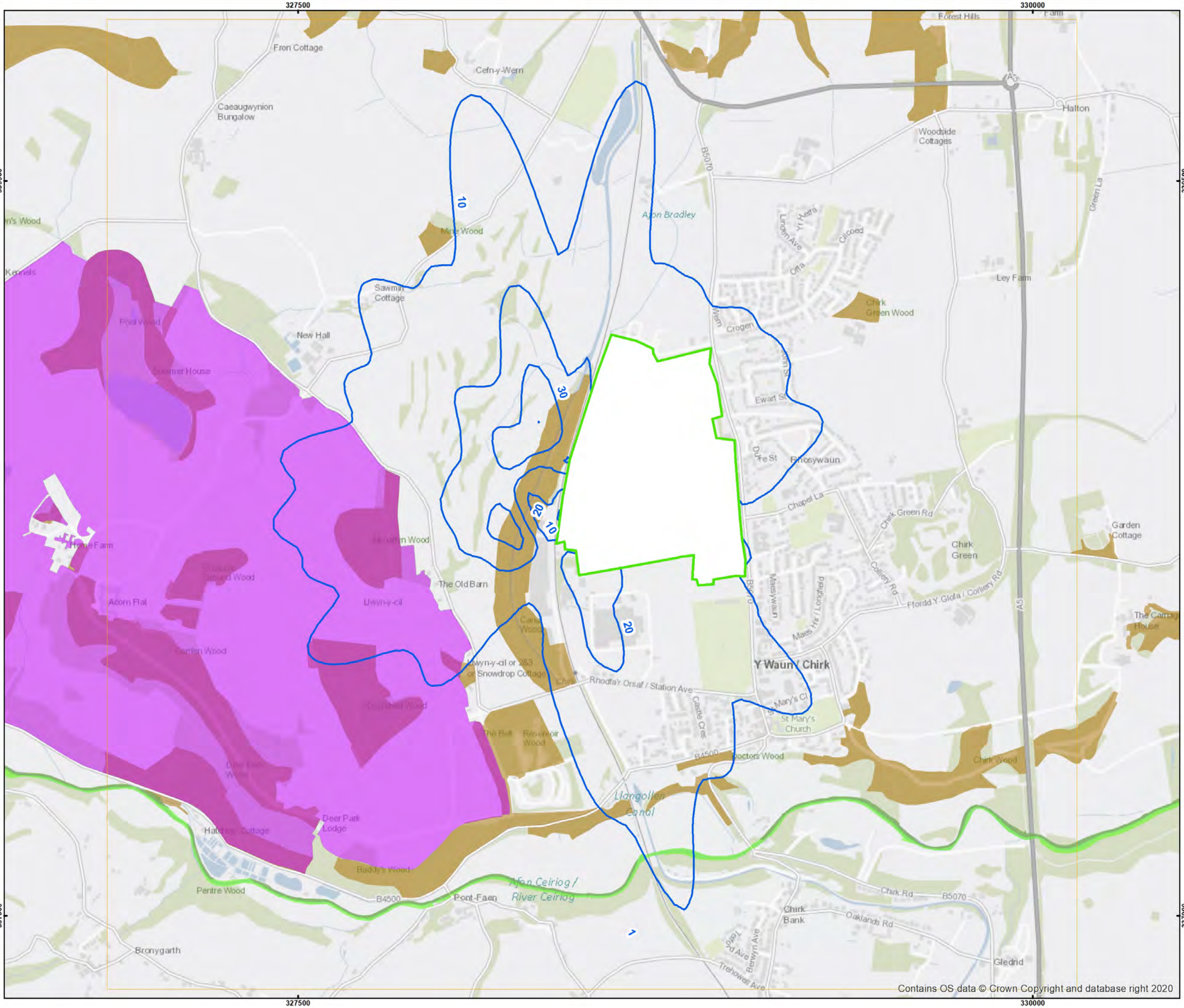

Legend

- Installation Boundary
- Modelling domain
- PC as % of CL 200ug/m3
- SAC
- SSSI
- Ancient Woodland

Client:	Kronospan
Site:	Chirk
Project:	2376
Title:	Figure 31 - Daily mean NOx - normal operations - worst case emission scenario
Drawn by: Rosalind Flavell	Date: 09/09/2021

0 0.125 0.25 0.5 km

N

Scale: 1:12,000

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B Source Inputs

The following section details the source input data for each item of plant. The ELVs are as set out in the EP application.

For K7 biomass plant emissions of CH_2O, HCl and HF have been included as requested by NRW. The emissions of CH_2O have been taken from the monitored data, and emissions of HCl and HF from the large combustion plant BREF as a daily average.

The emissions from the WESP 32 are those from the contrioll presses, a correction has been made for the temperature to account for the temperature loss through the ducting from the monitoring duct which is closer to the abatement system.

Table 36: Source Data

Parameter	Unit	A1	A5	A6	WESP 32	MDF 1	MDF 2	WESP 21	K1	K5	K6	Gas Engines
Height	m	25.0	17.5	16.0	65.5	50.0	57.0	50.0	10.2	14.5	21.4	22.0
Internal diameter	m	0.50	1.65	0.90	4.80	1.80	2.96	4.00	0.50	1.00	1.60	1.20
Temperature	°C	248	29	35.5	22	63	73	57	168	310	310	206
Volumetric flow rate	Am^3/s	3.97	28.47	6.67	91.76	56.18	115.57		1.04	9.30	10.88	21.40
Exit velocity	m/s	20.2	13.3	10.5	5.1	22.1	16.8	6.0	5.3	11.8	5.4	18.9
Moisture content	%	5.3	-	-	-	12.0	12.0	6.0	14.8	15.1	15.1	9.7
Oxygen content	% dry basis	5.7	-	-	-	19.0	19.0	18.0	5.3	3.1	3.1	11.4
Volumetric flow rate	Nm^3/s	3.05	25.62	5.79	84.92	40.17	80.25	76.25	0.48	3.68	4.30	6.59
Reference conditions	-	273K, no correction of oxygen or moisture	273K, no correction of oxygen or moisture	273K, no correction of oxygen or moisture	273K, no correction of oxygen or moisture	dry, 273K, no correction for oxygen	dry, 273K, no correction for oxygen	dry, 273K, 18% reference oxygen	dry, 273K, 3% reference oxygen	dry, 273K, 3% reference oxygen	dry, 273K, 3% reference oxygen	dry, 273K, 3% reference oxygen
ELV												
NOX emissions	mg/Nm^3	-	-	-	-	250	250	250	200	200	200	280
NOX emissions (Typical)	mg/Nm^3	-	-	-	-	100	100	100	-	-	-	-
CO	mg/Nm^3	-	-	-	-	-	-	-	-	-	-	-
PM	mg/Nm^3	-	20	20	15	20	20	30	-	-	-	-
TVOC	mg/Nm^3	-	50	50	100	120	120	200	-	-	-	-
CVOC	mg/Nm^3	-	-	-	-	-	-	-	-	-	-	-
CH20	mg/Nm^3	5	5	5	15	15	15	15	-	-	-	-
VOC	mg/Nm^3	-	50	50	-	120	120	200	-	-	-	-
Emission rate												
NOX emissions	g/s	-	-	-	-	10.043	20.063	15.666	0.096	0.736	0.861	1.641
NOX emissions (Typical)	g/s	-	-	-	-	4.017	8.025	6.267	-	-	-	-
CO	g/s	-	-	-	-	-	-	-	-	-	-	-
PM	g/s	-	0.512	0.116	1.274	0.803	1.605	1.880	-	-	-	-
TVOC	g/s	-	1.281	0.289	8.492	4.820	9.630	12.533	-	-	-	-
CVOC	g/s	-	-	-	-	-	-	-	-	-	-	-
CH20	g/s	0.015	0.128	0.029	1.274	0.603	1.204	0.940	-	-	-	-
VOC	g/s	-	1.281	0.289	-	4.820	9.630	12.533	-	-	-	-

Table 37: Source Data

Parameter	Unit	K7		K8	
Height	m	36.5		70.0	
Internal diameter	m	1.9		1.69	
Temperature	°C	359		175	
Volumetric flow rate	Am^3/s	95.72		26.54	
Exit velocity	m/s	33.8		11.8	
Moisture content	%	11.0		11.0	
Oxygen content	% dry basis	11.6		11.6	
Volumetric flow rate	Nm^3/s	23.02		9.00	
Reference conditions	-	dry, 273K, 6% reference oxygen		dry, 273K, 6% reference oxygen	
Emissions		**mg/Nm^3**	**g/s**	**mg/Nm^3**	**g/s**
NOx		250	5.755	300	2.701
CO		650	14.964	75	0.675
PM		50	1.151	15	0.135
TVOC		-	-	15	0.135
CH20		0.5	0.011	-	-
VOC		-	-	15	0.135
HCl		35	0.806	15	0.135
SO2		200	4.604	75	0.675
HF		2	0.035	3	0.027
NH3		-	-	15	0.135
Other metals (1)		-	-	0.5	4.502 mg/s
Cd and Tl		-	-	0.05	0.450 mg/s
Hg		-	-	0.05	0.450 mg/s
Dioxins and furans		-	-	0.1 ng/Nm^3	0.900 ng/s
Benzo(a)pyrene (PaHs)(2)		-	-	0.3 $\mu g/Nm^3$	2.701 µg/s
PCBs(3)		-	-	7.5 $\mu g/Nm^3$	67.528 µg/s

NOTES:

(1) Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

(2) The maximum concentration of BaP recorded at a UK plant is 0.2 $\mu g/Nm^3$ (2019 Waste Incineration BREF, Figure 8.121). This is assumed to be the emission concentration for the K8 converted to 6% reference oxygen content.

(3) Table 3.8 of the 2006 Waste Incineration BREF states that the annual average total PCBs is less than 0.005 mg/Nm^3 (dry, 11% oxygen, 273K). In lieu of other available operational data, this has been assumed to be the emission concentration for the Facility, converted to 6% reference oxygen content.

Table 38: Source Data

Parameter	Unit	Press abatement system (testing only)	
Height	m	22	
Internal diameter	m	2.33	
Temperature	°C	32	
Volumetric flow rate	Am^3/s	94.87	
Exit velocity	m/s	22.2	
Moisture content	%	-	
Oxygen content	% dry basis	-	
Volumetric flow rate	Nm^3/s	84.92	
Reference conditions	-	273K, no correction of oxygen or moisture	
Emissions		**mg/Nm^3**	**g/s**
PM		15	1.274
TVOC		100	8.492
CH20		15	1.274
VOC		100	8.492

Table 39: Drier Emissions

Scenario		**MDF 1 Offline**	**MDF 2 Offline**		**MDF 1 and 2 Offline**
Parameter	Unit	MDF 2	MDF 1	Gas Engine x 1	
Sources		K7, K8 and 4 gas engines	K7, K8 and 2 gas engines	1 engine to dedicated stack	All to own stacks (see Table 36 for inputs)
Height	m	57.0	50.0	22.0	-
Internal diameter	m	2.96	1.80	1.20	-
Temperature	°C	73	63	206	-
Volumetric flow rate	Am3/s	115.57	56.18	21.40	-
Exit velocity	m/s	16.8	22.1	18.9	-
Emission rate					-
NOX emissions	g/s	20.063	10.043	1.641	-
NOX emissions (Typical)	g/s	8.025	4.017	-	-
CO	g/s	15.649	15.649	-	-
PM	g/s	1.605	0.803	-	-
TVOC	g/s	9.630	4.82	-	-
CVOC	g/s	-	-	-	-
CH20	g/s	1.204	0.603	-	-
VOC	g/s	9.630	4.820	-	-
HCl	g/s	0.941	0.941	-	-
SO2	g/s	5.280	5.280	-	-
HF	g/s	0.093	0.093	-	-
NH3	g/s	0.135	0.135	-	-
Total Metals	mg/s	4.502	4.502	-	-
Cd and Tl	mg/s	0.450	0.450	-	-
Hg	mg/s	0.450	0.450	-	-
Dioxins and furans	ng/s	0.900	0.900	-	-
Benzo(a)pyrene (PaHs)	µg/s	2.701	2.701	-	-
PCB	µg/s	67.528	67.528	-	-

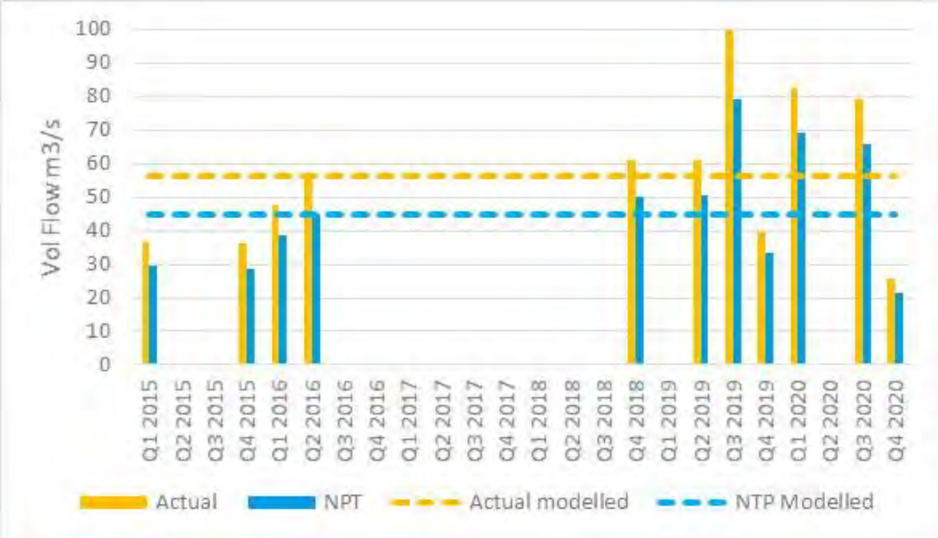
Table 40: Dust Filter Units

ID	Source	Flow rate (m^3/hr)	Flow rate (m^3/s)	Temperature (°C)	Height (m)	Diameter (m)	Dust load (mg/m^3)	Dust emission rate (g/s)
B01	MDF Finishing Line Sander	150,000	41.7	20	11.5	1.4	5	0.208
B02	MDF Finishing Line Kontra Saws	40,000	11.1	20	10.0	1	5	0.056
B03	MDF 2 Cross Cut Saw & Hoggers	50,000	13.9	20	19.8	1.8	5	0.069
B04	MDF 1 Cross Cut Saw & Hoggers	45,700	12.7	20	19.5	1.6	5	0.063
B05	MDF 1 404+405 De-dust	30,000	8.3	20	33.2	1.5	2	0.017
B06	MDF 2 Forming Extraction 423	147,300	40.9	20	14.7	2.8	5	0.205
B07	Particle Board General Line Extraction (423)	96,000	26.7	20	18.2	2.2	5	0.133
B08	Particle Board Hamatec Dust Cleaning	30,000	8.3	20	5.4	0.8	2	0.017
B09	Particle Board Core Layer De-dust	75,000	20.8	20	9.8	1.5	5	0.104
B10	Particle Board Surface Layer De-dust	60,000	16.7	20	9.8	1.5	5	0.083
B11	Particle Board Conidur De-dust	60,000	16.7	20	9.8	1.5	5	0.083
B12	Particle Board Mat Former	80,000	22.2	50	16.6	1.9	5	0.111
B13	Particle Board Sander	170,000	47.2	20	16.6	5.7	5	0.236
B14	Tongue & Groove	30,000	8.3	25	18.2	5.4	5	0.042
B15	Particle Board Ferro	38,000	10.6	80	19.3	7.5	5	0.053
B16	Melemine Faced P1 Press & Lath Machine	57,500	16.0	20	21.7	1.5	2	0.032
B17	Melemine Faced P2 MF Press	57,500	16.0	20	21.7	1.5	2	0.032
B18	Melemine Faced P3 MF Press	24,050	6.7	20	20.4	1.5	5	0.033
B19	Melemine Faced P4 MF Press	57,500	16.0		16.5	1.5	2	0.032

ID	Source	Flow rate (m^3/hr)	Flow rate (m^3/s)	Temperature (°C)	Height (m)	Diameter (m)	Dust load (mg/m^3)	Dust emission rate (g/s)
B20	Particle Board Pre-screening Zeno Extraction	43,020	12.0	20	16.5	1.4	5	0.060
B21	Particle Board Pre-screening Air Grader	90,000	25.0	20	13.2	0.9	0.15	0.004
B22	MDF 1 & 2 Boardbreaker Filter	25,000	6.9	20	9.2	1.1	5	0.035
B23	Chip Preparation Building TST Filter 1	25,000	6.9	50	14.5	1.2	5	0.035
B24	Chip Preparation Building TST Filter 2	25,000	6.9	50	14.5	1.2	5	0.035
B25	Chip Preparation Building - Line No.1	96,000	26.7	50	13.2	1.6	5	0.133
B26	Chip Preparation Building - Line No.2	60,000	16.7	20	8.7	1.5	2	0.033
B27	Kronoplus Extraction Silo Filter	9,800	2.7	20	13.3	0.4	5	0.014
B28	Kronoplus Worktop Line	70,000	19.4	20	12.3	1.3	5	0.097
B29	Kronoplus Flooring Line No.2 & Selco Saw	89,250	24.8	20	10.0	2.3	5	0.124
B30	Kronoplus Flooring Line No.1	105,000	29.2	20	11.2	1.8	2	0.058
B31	Kronoplus Flooring Line No.3	98,000	27.2	20	11.3	1.8	5	0.136

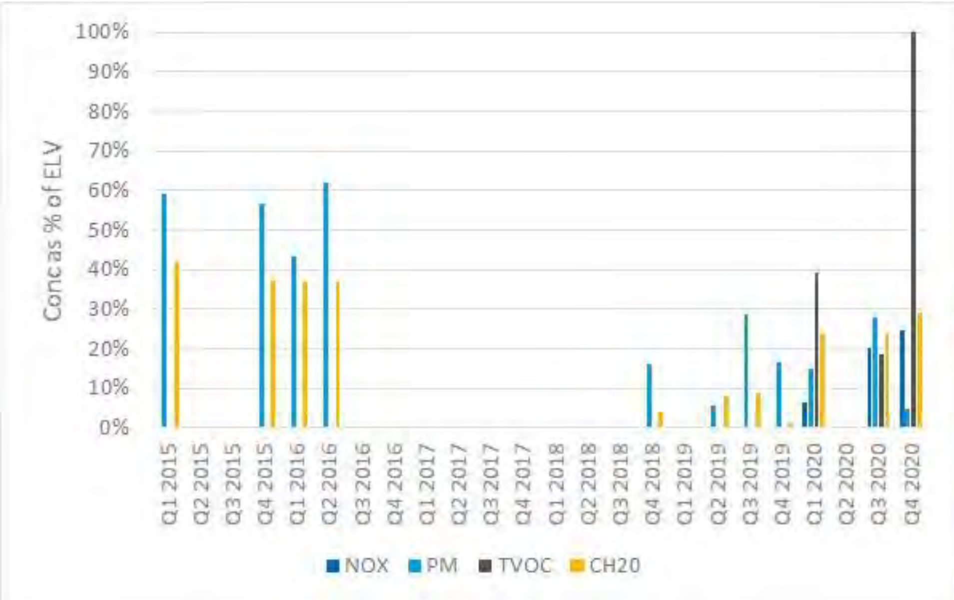
NOTES:
Modelled with vol flow rather than velocity in ADMS.

Figure 32: MDF 1 Cyclone Vol Flow Analysis



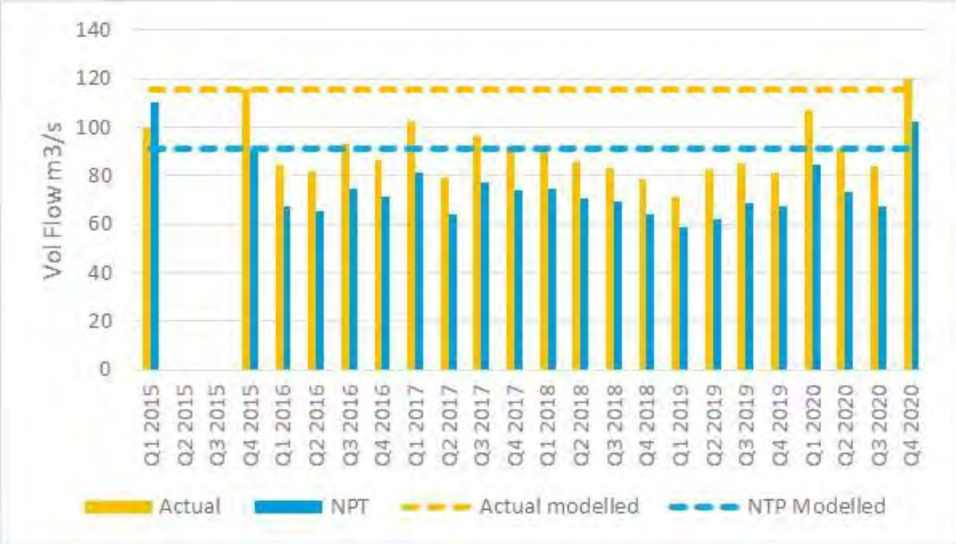
Source: Emissions Monitoring Reports

Figure 33: MDF 1 Cyclone Emissions Analysis



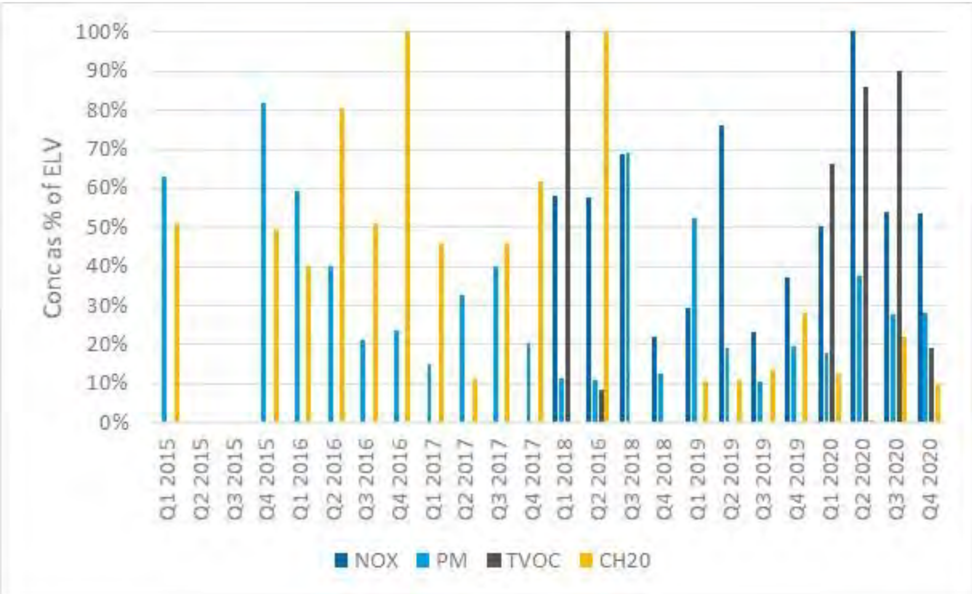
Source: Emissions Monitoring Reports

Figure 34: MDF 2 Cyclone Vol Flow Analysis



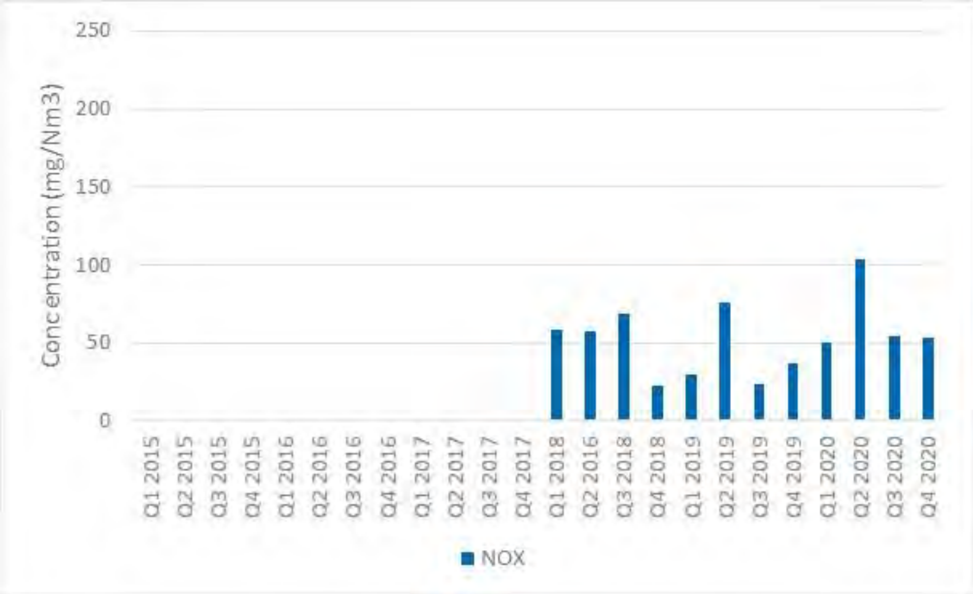
Source: Emissions Monitoring Reports

Figure 35: MDF 2 Cyclone Emissions Analysis



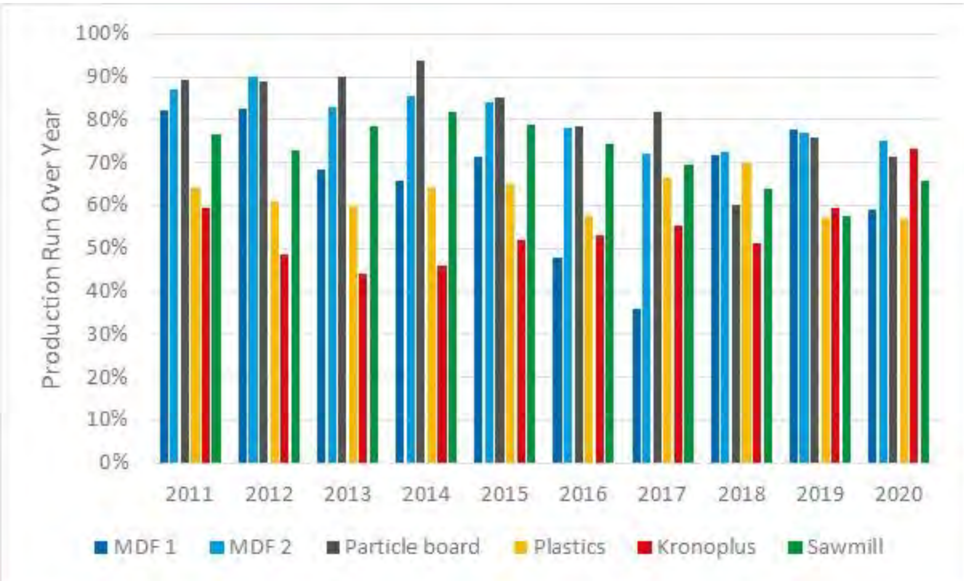
Source: Emissions Monitoring Reports

Figure 36: MDF 2 Cyclone Emissions Analysis - NOx



Source: Emissions Monitoring Reports

Figure 37: Summary of Operational Loading for Facility



Source: Kronospan

Table 41: Source Locations

Source name	X (m)	Y (m)
A1	328713.10	338586.30
A5	328612.40	338370.90
A6	328631.80	338374.60
WESP 32	328404.30	338343.50
MDF 1 Drier WC	328451.70	338233.20
MDF 2 Drier WC	328451.20	338252.80
WESP 21 WC	328384.50	338405.90
K1	328714.30	338786.80
K5	328520.52	338333.25
K6	328460.19	338308.32
Gas Engine 1	328495.71	338418.65
Gas Engine 2	328501.53	338419.62
Gas Engine 3	328507.45	338420.38
Gas Engine 4	328513.22	338421.30
Gas Engine 5	328519.01	338422.15
K7	328434.47	338315.74
K8	328468.40	338353.70
B01	328629.50	338265.74
B02	328596.22	338256.08
B03	328586.56	338254.44
B04	328578.55	338253.20
B05	328452.00	338224.00
B06	328451.00	338250.00
B07	328496.75	338327.92
B08	328429.00	338360.00
B09	328420.00	338372.00
B10	328419.00	338379.00
B11	328414.00	338382.00
B12	328597.00	338342.00
B13	328608.00	338344.00
B14	328634.00	338349.00
B15	328645.00	338351.00
B16	328714.00	338489.00
B17	328708.00	338489.00
B18	328717.00	338476.00
B19	328710.00	338475.00

Source name	X (m)	Y (m)
B20	328547.34	338525.51
B21	328539.00	338524.00
B22	328473.00	338516.00
B23	328472.00	338524.00
B24	328472.00	338527.00
B25	328467.65	338525.93
B26	328462.00	338525.00
B27	328668.00	338793.00
B28	328666.00	338799.00
B29	328668.00	338804.00
B30	328668.00	338810.00
B31	328669.00	338816.00
Press abatement system	328529.32	338285.40

C APIS Critical Loads

All data sourced from APIS as accessed on 23/07/2021. Background data from the 3 year average 2017 to 2019.

Table 42: Nitrogen Deposition Critical Loads

Site	NCL class	kgN/ha/yr		
		Lower CL	Upper CL	Background
River Dee and Bala Lake SAC, SSSI	Not sensitive	-	-	22.40
Johnstown Newt Sites SAC	Not sensitive	-	-	24.50
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.14
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.14
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.14
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.14
Berwyn and South Clwyd Mountains SAC	Sub-atlantic semi-dry calcareous grassland	15	25	21.14
Berwyn SPA	Broadleaved deciduous woodland	10	20	31.36
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	21.14
Chirk Castle SSSI	Fagus Woodland	10	20	35.00
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	22.40
Nant-y-belan & Prynella Woods SSSI	Fagus Woodland	10	20	33.60
Barracks Field	Low and medium altitude hay meadows	20	30	22.40
Ceod-Y-Canal Wood	Fagus Woodland	10	20	35.00
Various Ancient Woodlands	Fagus Woodland	10	20	35.00

Source: APIS

Table 43: Acid Deposition Minimum Critical Loads

Site	Acidity class	KeqN or S /ha/yr		KeqN or S /ha/yr		
		N	S	ClminN	CLmaxN	CLmaxS
River Dee and Bala Lake SAC, SSSI	Not sensitive	1.60	0.19	-	-	-
Johnstown Newt Sites SAC	Not sensitive	1.75	0.19	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.51	0.21	0.178	0.551	0.23
Berwyn and South Clwyd Mountains SAC	Bogs	1.51	0.21	0.321	0.66	0.339
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.51	0.21	0.49	0.882	0.23
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.51	0.21	0.856	4.856	4
Berwyn SPA	Unmanaged broadleafed / coniferous woodland	2.24	0.26	0.142	0.89	0.605
Chirk Castle SSSI	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.142	1.892	1.75
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.60	0.19	0.856	4.856	4
Chirk Castle SSSI	Acid grassland	1.60	0.19	0.223	1.123	0.9
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleafed / coniferous woodland	2.40	0.25	0.357	3.791	2.722
Barracks Field	Calcareous grassland (using base cation)	1.60	0.19	1.071	5.071	4
Barracks Field	Acid grassland	1.60	0.19	0.438	2.088	1.65
Ceod-Y-Canal Wood	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.142	1.864	1.722
Various Ancient Woodlands	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.142	1.864	1.722

Source: APIS

Table 44: Acid Deposition Maximum Critical Loads

Site	Acidity class	KeqN or S /ha/yr		KeqN or S /ha/yr		
		N	S	ClminN	CLmaxN	CLmaxS
River Dee and Bala Lake SAC, SSSI	Not sensitive	1.60	0.19	-	-	-
Johnstown Newt Sites SAC	Not sensitive	1.75	0.19	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.51	0.21	0.536	4.358	4.18
Berwyn and South Clwyd Mountains SAC	Bogs	1.51	0.21	0.321	1.367	1.046
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.51	0.21	1.107	5.072	4.18
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.51	0.21	1.214	5.252	4.058
Berwyn SPA	Unmanaged broadleafed / coniferous woodland	2.24	0.26	0.5	3.933	3.576
Chirk Castle SSSI	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.142	1.864	1.722
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.60	0.19	0.856	4.856	4
Chirk Castle SSSI	Acid grassland	1.60	0.19	0.223	1.123	0.9
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleafed / coniferous woodland	2.40	0.25	0.357	1.879	1.522
Barracks Field	Calcareous grassland (using base cation)	1.60	0.19	1.071	5.071	4
Barracks Field	Acid grassland	1.60	0.19	0.438	2.088	1.65
Ceod-Y-Canal Wood	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.142	1.864	1.722
Various Ancient Woodlands	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.142	1.864	1.722

Source: APIS

D Detailed Results Tables – Normal Operations

Under normal operating conditions point source emissions to atmosphere from the Facility are from the following sources:

1. K1 boiler;
2. the MDF 1 and MDF 2 cyclones;
3. the WESP 32
4. the WESP 21;
5. the emissions control system from the Formalin Plant (A1);
6. the wet scrubbers on the paper impregnation plant (A5 and A6); and
7. the dust filter units.

Table 45: Dispersion Modelling Results – Max Outside Installation Boundary

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	40	10.84	4.76	5.14	5.85	4.26	5.08	5.85	14.6%	16.69	41.7%
	99.79th%ile of hourly means	µg/m³	200	21.68	36.52	37.74	37.29	35.88	36.83	37.74	18.9%	59.42	29.7%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	40	10.84	11.85	12.81	14.59	10.60	12.66	14.59	36.5%	25.43	63.6%
	99.79th%ile of hourly means	µg/m³	200	21.68	91.28	94.34	93.21	89.70	92.07	94.34	47.2%	116.02	58.0%
PM_{10}	Annual mean	µg/m³	40	15.39	13.50	14.31	12.57	12.02	11.26	14.31	35.8%	29.70	74.3%
	90.41st%ile of daily means	µg/m³	50	15.39	34.96	32.74	27.62	31.47	26.91	34.96	69.9%	50.35	100.7%
$PM_{2.5}$	Annual mean	µg/m³	20	10.94	13.50	14.31	12.57	12.02	11.26	14.31	71.6%	25.25	126.3%
Formaldehyde	Annual mean	µg/m³	5	1	1.24	1.54	1.43	1.30	1.57	1.57	31.4%	2.57	51.4%
	Hourly mean	µg/m³	100	2	48.48	37.49	34.36	54.46	45.26	54.46	54.5%	56.46	56.5%
VOCs	Annual mean	µg/m³	-	-	15.48	16.16	17.78	13.47	15.48	17.78	-	-	-
	Hourly mean	µg/m³	-	-	274.36	233.44	224.19	315.94	242.05	315.94	-	-	-
Carbon monoxide	8 hour running mean	µg/m³	10,000	224	40.37	40.73	38.91	36.09	38.36	40.73	0.4%	264.73	2.6%
	Hourly mean	µg/m³	30,000	224	64.06	65.03	57.83	59.11	63.29	65.03	0.2%	289.03	1.0%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	6.78	6.67	6.38	6.35	5.58	6.81	6.81	5.4%	13.59	10.9%
	99.73rd%ile of hourly means	µg/m³	350	6.78	15.50	15.47	14.74	15.79	14.75	15.79	4.5%	22.57	6.4%

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
	99.9th%ile of 15 min. means	µg/m^3	266	6.78	18.17	17.62	17.38	18.36	18.05	18.36	6.9%	25.14	9.5%
Hydrogen chloride	Hourly mean	µg/m^3	750	1.42	4.24	4.30	3.83	3.86	4.17	4.30	0.6%	5.72	0.8%
Hydrogen fluoride	Annual mean	µg/m^3	16	2.35	0.01	0.01	0.01	0.01	0.01	0.01	0.08%	2.36	14.8%
	Hourly mean	µg/m^3	160	4.7	0.36	0.36	0.32	0.32	0.35	0.36	0.2%	5.06	3.2%
Ammonia	Annual mean	µg/m^3	180	2.05	0.03	0.03	0.03	0.03	0.03	0.03	0.02%	2.08	1.2%
	Hourly mean	µg/m^3	2,500	4.1	1.11	1.09	0.99	1.09	1.09	1.11	0.04%	5.21	0.2%
Mercury	Annual mean	ng/m^3	250	2.8	0.09	0.11	0.11	0.10	0.12	0.12	0.05%	2.92	1.2%
	Hourly mean	ng/m^3	7,500	5.6	3.70	3.64	3.31	3.64	3.64	3.70	0.05%	9.30	0.1%
Cadmium	Annual mean	ng/m^3	5	0.08	0.09	0.11	0.11	0.10	0.12	0.12	2.3%	0.20	3.9%
	Hourly mean	ng/m^3	-	0.16	3.70	3.64	3.31	3.64	3.64	3.70	-	3.86	-
PAHs (as BaP)	Annual mean	pg/m^3	250	980	0.56	0.65	0.64	0.59	0.69	0.69	0.3%	980.69	392.3%
Dioxins	Annual mean	fg/m^3	-	32.99	0.19	0.22	0.21	0.20	0.23	0.23	-	33.22	-
PCBs	Annual mean	ng/m^3	200	0.13	0.01	0.02	0.02	0.01	0.02	0.02	0.009%	0.15	0.1%
	Hourly mean	ng/m^3	6,000	0.26	0.56	0.55	0.50	0.55	0.55	0.56	0.009%	0.81	0.01%
Other metals	Annual mean	ng/m^3	-	-	0.93	1.08	1.06	0.98	1.15	1.15	-	-	-
	Hourly mean	ng/m^3	-	-	36.95	36.42	33.14	36.40	36.43	36.95	-	-	-

Table 46: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide - Likely Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.02	1.16	1.11	1.02	1.05	1.16	2.9%	12.00	30.0%
Lodge Farm	0.83	1.01	1.16	0.85	0.96	1.16	2.9%	12.00	30.0%
Lodgefield Park	1.15	1.41	1.62	1.22	1.38	1.62	4.1%	12.46	31.2%
Rhosywaun	2.75	2.76	3.41	3.08	3.77	3.77	9.4%	14.61	36.5%
Chirk Community Hospital	1.52	1.55	1.87	1.71	2.02	2.02	5.1%	12.86	32.2%
Chirk Infant School	1.64	1.69	2.19	2.02	2.62	2.62	6.5%	13.46	33.6%
Highfield Farm	1.10	1.12	1.38	1.29	1.70	1.70	4.3%	12.54	31.4%
Maes-y-Waun	1.12	0.98	1.29	1.15	1.45	1.45	3.6%	12.29	30.7%
Collery Road	1.10	0.82	1.11	0.96	1.09	1.11	2.8%	11.95	29.9%
St Mary's Church	0.35	0.27	0.36	0.33	0.44	0.44	1.1%	11.28	28.2%
Station Avenue	1.67	1.27	1.50	1.29	1.38	1.67	4.2%	12.51	31.3%
Llwyn-y-cil	1.22	1.13	0.71	1.09	0.55	1.22	3.0%	12.06	30.1%
New Hall	0.57	0.73	0.55	0.48	0.53	0.73	1.8%	11.57	28.9%
Chirk Court	1.31	1.26	1.70	1.51	1.95	1.95	4.9%	12.79	32.0%

NOTES:

Impacts presented for the likely emissions scenario assuming a 70% conversion of NOx to NO_2. A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 47: Dispersion Modelling Results – Impact at Receptors - 99.79%ile of 1-hour Nitrogen Dioxide - Likley Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	10.07	10.47	10.34	10.17	9.86	10.47	5.2%	32.15	16.1%
Lodge Farm	7.53	7.46	7.37	7.49	7.33	7.53	3.8%	29.21	14.6%
Lodgefield Park	9.31	9.16	9.18	9.38	9.25	9.38	4.7%	31.06	15.5%
Rhosywaun	13.28	13.29	13.54	13.67	13.65	13.67	6.8%	35.35	17.7%
Chirk Community Hospital	8.61	8.61	8.52	8.67	8.80	8.80	4.4%	30.48	15.2%
Chirk Infant School	12.30	12.23	12.13	12.65	12.41	12.65	6.3%	34.33	17.2%
Highfield Farm	7.15	7.16	7.17	7.18	7.21	7.21	3.6%	28.89	14.4%
Maes-y-Waun	13.39	13.10	13.13	13.29	13.12	13.39	6.7%	35.07	17.5%
Collery Road	12.09	12.23	12.29	12.19	12.51	12.51	6.3%	34.19	17.1%
St Mary's Church	5.44	5.13	5.28	5.10	5.13	5.44	2.7%	27.12	13.6%
Station Avenue	13.60	14.11	13.84	13.40	13.79	14.11	7.1%	35.79	17.9%
Llwyn-y-cil	16.90	17.38	16.09	16.19	15.42	17.38	8.7%	39.06	19.5%
New Hall	9.81	9.93	9.83	9.14	9.80	9.93	5.0%	31.61	15.8%
Chirk Court	13.58	13.47	13.73	13.78	14.38	14.38	7.2%	36.06	18.0%

NOTES:

Impacts presented for the likely emissions scenario assuming a 35% conversion of NOx to NO_2. A comparison made to the 1-hour mean AQAL of 200 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 48: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide - Worst-case Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	2.49	2.82	2.73	2.50	2.55	2.82	7.1%	13.66	34.2%
Lodge Farm	2.01	2.47	2.84	2.06	2.34	2.84	7.1%	13.68	34.2%
Lodgefield Park	2.77	3.40	3.92	2.94	3.33	3.92	9.8%	14.76	36.9%
Rhosywaun	6.67	6.75	8.32	7.51	9.19	9.19	23.0%	20.03	50.1%
Chirk Community Hospital	3.68	3.76	4.55	4.14	4.89	4.89	12.2%	15.73	39.3%
Chirk Infant School	4.01	4.17	5.39	4.97	6.45	6.45	16.1%	17.29	43.2%
Highfield Farm	2.71	2.78	3.43	3.20	4.20	4.20	10.5%	15.04	37.6%
Maes-y-Waun	2.72	2.38	3.15	2.80	3.56	3.56	8.9%	14.40	36.0%
Collery Road	2.71	2.02	2.72	2.34	2.68	2.72	6.8%	13.56	33.9%
St Mary's Church	0.86	0.68	0.88	0.81	1.08	1.08	2.7%	11.92	29.8%
Station Avenue	4.15	3.14	3.73	3.19	3.43	4.15	10.4%	14.99	37.5%
Llwyn-y-cil	3.03	2.81	1.76	2.70	1.37	3.03	7.6%	13.87	34.7%
New Hall	1.38	1.79	1.35	1.16	1.32	1.79	4.5%	12.63	31.6%
Chirk Court	3.17	3.07	4.15	3.69	4.79	4.79	12.0%	15.63	39.1%

NOTES:

Impacts presented for the worst-case emissions scenario assuming a 70% conversion of NOx to NO_2. A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 49: Dispersion Modelling Results – Impact at Receptors - 99.79%ile of 1-hour Nitrogen Dioxide - Worst-case Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	25.13	26.16	25.83	25.38	24.62	26.16	13.1%	47.84	23.9%
Lodge Farm	18.40	18.20	18.11	18.31	17.93	18.40	9.2%	40.08	20.0%
Lodgefield Park	22.62	22.31	22.48	22.89	22.50	22.89	11.4%	44.57	22.3%
Rhosywaun	33.19	33.22	33.85	34.17	34.12	34.17	17.1%	55.85	27.9%
Chirk Community Hospital	21.43	21.36	21.24	21.42	21.81	21.81	10.9%	43.49	21.7%
Chirk Infant School	30.74	30.57	30.33	31.63	31.02	31.63	15.8%	53.31	26.7%
Highfield Farm	17.85	17.88	17.90	17.93	17.98	17.98	9.0%	39.66	19.8%
Maes-y-Waun	33.48	32.74	32.82	33.23	32.78	33.48	16.7%	55.16	27.6%
Collery Road	30.19	30.57	30.72	30.48	31.26	31.26	15.6%	52.94	26.5%
St Mary's Church	13.58	12.81	13.18	12.75	12.81	13.58	6.8%	35.26	17.6%
Station Avenue	33.99	35.26	34.59	33.49	34.46	35.26	17.6%	56.94	28.5%
Llwyn-y-cil	42.19	43.37	39.93	40.27	38.08	43.37	21.7%	65.05	32.5%
New Hall	24.52	24.83	24.57	22.80	24.48	24.83	12.4%	46.51	23.3%
Chirk Court	33.96	33.68	34.33	34.44	35.94	35.94	18.0%	57.62	28.8%

NOTES:

Impacts presented for the worst-case emissions scenario assuming a 35% conversion of NOx to NO_2. A comparison made to the 1-hour mean AQAL of 200 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 50: Dispersion Modelling Results – Impact at Receptors - Annual Mean PM10

Receptor	Process Contribution (PC) ($\mu g/m^3$)						Max as % of AQAL	PEC (PC +Bg) ($\mu g/m^3$)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.43	1.59	1.50	1.41	1.51	1.59	4.0%	16.98	42.4%
Lodge Farm	1.15	1.34	1.46	1.21	1.36	1.46	3.7%	16.85	42.1%
Lodgefield Park	1.76	2.04	2.23	1.89	2.12	2.23	5.6%	17.62	44.1%
Rhosywaun	4.75	4.75	5.61	5.32	6.36	6.36	15.9%	21.75	54.4%
Chirk Community Hosp	2.20	2.24	2.54	2.52	2.99	2.99	7.5%	18.38	45.9%
Chirk Infant School	3.09	3.01	3.62	3.53	4.69	4.69	11.7%	20.08	50.2%
Highfield Farm	1.52	1.48	1.72	1.73	2.28	2.28	5.7%	17.67	44.2%
Maes-y-Waun	2.34	1.85	2.33	2.19	2.70	2.70	6.7%	18.09	45.2%
Collery Road	2.11	1.64	1.95	1.77	1.90	2.11	5.3%	17.50	43.8%
St Mary's Church	0.45	0.34	0.43	0.44	0.55	0.55	1.4%	15.94	39.9%
Station Avenue	2.54	2.14	2.25	2.15	1.86	2.54	6.3%	17.93	44.8%
Llwyn-y-cil	1.78	1.83	1.25	1.84	0.81	1.84	4.6%	17.23	43.1%
New Hall	0.93	0.98	0.83	0.86	0.83	0.98	2.5%	16.37	40.9%
Chirk Court	2.86	2.53	3.14	2.99	3.87	3.87	9.7%	19.26	48.1%

NOTES:

Impacts presented assume all the dust is as PM_{10}. A comparison made to the annual mean AQAL of 40 $\mu g/m^3$ where appropriate. A background concentration of 15.39 $\mu g/m^3$ has been applied to calculate the PEC.

Table 51: Dispersion Modelling Results – Impact at Receptors - 90.41%ile of 24-hour PM10

Receptor	Process Contribution (PC) (µg/m^3)						Max as % of AQAL	PEC (PC +Bg) (µg/m^3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	5.13	4.90	4.44	4.97	5.01	5.13	10.3%	20.52	41.0%
Lodge Farm	3.54	3.89	3.88	3.75	3.86	3.89	7.8%	19.28	38.6%
Lodgefield Park	5.45	5.92	5.87	5.47	5.64	5.92	11.8%	21.31	42.6%
Rhosywaun	12.99	12.34	12.70	14.01	15.00	15.00	30.0%	30.39	60.8%
Chirk Community Hosp	6.44	5.98	6.13	6.92	7.04	7.04	14.1%	22.43	44.9%
Chirk Infant School	9.70	9.46	9.51	9.94	11.73	11.73	23.5%	27.12	54.2%
Highfield Farm	4.91	4.75	4.81	4.95	5.85	5.85	11.7%	21.24	42.5%
Maes-y-Waun	8.09	6.48	7.55	6.83	8.31	8.31	16.6%	23.70	47.4%
Collery Road	7.57	6.72	6.82	6.05	7.06	7.57	15.1%	22.96	45.9%
St Mary's Church	1.73	1.37	1.69	1.68	1.85	1.85	3.7%	17.24	34.5%
Station Avenue	8.94	8.17	8.51	7.57	7.36	8.94	17.9%	24.33	48.7%
Llwyn-y-cil	7.78	7.54	4.32	7.84	3.28	7.84	15.7%	23.23	46.5%
New Hall	3.16	3.35	3.02	3.17	2.88	3.35	6.7%	18.74	37.5%
Chirk Court	9.36	9.16	9.59	9.09	10.58	10.58	21.2%	25.97	51.9%

NOTES:

Impacts presented assume all the dust is as PM_{10}. A comparison made to the daily mean AQAL of 50 µg/m^3 where appropriate. A background concentration of 15.39 µg/m^3 has been applied to calculate the PEC.

Table 52: Dispersion Modelling Results – Impact at Receptors - Annual Mean PM2.5

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m³)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.43	1.59	1.50	1.41	1.51	1.59	7.9%	12.53	62.6%
Lodge Farm	1.15	1.34	1.46	1.21	1.36	1.46	7.3%	12.40	62.0%
Lodgefield Park	1.76	2.04	2.23	1.89	2.12	2.23	11.2%	13.17	65.9%
Rhosywaun	4.75	4.75	5.61	5.32	6.36	6.36	31.8%	17.30	86.5%
Chirk Community Hosp	2.20	2.24	2.54	2.52	2.99	2.99	14.9%	13.93	69.6%
Chirk Infant School	3.09	3.01	3.62	3.53	4.69	4.69	23.4%	15.63	78.1%
Highfield Farm	1.52	1.48	1.72	1.73	2.28	2.28	11.4%	13.22	66.1%
Maes-y-Waun	2.34	1.85	2.33	2.19	2.70	2.70	13.5%	13.64	68.2%
Collery Road	2.11	1.64	1.95	1.77	1.90	2.11	10.6%	13.05	65.3%
St Mary's Church	0.45	0.34	0.43	0.44	0.55	0.55	2.8%	11.49	57.5%
Station Avenue	2.54	2.14	2.25	2.15	1.86	2.54	12.7%	13.48	67.4%
Llwyn-y-cil	1.78	1.83	1.25	1.84	0.81	1.84	9.2%	12.78	63.9%
New Hall	0.93	0.98	0.83	0.86	0.83	0.98	4.9%	11.92	59.6%
Chirk Court	2.86	2.53	3.14	2.99	3.87	3.87	19.3%	14.81	74.0%

NOTES:

Impacts presented assume all the dust is as $PM_{2.5}$. A comparison made to the annual mean AQAL of 20 µg/m³ where appropriate. A background concentration of 10.94 µg/m³ has been applied to calculate the PEC.

Table 53: Dispersion Modelling Results – Impact at Receptors - Annual Mean Formaldehyde

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m³)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	0.39	0.43	0.42	0.39	0.40	0.43	8.6%	1.43	28.6%
Lodge Farm	0.29	0.36	0.41	0.30	0.34	0.41	8.3%	1.41	28.3%
Lodgefield Park	0.40	0.49	0.57	0.43	0.49	0.57	11.4%	1.57	31.4%
Rhosywaun	1.00	1.02	1.26	1.16	1.39	1.39	27.8%	2.39	47.8%
Chirk Community Hospital	0.54	0.55	0.66	0.62	0.72	0.72	14.4%	1.72	34.4%
Chirk Infant School	0.63	0.66	0.83	0.78	1.02	1.02	20.3%	2.02	40.3%
Highfield Farm	0.41	0.42	0.51	0.48	0.63	0.63	12.6%	1.63	32.6%
Maes-y-Waun	0.45	0.38	0.50	0.45	0.57	0.57	11.3%	1.57	31.3%
Collery Road	0.47	0.35	0.46	0.40	0.45	0.47	9.4%	1.47	29.4%
St Mary's Church	0.13	0.10	0.13	0.12	0.16	0.16	3.2%	1.16	23.2%
Station Avenue	0.67	0.52	0.60	0.52	0.54	0.67	13.4%	1.67	33.4%
Llwyn-y-cil	0.42	0.40	0.25	0.37	0.19	0.42	8.3%	1.42	28.3%
New Hall	0.22	0.28	0.22	0.19	0.21	0.28	5.6%	1.28	25.6%
Chirk Court	0.51	0.48	0.63	0.57	0.74	0.74	14.9%	1.74	34.9%

NOTES:

A comparison made to the annual mean AQAL of 5 µg/m³ where appropriate. A background concentration of 1 µg/m³ has been applied to calculate the PEC.

Table 54: Dispersion Modelling Results – Impact at Receptors - Maximum 1-hour Mean Formaldehyde

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m³)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	9.41	8.96	9.02	8.72	9.69	9.69	9.7%	11.69	11.7%
Lodge Farm	7.68	7.19	6.13	7.97	6.46	7.97	8.0%	9.97	10.0%
Lodgefield Park	9.00	8.24	7.46	8.21	8.03	9.00	9.0%	11.00	11.0%
Rhosywaun	12.88	13.74	14.23	13.52	12.68	14.23	14.2%	16.23	16.2%
Chirk Community Hospital	7.50	8.48	8.72	8.27	7.85	8.72	8.7%	10.72	10.7%
Chirk Infant School	11.27	11.55	10.90	11.70	11.62	11.70	11.7%	13.70	13.7%
Highfield Farm	6.10	6.48	6.05	7.10	6.15	7.10	7.1%	9.10	9.1%
Maes-y-Waun	12.52	12.68	11.30	11.88	11.72	12.68	12.7%	14.68	14.7%
Collery Road	10.93	10.32	10.35	11.04	10.60	11.04	11.0%	13.04	13.0%
St Mary's Church	5.20	6.89	4.88	6.63	4.45	6.89	6.9%	8.89	8.9%
Station Avenue	12.12	11.41	12.44	11.11	12.09	12.44	12.4%	14.44	14.4%
Llwyn-y-cil	16.99	16.01	15.26	15.41	22.70	22.70	22.7%	24.70	24.7%
New Hall	9.63	8.42	9.42	9.44	9.22	9.63	9.6%	11.63	11.6%
Chirk Court	15.27	13.26	13.08	13.15	14.49	15.27	15.3%	17.27	17.3%

NOTES:
A comparison made to the 1-hour mean AQAL of 100 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 1 µg/m³ has been applied to calculate the PEC.

Table 55: Long-Term Metals Results – Point of Maximum Impact

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV [(1)]	Metals emitted as per EA maximum			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	6	0.50	1.15	19.22%	1.65	27.49%	7.5%	0.09	1.44%	0.58	9.71%
Antimony	5000	1.30	1.15	0.02%	2.45	0.05%	3.5%	0.04	0.0008%	1.34	0.03%
Chromium	5000	1.41	1.15	0.02%	2.57	0.05%	27.6%	0.32	0.006%	1.73	0.03%
Chromium (VI)	0.2	0.28	1.15	576.5%	1.44	717.8%	0.039%	0.00	0.23%	0.28	141.48%
Cobalt	-	0.06	1.15	-	1.21	-	1.7%	0.02	-	0.08	-
Copper	10000	2.03	1.15	0.01%	3.19	0.03%	8.7%	0.10	0.0010%	2.13	0.02%
Lead	250	3.43	1.15	0.46%	4.59	1.83%	15.1%	0.17	0.07%	3.61	1.44%
Manganese	150	2.24	1.15	0.77%	3.39	2.26%	18.0%	0.21	0.14%	2.45	1.63%
Nickel	20	0.52	1.15	5.77%	1.67	8.35%	66.1%	0.76	3.81%	1.28	6.39%
Vanadium	5000	0.64	1.15	0.02%	1.79	0.04%	1.8%	0.02	0.0004%	0.66	0.013%

NOTES:

[(1)] Metal concentration from the EA metals guidance document (v.4) Table A1 has been converted to 6% reference oxygen content and then calculated as a percentage of the ELV for total metals of 0.5 mg/Nm³.

Table 56: Short-Term Metals Results – Point of Maximum Impact

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV [(1)]	Metals emitted no worse than a currently permitted facility			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	-	0.99	0.99	36.95	-	37.94	-	7.5%	2.78	-	3.77
Antimony	150,000	2.60	2.60	36.95	0.02%	39.55	0.03%	3.5%	1.28	0.0009%	3.88
Chromium	150,000	2.83	2.83	36.95	0.02%	39.78	0.03%	27.6%	10.22	0.007%	13.04
Chromium (VI)	-	0.57	0.57	36.95	-	37.52	-	0.039%	0.01	-	0.58
Cobalt	-	0.12	0.12	36.95	-	37.07	-	1.7%	0.62	-	0.74
Copper	200,000	4.07	4.07	36.95	0.02%	41.02	0.02%	8.7%	3.22	0.002%	7.29
Lead	-	6.87	6.87	36.95	-	43.82	-	15.1%	5.59	-	12.45
Manganese	1,500,000	4.48	4.48	36.95	0.002%	41.43	0.003%	18.0%	6.66	0.0004%	11.14
Nickel	-	1.03	1.03	36.95	-	37.98	-	66.1%	24.43	-	25.46
Vanadium	1,000	1.28	1.28	36.95	3.70%	38.23	3.82%	1.8%	0.67	0.07%	1.94

NOTES:

[(1)] Metal concentration from the EA metals guidance document (v.4) Table A1 has been converted to 6% reference oxygen content and then calculated as a percentage of the ELV for total metals of 0.5 mg/Nm³.

Table 57: Impact at River Dee and Bala Lake SAC

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	10.68	1.52	1.25	1.31	1.19	1.19	1.52	5.1%	12.20	40.7%
	Daily mean	µg/m³	75	10.68	18.87	17.05	14.76	14.54	23.40	23.40	31.2%	34.08	45.4%
	Daily mean	µg/m³	200	10.68	18.87	17.05	14.76	14.54	23.40	23.40	11.7%	34.08	17.0%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	10.68	3.78	3.11	3.25	2.96	2.95	3.78	12.6%	14.46	48.2%
	Daily mean	µg/m³	75	10.68	47.11	42.51	36.80	36.31	58.36	58.36	77.8%	69.04	92.1%
	Daily mean	µg/m³	200	10.68	47.11	42.51	36.80	36.31	58.36	58.36	29.2%	69.04	34.5%
Sulphur dioxide	Annual mean	µg/m³	20	0.79	0.33	0.28	0.28	0.26	0.27	0.33	1.7%	1.12	5.6%
Ammonia	Annual mean	µg/m³	3	2.05	0.013	0.011	0.011	0.010	0.010	0.013	0.4%	2.06	68.8%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.03	0.03	0.02	0.02	0.02	0.03	0.5%	-	-
	Daily mean	µg/m³	0.5	-	0.06	0.06	0.05	0.05	0.07	0.07	13.7%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 337500 taken from APIS.

Table 58: Impact at Johnstown Newt Site

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	12.69	0.15	0.17	0.18	0.15	0.15	0.18	0.6%	12.87	42.9%
	Daily mean	µg/m³	75	12.69	1.35	1.23	1.37	1.76	1.06	1.76	2.3%	14.45	19.3%
	Daily mean	µg/m³	200	12.69	1.35	1.23	1.37	1.76	1.06	1.76	0.9%	14.45	7.2%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	12.69	0.37	0.42	0.45	0.37	0.37	0.45	1.5%	13.14	43.8%
	Daily mean	µg/m³	75	12.69	3.34	3.06	3.41	4.36	2.64	4.36	5.8%	17.05	22.7%
	Daily mean	µg/m³	200	12.69	3.34	3.06	3.41	4.36	2.64	4.36	2.2%	17.05	8.5%
Sulphur dioxide	Annual mean	µg/m³	20	1.55	0.04	0.04	0.05	0.04	0.04	0.05	0.2%	1.60	8.0%
Ammonia	Annual mean	µg/m³	3	2.99	0.0012	0.0013	0.0014	0.0012	0.0012	0.0014	0.05%	2.99	99.7%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.002	0.002	0.001	0.001	0.001	0.002	0.04%	-	-
	Daily mean	µg/m³	0.5	-	0.004	0.004	0.005	0.005	0.004	0.005	1.1%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 337500 taken from APIS.

Table 59: Impact at Berwyn Mountains SAC and Berwyn SPA

Pollutant	Quantity	Units	AQAL	Bg Conc.	Process Concentration (PC)						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	7.72	0.13	0.18	0.14	0.14	0.17	0.18	0.6%	7.90	26.3%
	Daily mean	µg/m³	75	7.72	1.80	2.31	2.09	1.96	2.03	2.31	3.1%	10.03	13.4%
	Daily mean	µg/m³	200	7.72	1.80	2.31	2.09	1.96	2.03	2.31	1.2%	10.03	5.0%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	7.72	0.32	0.45	0.35	0.35	0.43	0.45	1.5%	8.17	27.2%
	Daily mean	µg/m³	75	7.72	4.48	5.75	5.19	4.83	5.06	5.75	7.7%	13.47	18.0%
	Daily mean	µg/m³	200	7.72	4.48	5.75	5.19	4.83	5.06	5.75	2.9%	13.47	6.7%
Sulphur dioxide	Annual mean	µg/m³	10	0.76	0.03	0.05	0.03	0.03	0.04	0.05	0.5%	0.81	8.1%
Ammonia	Annual mean	µg/m³	1	1.39	0.0010	0.0014	0.0011	0.0011	0.0014	0.0014	0.1%	1.39	139.1%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.002	0.002	0.002	0.002	0.003	0.003	0.1%	-	-
	Daily mean	µg/m³	0.5	-	0.005	0.008	0.007	0.006	0.007	0.008	1.6%	-	-

NOTES:
PC calculated for a single point closest to the Facility.
Background concentration for grid square 324500, 342500 taken from APIS.

Table 60: Impact at Chirk Castle SSSI

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	7.18	2.65	2.27	1.44	2.04	1.13	2.65	8.8%	9.83	32.8%
	Daily mean	µg/m³	75	7.18	29.28	26.44	26.89	29.25	24.69	29.28	39.0%	36.46	48.6%
	Daily mean	µg/m³	200	7.18	29.28	26.44	26.89	29.25	24.69	29.28	14.6%	36.46	18.2%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	7.18	6.60	5.64	3.58	5.06	2.80	6.60	22.0%	13.78	45.9%
	Daily mean	µg/m³	75	7.18	72.96	65.67	67.13	72.99	61.69	72.99	97.3%	80.17	106.9%
	Daily mean	µg/m³	200	7.18	72.96	65.67	67.13	72.99	61.69	72.99	36.5%	80.17	40.1%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.38	0.31	0.21	0.27	0.17	0.38	3.8%	1.17	11.7%
Ammonia	Annual mean	µg/m³	1	2.05	0.02	0.01	0.01	0.01	0.01	0.02	1.9%	2.07	206.9%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.04	0.03	0.04	0.03	0.03	0.04	0.8%	-	-
	Daily mean	µg/m³	0.5	-	0.09	0.07	0.07	0.07	0.08	0.09	17.8%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 327500, 338500 taken from APIS.

Table 61: Impact at Nant-y-Belan & Prynella Woods SSSI

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	12.2	0.57	0.58	0.65	0.65	0.75	0.75	2.5%	12.95	43.2%
	Daily mean	µg/m³	75	12.2	4.06	4.53	4.95	4.51	4.07	4.95	6.6%	17.15	22.9%
	Daily mean	µg/m³	200	12.2	4.06	4.53	4.95	4.51	4.07	4.95	2.5%	17.15	8.6%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	12.2	1.40	1.43	1.61	1.60	1.85	1.85	6.2%	14.05	46.8%
	Daily mean	µg/m³	75	12.2	10.05	11.23	12.26	11.18	10.09	12.26	16.3%	24.46	32.6%
	Daily mean	µg/m³	200	12.2	10.05	11.23	12.26	11.18	10.09	12.26	6.1%	24.46	12.2%
Sulphur dioxide	Annual mean	µg/m³	10	1.29	0.13	0.13	0.15	0.15	0.17	0.17	1.7%	1.46	14.6%
Ammonia	Annual mean	µg/m³	1	1.95	0.004	0.004	0.005	0.005	0.006	0.006	0.6%	1.96	195.6%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.005	0.007	0.005	0.005	0.006	0.007	0.1%	-	-
	Daily mean	µg/m³	0.5	-	0.013	0.015	0.016	0.014	0.013	0.016	3.3%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 340500 taken from APIS.

Table 62: Impact at Barracks Field

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	12.11	1.03	1.19	1.36	1.17	1.32	1.36	4.5%	13.47	44.9%
	Daily mean	µg/m³	75	12.11	7.25	8.09	8.69	9.39	7.83	9.39	12.5%	21.50	28.7%
	Daily mean	µg/m³	200	12.11	7.25	8.09	8.69	9.39	7.83	9.39	4.7%	21.50	10.8%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	12.11	2.52	2.93	3.34	2.87	3.24	3.34	11.1%	15.45	51.5%
	Daily mean	µg/m³	75	12.11	17.86	20.00	21.50	23.20	19.34	23.20	30.9%	35.31	47.1%
	Daily mean	µg/m³	200	12.11	17.86	20.00	21.50	23.20	19.34	23.20	11.6%	35.31	17.7%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.20	0.24	0.29	0.22	0.25	0.29	2.9%	1.08	10.8%
Ammonia	Annual mean	µg/m³	1	2.05	0.007	0.008	0.010	0.008	0.009	0.010	1.0%	2.06	206.0%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.009	0.013	0.011	0.009	0.012	0.013	0.3%	-	-
	Daily mean	µg/m³	0.5	-	0.02	0.03	0.03	0.03	0.02	0.03	5.8%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 339500 taken from APIS.

Table 63: Impact at Coed-Y-Canal Wood

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	13.81	4.62	6.51	5.52	4.39	5.10	6.51	21.7%	20.32	67.7%
	Daily mean	µg/m³	75	13.81	76.28	62.71	74.94	86.58	70.59	86.58	115.4%	100.39	133.9%
	Daily mean	µg/m³	200	13.81	76.28	62.71	74.94	86.58	70.59	86.58	43.3%	100.39	50.2%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	13.81	11.33	16.11	13.68	10.76	12.67	16.11	53.7%	29.92	99.7%
	Daily mean	µg/m³	75	13.81	190.27	156.20	187.34	216.43	176.46	216.43	288.6%	230.24	307.0%
	Daily mean	µg/m³	200	13.81	190.27	156.20	187.34	216.43	176.46	216.43	108.2%	230.24	115.1%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.54	0.64	0.59	0.48	0.54	0.64	6.4%	1.43	14.3%
Ammonia	Annual mean	µg/m³	1	2.05	0.03	0.03	0.03	0.02	0.03	0.03	3.2%	2.08	208.2%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.03	0.04	0.04	0.04	0.04	0.04	0.9%	-	-
	Daily mean	µg/m³	0.5	-	0.11	0.09	0.12	0.14	0.12	0.14	28.6%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 339500 taken from APIS.

Table 64: Impact at Maximum Impacted Ancient Woodland

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	13.81	2.86	2.32	2.47	2.23	2.63	2.86	9.5%	16.67	55.6%
	Daily mean	µg/m³	75	13.81	30.83	27.82	29.71	29.64	26.76	30.83	41.1%	44.64	59.5%
	Daily mean	µg/m³	200	13.81	30.83	27.82	29.71	29.64	26.76	30.83	15.4%	44.64	22.3%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	13.81	7.11	5.76	6.01	5.41	6.36	7.11	23.7%	20.92	69.7%
	Daily mean	µg/m³	75	13.81	76.98	69.49	74.20	73.93	66.82	76.98	102.6%	90.79	121.0%
	Daily mean	µg/m³	200	13.81	76.98	69.49	74.20	73.93	66.82	76.98	38.5%	90.79	45.4%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.45	0.41	0.48	0.41	0.47	0.48	4.8%	1.27	12.7%
Ammonia	Annual mean	µg/m³	1	2.05	0.02	0.02	0.02	0.01	0.02	0.02	1.9%	2.07	206.9%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.04	0.04	0.03	0.03	0.03	0.04	0.8%	-	-
	Daily mean	µg/m³	0.5	-	0.10	0.07	0.07	0.07	0.08	0.10	20.2%	-	-

NOTES:
PC calculated as maximum across the grid points within any ancient woodland in the modelling domain.
Background concentration for grid square 329500, 339500 taken from APIS.

Table 65: Annual Mean PC for Deposition Analysis

Site	Annual mean Process Contribution (µg/m³)				
	Nitrogen dioxide (likely case)	Nitrogen dioxide (worst-case)	Sulphur dioxide	Hydrogen chloride	Ammonia
River Dee and Bala Lake SAC, SSSI	1.066	2.646	0.334	0.060	0.013
Johnstown Newt Sites SAC	0.128	0.316	0.048	0.008	0.001
Berwyn and South Clwyd Mountains SAC	0.127	0.316	0.046	0.008	0.001
Berwyn SPA	0.127	0.316	0.046	0.008	0.001
Chirk Castle SSSI	1.858	4.621	0.381	0.069	0.019
Nant-y-belan & Prynella Woods SSSI	0.524	1.292	0.168	0.030	0.006
Barracks Field	6.574	2.340	0.292	0.052	0.010
Ceod-Y-Canal Wood	4.557	11.275	0.636	0.115	0.032
Various Ancient Woodlands	2.002	4.978	0.483	0.087	0.019

NOTES:

PC calculated as maximum across the grid points within each ecological site if within the modelling domain.

Table 66: Deposition Calculation - Grassland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Likely case							
River Dee and Bala Lake SAC, SSSI	0.154	0.632	0.922	0.067	0.220	0.016	0.065
Johnstown Newt Sites SAC	0.018	0.090	0.130	0.007	0.026	0.002	0.009
Berwyn and South Clwyd Mountains SAC	0.018	0.086	0.125	0.007	0.026	0.002	0.009
Berwyn SPA	0.018	0.086	0.125	0.007	0.026	0.002	0.009
Chirk Castle SSSI	0.267	0.722	1.060	0.098	0.365	0.026	0.075
Nant-y-belan & Prynella Woods SSSI	0.075	0.319	0.463	0.029	0.104	0.007	0.033
Barracks Field	0.947	0.553	0.802	0.050	0.996	0.071	0.057
Ceod-Y-Canal Wood	0.656	1.204	1.765	0.167	0.823	0.059	0.125
Various Ancient Woodlands	0.288	0.914	1.328	0.097	0.385	0.028	0.095
Worst-case							
River Dee and Bala Lake SAC, SSSI	0.381	0.632	0.922	0.067	0.448	0.032	0.065
Johnstown Newt Sites SAC	0.046	0.090	0.130	0.007	0.053	0.004	0.009
Berwyn and South Clwyd Mountains SAC	0.045	0.086	0.125	0.007	0.053	0.004	0.009
Berwyn SPA	0.045	0.086	0.125	0.007	0.053	0.004	0.009
Chirk Castle SSSI	0.665	0.722	1.060	0.098	0.763	0.055	0.075
Nant-y-belan & Prynella Woods SSSI	0.186	0.319	0.463	0.029	0.215	0.015	0.033
Barracks Field	0.337	0.553	0.802	0.050	0.387	0.028	0.057
Ceod-Y-Canal Wood	1.624	1.204	1.765	0.167	1.791	0.128	0.125
Various Ancient Woodlands	0.717	0.914	1.328	0.097	0.814	0.058	0.095

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
NOTE: deposition of sulphur, hydrogen chloride and ammonia is the same between the likely and worst-case scenario, the NOx changes which means that the overall N, and acid N deposition changes but acid S deposition remains the same.							

Table 67: Deposition Calculation - Woodland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Likely case							
River Dee and Bala Lake SAC, SSSI	0.307	1.265	2.212	0.100	0.407	0.029	0.141
Johnstown Newt Sites SAC	0.037	0.180	0.313	0.011	0.048	0.003	0.020
Berwyn and South Clwyd Mountains SAC	0.037	0.172	0.300	0.011	0.048	0.003	0.019
Berwyn SPA	0.037	0.172	0.300	0.011	0.048	0.003	0.019
Chirk Castle SSSI	0.535	1.443	2.543	0.147	0.682	0.049	0.162
Nant-y-belan & Prynella Woods SSSI	0.151	0.637	1.110	0.043	0.194	0.014	0.071
Barracks Field	1.893	1.105	1.926	0.074	1.968	0.141	0.123
Ceod-Y-Canal Wood	1.312	2.408	4.236	0.251	1.563	0.112	0.270
Various Ancient Woodlands	0.577	1.829	3.187	0.145	0.722	0.052	0.204
Worst-case							
River Dee and Bala Lake SAC, SSSI	0.762	1.265	2.212	0.100	0.862	0.062	0.141
Johnstown Newt Sites SAC	0.091	0.180	0.313	0.011	0.102	0.007	0.020
Berwyn and South Clwyd Mountains SAC	0.091	0.172	0.300	0.011	0.102	0.007	0.019
Berwyn SPA	0.091	0.172	0.300	0.011	0.102	0.007	0.019
Chirk Castle SSSI	1.331	1.443	2.543	0.147	1.478	0.106	0.162
Nant-y-belan & Prynella Woods SSSI	0.372	0.637	1.110	0.043	0.415	0.030	0.071
Barracks Field	0.674	1.105	1.926	0.074	0.748	0.053	0.123
Ceod-Y-Canal Wood	3.247	2.408	4.236	0.251	3.498	0.250	0.270
Various Ancient Woodlands	1.434	1.829	3.187	0.145	1.579	0.113	0.204

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
NOTE: deposition of sulphur, hydrogen chloride and ammonia is the same between the likely and worst-case scenario, the NOx changes which means that the overall N, and acid N deposition changes but acid S deposition remains the same.							

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Table 68: Nitrogen Deposition

Site	NCL Class	kgN/ha/yr			PC			PEC	
		Lower CL	Upper CL	Background	kgN/ha/yr	% of LCL	% of UCL	% of LCL	% of UCL
Likely case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	-	-	22.40	0.220	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	-	-	24.50	0.026	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.14	0.026	0.5%	0.3%	423.3%	211.7%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.14	0.026	0.5%	0.3%	423.3%	211.7%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.14	0.026	0.3%	0.2%	211.7%	141.1%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.14	0.026	0.3%	0.1%	211.7%	105.8%
Berwyn and South Clwyd Mountains SAC	Sub-atlantic semi-dry calcareous grassland	15	25	21.14	0.026	0.2%	0.1%	141.1%	84.7%
Berwyn SPA	Broadleaved deciduous woodland	10	20	31.36	0.048	0.5%	0.2%	314.1%	157.0%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	21.14	0.026	0.3%	0.1%	211.7%	105.8%
Chirk Castle SSSI	Fagus Woodland	10	20	35.00	0.682	6.8%	3.4%	356.8%	178.4%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	22.40	0.365	1.8%	1.2%	113.8%	75.9%
Nant-y-belan & Prynella Woods SSSI	Fagus Woodland	10	20	33.60	0.194	1.9%	1.0%	337.9%	169.0%
Barracks Field	Low and medium altitude hay meadows	20	30	22.40	0.996	5.0%	3.3%	117.0%	78.0%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	35.00	1.563	15.6%	7.8%	365.6%	182.8%
Various Ancient Woodlands	Fagus Woodland	10	20	35.00	0.722	7.2%	3.6%	357.2%	178.6%
Worst-case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	-	-	22.40	0.448	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	-	-	24.50	0.053	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.14	0.053	1.1%	0.5%	423.9%	211.9%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.14	0.053	1.1%	0.5%	423.9%	211.9%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.14	0.053	0.5%	0.4%	211.9%	141.3%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.14	0.053	0.5%	0.3%	211.9%	106.0%
Berwyn and South Clwyd Mountains SAC	Sub-atlantic semi-dry calcareous grassland	15	25	21.14	0.053	0.4%	0.2%	141.3%	84.8%
Berwyn SPA	Broadleaved deciduous woodland	10	20	31.36	0.102	1.0%	0.5%	314.6%	157.3%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	21.14	0.053	0.5%	0.3%	211.9%	106.0%
Chirk Castle SSSI	Fagus Woodland	10	20	35.00	1.478	14.8%	7.4%	364.8%	182.4%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	22.40	0.763	3.8%	2.5%	115.8%	77.2%
Nant-y-belan & Prynella Woods SSSI	Fagus Woodland	10	20	33.60	0.415	4.2%	2.1%	340.2%	170.1%
Barracks Field	Low and medium altitude hay meadows	20	30	22.40	0.387	1.9%	1.3%	113.9%	76.0%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	35.00	3.498	35.0%	17.5%	385.0%	192.5%
Various Ancient Woodlands	Fagus Woodland	10	20	35.00	1.579	15.8%	7.9%	365.8%	182.9%

Table 69: Acid Deposition

Site	Acidity Class	Bg		PC		PC		PEC	
		N (keqN/hr/yr)	S (keqS/hr/yr)	N (keqN/hr/yr)	S (keqS/hr/yr)	As % of CLmin	As % of CLmax	As % of CLmin	As % of CLmax
Likely case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	1.60	0.19	0.016	0.065	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	1.75	0.19	0.002	0.009	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.51	0.21	0.002	0.009	2.0%	0.2%	314.1%	39.7%
Berwyn and South Clwyd Mountains SAC	Bogs	1.51	0.21	0.002	0.009	1.6%	0.8%	262.2%	126.6%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.51	0.21	0.002	0.009	1.2%	0.2%	196.2%	34.1%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.51	0.21	0.002	0.009	0.2%	0.2%	35.6%	33.0%
Berwyn SPA	Unmanaged broadleafed / coniferous woodland	2.24	0.26	0.003	0.019	2.5%	0.6%	283.4%	64.1%
Chirk Castle SSSI	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.049	0.162	11.1%	11.3%	154.9%	157.2%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.60	0.19	0.026	0.075	2.1%	2.1%	38.9%	38.9%
Chirk Castle SSSI	Acid grassland	1.60	0.19	0.026	0.075	9.0%	9.0%	168.4%	168.4%
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleafed / coniferous woodland	2.40	0.25	0.014	0.071	2.2%	4.5%	72.1%	145.6%
Barracks Field	Calcareous grassland (using base cation)	1.60	0.19	0.071	0.057	2.5%	2.5%	37.8%	37.8%
Barracks Field	Acid grassland	1.60	0.19	0.071	0.057	6.1%	6.1%	91.9%	91.9%
Ceod-Y-Canal Wood	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.112	0.270	20.5%	20.5%	166.4%	166.4%
Various Ancient Woodlands	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.052	0.204	13.7%	13.7%	159.6%	159.6%
Worst-case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	1.60	0.19	0.032	0.065	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	1.75	0.19	0.004	0.009	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.51	0.21	0.004	0.009	2.3%	0.3%	314.5%	39.8%
Berwyn and South Clwyd Mountains SAC	Bogs	1.51	0.21	0.004	0.009	1.9%	0.9%	262.5%	126.8%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.51	0.21	0.004	0.009	1.4%	0.3%	196.4%	34.2%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.51	0.21	0.004	0.009	0.3%	0.2%	35.7%	33.0%
Berwyn SPA	Unmanaged broadleafed / coniferous woodland	2.24	0.26	0.007	0.019	3.0%	0.7%	283.9%	64.2%
Chirk Castle SSSI	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.106	0.162	14.1%	14.3%	157.9%	160.3%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.60	0.19	0.055	0.075	2.7%	2.7%	39.5%	39.5%
Chirk Castle SSSI	Acid grassland	1.60	0.19	0.055	0.075	11.5%	11.5%	170.9%	170.9%
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleafed / coniferous woodland	2.40	0.25	0.030	0.071	2.7%	5.4%	72.6%	146.4%
Barracks Field	Calcareous grassland (using base cation)	1.60	0.19	0.028	0.057	1.7%	1.7%	37.0%	37.0%
Barracks Field	Acid grassland	1.60	0.19	0.028	0.057	4.1%	4.1%	89.8%	89.8%
Ceod-Y-Canal Wood	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.250	0.270	27.9%	27.9%	173.8%	173.8%
Various Ancient Woodlands	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.113	0.204	17.0%	17.0%	162.9%	162.9%

E Detailed Results Tables – MDF 2 Offline

If the MDF 2 drier is offline:

- the MDF 1 drier will use the exhaust gases from the K7 biomass plant and the K8 biomass plant and two gas engines;
- the electricity needed on site would be reduced so only 3 gas engines would be needed; and
- the exhaust gases of two engines would be used in MDF 1 drier, and one of the engines would need to vent to atmosphere via its own dedicated stack.

Table 70: Dispersion Modelling Results – Max Outside Installation Boundary

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	40	10.84	5.82	5.78	6.32	4.90	5.51	6.32	15.8%	17.16	42.9%
	99.79th%ile of hourly means	µg/m³	200	21.68	48.69	41.47	43.09	55.76	49.27	55.76	27.9%	77.44	38.7%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	40	10.84	12.84	13.33	15.00	11.19	13.00	15.00	37.5%	25.84	64.6%
	99.79th%ile of hourly means	µg/m³	200	21.68	115.87	96.68	94.28	132.70	99.57	132.70	66.3%	154.38	77.2%
PM_{10}	Annual mean	µg/m³	40	15.39	13.54	14.35	12.64	12.06	11.30	14.35	35.9%	29.74	74.3%
	90.41st%ile of daily means	µg/m³	50	15.39	34.96	32.74	27.63	31.45	26.43	34.96	69.9%	50.35	100.7%
$PM_{2.5}$	Annual mean	µg/m³	20	10.94	13.54	14.35	12.64	12.06	11.30	14.35	71.7%	25.29	126.4%
Formaldehyde	Annual mean	µg/m³	5	1	1.23	1.42	1.91	1.17	1.42	1.91	38.3%	2.91	58.3%
	Hourly mean	µg/m³	100	2	46.26	36.46	44.26	53.64	45.15	53.64	53.6%	55.64	55.6%
VOCs	Annual mean	µg/m³	-	-	15.40	16.03	24.86	13.41	15.37	24.86	-	-	-
	Hourly mean	µg/m³	-	-	243.92	211.50	374.06	286.58	216.99	374.06	-	-	-
Carbon monoxide	8 hour running mean	µg/m³	10,000	224	81.15	83.95	79.23	66.95	73.33	83.95	0.8%	307.95	3.1%
	Hourly mean	µg/m³	30,000	224	128.42	126.57	115.17	126.50	126.62	128.42	0.4%	352.42	1.2%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	6.78	12.70	11.57	11.75	9.85	12.47	12.70	10.2%	19.48	15.6%
	99.73rd%ile of hourly means	µg/m³	350	6.78	30.12	29.36	27.18	30.12	27.29	30.12	8.6%	36.90	10.5%

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
	99.9th%ile of 15 min. means	µg/m³	266	6.78	35.16	34.52	31.20	36.98	35.31	36.98	13.9%	43.76	16.5%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	7.73	7.62	6.93	7.61	7.62	7.73	1.0%	9.15	1.2%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.01	0.01	0.02	0.02	0.10%	2.37	14.8%
	Hourly mean	µg/m³	160	4.7	0.51	0.50	0.46	0.50	0.50	0.51	0.3%	5.21	3.3%
Ammonia	Annual mean	µg/m³	180	2.05	0.03	0.03	0.03	0.03	0.03	0.03	0.02%	2.08	1.2%
	Hourly mean	µg/m³	2,500	4.1	1.11	1.09	0.99	1.09	1.09	1.11	0.04%	5.21	0.2%
Mercury	Annual mean	ng/m³	250	2.8	0.09	0.11	0.11	0.10	0.12	0.12	0.05%	2.92	1.2%
	Hourly mean	ng/m³	7,500	5.6	3.70	3.64	3.31	3.64	3.64	3.70	0.05%	9.30	0.12%
Cadmium	Annual mean	ng/m³	5	0.08	0.09	0.11	0.11	0.10	0.12	0.12	2.3%	0.20	3.9%
	Hourly mean	ng/m³	-	0.16	3.70	3.64	3.31	3.64	3.64	3.70	-	3.86	-
PAHs (as BaP)	Annual mean	pg/m³	250	980	0.56	0.65	0.64	0.59	0.69	0.69	0.3%	980.69	392.3%
Dioxins	Annual mean	fg/m³	-	32.99	0.19	0.22	0.21	0.20	0.23	0.23	-	33.22	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.02	0.02	0.01	0.02	0.02	0.009%	0.15	0.07%
	Hourly mean	ng/m³	6,000	0.26	0.56	0.55	0.50	0.55	0.55	0.56	0.009%	0.81	0.01%
Other metals	Annual mean	ng/m³	-	-	0.93	1.08	1.06	0.98	1.15	1.15	-	-	-
	Hourly mean	ng/m³	-	-	36.95	36.42	33.14	36.40	36.43	36.95	-	-	-

Table 71: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide - Likely Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	0.89	1.03	0.99	0.90	0.93	1.03	2.6%	11.87	29.7%
Lodge Farm	0.74	0.89	1.01	0.76	0.87	1.01	2.5%	11.85	29.6%
Lodgefield Park	1.06	1.29	1.46	1.13	1.29	1.46	3.6%	12.30	30.7%
Rhosywaun	2.84	2.81	3.45	3.19	3.92	3.92	9.8%	14.76	36.9%
Chirk Community Hospital	1.38	1.38	1.64	1.54	1.84	1.84	4.6%	12.68	31.7%
Chirk Infant School	1.46	1.51	1.90	1.75	2.36	2.36	5.9%	13.20	33.0%
Highfield Farm	0.93	0.96	1.14	1.07	1.46	1.46	3.7%	12.30	30.8%
Maes-y-Waun	1.12	0.90	1.21	1.08	1.37	1.37	3.4%	12.21	30.5%
Collery Road	1.07	0.78	1.02	0.90	1.04	1.07	2.7%	11.91	29.8%
St Mary's Church	0.30	0.22	0.30	0.28	0.37	0.37	0.9%	11.21	28.0%
Station Avenue	1.51	1.14	1.33	1.16	1.21	1.51	3.8%	12.35	30.9%
Llwyn-y-cil	1.13	1.06	0.66	1.06	0.51	1.13	2.8%	11.97	29.9%
New Hall	0.54	0.63	0.50	0.46	0.50	0.63	1.6%	11.47	28.7%
Chirk Court	1.27	1.16	1.54	1.37	1.79	1.79	4.5%	12.63	31.6%

NOTES:

Impacts presented for the likely emissions scenario assuming a 70% conversion of NOx to NO_2. A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 72: Dispersion Modelling Results – Impact at Receptors - 99.79%ile of 1-hour Nitrogen Dioxide - Likley Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	9.07	9.22	8.83	9.08	8.89	9.22	4.6%	30.90	15.5%
Lodge Farm	8.28	8.33	8.27	7.92	8.18	8.33	4.2%	30.01	15.0%
Lodgefield Park	9.93	10.33	9.87	10.04	10.04	10.33	5.2%	32.01	16.0%
Rhosywaun	14.55	14.35	14.41	14.60	14.49	14.60	7.3%	36.28	18.1%
Chirk Community Hospital	9.26	9.10	9.15	9.03	9.02	9.26	4.6%	30.94	15.5%
Chirk Infant School	11.30	11.31	11.24	11.23	11.45	11.45	5.7%	33.13	16.6%
Highfield Farm	7.20	7.16	7.29	7.22	7.26	7.29	3.6%	28.97	14.5%
Maes-y-Waun	11.79	11.82	11.81	11.72	11.69	11.82	5.9%	33.50	16.7%
Collery Road	10.04	10.04	9.83	10.03	10.09	10.09	5.0%	31.77	15.9%
St Mary's Church	5.31	4.83	5.23	5.26	5.20	5.31	2.7%	26.99	13.5%
Station Avenue	11.78	11.44	11.49	11.43	11.20	11.78	5.9%	33.46	16.7%
Llwyn-y-cil	17.03	17.52	16.74	17.39	14.29	17.52	8.8%	39.20	19.6%
New Hall	8.84	8.80	9.20	9.00	8.86	9.20	4.6%	30.88	15.4%
Chirk Court	12.77	12.43	12.55	12.39	12.56	12.77	6.4%	34.45	17.2%

NOTES:

Impacts presented for the likely emissions scenario assuming a 35% conversion of NOx to NO_2. A comparison made to the 1-hour mean AQAL of 200 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 73: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide - Worst-case Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.92	2.20	2.12	1.94	1.98	2.20	5.5%	13.04	32.6%
Lodge Farm	1.59	1.92	2.17	1.64	1.87	2.17	5.4%	13.01	32.5%
Lodgefield Park	2.26	2.74	3.10	2.41	2.75	3.10	7.7%	13.94	34.8%
Rhosywaun	5.98	5.95	7.26	6.71	8.28	8.28	20.7%	19.12	47.8%
Chirk Community Hospital	2.98	2.99	3.53	3.32	3.94	3.94	9.8%	14.78	36.9%
Chirk Infant School	3.13	3.28	4.09	3.77	5.10	5.10	12.7%	15.94	39.8%
Highfield Farm	2.04	2.10	2.49	2.35	3.20	3.20	8.0%	14.04	35.1%
Maes-y-Waun	2.36	1.93	2.59	2.32	2.96	2.96	7.4%	13.80	34.5%
Collery Road	2.28	1.66	2.20	1.94	2.24	2.28	5.7%	13.12	32.8%
St Mary's Church	0.65	0.48	0.65	0.61	0.81	0.81	2.0%	11.65	29.1%
Station Avenue	3.34	2.51	2.97	2.55	2.69	3.34	8.3%	14.18	35.4%
Llwyn-y-cil	2.52	2.38	1.49	2.39	1.15	2.52	6.3%	13.36	33.4%
New Hall	1.17	1.40	1.11	1.00	1.10	1.40	3.5%	12.24	30.6%
Chirk Court	2.68	2.48	3.30	2.94	3.89	3.89	9.7%	14.73	36.8%

NOTES:

Impacts presented for the worst-case emissions scenario assuming a 70% conversion of NOx to NO_2. A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 74: Dispersion Modelling Results – Impact at Receptors - 99.79%ile of 1-hour Nitrogen Dioxide - Worst-case Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	20.27	20.62	19.70	20.16	19.58	20.62	10.3%	42.30	21.1%
Lodge Farm	17.54	17.98	17.24	17.00	17.43	17.98	9.0%	39.66	19.8%
Lodgefield Park	21.17	21.52	20.65	21.15	21.29	21.52	10.8%	43.20	21.6%
Rhosywaun	32.40	31.66	31.78	32.09	31.69	32.40	16.2%	54.08	27.0%
Chirk Community Hospital	20.82	20.40	20.87	20.24	20.26	20.87	10.4%	42.55	21.3%
Chirk Infant School	24.44	24.32	24.09	24.32	24.69	24.69	12.3%	46.37	23.2%
Highfield Farm	15.77	15.61	15.88	15.79	15.82	15.88	7.9%	37.56	18.8%
Maes-y-Waun	25.69	25.62	25.25	25.29	25.52	25.69	12.8%	47.37	23.7%
Collery Road	22.42	22.37	21.97	22.41	22.62	22.62	11.3%	44.30	22.1%
St Mary's Church	11.76	10.43	11.45	11.46	11.45	11.76	5.9%	33.44	16.7%
Station Avenue	26.30	25.93	25.81	25.64	25.35	26.30	13.2%	47.98	24.0%
Llwyn-y-cil	38.54	40.02	38.22	40.01	32.94	40.02	20.0%	61.70	30.9%
New Hall	20.11	19.73	20.63	20.14	20.04	20.63	10.3%	42.31	21.2%
Chirk Court	26.96	26.31	26.66	26.75	27.05	27.05	13.5%	48.73	24.4%

NOTES:

Impacts presented for the worst-case emissions scenario assuming a 35% conversion of NOx to NO_2. A comparison made to the 1-hour mean AQAL of 200 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 75: Dispersion Modelling Results – Impact at Receptors - Annual Mean PM10

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m³)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.35	1.49	1.41	1.33	1.42	1.49	3.7%	16.88	42.2%
Lodge Farm	1.09	1.26	1.36	1.15	1.28	1.36	3.4%	16.75	41.9%
Lodgefield Park	1.68	1.94	2.11	1.81	2.03	2.11	5.3%	17.50	43.7%
Rhosywaun	4.60	4.59	5.40	5.15	6.16	6.16	15.4%	21.55	53.9%
Chirk Community Hosp	2.10	2.13	2.39	2.39	2.84	2.84	7.1%	18.23	45.6%
Chirk Infant School	2.96	2.87	3.43	3.36	4.48	4.48	11.2%	19.87	49.7%
Highfield Farm	1.42	1.38	1.59	1.61	2.14	2.14	5.3%	17.53	43.8%
Maes-y-Waun	2.27	1.78	2.24	2.12	2.60	2.60	6.5%	17.99	45.0%
Collery Road	2.04	1.58	1.87	1.71	1.83	2.04	5.1%	17.43	43.6%
St Mary's Church	0.42	0.32	0.39	0.41	0.51	0.51	1.3%	15.90	39.8%
Station Avenue	2.41	2.04	2.13	2.05	1.75	2.41	6.0%	17.80	44.5%
Llwyn-y-cil	1.70	1.76	1.20	1.79	0.77	1.79	4.5%	17.18	42.9%
New Hall	0.90	0.93	0.79	0.83	0.79	0.93	2.3%	16.32	40.8%
Chirk Court	2.78	2.44	3.01	2.88	3.73	3.73	9.3%	19.12	47.8%

NOTES:

Impacts presented assume all the dust is as PM_{10}. A comparison made to the annual mean AQAL of 40 µg/m³ where appropriate. A background concentration of 15.39 µg/m³ has been applied to calculate the PEC.

Table 76: Dispersion Modelling Results – Impact at Receptors - 90.41%ile of 24-hour PM10

Receptor	Process Contribution (PC) (µg/m^3)						Max as % of AQAL	PEC (PC +Bg) (µg/m^3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	4.68	4.80	4.30	4.62	4.53	4.80	9.6%	20.19	40.4%
Lodge Farm	3.28	3.62	3.61	3.52	3.64	3.64	7.3%	19.03	38.1%
Lodgefield Park	4.94	5.58	5.52	5.24	5.40	5.58	11.2%	20.97	41.9%
Rhosywaun	12.40	11.84	12.41	13.49	14.36	14.36	28.7%	29.75	59.5%
Chirk Community Hosp	5.90	5.62	5.80	6.36	6.66	6.66	13.3%	22.05	44.1%
Chirk Infant School	9.37	9.26	8.81	9.62	11.51	11.51	23.0%	26.90	53.8%
Highfield Farm	4.58	4.35	4.47	4.58	5.71	5.71	11.4%	21.10	42.2%
Maes-y-Waun	8.04	6.33	7.53	6.73	8.09	8.09	16.2%	23.48	47.0%
Collery Road	7.48	6.40	6.57	5.74	6.84	7.48	15.0%	22.87	45.7%
St Mary's Church	1.66	1.19	1.61	1.51	1.73	1.73	3.5%	17.12	34.2%
Station Avenue	8.68	7.97	7.92	7.05	7.08	8.68	17.4%	24.07	48.1%
Llwyn-y-cil	7.15	7.30	4.23	7.60	3.06	7.60	15.2%	22.99	46.0%
New Hall	3.10	3.23	2.77	2.97	2.77	3.23	6.5%	18.62	37.2%
Chirk Court	9.15	8.91	9.39	8.84	10.11	10.11	20.2%	25.50	51.0%

NOTES:

Impacts presented assume all the dust is as PM_{10}. A comparison made to the daily mean AQAL of 50 µg/m^3 where appropriate. A background concentration of 15.39 µg/m^3 has been applied to calculate the PEC.

Table 77: Dispersion Modelling Results – Impact at Receptors - Annual Mean PM2.5

Receptor	Process Contribution (PC) (µg/m^3)						Max as % of AQAL	PEC (PC +Bg) (µg/m^3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.35	1.49	1.41	1.33	1.42	1.49	7.5%	12.43	62.2%
Lodge Farm	1.09	1.26	1.36	1.15	1.28	1.36	6.8%	12.30	61.5%
Lodgefield Park	1.68	1.94	2.11	1.81	2.03	2.11	10.5%	13.05	65.2%
Rhosywaun	4.60	4.59	5.40	5.15	6.16	6.16	30.8%	17.10	85.5%
Chirk Community Hosp	2.10	2.13	2.39	2.39	2.84	2.84	14.2%	13.78	68.9%
Chirk Infant School	2.96	2.87	3.43	3.36	4.48	4.48	22.4%	15.42	77.1%
Highfield Farm	1.42	1.38	1.59	1.61	2.14	2.14	10.7%	13.08	65.4%
Maes-y-Waun	2.27	1.78	2.24	2.12	2.60	2.60	13.0%	13.54	67.7%
Collery Road	2.04	1.58	1.87	1.71	1.83	2.04	10.2%	12.98	64.9%
St Mary's Church	0.42	0.32	0.39	0.41	0.51	0.51	2.6%	11.45	57.3%
Station Avenue	2.41	2.04	2.13	2.05	1.75	2.41	12.1%	13.35	66.8%
Llwyn-y-cil	1.70	1.76	1.20	1.79	0.77	1.79	8.9%	12.73	63.6%
New Hall	0.90	0.93	0.79	0.83	0.79	0.93	4.6%	11.87	59.3%
Chirk Court	2.78	2.44	3.01	2.88	3.73	3.73	18.6%	14.67	73.3%

NOTES:

Impacts presented assume all the dust is as $PM_{2.5}$. A comparison made to the annual mean AQAL of 20 µg/m^3 where appropriate. A background concentration of 10.94 µg/m^3 has been applied to calculate the PEC.

Table 78: Impact at River Dee and Bala Lake SAC

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	10.68	1.27	1.00	1.10	0.98	0.97	1.27	4.2%	11.95	39.8%
	Daily mean	µg/m³	75	10.68	14.48	12.67	13.71	11.29	20.92	20.92	27.9%	31.60	42.1%
	Daily mean	µg/m³	200	10.68	14.48	12.67	13.71	11.29	20.92	20.92	10.5%	31.60	15.8%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	10.68	2.84	2.26	2.45	2.20	2.17	2.84	9.5%	13.52	45.1%
	Daily mean	µg/m³	75	10.68	33.13	28.72	30.24	25.49	47.09	47.09	62.8%	57.77	77.0%
	Daily mean	µg/m³	200	10.68	33.13	28.72	30.24	25.49	47.09	47.09	23.5%	57.77	28.9%
Sulphur dioxide	Annual mean	µg/m³	20	0.79	0.50	0.42	0.42	0.40	0.38	0.50	2.5%	1.29	6.5%
Ammonia	Annual mean	µg/m³	3	2.05	0.01	0.01	0.01	0.01	0.01	0.01	0.4%	2.06	68.8%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.03	0.03	0.02	0.02	0.02	0.03	0.7%	-	-
	Daily mean	µg/m³	0.5	-	0.08	0.07	0.06	0.06	0.10	0.10	19.7%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 337500 taken from APIS.

Table 79: Impact at Johnstown Newt Site

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	12.69	0.11	0.13	0.13	0.11	0.11	0.13	0.4%	12.82	42.7%
	Daily mean	µg/m³	75	12.69	1.10	0.94	0.97	1.39	0.88	1.39	1.9%	14.08	18.8%
	Daily mean	µg/m³	200	12.69	1.10	0.94	0.97	1.39	0.88	1.39	0.7%	14.08	7.0%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	12.69	0.25	0.28	0.30	0.25	0.25	0.30	1.0%	12.99	43.3%
	Daily mean	µg/m³	75	12.69	2.41	2.06	2.18	3.09	1.92	3.09	4.1%	15.78	21.0%
	Daily mean	µg/m³	200	12.69	2.41	2.06	2.18	3.09	1.92	3.09	1.5%	15.78	7.9%
Sulphur dioxide	Annual mean	µg/m³	20	1.55	0.05	0.05	0.06	0.05	0.05	0.06	0.3%	1.61	8.0%
Ammonia	Annual mean	µg/m³	3	2.99	0.00	0.00	0.00	0.00	0.00	0.00	0.05%	2.99	99.7%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.002	0.002	0.002	0.002	0.002	0.002	0.04%	-	-
	Daily mean	µg/m³	0.5	-	0.005	0.005	0.005	0.006	0.004	0.006	1.3%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 337500 taken from APIS.

Table 80: Impact at Berwyn Mountains SAC and Berwyn SPA

Pollutant	Quantity	Units	AQAL	Bg Conc.	Process Concentration (PC)						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	7.72	0.10	0.14	0.11	0.11	0.13	0.14	0.5%	7.86	26.2%
	Daily mean	µg/m³	75	7.72	1.44	1.58	1.52	1.47	1.39	1.58	2.1%	9.30	12.4%
	Daily mean	µg/m³	200	7.72	1.44	1.58	1.52	1.47	1.39	1.58	0.8%	9.30	4.6%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	7.72	0.22	0.30	0.24	0.24	0.30	0.30	1.0%	8.02	26.7%
	Daily mean	µg/m³	75	7.72	3.24	3.60	3.41	3.27	3.13	3.60	4.8%	11.32	15.1%
	Daily mean	µg/m³	200	7.72	3.24	3.60	3.41	3.27	3.13	3.60	1.8%	11.32	5.7%
Sulphur dioxide	Annual mean	µg/m³	10	0.76	0.04	0.06	0.04	0.04	0.05	0.06	0.6%	0.82	8.2%
Ammonia	Annual mean	µg/m³	1	1.39	0.001	0.001	0.001	0.001	0.001	0.001	0.1%	1.39	139.1%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.002	0.003	0.002	0.002	0.003	0.003	0.1%	-	-
	Daily mean	µg/m³	0.5	-	0.006	0.009	0.008	0.007	0.007	0.009	1.8%	-	-

NOTES:

PC calculated for a single point closest to the Facility.

Background concentration for grid square 324500, 342500 taken from APIS.

Table 81: Impact at Chirk Castle SSSI

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	7.18	2.55	2.19	1.37	1.98	1.11	2.55	8.5%	9.73	32.4%
	Daily mean	µg/m³	75	7.18	30.62	29.05	25.10	28.02	25.41	30.62	40.8%	37.80	50.4%
	Daily mean	µg/m³	200	7.18	30.62	29.05	25.10	28.02	25.41	30.62	15.3%	37.80	18.9%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	7.18	5.75	4.94	3.09	4.46	2.47	5.75	19.2%	12.93	43.1%
	Daily mean	µg/m³	75	7.18	68.42	64.74	56.79	62.79	56.85	68.42	91.2%	75.60	100.8%
	Daily mean	µg/m³	200	7.18	68.42	64.74	56.79	62.79	56.85	68.42	34.2%	75.60	37.8%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.74	0.58	0.38	0.50	0.33	0.74	7.4%	1.53	15.3%
Ammonia	Annual mean	µg/m³	1	2.05	0.02	0.01	0.01	0.01	0.01	0.02	1.9%	2.07	206.9%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.06	0.04	0.05	0.04	0.04	0.06	1.1%	-	-
	Daily mean	µg/m³	0.5	-	0.13	0.10	0.09	0.09	0.11	0.13	25.9%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 327500, 338500 taken from APIS.

Table 82: Impact at Nant-y-Belan & Prynella Woods SSSI

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	12.2	0.46	0.47	0.52	0.52	0.60	0.60	2.0%	12.80	42.7%
	Daily mean	µg/m³	75	12.2	3.22	3.85	3.60	3.38	3.03	3.85	5.1%	16.05	21.4%
	Daily mean	µg/m³	200	12.2	3.22	3.85	3.60	3.38	3.03	3.85	1.9%	16.05	8.0%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	12.2	1.02	1.03	1.15	1.15	1.33	1.33	4.4%	13.53	45.1%
	Daily mean	µg/m³	75	12.2	7.13	8.37	8.02	7.53	6.72	8.37	11.2%	20.57	27.4%
	Daily mean	µg/m³	200	12.2	7.13	8.37	8.02	7.53	6.72	8.37	4.2%	20.57	10.3%
Sulphur dioxide	Annual mean	µg/m³	10	1.29	0.16	0.17	0.19	0.19	0.22	0.22	2.2%	1.51	15.1%
Ammonia	Annual mean	µg/m³	1	1.95	0.004	0.004	0.005	0.005	0.006	0.006	0.6%	1.96	195.6%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.006	0.007	0.006	0.006	0.007	0.007	0.1%	-	-
	Daily mean	µg/m³	0.5	-	0.015	0.016	0.018	0.016	0.015	0.018	3.6%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 340500 taken from APIS.

Table 83: Impact at Barracks Field

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	12.11	0.90	1.02	1.13	1.03	1.16	1.16	3.9%	13.27	44.2%
	Daily mean	µg/m³	75	12.11	6.48	7.52	6.55	7.36	6.05	7.52	10.0%	19.63	26.2%
	Daily mean	µg/m³	200	12.11	6.48	7.52	6.55	7.36	6.05	7.52	3.8%	19.63	9.8%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	12.11	1.95	2.22	2.47	2.25	2.52	2.52	8.4%	14.63	48.8%
	Daily mean	µg/m³	75	12.11	14.13	16.31	14.44	16.20	13.27	16.31	21.7%	28.42	37.9%
	Daily mean	µg/m³	200	12.11	14.13	16.31	14.44	16.20	13.27	16.31	8.2%	28.42	14.2%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.27	0.32	0.37	0.30	0.34	0.37	3.7%	1.16	11.6%
Ammonia	Annual mean	µg/m³	1	2.05	0.007	0.008	0.010	0.008	0.009	0.010	1.0%	2.06	206.0%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.011	0.015	0.012	0.011	0.013	0.015	0.3%	-	-
	Daily mean	µg/m³	0.5	-	0.03	0.03	0.03	0.03	0.03	0.03	6.6%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 339500 taken from APIS.

Table 84: Impact at Coed-Y-Canal Wood

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	13.81	5.36	7.15	6.40	4.90	5.52	7.15	23.8%	20.96	69.9%
	Daily mean	µg/m³	75	13.81	90.67	73.60	70.90	82.81	68.91	90.67	120.9%	104.48	139.3%
	Daily mean	µg/m³	200	13.81	90.67	73.60	70.90	82.81	68.91	90.67	45.3%	104.48	52.2%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	13.81	11.69	15.61	13.21	10.23	12.23	15.61	52.0%	29.42	98.1%
	Daily mean	µg/m³	75	13.81	202.92	167.09	170.66	204.60	156.71	204.60	272.8%	218.41	291.2%
	Daily mean	µg/m³	200	13.81	202.92	167.09	170.66	204.60	156.71	204.60	102.3%	218.41	109.2%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.98	1.26	1.12	0.92	1.05	1.26	12.6%	2.05	20.5%
Ammonia	Annual mean	µg/m³	1	2.05	0.03	0.03	0.03	0.02	0.03	0.03	3.2%	2.08	208.2%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.05	0.06	0.06	0.05	0.06	0.06	1.2%	-	-
	Daily mean	µg/m³	0.5	-	0.16	0.14	0.18	0.23	0.16	0.23	46.1%	-	-

NOTES:
PC calculated as maximum across the grid points within the ecological site in the modelling domain.
Background concentration for grid square 329500, 339500 taken from APIS.

Table 85: Impact at Maximum Impacted Ancient Woodland

Pollutant	Quantity	Units	CL	Bg Conc.	Process Concentration (PC)						Max as % of CL	PEC (PC +Bg)	PEC as % of CL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	30	13.81	2.85	2.30	2.15	2.02	2.36	2.85	9.5%	16.66	55.5%
	Daily mean	µg/m³	75	13.81	34.60	28.38	28.64	29.23	26.36	34.60	46.1%	48.41	64.5%
	Daily mean	µg/m³	200	13.81	34.60	28.38	28.64	29.23	26.36	34.60	17.3%	48.41	24.2%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	30	13.81	6.39	5.18	4.64	4.41	5.07	6.39	21.3%	20.20	67.3%
	Daily mean	µg/m³	75	13.81	77.28	64.02	64.79	65.88	58.85	77.28	103.0%	91.09	121.4%
	Daily mean	µg/m³	200	13.81	77.28	64.02	64.79	65.88	58.85	77.28	38.6%	91.09	45.5%
Sulphur dioxide	Annual mean	µg/m³	10	0.79	0.73	0.60	0.63	0.57	0.63	0.73	7.3%	1.52	15.2%
Ammonia	Annual mean	µg/m³	1	2.05	0.02	0.02	0.02	0.01	0.02	0.02	1.9%	2.07	206.9%
Hydrogen fluoride	Weekly mean	µg/m³	5	-	0.05	0.05	0.04	0.04	0.04	0.05	1.1%	-	-
	Daily mean	µg/m³	0.5	-	0.14	0.10	0.10	0.09	0.11	0.14	28.5%	-	-

NOTES:

PC calculated as maximum across the grid points within any ancient woodland in the modelling domain.

Background concentration for grid square 329500, 339500 taken from APIS.

Table 86: Annual Mean PC for Deposition Analysis

Site	Annual mean Process Contribution (µg/m³)				
	Nitrogen dioxide (likely case)	Nitrogen dioxide (worst-case)	Sulphur dioxide	Hydrogen chloride	Ammonia
River Dee and Bala Lake SAC, SSSI	0.892	1.986	0.503	0.090	0.013
Johnstown Newt Sites SAC	0.093	0.208	0.055	0.010	0.001
Berwyn and South Clwyd Mountains SAC	0.095	0.213	0.055	0.010	0.001
Berwyn SPA	0.095	0.213	0.055	0.010	0.001
Chirk Castle SSSI	1.785	4.023	0.736	0.131	0.019
Nant-y-belan & Prynella Woods SSSI	0.422	0.931	0.216	0.038	0.006
Barracks Field	5.267	1.765	0.373	0.067	0.010
Ceod-Y-Canal Wood	5.008	10.929	1.258	0.224	0.032
Various Ancient Woodlands	1.993	4.473	0.729	0.130	0.019

NOTES:
PC calculated as maximum across the grid points within each ecological site if within the modelling domain.

Table 87: Deposition Calculation - Grassland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Likely case							
River Dee and Bala Lake SAC, SSSI	0.128	0.952	1.375	0.067	0.195	0.014	0.098
Johnstown Newt Sites SAC	0.013	0.105	0.151	0.007	0.021	0.001	0.011
Berwyn and South Clwyd Mountains SAC	0.014	0.105	0.151	0.007	0.021	0.002	0.011
Berwyn SPA	0.014	0.105	0.151	0.007	0.021	0.002	0.011
Chirk Castle SSSI	0.257	1.393	2.012	0.098	0.355	0.025	0.144
Nant-y-belan & Prynella Woods SSSI	0.061	0.408	0.589	0.029	0.089	0.006	0.042
Barracks Field	0.758	0.706	1.020	0.050	0.808	0.058	0.073
Ceod-Y-Canal Wood	0.721	2.380	3.438	0.167	0.888	0.063	0.246
Various Ancient Woodlands	0.287	1.381	1.994	0.097	0.384	0.027	0.142
Worst-case							
River Dee and Bala Lake SAC, SSSI	0.286	0.952	1.375	0.067	0.353	0.025	0.098
Johnstown Newt Sites SAC	0.030	0.105	0.151	0.007	0.037	0.003	0.011
Berwyn and South Clwyd Mountains SAC	0.031	0.105	0.151	0.007	0.038	0.003	0.011
Berwyn SPA	0.031	0.105	0.151	0.007	0.038	0.003	0.011
Chirk Castle SSSI	0.579	1.393	2.012	0.098	0.677	0.048	0.144
Nant-y-belan & Prynella Woods SSSI	0.134	0.408	0.589	0.029	0.163	0.012	0.042
Barracks Field	0.254	0.706	1.020	0.050	0.304	0.022	0.073
Ceod-Y-Canal Wood	1.574	2.380	3.438	0.167	1.741	0.124	0.246
Various Ancient Woodlands	0.644	1.381	1.994	0.097	0.741	0.053	0.142

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
NOTE: deposition of sulphur, hydrogen chloride and ammonia is the same between the likely and worst-case scenario, the NOx changes which means that the overall N, and acid N deposition changes but acid S deposition remains the same.							

Table 88: Deposition Calculation - Woodland

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
Likely case							
River Dee and Bala Lake SAC, SSSI	0.257	1.904	3.300	0.100	0.357	0.025	0.212
Johnstown Newt Sites SAC	0.027	0.210	0.363	0.011	0.038	0.003	0.023
Berwyn and South Clwyd Mountains SAC	0.027	0.209	0.363	0.011	0.038	0.003	0.023
Berwyn SPA	0.027	0.209	0.363	0.011	0.038	0.003	0.023
Chirk Castle SSSI	0.514	2.786	4.829	0.147	0.661	0.047	0.310
Nant-y-belan & Prynella Woods SSSI	0.121	0.816	1.415	0.043	0.164	0.012	0.091
Barracks Field	1.517	1.413	2.449	0.074	1.591	0.114	0.157
Ceod-Y-Canal Wood	1.442	4.761	8.251	0.251	1.693	0.121	0.530
Various Ancient Woodlands	0.574	2.761	4.785	0.145	0.719	0.051	0.307
Worst-case							
River Dee and Bala Lake SAC, SSSI	0.572	1.904	3.300	0.100	0.672	0.048	0.212
Johnstown Newt Sites SAC	0.060	0.210	0.363	0.011	0.071	0.005	0.023
Berwyn and South Clwyd Mountains SAC	0.061	0.209	0.363	0.011	0.072	0.005	0.023
Berwyn SPA	0.061	0.209	0.363	0.011	0.072	0.005	0.023
Chirk Castle SSSI	1.159	2.786	4.829	0.147	1.305	0.093	0.310
Nant-y-belan & Prynella Woods SSSI	0.268	0.816	1.415	0.043	0.311	0.022	0.091
Barracks Field	0.508	1.413	2.449	0.074	0.583	0.042	0.157
Ceod-Y-Canal Wood	3.148	4.761	8.251	0.251	3.398	0.243	0.530
Various Ancient Woodlands	1.288	2.761	4.785	0.145	1.434	0.102	0.307

Site	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
NOTE: deposition of sulphur, hydrogen chloride and ammonia is the same between the likely and worst-case scenario, the NOx changes which means that the overall N, and acid N deposition changes but acid S deposition remains the same.							

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Table 89: Nitrogen Deposition

Site	NCL Class	kgN/ha/yr			PC			PEC	
		Lower CL	Upper CL	Background	kgN/ha/yr	% of LCL	% of UCL	% of LCL	% of UCL
Likely case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	-	-	22.40	0.195	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	-	-	24.50	0.021	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.14	0.021	0.4%	0.2%	423.2%	211.6%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.14	0.021	0.4%	0.2%	423.2%	211.6%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.14	0.021	0.2%	0.1%	211.6%	141.1%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.14	0.021	0.2%	0.1%	211.6%	105.8%
Berwyn and South Clwyd Mountains SAC	Sub-atlantic semi-dry calcareous grassland	15	25	21.14	0.021	0.1%	0.1%	141.1%	84.6%
Berwyn SPA	Broadleaved deciduous woodland	10	20	31.36	0.038	0.4%	0.2%	314.0%	157.0%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	21.14	0.021	0.2%	0.1%	211.6%	105.8%
Chirk Castle SSSI	Fagus Woodland	10	20	35.00	0.661	6.6%	3.3%	356.6%	178.3%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	22.40	0.355	1.8%	1.2%	113.8%	75.8%
Nant-y-belan & Prynella Woods SSSI	Fagus Woodland	10	20	33.60	0.164	1.6%	0.8%	337.6%	168.8%
Barracks Field	Low and medium altitude hay meadows	20	30	22.40	0.808	4.0%	2.7%	116.0%	77.4%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	35.00	1.693	16.9%	8.5%	366.9%	183.5%
Various Ancient Woodlands	Fagus Woodland	10	20	35.00	0.719	7.2%	3.6%	357.2%	178.6%
Worst-case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	-	-	22.40	0.353	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	-	-	24.50	0.037	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Raised and blanket bogs	5	10	21.14	0.038	0.8%	0.4%	423.6%	211.8%
Berwyn and South Clwyd Mountains SAC	Alpine and subalpine grasslands	5	10	21.14	0.038	0.8%	0.4%	423.6%	211.8%
Berwyn and South Clwyd Mountains SAC	Valley mires, poor fens and transition mires	10	15	21.14	0.038	0.4%	0.3%	211.8%	141.2%
Berwyn and South Clwyd Mountains SAC	Dry heaths	10	20	21.14	0.038	0.4%	0.2%	211.8%	105.9%
Berwyn and South Clwyd Mountains SAC	Sub-atlantic semi-dry calcareous grassland	15	25	21.14	0.038	0.3%	0.2%	141.2%	84.7%
Berwyn SPA	Broadleaved deciduous woodland	10	20	31.36	0.072	0.7%	0.4%	314.3%	157.2%
Berwyn SPA	Northern wet heath: Calluna-dominated wet heath (upland moorland)	10	20	21.14	0.038	0.4%	0.2%	211.8%	105.9%
Chirk Castle SSSI	Fagus Woodland	10	20	35.00	1.305	13.1%	6.5%	363.1%	181.5%
Chirk Castle SSSI	Low and medium altitude hay meadows	20	30	22.40	0.677	3.4%	2.3%	115.4%	76.9%
Nant-y-belan & Prynella Woods SSSI	Fagus Woodland	10	20	33.60	0.311	3.1%	1.6%	339.1%	169.6%
Barracks Field	Low and medium altitude hay meadows	20	30	22.40	0.304	1.5%	1.0%	113.5%	75.7%
Ceod-Y-Canal Wood	Fagus Woodland	10	20	35.00	3.398	34.0%	17.0%	384.0%	192.0%
Various Ancient Woodlands	Fagus Woodland	10	20	35.00	1.434	14.3%	7.2%	364.3%	182.2%

Table 90: Acid Deposition

Site	Acidity Class	Bg		PC		PC		PEC	
		N (keqN/hr/yr)	S (keqS/hr/yr)	N (keqN/hr/yr)	S (keqS/hr/yr)	As % of CLmin	As % of CLmax	As % of CLmin	As % of CLmax
Likely case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	1.60	0.19	0.014	0.098	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	1.75	0.19	0.001	0.011	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.51	0.21	0.002	0.011	2.2%	0.3%	314.4%	39.7%
Berwyn and South Clwyd Mountains SAC	Bogs	1.51	0.21	0.002	0.011	1.9%	0.9%	262.5%	126.7%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.51	0.21	0.002	0.011	1.4%	0.2%	196.4%	34.2%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.51	0.21	0.002	0.011	0.3%	0.2%	35.7%	33.0%
Berwyn SPA	Unmanaged broadleafed / coniferous woodland	2.24	0.26	0.003	0.023	2.9%	0.7%	283.8%	64.2%
Chirk Castle SSSI	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.047	0.310	18.9%	19.2%	162.7%	165.1%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.60	0.19	0.025	0.144	3.5%	3.5%	40.3%	40.3%
Chirk Castle SSSI	Acid grassland	1.60	0.19	0.025	0.144	15.1%	15.1%	174.5%	174.5%
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleafed / coniferous woodland	2.40	0.25	0.012	0.091	2.7%	5.5%	72.6%	146.5%
Barracks Field	Calcareous grassland (using base cation)	1.60	0.19	0.058	0.073	2.6%	2.6%	37.9%	37.9%
Barracks Field	Acid grassland	1.60	0.19	0.058	0.073	6.3%	6.3%	92.0%	92.0%
Ceod-Y-Canal Wood	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.121	0.530	34.9%	34.9%	180.8%	180.8%
Various Ancient Woodlands	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.051	0.307	19.2%	19.2%	165.2%	165.2%
Worst-case									
River Dee and Bala Lake SAC, SSSI	Not sensitive	1.60	0.19	0.025	0.098	-	-	-	-
Johnstown Newt Sites SAC	Not sensitive	1.75	0.19	0.003	0.011	-	-	-	-
Berwyn and South Clwyd Mountains SAC	Montane	1.51	0.21	0.003	0.011	2.5%	0.3%	314.6%	39.8%
Berwyn and South Clwyd Mountains SAC	Bogs	1.51	0.21	0.003	0.011	2.0%	1.0%	262.7%	126.8%
Berwyn and South Clwyd Mountains SAC	Dwarf shrub heath	1.51	0.21	0.003	0.011	1.5%	0.3%	196.5%	34.2%
Berwyn and South Clwyd Mountains SAC	Calcareous grassland (using base cation)	1.51	0.21	0.003	0.011	0.3%	0.3%	35.7%	33.0%
Berwyn SPA	Unmanaged broadleafed / coniferous woodland	2.24	0.26	0.005	0.023	3.2%	0.7%	284.1%	64.3%
Chirk Castle SSSI	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.093	0.310	21.3%	21.6%	165.1%	167.6%
Chirk Castle SSSI	Calcareous grassland (using base cation)	1.60	0.19	0.048	0.144	4.0%	4.0%	40.8%	40.8%
Chirk Castle SSSI	Acid grassland	1.60	0.19	0.048	0.144	17.1%	17.1%	176.5%	176.5%
Nant-y-belan & Prynella Woods SSSI	Unmanaged broadleafed / coniferous woodland	2.40	0.25	0.022	0.091	3.0%	6.0%	72.9%	147.1%
Barracks Field	Calcareous grassland (using base cation)	1.60	0.19	0.022	0.073	1.9%	1.9%	37.2%	37.2%
Barracks Field	Acid grassland	1.60	0.19	0.022	0.073	4.5%	4.5%	90.3%	90.3%
Ceod-Y-Canal Wood	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.243	0.530	41.5%	41.5%	187.4%	187.4%
Various Ancient Woodlands	Unmanaged broadleafed / coniferous woodland	2.50	0.22	0.102	0.307	22.0%	22.0%	167.9%	167.9%

F Detailed Results Tables – MDF 1 Offline

If the MDF 1 drier is offline:

- the MDF 2 drier will use the exhaust gases from the K7 biomass plant and the K8 biomass plant and four gas engines;
- the electricity needed on site would be reduced so only 4 gas engines would be needed.

Table 91: Dispersion Modelling Results – Max Outside Installation Boundary

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	40	10.84	4.65	5.01	5.75	4.18	4.96	5.75	14.4%	16.59	41.5%
	99.79th%ile of hourly means	µg/m³	200	21.68	46.63	38.81	36.70	52.51	40.77	52.51	26.3%	74.19	37.1%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	40	10.84	11.58	12.49	14.33	10.40	12.38	14.33	35.8%	25.17	62.9%
	99.79th%ile of hourly means	µg/m³	200	21.68	116.56	97.01	91.74	131.26	101.91	131.26	65.6%	152.94	76.5%
PM_{10}	Annual mean	µg/m³	40	15.39	13.47	14.28	12.55	12.00	11.23	14.28	35.7%	29.67	74.2%
	90.41st%ile of daily means	µg/m³	50	15.39	34.96	32.74	27.62	31.47	26.43	34.96	69.9%	50.35	100.7%
$PM_{2.5}$	Annual mean	µg/m³	20	10.94	13.47	14.28	12.55	12.00	11.23	14.28	71.4%	25.22	126.1%
Formaldehyde	Annual mean	µg/m³	5	1	1.22	1.40	1.90	1.19	1.44	1.90	38.0%	2.90	58.0%
	Hourly mean	µg/m³	100	2	46.08	36.46	44.77	52.75	45.04	52.75	52.7%	54.75	54.7%
VOCs	Annual mean	µg/m³	-	-	15.30	15.94	24.75	13.33	15.28	24.75	-	-	-
	Hourly mean	µg/m³	-	-	250.22	211.50	378.17	290.73	217.84	378.17	-	-	-
Carbon monoxide	8 hour running mean	µg/m³	10,000	224	39.77	40.21	38.74	35.69	38.09	40.21	0.4%	264.21	2.6%
	Hourly mean	µg/m³	30,000	224	62.61	63.64	56.76	58.02	61.96	63.64	0.2%	287.64	1.0%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	6.78	6.01	6.01	5.98	5.25	6.19	6.19	5.0%	12.97	10.4%
	99.73rd%ile of hourly means	µg/m³	350	6.78	14.28	13.99	13.47	14.45	13.60	14.45	4.1%	21.23	6.1%

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
	99.9th%ile of 15 min. means	µg/m³	266	6.78	16.82	16.00	15.80	16.98	16.02	16.98	6.4%	23.76	8.9%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	3.71	3.77	3.36	3.43	3.67	3.77	0.5%	5.19	0.7%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.01	0.01	0.01	0.01	0.06%	2.36	14.7%
	Hourly mean	µg/m³	160	4.7	0.24	0.25	0.22	0.23	0.24	0.25	0.2%	4.95	3.1%
Ammonia	Annual mean	µg/m³	180	2.05	0.02	0.02	0.03	0.02	0.03	0.03	0.02%	2.08	1.2%
	Hourly mean	µg/m³	2,500	4.1	0.73	0.74	0.66	0.68	0.72	0.74	0.03%	4.84	0.2%
Mercury	Annual mean	ng/m³	250	2.8	0.06	0.07	0.09	0.08	0.09	0.09	0.04%	2.89	1.2%
	Hourly mean	ng/m³	7,500	5.6	2.44	2.48	2.21	2.26	2.42	2.48	0.03%	8.08	0.11%
Cadmium	Annual mean	ng/m³	5	0.08	0.06	0.07	0.09	0.08	0.09	0.09	1.8%	0.17	3.4%
	Hourly mean	ng/m³	-	0.16	2.44	2.48	2.21	2.26	2.42	2.48	-	2.64	-
PAHs (as BaP)	Annual mean	pg/m³	250	980	0.39	0.44	0.53	0.48	0.55	0.55	0.2%	980.55	392.2%
Dioxins	Annual mean	fg/m³	-	32.99	0.13	0.15	0.18	0.16	0.18	0.18	-	33.17	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01	0.01	0.01	0.01	0.01	0.007%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	0.37	0.37	0.33	0.34	0.36	0.37	0.006%	0.63	0.01%
Other metals	Annual mean	ng/m³	-	-	0.64	0.73	0.88	0.79	0.91	0.91	-	-	-
	Hourly mean	ng/m³	-	-	24.42	24.82	22.14	22.63	24.16	24.82	-	-	-

G Detailed Results Tables – MDF 1&2 Offline

If both MDF driers are offline, the exhaust gases from the biomass plant and gas engines would vent to atmosphere via their dedicated stacks. If the MDF driers were not online, the power and heat needed for the site would be reduced and these combustion plants would not be needed and would be shut down. Kronospan would not operate the combustion plant in power only generation mode for prolonged periods as the board manufacturing process will not have a significant power demand when the MDF 1 and MDF 2 driers are offline. Therefore, this operating scenario would only occur for short periods. However, results for all averaging periods have been provided for completeness.

Table 92: Dispersion Modelling Results – Max Outside Installation Boundary

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	40	10.84	10.33	10.75	9.69	8.10	9.83	10.75	26.9%	21.59	54.0%
	99.79th%ile of hourly means	µg/m³	200	21.68	68.72	72.26	63.01	63.19	58.86	72.26	36.1%	93.94	47.0%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	40	10.84	17.19	16.78	17.16	13.73	15.07	17.19	43.0%	28.03	70.1%
	99.79th%ile of hourly means	µg/m³	200	21.68	103.60	105.08	99.28	106.61	98.74	106.61	53.3%	128.29	64.1%
PM_{10}	Annual mean	µg/m³	40	15.39	13.63	14.64	12.77	12.17	11.45	14.64	36.6%	30.03	75.1%
	90.41st%ile of daily means	µg/m³	50	15.39	35.04	33.05	27.71	31.60	26.55	35.04	70.1%	50.43	100.9%
$PM_{2.5}$	Annual mean	µg/m³	20	10.94	13.63	14.64	12.77	12.17	11.45	14.64	73.2%	25.58	127.9%
Formaldehyde	Annual mean	µg/m³	5	1	1.21	1.29	1.36	1.07	1.30	1.36	27.1%	2.36	47.1%
	Hourly mean	µg/m³	100	2	44.19	36.46	28.15	51.93	44.92	51.93	51.9%	53.93	53.9%
VOCs	Annual mean	µg/m³	-	-	15.22	15.81	17.53	13.27	15.18	17.53	-	-	-
	Hourly mean	µg/m³	-	-	220.41	211.50	197.16	262.00	217.40	262.00	-	-	-
Carbon monoxide	8 hour running mean	µg/m³	10,000	224	169.03	174.37	138.69	141.46	161.20	174.37	1.7%	398.37	4.0%
	Hourly mean	µg/m³	30,000	224	194.28	195.39	192.56	181.22	193.48	195.39	0.7%	419.39	1.4%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	6.78	27.00	28.29	17.97	12.13	22.45	28.29	22.6%	35.07	28.1%
	99.73rd%ile of hourly means	µg/m³	350	6.78	48.23	56.21	50.94	35.28	51.83	56.21	16.1%	62.99	18.0%

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
	99.9th%ile of 15 min. means	µg/m³	266	6.78	55.24	60.33	56.42	47.83	56.76	60.33	22.7%	67.11	25.2%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	10.46	10.52	10.37	9.76	10.42	10.52	1.4%	11.94	1.6%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.01	0.01	0.01	0.01	0.08%	2.36	14.8%
	Hourly mean	µg/m³	160	4.7	0.45	0.46	0.45	0.42	0.45	0.46	0.3%	5.16	3.2%
Ammonia	Annual mean	µg/m³	180	2.05	0.01	0.01	0.02	0.02	0.02	0.02	0.01%	2.07	1.1%
	Hourly mean	µg/m³	2,500	4.1	0.79	0.80	0.74	0.71	0.84	0.84	0.03%	4.94	0.2%
Mercury	Annual mean	ng/m³	250	2.8	0.05	0.05	0.06	0.06	0.07	0.07	0.03%	2.87	1.1%
	Hourly mean	ng/m³	7,500	5.6	2.63	2.67	2.46	2.37	2.80	2.80	0.04%	8.40	0.11%
Cadmium	Annual mean	ng/m³	5	0.08	0.05	0.05	0.06	0.06	0.07	0.07	1.3%	0.15	2.9%
	Hourly mean	ng/m³	-	0.16	2.63	2.67	2.46	2.37	2.80	2.80	-	2.96	-
PAHs (as BaP)	Annual mean	pg/m³	250	980	0.27	0.27	0.37	0.34	0.39	0.39	0.2%	980.39	392.2%
Dioxins	Annual mean	fg/m³	-	32.99	0.09	0.09	0.12	0.11	0.13	0.13	-	33.12	-
PCBs	Annual mean	ng/m³	200	0.13	0.01	0.01	0.01	0.01	0.01	0.01	0.005%	0.14	0.07%
	Hourly mean	ng/m³	6,000	0.26	0.39	0.40	0.37	0.36	0.42	0.42	0.007%	0.68	0.01%
Other metals	Annual mean	ng/m³	-	-	0.45	0.45	0.61	0.56	0.65	0.65	-	-	-
	Hourly mean	ng/m³	-	-	26.25	26.71	24.61	23.70	27.96	27.96	-	-	-

H Detailed Results Tables – K7 and K8 Biomass Plants Offline

The only change to normal operations would be the removal of emissions from the K7 and K8 biomass plant and the NOx emissions from the K5 and K6 gas heaters. As such results have only been presented for NO_2.

Table 93: Dispersion Modelling Results – Max Outside Installation Boundary

Pollutant	Quantity	Units	AQAL	Bg Conc.	Max Process Contribution (PC) outside Installation Boundary						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2013	2014	2015	2016	2017	Max			
Nitrogen dioxide (likely case)	Annual mean	µg/m³	40	10.84	13.00	14.63	15.85	11.58	13.96	15.85	39.6%	26.69	66.7%
	99.79th%ile of hourly means	µg/m³	200	21.68	96.65	99.58	98.09	95.36	97.32	99.58	49.8%	121.26	60.6%
Nitrogen dioxide (worst-case)	Annual mean	µg/m³	40	10.84	5.91	6.97	7.11	5.25	6.38	7.11	17.8%	17.95	44.9%
	99.79th%ile of hourly means	µg/m³	200	21.68	60.00	43.00	74.99	78.36	54.88	78.36	39.2%	100.04	50.0%

Table 94: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide - Likely Emissions Scenario

Receptor	Process Contribution (PC) (µg/m^3)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	1.20	1.36	1.31	1.20	1.23	1.36	3.4%	12.20	30.5%
Lodge Farm	0.96	1.18	1.35	0.99	1.12	1.35	3.4%	12.19	30.5%
Lodgefield Park	1.35	1.65	1.90	1.42	1.62	1.90	4.7%	12.74	31.8%
Rhosywaun	3.40	3.43	4.23	3.82	4.65	4.65	11.6%	15.49	38.7%
Chirk Community Hospital	1.79	1.83	2.20	2.01	2.38	2.38	6.0%	13.22	33.1%
Chirk Infant School	2.19	2.27	2.88	2.66	3.50	3.50	8.7%	14.34	35.8%
Highfield Farm	1.37	1.39	1.70	1.60	2.10	2.10	5.3%	12.94	32.4%
Maes-y-Waun	1.44	1.23	1.64	1.46	1.86	1.86	4.7%	12.70	31.8%
Collery Road	1.40	1.03	1.38	1.20	1.37	1.40	3.5%	12.24	30.6%
St Mary's Church	0.41	0.32	0.42	0.39	0.52	0.52	1.3%	11.36	28.4%
Station Avenue	2.10	1.59	1.87	1.62	1.70	2.10	5.2%	12.94	32.3%
Llwyn-y-cil	1.58	1.47	0.92	1.41	0.70	1.58	4.0%	12.42	31.1%
New Hall	0.68	0.85	0.65	0.58	0.64	0.85	2.1%	11.69	29.2%
Chirk Court	1.72	1.66	2.22	1.98	2.59	2.59	6.5%	13.43	33.6%

NOTES:

Impacts presented for the likely emissions scenario assuming a 70% conversion of NOx to NO_2. A comparison made to the annual mean AQAL of 40 µg/m^3 where appropriate. A background concentration of 10.84 µg/m^3 has been applied to calculate the PEC.

Table 95: Dispersion Modelling Results – Impact at Receptors - 99.79%ile of 1-hour Nitrogen Dioxide - Likley Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	11.41	11.76	11.56	11.41	11.05	11.76	5.9%	33.44	16.7%
Lodge Farm	8.75	8.68	8.69	8.68	8.60	8.75	4.4%	30.43	15.2%
Lodgefield Park	10.86	10.56	10.58	10.72	10.76	10.86	5.4%	32.54	16.3%
Rhosywaun	16.18	16.50	16.46	16.83	16.83	16.83	8.4%	38.51	19.3%
Chirk Community Hospital	10.19	10.17	10.13	10.17	10.32	10.32	5.2%	32.00	16.0%
Chirk Infant School	15.20	14.92	14.76	15.33	14.93	15.33	7.7%	37.01	18.5%
Highfield Farm	8.60	8.59	8.44	8.55	8.55	8.60	4.3%	30.28	15.1%
Maes-y-Waun	16.25	16.14	16.44	16.01	16.30	16.44	8.2%	38.12	19.1%
Collery Road	13.92	14.30	14.33	14.36	14.58	14.58	7.3%	36.26	18.1%
St Mary's Church	6.34	5.91	6.25	6.14	6.19	6.34	3.2%	28.02	14.0%
Station Avenue	15.63	16.19	15.87	15.49	15.83	16.19	8.1%	37.87	18.9%
Llwyn-y-cil	18.93	19.75	17.65	17.91	17.38	19.75	9.9%	41.43	20.7%
New Hall	11.20	11.27	11.26	10.61	11.09	11.27	5.6%	32.95	16.5%
Chirk Court	16.85	17.48	17.24	17.13	17.89	17.89	8.9%	39.57	19.8%

NOTES:

Impacts presented for the likely emissions scenario assuming a 35% conversion of NOx to NO_2. A comparison made to the 1-hour mean AQAL of 200 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 10.84 µg/m³ has been applied to calculate the PEC.

Table 96: Dispersion Modelling Results – Impact at Receptors - Annual Mean Nitrogen Dioxide - Worst-case Emissions Scenario

Receptor	Process Contribution (PC) ($\mu g/m^3$)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	2.67	3.03	2.92	2.68	2.74	3.03	7.6%	13.87	34.7%
Lodge Farm	2.15	2.63	3.03	2.20	2.50	3.03	7.6%	13.87	34.7%
Lodgefield Park	2.97	3.64	4.20	3.14	3.56	4.20	10.5%	15.04	37.6%
Rhosywaun	7.32	7.42	9.15	8.25	10.07	10.07	25.2%	20.91	52.3%
Chirk Community Hospital	3.95	4.04	4.88	4.45	5.25	5.25	13.1%	16.09	40.2%
Chirk Infant School	4.56	4.75	6.08	5.61	7.33	7.33	18.3%	18.17	45.4%
Highfield Farm	2.99	3.05	3.74	3.51	4.61	4.61	11.5%	15.45	38.6%
Maes-y-Waun	3.04	2.63	3.50	3.11	3.97	3.97	9.9%	14.81	37.0%
Collery Road	3.00	2.22	2.99	2.59	2.97	3.00	7.5%	13.84	34.6%
St Mary's Church	0.92	0.72	0.95	0.87	1.16	1.16	2.9%	12.00	30.0%
Station Avenue	4.58	3.46	4.10	3.52	3.75	4.58	11.5%	15.42	38.6%
Llwyn-y-cil	3.39	3.15	1.98	3.02	1.52	3.39	8.5%	14.23	35.6%
New Hall	1.49	1.91	1.45	1.26	1.42	1.91	4.8%	12.75	31.9%
Chirk Court	3.58	3.47	4.66	4.16	5.44	5.44	13.6%	16.28	40.7%

NOTES:

Impacts presented for the worst-case emissions scenario assuming a 70% conversion of NOx to NO_2. A comparison made to the annual mean AQAL of 40 $\mu g/m^3$ where appropriate. A background concentration of 10.84 $\mu g/m^3$ has been applied to calculate the PEC.

Table 97: Dispersion Modelling Results – Impact at Receptors - 99.79%ile of 1-hour Nitrogen Dioxide - Worst-case Emissions Scenario

Receptor	Process Contribution (PC) (µg/m³)						Max as % of AQAL	PEC (PC +Bg) (µg/m3)	PEC as % of AQAL
	2013	2014	2015	2016	2017	Max			
Afron Bradley Farm	26.28	27.61	26.96	26.62	25.85	27.61	13.8%	49.29	24.6%
Lodge Farm	19.53	19.33	19.23	19.49	19.15	19.53	9.8%	41.21	20.6%
Lodgefield Park	24.06	23.74	23.81	24.31	23.87	24.31	12.2%	45.99	23.0%
Rhosywaun	36.00	36.28	36.64	37.34	37.36	37.36	18.7%	59.04	29.5%
Chirk Community Hospital	22.91	22.80	22.72	22.86	23.27	23.27	11.6%	44.95	22.5%
Chirk Infant School	33.71	33.27	32.82	34.32	33.44	34.32	17.2%	56.00	28.0%
Highfield Farm	19.08	19.20	19.03	19.14	19.16	19.20	9.6%	40.88	20.4%
Maes-y-Waun	36.54	35.42	36.17	36.02	35.69	36.54	18.3%	58.22	29.1%
Collery Road	32.09	32.56	32.75	32.79	33.09	33.09	16.5%	54.77	27.4%
St Mary's Church	14.32	13.49	14.19	13.57	13.84	14.32	7.2%	36.00	18.0%
Station Avenue	35.96	37.21	36.68	35.52	36.51	37.21	18.6%	58.89	29.4%
Llwyn-y-cil	44.11	45.73	42.02	41.82	40.57	45.73	22.9%	67.41	33.7%
New Hall	25.86	26.20	26.04	24.12	25.58	26.20	13.1%	47.88	23.9%
Chirk Court	36.78	37.47	37.96	37.32	38.53	38.53	19.3%	60.21	30.1%

NOTES:

Impacts presented for the worst-case emissions scenario assuming a 35% conversion of NOx to NO_2. A comparison made to the 1-hour mean AQAL of 200 µg/m³ where appropriate. A background concentration two times the annual mean concentration of 10.84 µg/m³ has been applied to calculate the PEC.

I Detailed Results Tables – Cumulative Ecological Impacts

This section sets out the results of the cumulative modelling at the ecological sites. Each of the cumulative sources individually are screened out as insignificant. This has been reported to quantify the total impact.

Table 98: Impact at River Dee and Bala Lake SAC

Pollutant	Quantity	AQAL (µg/m³)	Kronospan	Mondelez	Peaking plant
Nitrogen dioxide (likely case)	Annual mean	30	5.1%	0.2%	0.1%
	Daily mean	200	32.0%	1.0%	1.8%
	Daily mean	200	12.0%	0.4%	0.7%
Nitrogen dioxide (worst-case)	Annual mean	30	12.6%	0.2%	0.1%
	Daily mean	200	78.6%	1.0%	1.8%
	Daily mean	200	29.5%	0.4%	0.7%
NOTES: *Maximum impact across any point, as such the maximum may not occur from each plant at the same place.*					

Table 99: Impact at Chirk Castle SSSI

Pollutant	Quantity	AQAL (µg/m³)	Kronospan	Mondelez	Peaking plant
Nitrogen dioxide (likely case)	Annual mean	30	8.8%	0.3%	0.1%
	Daily mean	200	39.2%	1.3%	1.7%
	Daily mean	200	14.7%	0.5%	0.6%
Nitrogen dioxide (worst-case)	Annual mean	30	22.0%	0.3%	0.1%
	Daily mean	200	97.5%	1.3%	1.7%
	Daily mean	200	36.6%	0.5%	0.6%
NOTES: *Maximum impact across any point, as such the maximum may not occur from each plant at the same place.*					

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