Kronospan Low Carbon CHP Facility

Appendix 6C

Dispersion Modelling Methodology

Prepared for: Kronospan

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DNS5-4-024

1.0 INTRODUCTION

1.1 Background

1.1.1 Kronospan Limited (Kronospan) operates a panel board manufacturing facility at its site in Chirk, North Wales (the Kronospan Facility). This is regulated by Natural Resource Wales (NRW) under the terms of an Environmental Permit (EP) (reference EPR/BW999IG) with the latest variation (V10) issued in September 2023. A variation to align with the requirements of the Waste Incineration (WI) Best Available Techniques Conclusions (the BATC) is in the process of being determined. In addition, an additional application is currently pending with NRW to vary the existing EP to include the following:

i) Installation of an Oriented Strand Board (OSB) manufacturing process/plant.
ii) Amendments to the rail unloading and biomass handling and storage arrangements.
iii) Additional raw material storage areas, including the installation of hardstanding to some additional storage areas within the Log Yard.
iv) A new site access point and new lorry parking facility.
v) Additional surface water run-off lagoons/wetlands, including discharge of uncontaminated surface water run-off from the lagoons/wetlands.
vi) Additional land to be incorporated into the installation boundary to accommodate items iii, iv, and v.

1.1.2 The proposed changes involve the upgrading of previously mothballed driers to be used as OSB driers. Emissions from these sources would be ducted to the WESP 32 for abatement prior to release to atmosphere. Kronospan has planning permission for these changes.

1.1.3 The WESP 32 currently takes emissions from A31 and re-ducted emissions from emission points A5 and A6, each of these sources have limits on emissions of particulate matter (PM), total volatile organic carbon (TVOC), and formaldehyde (CH_2O). The OSB proposal introduces two directly heated driers on the OSB line for which the Panel Board Best Available Techniques (BAT) Reference document (BREF) includes BAT-AELs for oxides of nitrogen (NOx), PM, TVOC and CH_2O. This application is currently being determined by NRW and is not currently operational.

1.1.4 The Proposed Development is for the development of a Low Carbon Combined Heat and Power (CHP) Facility. This will be used to provide power and heat to the Kronospan Facility. As part of this the two existing gas turbines will be removed from site, and two of the gas engines which have not yet been constructed (but are permitted) would not be installed.

1.1.5 The CHP Facility will process waste wood and as such will be classified as a waste wood co-incinerator and need to comply with the requirements of the Waste Incineration (WI) BREF. This includes limits on emissions to air for the following suite of pollutants:

i) Oxides of nitrogen (NOx as nitrogen dioxide (NO_2);
ii) Sulphur dioxide (SO_2);
iii) Carbon monoxide (CO);
iv) Particulates (PM);
v) Hydrogen chloride (HCl);
vi) Volatile organic compounds (VOCs);
vii) Hydrogen fluoride (HF);
viii) Ammonia (NH_3);
ix) Mercury (Hg);
x) Cadmium (Cd) and thallium (Tl);
xi) Other group 3 heavy metals including arsenic (As), antimony (Sb), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), nickel (Ni) and vanadium (V); and
xii) Dioxins and furans and dioxin-like PCBs.

1.1.6 For the CHP Facility Kronospan are committing to a NOx emission limit value (ELV) of 105 mg/Nm^3 (273.15K, dry, 6% reference oxygen content, 101.3kPa) and an NH_3 ELV of 6.45 mg/Nm^3 (273.15K, dry, 6% reference oxygen content, 101.3kPa) which go well beyond the requirements of the WI BREF.

1.1.7 Therefore, this assessment considers those impacts which are affected by the application, namely:

- i) Impacts on human health from emissions of the above listed; and
- ii) Impacts on ecology from emissions of oxides of nitrogen, ammonia, sulphur dioxide, hydrogen chloride and hydrogen fluoride and the resultant effects on:
  - a) Nitrogen deposition; and
  - b) Acid deposition.

1.1.8 Impacts have been calculated for the following scenarios:

- i) **Baseline** - total impact of the Kronospan Facility operating as set out in the existing EP (excluding the OSB process);
- ii) **Baseline + OSB** - total impact of the Kronospan Facility operating as set out in the existing EP but including the OSB process which has planning consent; and
- iii) **Proposed** - the Kronospan Facility as proposed, including the OSB process and CHP Facility proposed as part of this planning application.

2.0 EMISSIONS POINTS TO ATMOSPHERE

2.1.1 For the purpose of this assessment, emissions to atmosphere have been split into two groups.

i) combustion plants which provide heat and power to the manufacturing process; and
ii) emission sources directly related to the panel board manufacturing process (process plant).

2.1.2 The combustion plants are set out in **Table 2.1**, and the panel board manufacturing process plant in **Table 2.2**. These tables set out the use of each combustion plant, and where the emissions are released to atmosphere.

2.1.3 As shown in **Table 2.1**, there are a number of combustion plants at the Kronospan Facility. Under normal operations, the hot exhaust gases from the combustion plants are used as a source of heat within the driers and released to atmosphere via the cyclones.

Table 2.1 – Combustion Sources – Baseline

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
Engine 4	Gas	21.28	Not currently installed.		MDF 1 or MDF 2 cyclone or dedicated stack
Engine 5	Gas	21.28			MDF 1 or MDF 2 cyclone or dedicated stack

Combustion Plant	Fuel	Thermal Capacity (MW)	Status	Use	Vents to Atmosphere via
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 2.2 – Process Plant - Baseline

Unit	Use	Vents to Atmosphere via
A1 Formalin ECS	Exhaust from the emissions control – formaldehyde plant	Dedicated stack only
A5 Resin / VITS wet scrubber	Exhaust from the wet scrubber on the Resin VITS 2,3 and 5 paper impregnation lines	WESP 32
A6 VITS wet scrubber	Exhaust from the wet scrubber on the Resin VITS 4 paper impregnation line	WESP 32
A30 MDF1 cyclone	Abatement for emissions from the MDF 1 drier	MDF 1 Cyclone
A29 MDF2 cyclone	Abatement for emissions from the MDF 2 drier	MDF 2 Cyclone
A28 WESP 32	Abatement of emissions from Resin and VITS, and additional abatement for emissions from the press abatement system A31.	WESP 32
A31 Press abatement system	Press abatement system on the MDF 1, MDF 2 and particleboard Contiroll (3 lines)	WESP 32

Table 2.3 – Combustion Sources – Baseline + OSB

Combustion Plant	Fuel	Thermal capacity (MW)	Status	Use	Vents to Atmosphere via
Natural Gas Heaters					
K1	Gas	2.25	No change from Baseline		No change from Baseline
K5	Gas	14.1	No change from Baseline		No change from Baseline
K6	Gas	16.5	No change from Baseline		No change from Baseline
Biomass Boilers					
K7	Biomass Gas	38	No change from Baseline		No change from Baseline
K8	Biomass	32	No change from Baseline		No change from Baseline
Gas Engines					
Engine 1	Gas	21.28	No change from Baseline		No change from Baseline
Engine 2	Gas	21.28	No change from Baseline		No change from Baseline
Engine 3	Gas	21.28	No change from Baseline		No change from Baseline
Engine 4	Gas	21.28	No change from Baseline		No change from Baseline
Engine 5	Gas	21.28	No change from Baseline		No change from Baseline
Gas Turbines					
GT1	Gas	20.5	No change from Baseline		No change from Baseline
GT2	Gas	20.5	No change from Baseline		No change from Baseline
Process driers – combustion plant					
MDF1	Gas	15	No change from Baseline		No change from Baseline
MDF2	Gas	32	No change from Baseline		No change from Baseline
Chip dryer	Wood Dust/Gas	45	No change from Baseline		No change from Baseline
OSB 1 drier	Wood Dust/Gas	35	Primary heat source	OSB drier. Direct drier.	WESP 32

Combustion Plant	Fuel	Thermal capacity (MW)	Status	Use	Vents to Atmosphere via
OSB 2 drier	Wood Dust/Gas	35	Primary heat source	OSB drier. Direct drier.	WESP 32

Table 2.4 – Process Plant - Baseline + OSB

Unit	Use	Vents to Atmosphere via
A1 Formalin ECS	No change from Baseline	No change from Baseline
A5 Resin / VITS wet scrubber	No change from Baseline	No change from Baseline
A6 VITS wet scrubber	No change from Baseline	No change from Baseline
A30 MDF1 cyclone	No change from Baseline	No change from Baseline
A29 MDF2 cyclone	No change from Baseline	No change from Baseline
A28 WESP 32 (Proposed in OSB EP variation application)	Abatement of emissions from Resin and VITS, OSB 1 and OSB 2 dryers and additional abatement for emissions from the press abatement system.	WESP 32
A31 Press abatement system (Proposed in OSB EP variation application)	Press abatement system on the MDF 1, MDF 2, particleboard, and OSB Contiroll (4 lines)	WESP 32

Table 2.5 – Combustion Sources – Proposed

Combustion Plant	Fuel	Thermal Capacity (MW)	Status	Use	Vents to Atmosphere via
Natural Gas Heaters					
K1	Gas	2.25	No change from Baseline		No change from Baseline
K5	Gas	14.1	No change from Baseline		No change from Baseline
K6	Gas	16.5	No change from Baseline		No change from Baseline
Biomass Boilers					
K7	Biomass Gas	38	Standy only		No change from Baseline
K8	Biomass	32	No change from Baseline		No change from Baseline
Gas Engines					
Engine 1	Gas	21.28	No change from Baseline		No change from Baseline
Engine 2	Gas	21.28	No change from Baseline		No change from Baseline
Engine 3	Gas	21.28	No change from Baseline		No change from Baseline
Engine 4	Gas	21.28	To be removed		To be removed
Engine 5	Gas	21.28	To be removed		To be removed
Gas Turbines					
GT1	Gas	20.5	To be removed		To be removed
GT2	Gas	20.5	To be removed		To be removed
Process driers – combustion plant					
MDF1	Gas	15	Standby for K8	No change from Baseline	No change from Baseline
MDF2	Gas	32	Standby for CHP	No change from Baseline	No change from Baseline
Chip dryer	Wood Dust/Gas	45	No change from Baseline		No change from Baseline
OSB 1 drier	Wood Dust/Gas	35	No change from Baseline + OSB		No change from Baseline + OSB

Combustion Plant	Fuel	Thermal Capacity (MW)	Status	Use	Vents to Atmosphere via
OSB 2 drier	Wood Dust/Gas	35	No change from Baseline + OSB		No change from Baseline + OSB
CHP Facility					
CHP Facility	Biomass	125	Primary heat and power source	Grate based combustion system producing electricity and 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

Table 2.6 – Process Plant - Proposed

Unit	Use	Vents to Atmosphere via
A1 Formalin ECS	No change from Baseline	No change from Baseline
A5 Resin / VITS wet scrubber	No change from Baseline	No change from Baseline
A6 VITS wet scrubber	No change from Baseline	No change from Baseline
A30 MDF1 cyclone	No change from Baseline	No change from Baseline
A29 MDF2 cyclone	No change from Baseline	No change from Baseline
A28 WESP 32 (Proposed in OSB EP variation application)	No change from Baseline + OSB	No change from Baseline + OSB
A31 Press abatement system (Proposed in OSB EP variation application)	No change from Baseline + OSB	No change from Baseline + OSB

3.0 OPERATING SCENARIOS

3.1.1 All of the combustion plants at the Kronospan Facility are configured with full redundancy. Therefore, in the event that a particular combustion plant is not available, other combustion plants can provide the heat and power required to maintain the operation of the board manufacturing process. For all other sources, it has been assumed that these are in continuous operation. The operating scenarios and associated emission sources in both normal operations, and in the event that certain board manufacturing plant or combustion plant is offline, are presented in the following sections and represent the full suite of operating scenarios considered within this assessment.

3.1 Normal Operations

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

i) K1 boiler;
ii) MDF 1 and MDF 2 cyclones;
iii) WESP 32;
iv) WESP 21;
v) emissions control system from the Formalin Plant (A1); and
vi) the dust filter units.

3.1.2 The arrangements for the release of emissions from the MDF 1 and MDF 2 cyclones is presented in **Image 3.1** and **Image 3.2**, and the point sources are explained in more detail in the following sections.

Image 3.1 – Normal Operations – "Existing" and "Existing + OSB" Scenarios

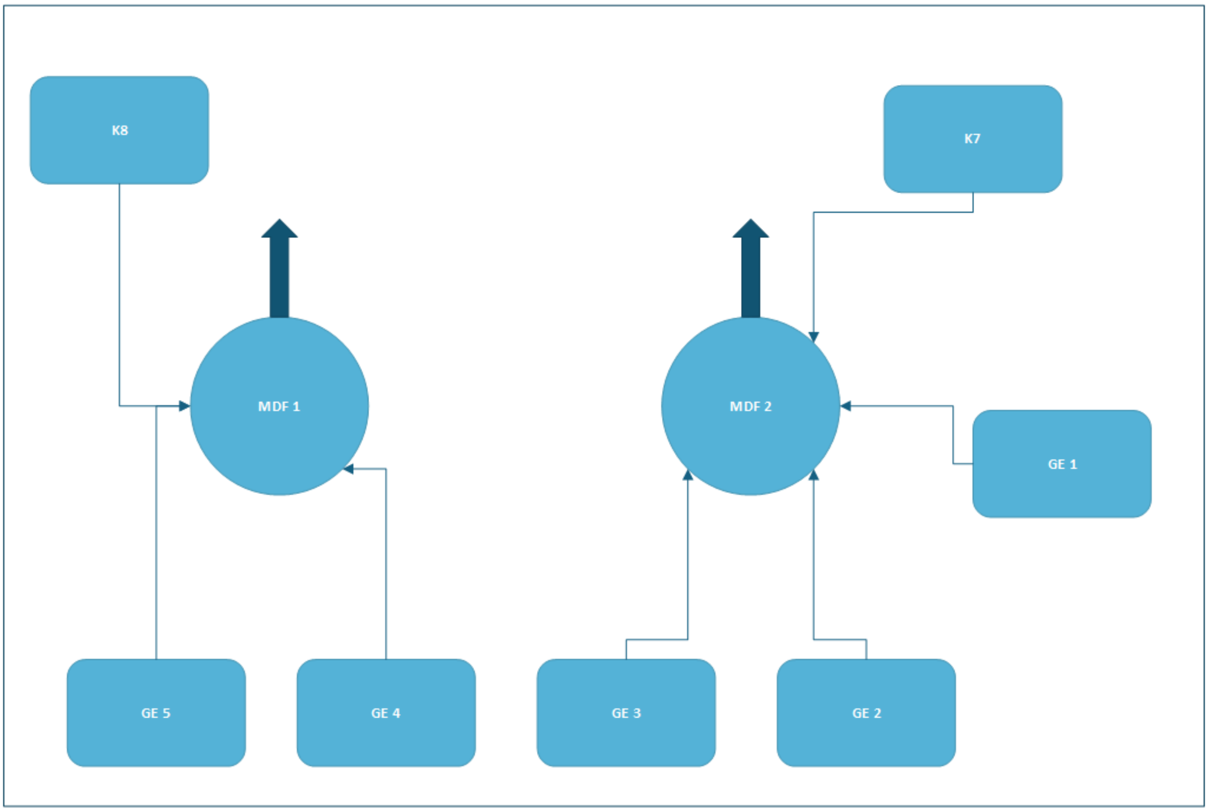
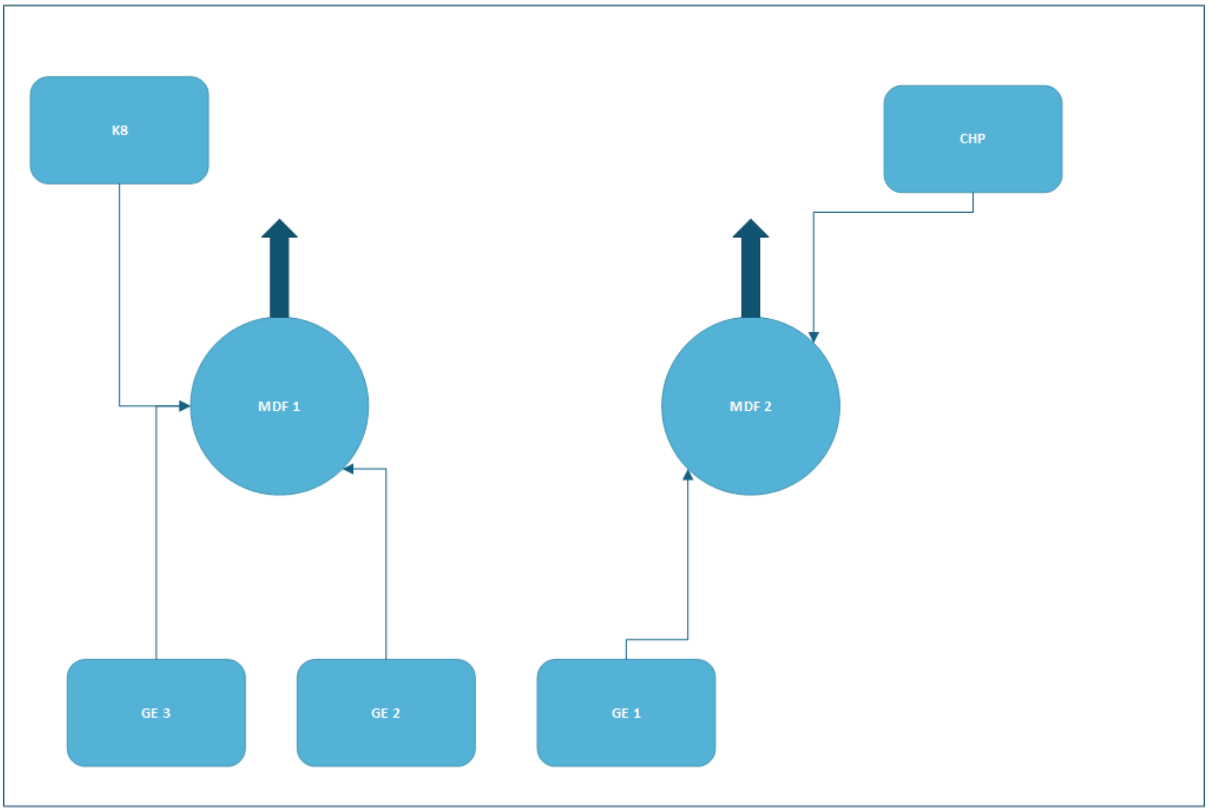


Image 3.2 – Normal Operations – "Proposed" Scenario



K1 Boiler

3.1.3 K1 is a 2.25MWth gas heater providing heating. The reference conditions for the boiler the ELV are expressed as mg/Nm^3 (273.15 K, 101.3 kPa, dry air, 3 % oxygen content by volume).

3.1.4 No changes are proposed to the operation of the K1 boiler within this planning application for the CHP Facility.

MDF 1 Cyclones

3.1.5 MDF 1 cyclones are fed from the MDF 1 drier which is a direct heat drier. The EP includes ELVs from the MDF 1 cyclones for NOx, carbon monoxide (CO), PM, TVOCs and CH_2O. The ELVs for the MDF 1 cyclones are expressed at 273.15 K, 101.3 kPa, dry air, 18% oxygen content by volume.

3.1.6 Under normal operations for the baseline and baseline + OSB scenarios, emissions from the MDF 1 cyclones consist of exhaust gases from the K8 biomass plant and up to two gas engines. The EP includes ELVs from K8 for the full suite of pollutants listed in Annex VI of the IED for co-incineration plants and ELVs for the gas engines for NOx. This includes half-hourly ELVs for certain pollutants. The variation to align with the WI BREF, which is currently being determined, will include more stringent ELVs accounting for the BAT-AELs set out in the Waste Incineration BREF, for K8. These have been accounted for in the modelling.

3.1.7 For modelling purposes when determining the impact of pollutants other than those for which an ELV has not been set for the MDF 1 cyclones, it has been assumed that the release rate from the K8 biomass plant vents to atmosphere via the MDF 1 cyclones under normal operations. The emission rate from K8 biomass plant has been divided by two to reflect that the emissions would be split across the two cyclones.

3.1.8 No changes are proposed to the operation of the MDF 1 cyclone during normal operation within this planning application for the CHP Facility.

MDF 2 Cyclones

3.1.9 MDF 2 cyclones are fed from the MDF 2 drier which is a direct heat drier. The EP includes ELVs from the MDF 2 cyclone for NOx, CO, PM, TVOC, CH_2O, HCl, and HF. The ELVs for the MDF 2 cyclones are expressed at 273.15 K, 101.3 kPa, dry air, 18% oxygen content by volume.

3.1.10 Under normal operations for the baseline and baseline + OSB scenarios, emissions from the MDF 2 cyclones consist of exhaust gases from the K7 biomass plant and up to three gas engines. The EP includes ELVs for the K7 biomass plant for NOx, CO, PM and SO_2 prior to the MDF 2 drier. For modelling purposes, it has been assumed that the release rate of SO_2 from the K7 biomass plant vents to atmosphere via the MDF 2 cyclones under normal operations. The emission rate from K7 biomass plant has been divided by four to reflect that the emissions would be split across the four cyclones. The K7 biomass plant is not considered to be a co-incinerator and as such the ELVs are not expected to change as a result of the WI BREF review process.

3.1.11 Under normal operations for the Proposed scenario, emissions from the MDF 2 cyclones will consist of exhaust gases from the CHP Facility and one gas engine. The EP will include ELVs for the CHP Facility for the full suite of pollutants listed in Annex VI of the IED for co-incineration plants accounting for the BAT-AELs set out in the Waste Incineration BREF. For modelling purposes, it has been assumed that the release rate of these substances from the CHP Facility vents to atmosphere via the MDF 2 cyclones under normal operations. The emission rate from CHP Facility has been divided by four to reflect that the emissions would be split across the four cyclones.

WESP 32

3.1.12 In the configuration the WESP 32 for the Baseline scenario includes emissions from three existing presses (the MDF 1 and 2 presses and the Particleboard Press) after the press abatement system (emission point A31), and emissions from the Resin 3,4 and 5 paper impregnation plant (previously from emission points A5 and A6). The EP includes ELVs to air for PM, TVOCs, and CH_2O. The ELVs are expressed at 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content. WESP 32 is used as a wet scrubber and to vent the emissions from the press abatement system at a greater height.

3.1.13 As part of the EP variation currently with NRW for determination, it is proposed that the emissions from the OSB 1 and OSB 2 driers would be ducted to the WESP 32 and this would be used as a wet electrostatic precipitator. An additional line would also be added to the press-abatement system. Within the EP application it is proposed that for compliance purposes there would be an emission limit on the emissions from the press abatement system combined with the emissions from the Resin 3,4 and 5 paper impregnation plants as per the existing EP, expressed at 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content. There would be a separate emission limit for the emissions from the OSB driers at the WESP 32, expressed at 273.15 K, 101.3 kPa, dry air, 18% oxygen content. In order to demonstrate compliance with the ELVs monitoring will be carried out periodically and during these periods the Resin 3,4 and 5 paper impregnation plants would be off-line and the press-abatement emissions would vent to atmosphere via the emergency stack. These changes have been reflected in the Baseline + OSB scenario.

3.1.14 No changes are proposed to the operation of the WESP 32 within this planning application for the CHP Facility.

Resin Reactors and Paper Impregnation Plant

3.1.15 The resin reactors and paper impregnation plant includes two wet scrubbers (A5 and A6). The EP includes ELVs for PM, CH_2O and TVOCs. These ELVs are expressed at 273.15 K, 101.3 kPa, dry gas, with no correction for oxygen content. However, these are only allowed to vent via their own stacks (A5 and A6) to facilitate a controlled shut-down on the plant. Under normal operations these emissions vent to atmosphere via WESP 32.

3.1.16 No changes are proposed to the operation of these plant within this planning application for the CHP Facility.

Formalin Plant

3.1.17 The Formalin Plant includes an emission control system, which vents to atmosphere via a dedicated stack (A1). The EP includes an ELV for CH_2O. The ELV is expressed at 273.15 K, 101.3 kPa, dry gas, with no correction for oxygen content.

3.1.18 No changes are proposed to the operation of the formalin plant within this planning application for the CHP Facility.

WESP 21

3.1.19 WESP 21 is used to abate the emissions from the directly heated drier. This 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 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 WESP 21. The EP includes emission limits for NOx, PM, TVOC and CH_2O. The ELVs for WESP 21 are expressed at 273.15 K, 101.3 kPa, dry gas, 18% oxygen content by volume.

3.1.20 No changes are proposed to the operation of the WESP 21 within this planning application for the CHP Facility.

3.2 Non-standard Operating Scenarios

WESP 32 or WESP 21 Offline

3.2.1 In the event of a malfunction on WESP 32 or WESP 21 unit the operations are to be terminated as soon as is reasonably practicable, but within a period not exceeding one hour, until such time as normal operations of the units can be restored. Kronospan is required to notify NRW in the event of this occurring and has a record of all these events occurring historically on WESP 32 when it was used to discharge emissions from the BAB driers (these have been mothballed). The reports show that, in most cases, WESP 32 recovered and that discharge to the chip drier emergency stack only lasts for a short period with the drier still operational. Therefore, releasing the exhaust gases from the chip drier emergency stack is considered to be an emergency scenario if the WESP 21 or WESP 32 is offline.

3.2.2 In the baseline scenario the WESP 32 is used as a wet scrubber for the abatement of emissions from the resin reactors and paper impregnation plant and to allow emissions from the press abatement system to be released at height to assist with dispersion of emissions. However, as part of the EP variation application currently being determined by NRW it is proposed to use WESP 32 as a wet-electrostatic precipitation for the abatement for the emissions from the sources currently venting via the WESP 32 and the additional OSB driers.

3.2.3 If there was a loss of power to the WESP 32 this would no longer work as an electrostatic field (for PM abatement) but would still act as a wet scrubber for the abatement of the VOCs and this would still have some reducing effect on PM emissions.

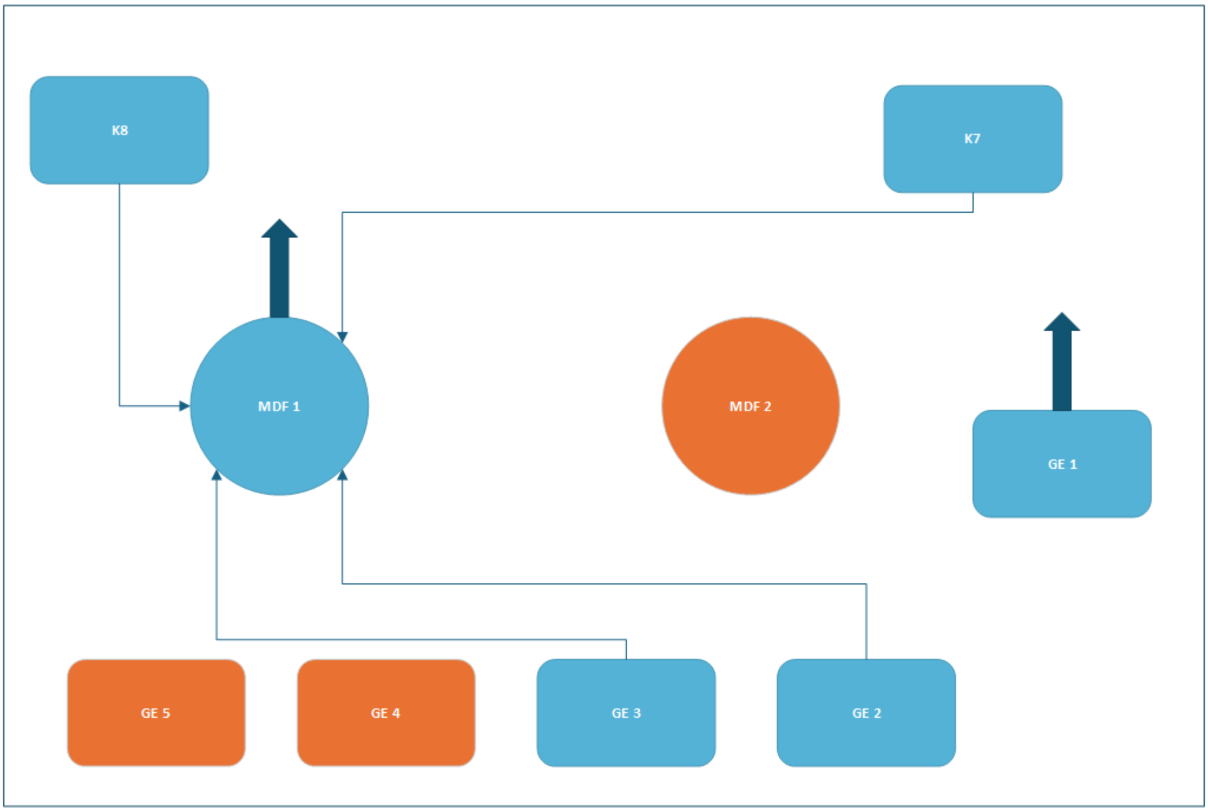
3.3 Existing Scenario

MDF 1 or MDF 2 Cyclone Offline

3.3.1 The MDF 1 and 2 driers are currently fed by exhaust gases from a mixture of the K7 biomass plant, the K8 biomass plant, gas engines, and gas turbines (if the gas engines are unavailable).

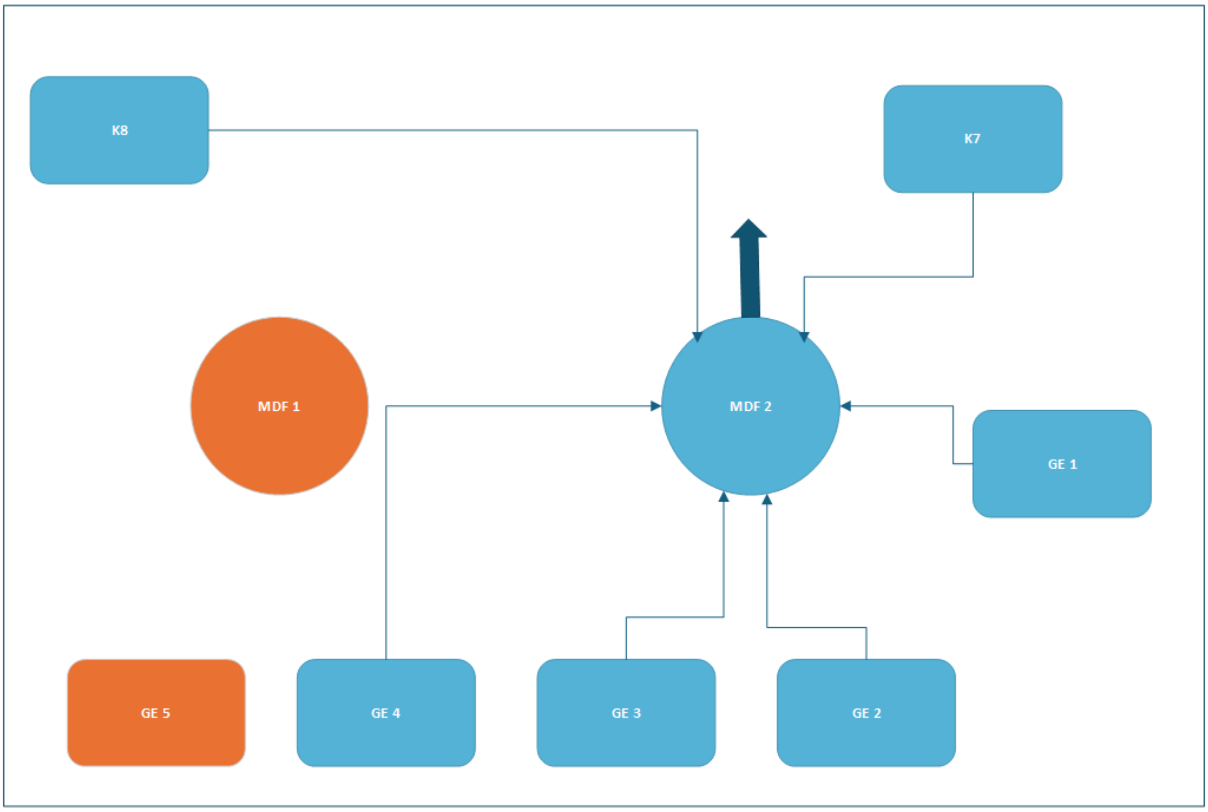
3.3.2 Currently MDF 1 drier normally takes the exhaust gases from K8 biomass plant and up to two gas engines. If MDF 2 cyclone is offline MDF 1 drier can take the exhaust gases from the K7 biomass plant, the K8 biomass plant and up to two gas engines. If the MDF 2 cyclone is offline the electricity demand for the site is reduced and only three gas engines would be 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 **Image 3.3**.

Image 3.3 – MDF 2 Cyclone Offline – "Existing" and "Existing + OSB" Scenarios



3.3.3 MDF 2 drier is the larger drier and normally takes the exhaust gases from the K7 biomass plant and up to three gas engines. 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. 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 **Image 3.4**.

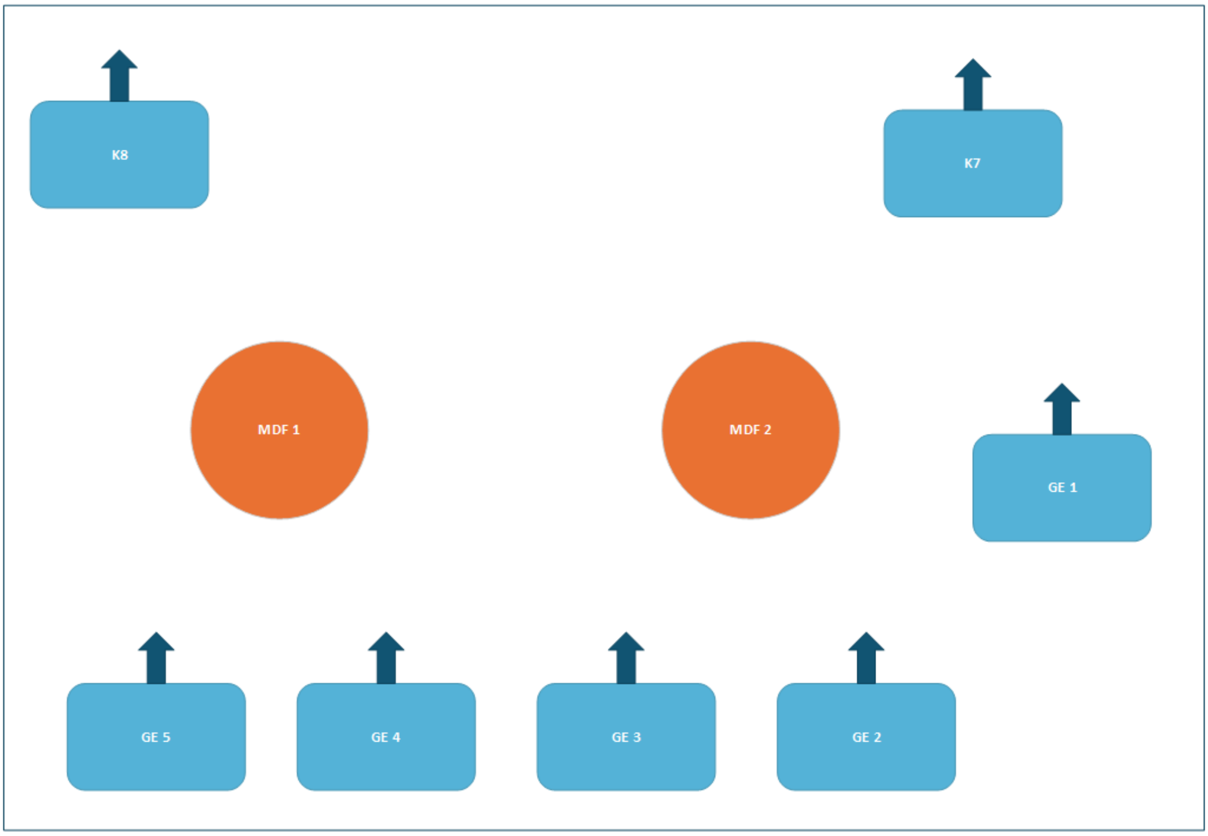
Image 3.4 – MDF 1 Cyclones Offline – "Existing" and "Existing + OSB" Scenarios



MDF 1 and 2 Cyclone Offline

3.3.4 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 **Image 3.5**.

Image 3.5 – MDF 1 and MDF 2 Cyclones Offline – “Existing” and “Existing + OSB” Scenarios



K7 or K8 Biomass Plant Offline

3.3.5 The 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 K7 or K8 biomass plant 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.

3.3.6 For dispersion modelling purposes, 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.

Gas Engine Unavailable

3.3.7 Back-up to the gas engines is provided by gas turbines. Gas Turbine 1 is ducted to MDF 1 drier, and Gas Turbine 2 is ducted to MDF 2 drier. This will not change the emissions from the driers. 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.

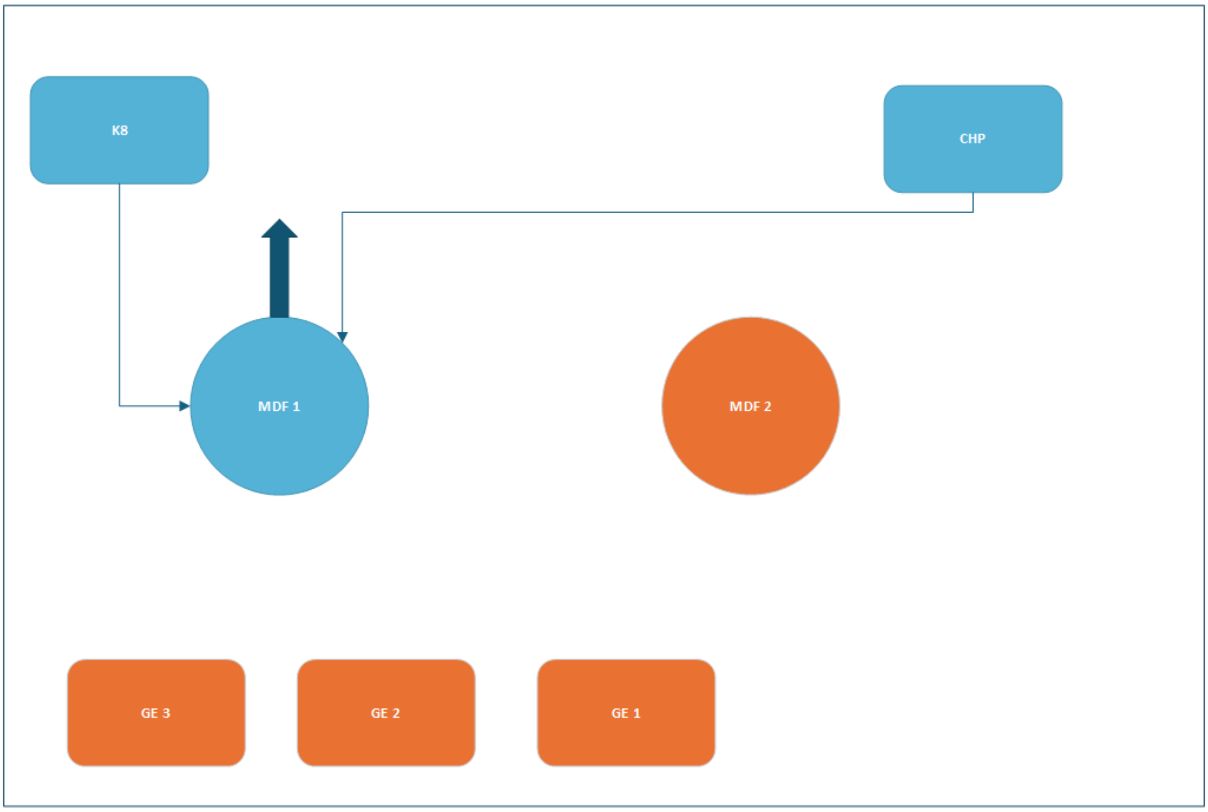
3.4 Proposed Scenario

MDF 1 or MDF 2 Cyclone Offline

3.4.1 As detailed, the MDF 1 and 2 driers are currently fed by exhaust gases from a mixture of the K7 biomass plant, the K8 biomass plant, gas engines, and gas turbines (if the gas engines are unavailable). It is proposed that the CHP Facility would replace the normal operation of the K7 biomass plant, two of the gas engines would not be installed, and the existing gas turbines would be removed.

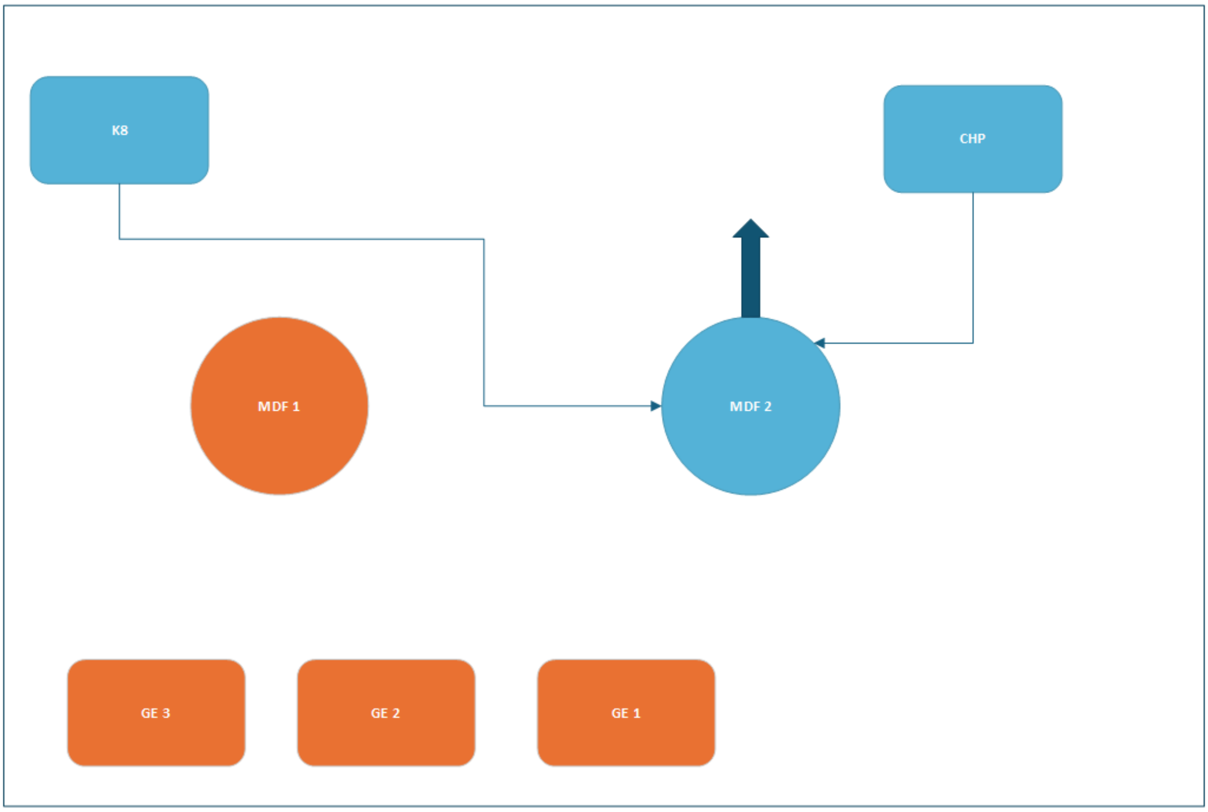
3.4.2 The MDF 1 drier would take the exhaust gases from K8 biomass plant and two gas engines. However, if MDF 2 cyclone is offline MDF 1 drier will be able to take the exhaust gases from the K8 biomass plant and the CHP Facility. If the MDF 2 cyclone is offline the electricity demand for the site is reduced and the gas engines would not be needed. This is presented in a graphical format in **Image 3.6**.

Image 3.6 – MDF 2 Cyclone Offline – "Proposed" Scenario



3.4.3 If MDF 1 cyclone is offline, MDF 2 drier can take the exhaust gases from the CHP Facility and the K8 biomass plant. If the MDF 1 cyclone is offline the electricity demand for the site is reduced. In this instance the gas engines would not be needed. This is presented in a graphical format in **Image 3.7**.

Image 3.7 – MDF 1 Cyclone Offline – "Proposed" Scenario



MDF 1 and 2 Cyclone Offline

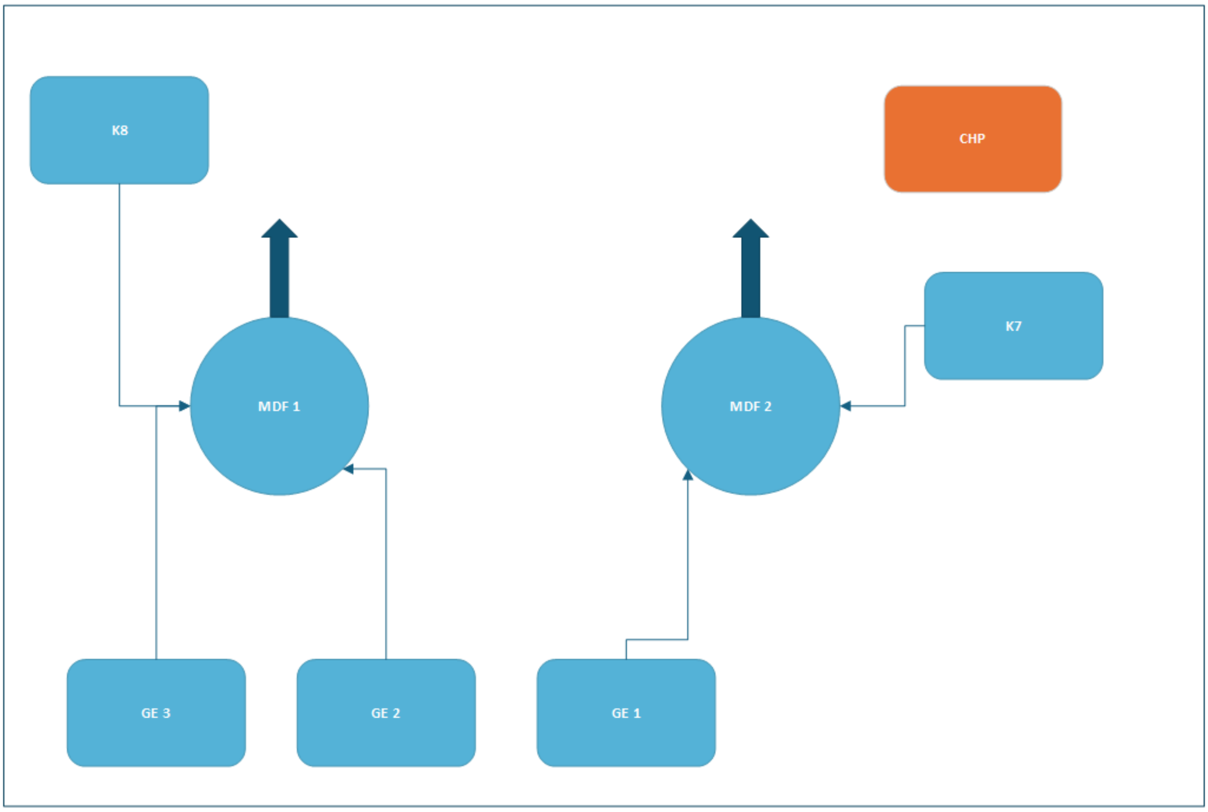
3.4.4 If MDF 1 and 2 cyclones are offline for a short period, the sources feeding the drier are required to release to atmosphere via their own dedicated stacks. This would only occur for extremely short and rare periods as the electricity and heat generated would not be able to be used by the manufacturing process. In this scenario, emissions from both the CHP Facility and K8 biomass plants 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.

3.4.5 If the MDF 1 and MDF 2 cyclones are offline power consumption on site would be reduced and the CHP would not be needed. However, Kronospan have applied for an export connection which would be in place by 2035. In this instance the CHP Facility would be used to export electricity to the national grid. The CHP Facility would be run in electricity only mode and the exhaust gases vent to atmosphere via the CHP stack.

CHP Facility Offline

3.4.6 In the event that the CHP Facility is offline in order to continue operations on site both power and steam are required. Power would be provided by the three gas engines and the K7 biomass plant would be used to heat the thermal oil for the process exhaust gases would be used in the drier. This is presented in a graphical format in **Image 3.8**.

Image 3.8 – CHP Offline – "Proposed" Scenario



4.0 DISPERSION MODELLING METHODOLOGY

4.1 Selection of Model

4.1.1 Detailed dispersion modelling has been undertaken using the model ADMS 6, 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.

4.1.2 ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of NRW and the Environment Agency (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.

4.2 Source and Emissions Data

4.2.1 The principal inputs to the model with respect to the emissions to air from the Kronospan Facility are presented in the following tables. When determining the release rate of pollutants, in the first instance the volumetric flow rate from each item of plant has been multiplied by the ELV. The volumetric flow rate and temperature of the release has been determined based on monitoring carried out between 2018 and 2024. This has shown that volumetric flow rates vary but the inputs used in the model are a realistic assumption of flow rates from the plant. Additional analysis of the monitored concentrations against the ELVs has shown that the plant operates below the respective ELVs and in some cases by a significant amount. Therefore, 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 Kronospan 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.

4.2.2 Within the Baseline scenario emissions from the WESP 32 only include those emissions from the press abatement system (A28) and the resin reactors and paper impregnation plant. However, for the Baseline + OSB scenario the volumetric flow rate for the press abatement system has been increased by increasing the existing flow rate to allow for the additional press system. This has then been combined with the emissions from the resin reactors and paper impregnation plant and included in the model as emission source WESP 32. As explained as part of the OSB EP application it is proposed that for compliance purposes there would be an emission limit on the emissions from the press abatement system combined with the emissions from the Resin 3,4 and 5 paper impregnation plants as per the existing EP, expressed at 273.15 K, 101.3 kPa, dry air, with no correction for oxygen content. There would be a separate emission limit for the emissions from the OSB driers at the WESP 32, expressed at 273.15 K, 101.3 kPa, dry air, 18% oxygen content. For modelling purposes, the emissions from the OSB driers via the WESP 32 have been included as a separate source within the model (WESP 32_OSB), at the same location as WESP 32 and the combined flue function used to combine the emissions from the WESP 32 and the WESP 32 OSB. This is considered the most appropriate way to represent these sources due to the differing emission parameters for each source.

Table 4.1 – Source Data (1)

Parameter	Unit	K1	K5	K6	GE	K7	K8	WESP 21	A1	MDF 1 (per cyclone – 2 emission points)	MDF 2 (per cyclone – 4 emission points)
Height	m	10.2	14.5	21.4	22.0	36.5	70.0	50.0	25.0	50.0	57.0
Internal diameter	m	0.48	1.00	1.60	1.20	1.90	1.70	4.00	0.60	1.80	2.96
Temperature	°C	147.3	261.0	271.0	305.2	287.6	162.5	58.5	253.9	56.2	62.3
Volumetric flow rate	Am^3/s	0.6	8.6	5.7	28.4	47.7	35.0	75.7	4.7	80.5	82.7
Exit velocity	m/s	3.3	11.0	5.1	25.1	16.8	15.4	5.7	16.6	31.6	12.0
Moisture content	%	7.0	5.1	5.0	8.4	9.0	8.0	16.8	5.2	9.0	10.1
Oxygen content	% dry basis	9.5	8.8	4.3	12.1	15.6	14.1	17.4	5.9	20.1	18.7
Reference oxygen content	% dry basis	3	3	3	3	6	6	18	11	-	-
Volumetric flow rate	Nm^3/s	0.2	2.8	2.5	6.1	7.6	9.3	62.4	3.5	60.8	60.5
Reference conditions	-	NTP 3% O_2	NTP 3% O_2	NTP 3% O_2	NTP 3% O_2	NTP 6% O_2	NTP 6% O_2	NTP 18% O_2	STP, dry	STP, dry	STP, dry
ELV											
NOx	mg/Nm^3	200	200	200	280	250	270	200	-	100	100
PM	mg/Nm^3	-	-	-	-	50	7.5	20	-	20	20
TVOC	mg/Nm^3	-	-	-	-	-	15	200	30	120	120
CH_2O	mg/Nm^3	-	-	-	-	-	-	10	5	15	15
SO_2	mg/Nm^3	-	-	-	-	200	60	-	-	-	-
HCl	mg/Nm^3	-	-	-	-	35	12	-	-	-	30
HF	mg/Nm^3	-	-	-	-	1	1	-	-	-	1
NH_3	mg/Nm^3	-	-	-	-	-	10	-	-	-	-
CO	mg/Nm^3	-	-	-	-	150	75	-	-	200	200
Hg	mg/Nm^3	-	-	-	-	-	0.03	-	-		
Cd and Tl	mg/Nm^3	-	-	-	-	-	0.03	-	-		
Other metals	mg/Nm^3	-	-	-	-	-	0.45	-	-		
Dioxins and furans	ng/Nm^3	-	-	-	-	-	0.09	-	-		
Dioxin-like-PCBs	mg/Nm^3	-	-	-	-	-	0.0075 (1)	-	-		
Release rate											
NOx	g/s	0.046	0.565	0.500	1.696	1.892	2.498	12.485	-	6.075	6.054
PM	g/s	-	-	-	-	0.378	0.069	1.248	-	1.215	1.211
TVOC	g/s	-	-	-	-	-	0.139	12.485	0.105	7.291	7.265
CH_2O	g/s	-	-	-	-	-	-	0.624	0.017	0.911	0.908
SO2	g/s	-	-	-	-	1.513	0.555	-	-	-	-
HCl	g/s	-	-	-	-	0.265	0.111	-	-	-	1.816
HF	g/s	-	-	-	-	0.008	0.009	-	-	-	0.061
NH3	g/s	-	-	-	-	-	0.093	-	-	-	-
CO	g/s	-	-	-	-	1.135	0.694	-	-	12.151	12.108
Hg	mg/s	-	-	-	-	-	0.278	-	-	-	-
Cd and Tl	mg/s	-	-	-	-	-	0.278	-	-	-	-
Other metals	mg/s	-	-	-	-	-	4.163	-	-	-	-
Dioxins and furans	ng/s	-	-	-	-	-	0.833	-	-	-	-
Dioxin-like-PCBs	mg/s	-	-	-	-	-	0.069	-	-	-	-

Notes:
(1) The Waste Incineration BREF provides a range of values for PCB emissions to air from European municipal waste incineration plants. This states that the annual average total PCBs is less than 0.005 mg/Nm^3 (dry, 11% oxygen, 273K). In lieu of other available data, this has been assumed to be the emission concentration for the K8 biomass plant converted to 6% reference O_2 content.

Table 4.1 – Source Data (2)

Parameter	Unit	A5	A6	Press Abatement (3 lines)	WESP 32 (existing) – Press abatement (3 lines) + A5 and A6)	WESP 32 (proposed) Press abatement (4 lines) + A5 and A6	OSB 1	OSB 2	WESP 32 (OSB)	CHP
Height	m	17.5	16.0	-	65.5	65.5	-	-	65.5	75
Internal diameter	m	1.65	0.90	-	4.80	4.80	-	-	4.80	2.2
Temperature	°C	25.4	34.0	35.7	32.1	32.6	135.0	135.0	135.0	200
Volumetric flow rate	Am^3/s	25.5	7.9	42.3	75.7	89.8	58.5	58.5	58.5	82.9
Exit velocity	m/s	11.9	12.4	-	4	5.0	-	-	-	21.8
Moisture content	%	2.6	4.6	4.0	-	-	32.6	32.6	32.6	19.4
Oxygen content	% dry basis	-	-	20.3	-	-	17.0	17.0	17.0	3.2
Reference oxygen content	% dry basis	-	-	-	-	-	18.0	18.0	18.0	6.0
Volumetric flow rate	Nm^3/s	22.7	6.7	35.9	80.30	-	35.2	35.2	70.4	45.9
Reference conditions	-	STP, dry	STP, dry	STP, dry	STP, dry	STP, dry	NTP 18% O2	NTP 18% O2	NTP 18% O2	NTP 6% O2
ELV										
NOx	mg/Nm^3	-	-	-	-	-	200	200	-	105
PM	mg/Nm^3	20	20	15	15	-	20	20	-	7.5
TVOC	mg/Nm^3	30	30	30	30	-	400	400	-	15
CH2O	mg/Nm^3	5	5	5	5	-	20	20	-	-
SO2	mg/Nm^3	-	-	-	-	-	-	-	-	45
HCl	mg/Nm^3	-	-	-	-	-	-	-	-	9
HF	mg/Nm^3	-	-	-	-	-	-	-	-	1.5
NH3	mg/Nm^3	-	-	-	-	-	-	-	-	6.45
CO	mg/Nm^3	-	-	-	-	-	-	-	-	75
Hg	mg/Nm^3	-	-	-	-	-	-	-	-	0.03
Cd and Tl	mg/Nm^3	-	-	-	-	-	-	-	-	0.03
Other metals	mg/Nm^3	-	-	-	-	-	-	-	-	0.45
Dioxins and furans	ng/Nm^3	-	-	-	-	-	-	-	-	0.06
Dioxin-like-PCBs	mg/Nm^3	-	-	-	-	-	-	-	-	0.0075 (1)
Release rate										
NOx	g/s	-	-	-	-	-	7.039	7.039	14.078	4.814
PM	g/s	0.454	0.134	0.539	1.370	1.127	0.704	0.704	1.408	0.344
TVOC	g/s	0.682	0.201	1.077	2.409	1.960	14.078	14.078	28.156	0.688
CH2O	g/s	0.114	0.034	0.180	0.403	0.328	0.704	0.704	1.408	-
SO2	g/s	-	-	-	-	-	-	-	-	2.063
HCl	g/s	-	-	-	-	-	-	-	-	0.413
HF	g/s	-	-	-	-	-	-	-	-	0.069
NH3	g/s	-	-	-	-	-	-	-	-	0.296
CO	g/s	-	-	-	-	-	-	-	-	3.439
Hg	mg/s	-	-	-	-	-	-	-	-	1.376
Cd and Tl	mg/s	-	-	-	-	-	-	-	-	1.376
Other metals	mg/s	-	-	-	-	-	-	-	-	20.633
Dioxins and furans	ng/s	-	-	-	-	-	-	-	-	2.751
Dioxin-like-PCBs	mg/s	-	-	-	-	-	-	-	-	0.344

Table 4.2 – Drier Emissions Scenarios

Scenario		Baseline and Baseline + OSB						Proposed				
		Normal Operations		**MDF 1 Offline**	**MDF 2 Offline**		**MDF 1 and 2 Offline**	**Normal Operations**		**MDF 1 Offline**	**MDF 2 Offline**	**MDF 1 and 2 Offline**
Parameter	**Unit**	**MDF 1 (per cyclone – 2 emission points)**	**MDF 2 (per cyclone – 4 emission points)**	**MDF 2 (per cyclone – 4 emission points)**	**MDF 1 (per cyclone – 2 emission points)**	**Gas Engine 1**		**MDF 1 (per cyclone – 2 emission points)**	**MDF 2 (per cyclone – 4 emission points)**	**MDF 2 (per cyclone – 4 emission points)**	**MDF 1 (per cyclone – 2 emission points)**	
Sources		K8 and 2 gas engines	K7 and 3 gas engines	K7, K8 and 4 gas engines	K7, K8 and 2 gas engines	1 engine to dedicated stack	All via own stacks	K8 and 2 gas engines	CHP and 1 gas engine	K8 and CHP	K8 and CHP	All via own stacks
Height	m	50.0	57.0	57.0	50.0	22.0	-	50.0	57.0	57.0	50.0	-
Internal diameter	m	1.80	2.96	2.96	1.80	1.20	-	1.80	2.96	2.96	1.80	-
Temperature	°C	56.2	62.3	62.3	56.2	305.2	-	56.2	62.3	62.3	56.2	-
Volumetric flow rate	Am3/s	80.5	82.7	82.7	80.5	28.4	-	80.5	82.7	82.7	80.5	-
Exit velocity	m/s	31.6	12.0	12.0	31.6	25.1	-	31.6	12.0	12.0	31.6	-
Release rate												
NOx	g/s	6.075	6.054	6.054	6.075	1.696	-	6.075	6.054	6.054	6.075	-
PM	g/s	1.215	1.211	1.211	1.215	-	-	1.215	1.211	1.211	1.215	-
TVOC	g/s	7.291	7.265	7.265	7.291	-	-	7.291	7.265	7.265	7.291	-
CH2O	g/s	0.911	0.908	0.908	0.911	-	-	0.911	0.908	0.908	0.911	-
SO2	g/s	0.278[1]	0.3784[2]	0.517[3]	1.034[4]	-	-	0.278[1]	0.516[4]	0.655[5]	1.309[6]	-
HCl	g/s	0.057[1]	0.066[2]	0.094[3]	0.188[4]	-	-	0.056[1]	0.103[4]	0.131[5]	0.262[6]	-
HF	g/s	0.005[1]	0.002[2]	0.004[3]	0.009[4]	-	-	0.005[1]	0.017[4]	0.020[5]	0.039[6]	-
NH3	g/s	0.047[1]	-	0.023[3]	0.047[4]	-	-	0.047[1]	0.074[4]	0.097[5]	0.195[6]	-
CO	g/s	12.151	12.108	12.108	12.151	-	-	12.151	12.108	12.108	12.151	-
Hg	mg/s	0.139[1]	-			-	-	0.139[1]	0.344[4]	0.414[5]	0.827[6]	-
Cd and Tl	mg/s	0.139[1]	-			-	-	0.139[1]	0.344[4]	0.414[5]	0.827[6]	-
Other metals	mg/s	2.082[1]	-			-	-	2.082[1]	5.158[4]	6.199[5]	12.398[6]	-
Dioxins and furans	ng/s	0.417[1]	-			-	-	0.417[1]	0.688[4]	0.896[5]	1.792[6]	-
Dioxin-like-PCBs	mg/s	0.035[1]	-			-	-	0.035[1]	0.086[4]	0.103[5]	0.207[6]	-

Notes:
(1) Calculated as emissions from K8 biomass plant divided by 2.
(2) Calculated as emissions from K7 biomass plant divided by 4
(3) Calculated as emissions from K7 biomass plus the K8 biomass plant divided by 4
(4) Calculated as emissions from CHP plant divided by 4
(5) Calculated as emissions from K8 biomass plant plus the CHP plant divided by 4
(6) Calculated as emissions from K8 biomass plant plus the CHP plant divided by 2

Table 4.3 – Source Locations – Baseline and Baseline + OSB

Source name	X (m)	Y (m)	Baseline and Baseline + OSB Scenario	Proposed Scenario
K1	328725.37	338795.09	Yes	Yes
A1	328721.59	338581.22	Yes	Yes
WESP 21	328449.10	338471.40	Yes	Yes
WESP 32	328414.40	338344.20	Yes	Yes
MDF1 A	328478.94	338231.10	Yes	Yes
MDF1 B	328484.91	338232.06	Yes	Yes
MDF2 A	328461.30	338253.40	Yes	Yes
MDF2 B	328467.17	338254.40	Yes	Yes
MDF2 C	328468.78	338243.94	Yes	Yes
MDF2 D	328462.87	338243.04	Yes	Yes
K5	328530.44	338333.94	Yes	Yes
K6	328470.32	338308.97	Yes	Yes
K7	328430.10	338315.50	Yes	Yes
K8	328504.15	338390.19	Yes	Yes
Gas Engine 1	328529.18	338422.85	Yes	Yes
Gas Engine 2	328523.38	338421.97	Yes	Yes
Gas Engine 3	328517.50	338421.13	Yes	Yes
Gas Engine 4	328511.70	338420.22	Yes	Removed
Gas Engine 5	328505.88	338419.36	Yes	Removed
CHP Facility	328522.28	338366.39	No	Yes

Table 4.4 – Source Locations – Dust Units

Source Name	X (m)	Y (m)
B01	328638.16	338257.09
B02	328605.10	338247.30
B03	328599.60	338246.60
B04	328594.60	338245.90
B05	328462.50	338229.80
B06	328452.60	338250.50
B07	328502.70	338330.30
B08	328436.40	338362.40
B09	328428.60	338377.20
B10	328427.70	338383.40
B11	328426.80	338388.30
B12	328608.00	338344.10
B13	328614.90	338345.20
B14	328644.10	338350.70
B15	328650.30	338351.60
B16	328722.20	338489.60
B17	328713.50	338488.90
B18	328724.20	338477.10
B19	328717.00	338475.80

Source Name	X (m)	Y (m)
B20	328569.20	338518.60
B21	328570.00	338524.20
B22	328499.80	338486.20
B23	328489.40	338559.40
B24	328481.10	338559.00
B25	328471.70	338557.50
B26	328462.20	338555.20
B27	328676.70	338796.90
B28	328674.50	338803.20
B29	328681.60	338809.30
B30	328680.30	338814.60
B31	328682.00	338819.80
Additional Dust Units – Baseline + OSB and Proposed Scenarios		
B32	328576.00	338524.10
B33	328496.10	338551.00
B34	328497.70	338541.80
B35	328426.10	338299.30
B36	328620.20	338250.30
B37	328629.70	338251.40
B38	328811.10	338291.10
B39	328820.30	338292.60
Re-located Dust Units – Baseline + OSB and Proposed Scenarios		
B01	328641.60	338255.50
B20	328576.20	338525.30
B23	328493.00	338520.45
B24	328488.06	338531.92
B25	328481.92	338531.05
B26	328471.78	338529.41

4.3 Other Inputs

4.3.1 Modelling has been undertaken using a nested grid of points; a 2 km x 2 km grid with a spatial resolution of 20 m nested within a 4.9 km x 4.9 km grid with a spatial resolution of 49 m. The high resolution of the finest grid has been chosen to ensure that the gridded output accurately captures the highest modelled concentrations. Reference should be made to **Figure 1** at the end of this Appendix for a graphical representation of the modelling domain used. The extent of the modelling domain is detailed in **Table 4.5**.

Table 4.5 – Modelling Domain

Parameter	Fine Grid	Wider Grid
Grid Spacing (m)	20	49

Parameter	Fine Grid	Wider Grid
Grid Start X	327700	326250
Grid Finish X	329700	331150
Grid Start Y	337550	336100
Grid Finish Y	339550	341000

Meteorological Data and Surface Characteristics

4.3.2 The impact of meteorological data was taken into account by using meteorological data from the RAF Shawbury meteorological recording station for the years 2020 to 2024 sourced from Air Pollution Services. RAF Shawbury is approximately 30 km to the south-east of the Facility and is the closest and most representative meteorological station available.

4.3.3 NRW guidance recommends that five years of data are used to take into account inter-annual fluctuations in meteorological conditions. The meteorological data from the period 2020 to 2024 represents the most recent five years of weather data. Wind roses for each year can be found in **Figure 2** at the end of this Appendix.

4.3.4 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 30 m for the dispersion site and 10 m for the meteorological site. The value of 30 m is recommended by CERC for mixed urban/industrial areas such as the dispersion site. The value of 10 m is recommended by CERC for small towns <50,000 inhabitants and is considered appropriate for the surroundings of the meteorological site.

4.3.5 The surface roughness length can be selected in ADMS for both the dispersion site and the meteorological site. The surface roughness has been set to 0.2 m for the meteorological site, which is appropriate for the relatively open surroundings of site. The surface roughness length varies widely across the modelling domain. To account for the varying surface roughness length a spatially varying surface roughness file has been generated and used as a model input. The land-use class for each point in the file has been estimated based on aerial mapping and the CERC roughness length classifications.

4.3.6 It is recommended by CERC that, where gradients within 500 m of the modelling domain are greater than 1 in 10, 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.

4.3.7 A terrain and surface roughness file large enough to cover the output grid of points was created using Ordnance Survey Terrain 50 data. The Johnstown Newt Site SAC, Berwyn and South Clwyd Mountains and Berwyn designated habitat sites lie outside of the output grid of points. Due to the distance to these receptors and the very low likelihood of a significant effect, the model has been run without the effect of terrain and a constant surface roughness length of 0.5 m which is appropriate for the dispersion site to assess the impact at these points.

4.3.8 The parameters for the spatially-varying terrain and surface roughness file are shown in the following table and a visual representation provided in **Figure 3** at the end of this Appendix.

Table 4.6 – Spatially Varying Surface Roughness and Terrain File Parameters

Parameter	Value
Grid points	64 x 64
Grid Start X (m)	325725
Grid Finish X (m)	331675
Grid Start Y (m)	335575
Grid Finish Y (m)	341525

4.3.9 A summary of the meteorological parameters used in the dispersion modelling is shown in the following table.

Table 4.7 – Meteorological Parameters

Parameter	Dispersion Site	Met Site
Surface roughness length	Variable	0.2 m
Minimum Monin-Obukov length	30 m	10 m

Buildings

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

i) Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.

ii) 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.

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

i) Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and

ii) Taller than 40% of the stack.

4.3.12 The ADMS 6 user guide also states that buildings less than one third of the stack height will not have any effect on dispersion.

4.3.13 A review of the site layout has been undertaken and the details of the applicable buildings are presented in the following table. A site plan showing which buildings have been included in the model is presented in **Figure 4** at the end of this Appendix. These are the building which are identified as having the potential to affect the dispersion of emissions from the sources.

Table 4.8 – Building Details

Building	Centre Point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
Baseline Scenario Buildings						
Main Factory A	328749.20	338386.40	11.50	438.25	230.60	81.1
K7 Boiler	328437.50	338318.00	31.00	22.50	33.00	181.0
CHIP	328434.90	338491.50	36.00	23.00	35.00	105.0
B	328438.00	338398.60	20.00	23.00	56.00	82.0
K8 - Biomass	328483.90	338387.20	30.00	45.00	40.00	82.0
Main Factory B	328515.30	338279.90	11.50	56.00	93.00	81.0
OSB	328511.20	338297.90	28.00	30.00	56.00	351.0
Raw Board	328715.70	338397.00	23.00	30.00	150.00	351.0
Silo A	328516.70	338488.60	26.00	25.50	-	-
Silo B	328543.50	338493.30	26.00	25.50	-	-
Silo C	328511.80	338515.60	26.00	25.50	-	-
Silo D	328540.20	338520.30	26.00	25.50	-	-
Chip Prep	328478.10	338514.90	26.00	30.00	30.00	81.0
Warehouse	328769.90	338783.30	6.00	98.00	182.00	89.0
MDF 2 Cyclones	328466.70	338249.10	42.00	20.00	20.00	81.0

Building	Centre Point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
GE 1 to 3	328520.80	338434.30	18.20	18.00	22.00	82.5
Kronoplus	328730.00	338589.90	6.00	11.00	23.00	81.0
Tanks	328712.10	338580.30	8.00	5.00	-	-
Baseline + OSB Scenario Additional Buildings						
Stores	328593.70	338203.20	14.00	186.00	30.00	81.0
East Warehouse	328886.80	338708.90	13.70	60.00	240.00	81.0
Silo 1	328529.50	338553.90	33.50	25.48	-	-
Silo 2	328522.40	338586.40	33.50	25.48	-	-
Chip Prep Extension	328474.90	338534.90	26.00	30.00	10.00	81.0
Proposed Scenario Additional Buildings						
CHP Facility	328483.81	338441.17	43.85	48.00	36.00	81.0

4.3.14 The extension to accommodate the OSB line has already been constructed and as such has been included in the Baseline scenario. The other additional buildings/structures included are those associated with the proposed EP variation which have not yet been constructed and as such have been included in the Baseline + OSB scenario.

Chemistry

4.3.15 Many of the sources 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.

4.3.16 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 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.

Background Concentrations

4.3.17 Background concentrations for the assessment have been derived from monitoring and national mapping as summarised in **Appendix 6B**. 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. When calculating the daily mean PM_{10} PEC the approach set out in LAQM.TG(22) box 7-16 has been applied in which the annual mean baseline concentration is added to the 90.41st percentile of 24-hour mean process contributions. The baseline (i.e. current operations) has been specifically modelled and the background concentration added to determine the baseline scenario PEC.

5.0 STACK HEIGHT ASSESSMENT

5.1.1 Under normal operations the exhaust gases from the CHP Facility would be used in the drying process. However, if the driers are offline and the CHP Facility was online these emissions would need to vent to atmosphere via a dedicated stack. The height of this stack has been determined by running the model for a range of stack heights and identifying the point at which there is a diminished reduction in ground level concentration with increased stack height. The maximum annual mean and 1-hour concentrations of nitrogen dioxide are presented in **Image 5.1** and **Image 5.2** respectively.

5.1.2 As shown, there is a change in the angle of the slope for annual mean impacts at 75 m. When considering the maximum 1-hour nitrogen dioxide impact there is a change in angle of the slope at 75 m and at 90 m. However, with a 75 m high stack the impact can be described as insignificant if it is assumed that the half-hourly ELV is double the daily mean ELV in line with the ratio between the daily and half-hourly ELV for oxides of nitrogen in the IED. 75 m is the point at which increasing the height of the stack further has a diminished reduction in ground level concentration and is seen as the appropriate stack height for the CHP Facility.

Image 5.1 – Stack Height Analysis – CHP – Annual Mean

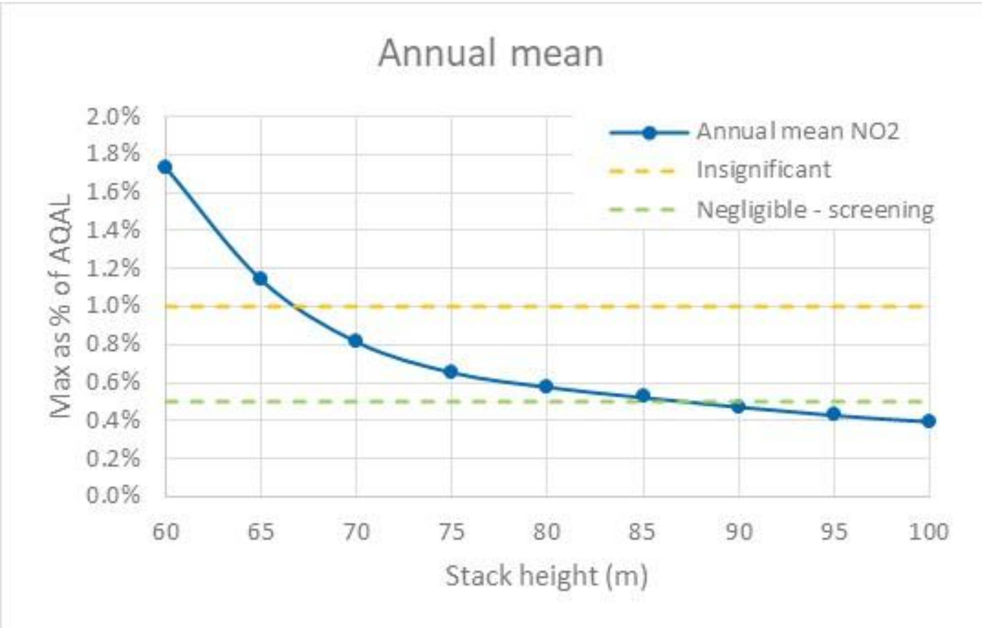
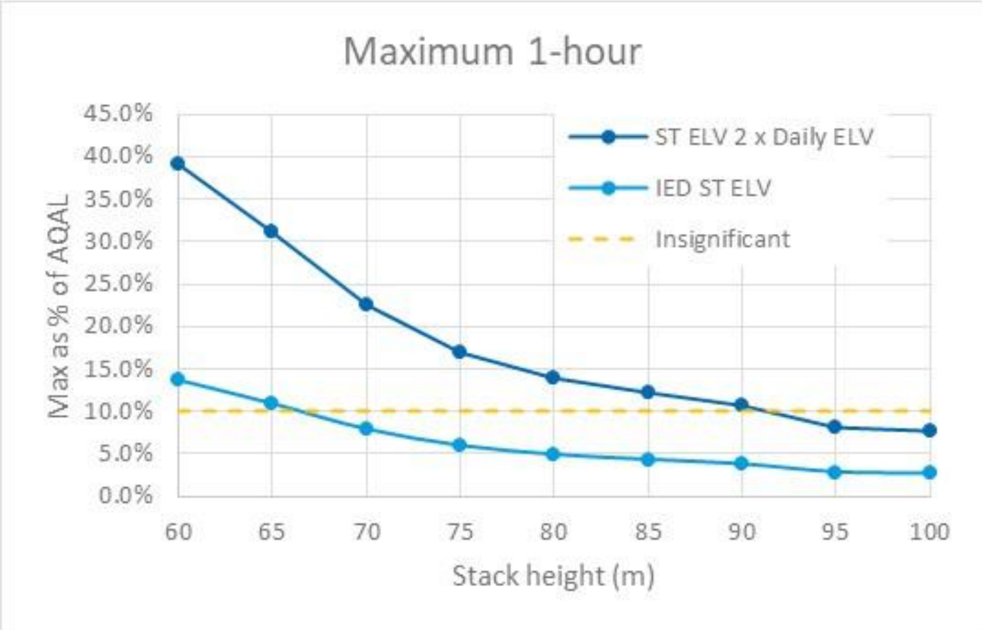
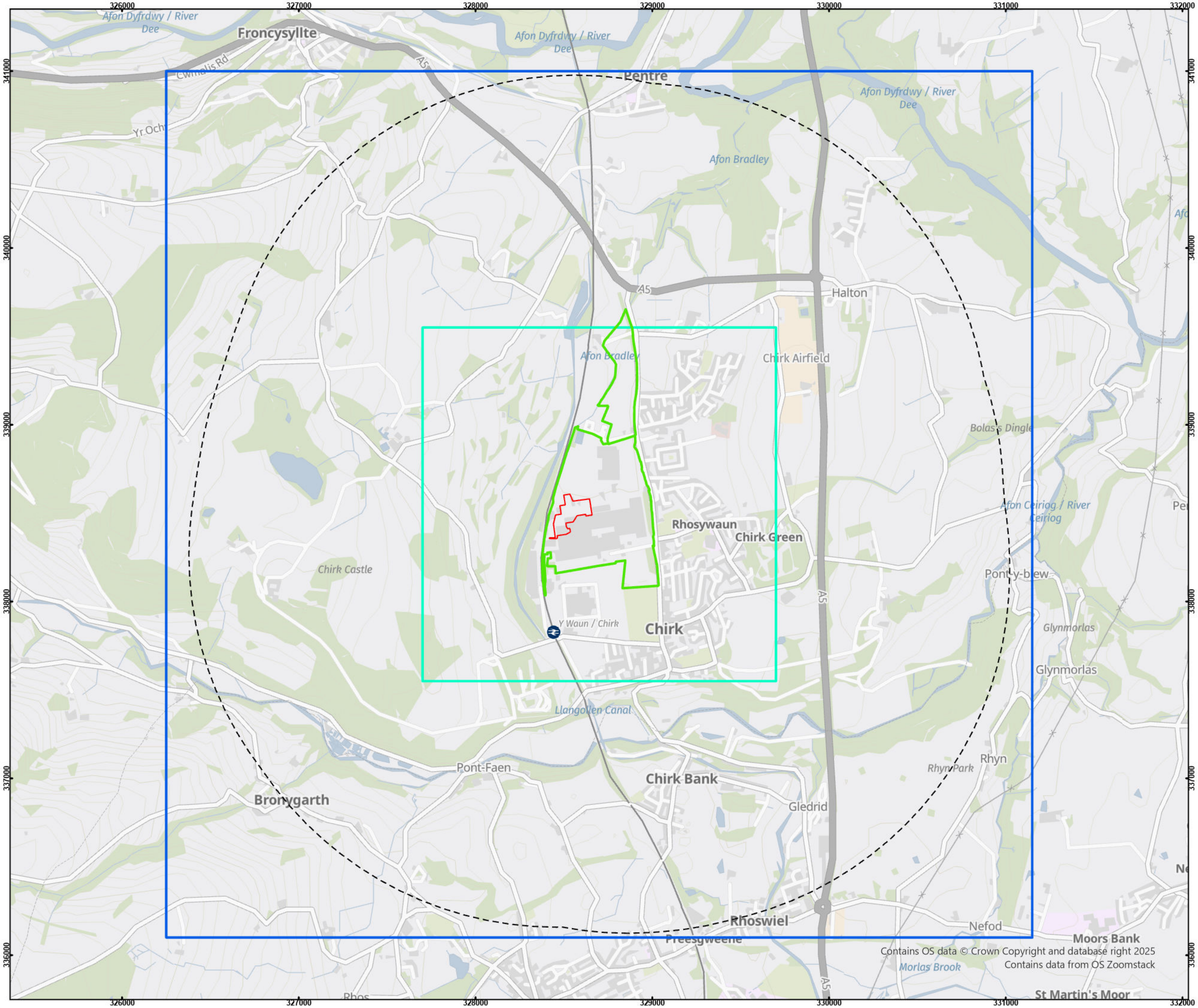


Image 5.2 – Stack Height Analysis – CHP – Maximum 1-hour





Legend

- 2km from Installation
- CHP Site Boundary
- Installation Boundary
- Fine Grid
- Main Grid

Client:	Axis
Site:	Kronospan - Chirk
Project:	CHP

Title:

Appendix 6C - Figure 1 - Modelling Domain

Drawn by: RSF	Date: 15/12/2025

0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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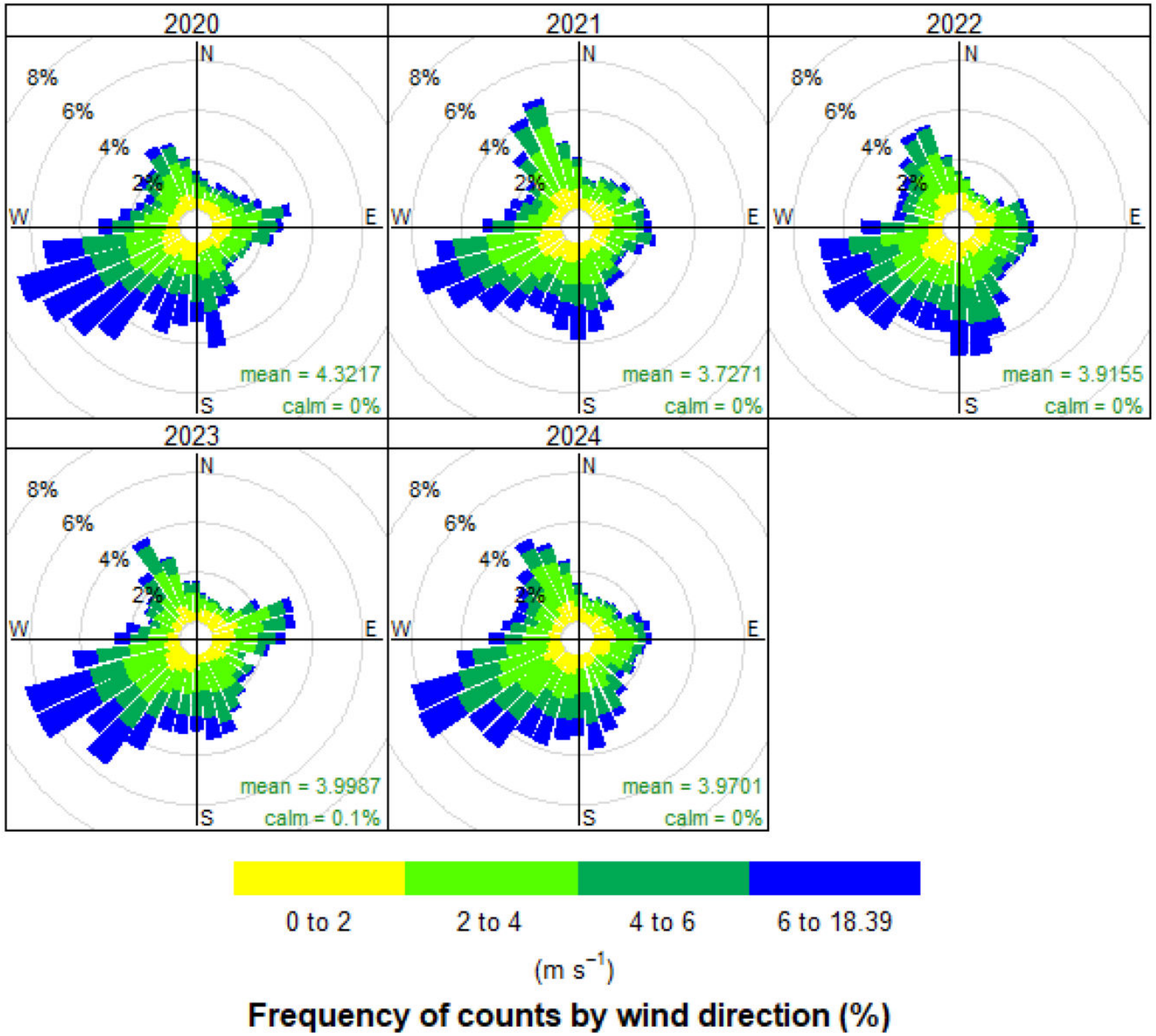


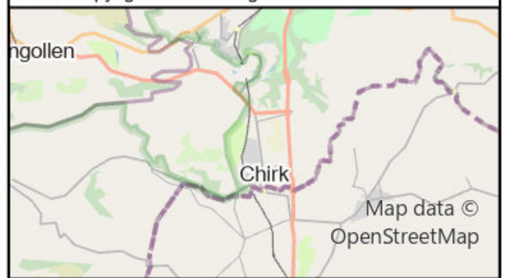
Notes:

Met data from Harwarden

Client:	Axis
Site:	Kronospan - Chirk
Project:	CHP
Title:	

Appendix 6C - Figure 2 - Wind Roses

Drawn by: RSF	Date: 15/12/2025



0 0.1 0.2 0.4 km

N

Scale: 1:10,000

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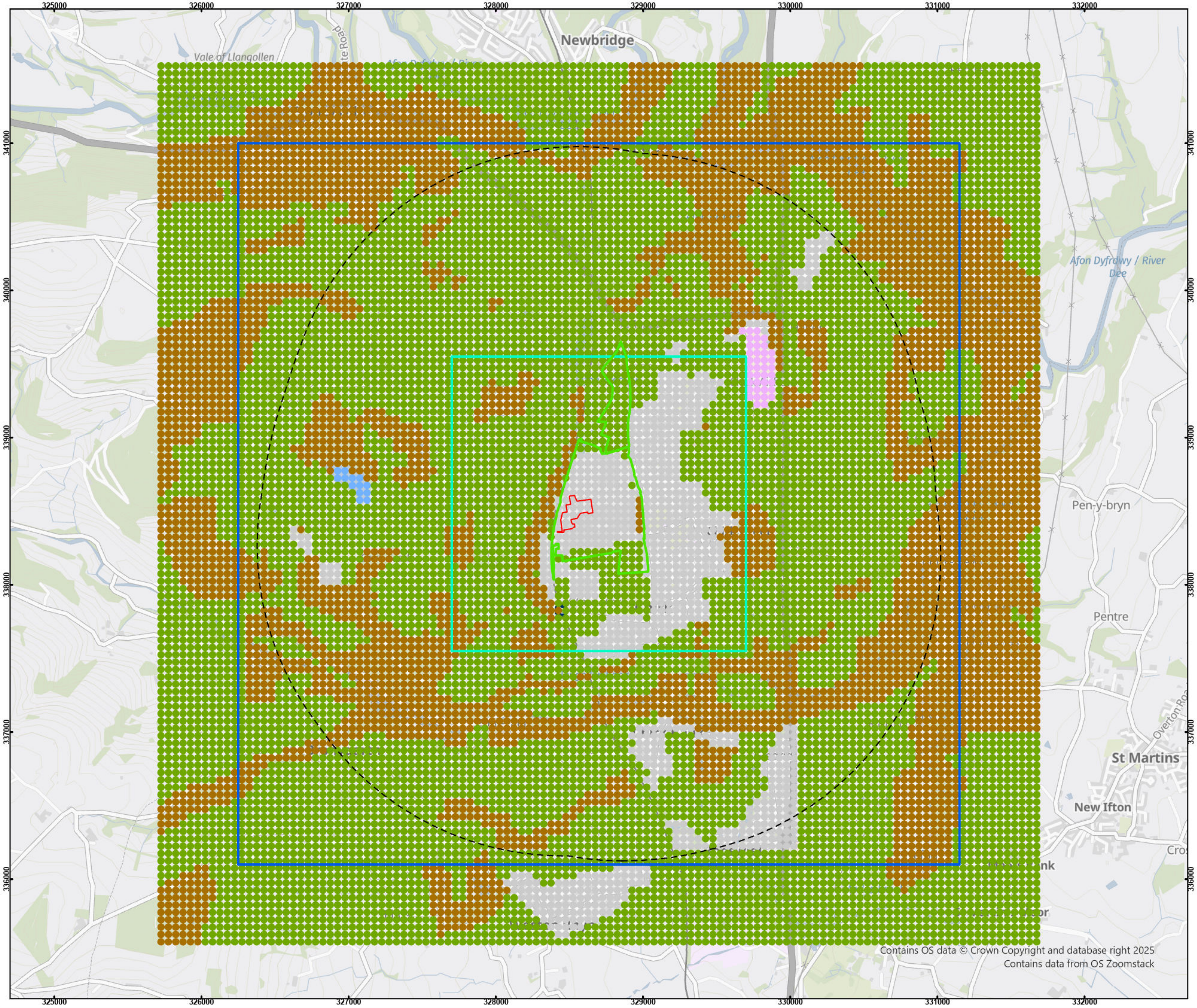

Legend

- 2km from Installation
- CHP Site Boundary
- Installation Boundary
- Fine Grid
- Main Grid
- 0.001
- 0.03
- 0.3
- 0.5
- 0.75

Client:	Axis
Site:	Kronospan - Chirk
Project:	CHP
Title:	

Appendix 6C - Figure 3 - Spatially Varying Surface Roughness and Terrain

Drawn by: RSF	Date: 15/12/2025

0 0.23 0.45 0.9 km

Scale: 1:24,000

N

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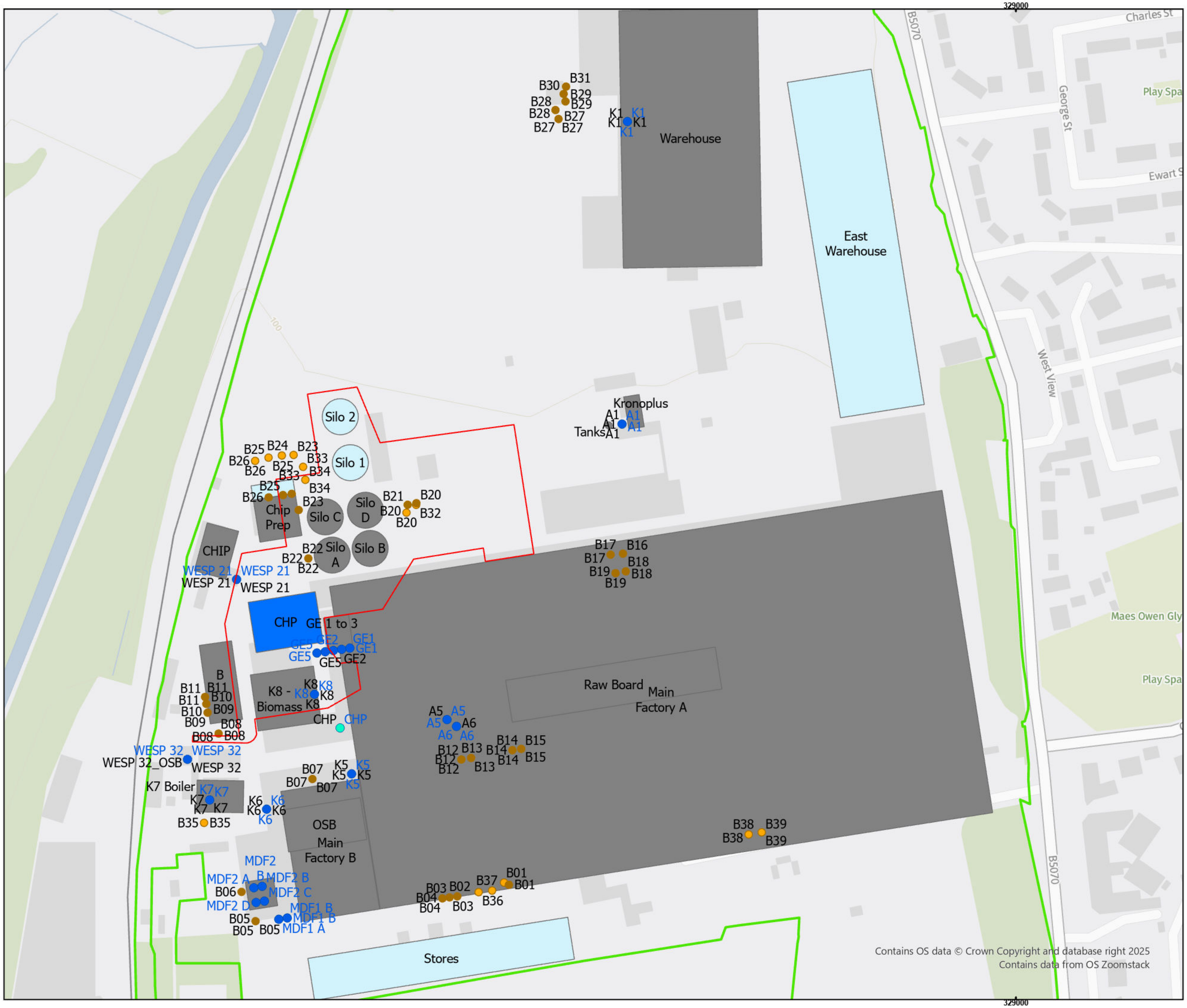

Legend

- CHP Site Boundary
- Installation Boundary
- Baseline and OSB Scenario - Point Sources
- Additional Point Sources - CHP
- Dust Units - Baseline
- Additional Dust Units - OSB Scenario
- Additional Dust Units - CHP
- Baseline Buildings
- Additional Buildings in OSB Scenario
- Additional Buildings in CHP Scenario

Client:	Axis
Site:	Kronospan - Chirk
Project:	CHP
Title:	Appendix 6C - Figure 4 - Buildings and Point Sources

Drawn by: RSF | Date: 15/12/2025

Chirk

0 0.03 0.05 0.1 km

N

Scale: 1:2,500

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