FICHTNER
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Kronospan

Chirk EP Application

WESP – effect of additional air

1 Introduction

Natural Resources Wales (NRW) has requested additional information regarding the emissions from the WESP (SEKA 21) stack (emission point 1) to support its determination of the application for an Environmental Permit (EP) for Kronospan's facility in Chirk, North Wales (the Facility).

Historically, the WESP was used as a Wet Electrostatic Precipitator to abate emissions from the two BAB driers (BAB 2 and BAB 3), and the combined flue gases from the press abatement systems were released to atmosphere via a stack close to the press abatement plant. However, at the request of Wrexham County Borough Council (WCBC), in 2016 the flue gases from the press abatement system were ducted into a point close to the top of the WESP stack in order to raise the discharge point from 22 metres above ground to 65 metres. This allowed the flue gases press abatement system and the abated flue gases from the BAB driers to mix prior to being released to atmosphere. In its existing WCBC EP Kronospan is permitted to release emissions from the press abatement system via the previous stack for short periods when carrying out monitoring to demonstrate compliance with the EP and for inspection, cleaning and maintenance purposes.

Due to changes in the manufacturing process, the BAB driers have recently been decommissioned. Therefore, the only flue gases which are currently released to atmosphere from the WESP, are from the press abatement systems. The ducting for the press abatement has been re-routed to enter the WESP via the port which was previously used by BAB 2. The WESP (SEKA 32) is not currently operated as a WESP abatement system.

The diameter of the WESP outlet is 1.5 metres.

To assist with the dispersion of the flue gases from the press abatement system, the Induced Draft (ID) fan from the remaining BAB 3 drier is used in a controlled manner. Regular visual plume inspections, wind speed and direction assessments are carried out and a decision is made on whether to run the ID fan or not, noting that this is run without the heater. Experience on site has shown that although running the ID fan increases the dispersion and dissipates the visible plume, in some instances the visible plume, and potential for grounding is exacerbated, as such a decision is made by the operator whether to run the ID fan or not.

2 Objective

This study has been conducted to determine the air quality impacts associated with operating the ID fan on ground level concentrations of the pollutants of concern and the visibility of the plume and potential for ground level impacts from the press abatement system when released from the WESP stack.

3 Modelling assumptions

Approximately 185 m of ducting is used to divert the exhaust gases from the press abatement system to the WESP stack. The monitoring data which is used to determine the parameters of the flue gases from the press abatement system is taken at the press abatement system original outlet point prior to ducting to the WESP. Therefore, there is expected to be some temperature loss through the ducting. The loss of heat through the duct has been calculated using the ambient temperature data from the meteorological data file. For the purpose of this calculation, the quarterly monitoring reports over the last two years have been reviewed and the report which included the highest moisture content used, as this is considered to be the most conservative. A summary of the key parameters from these reports can be found in Appendix A. As shown, the generally the flue gas temperature is fairly constant, but the moisture content does vary.

The temperature loss has been calculated assuming a constant emission temperature but variable ambient air conditions. The profile of the calculated temperature of the press abatement system flue gases, when released from the WESP stack can be found in Figure 1. The maximum loss of temperature was calculated to be approximately 10 °C. This has assumed the emissions from the press abatement system are as per the monitoring on 27 August 2020 (i.e. the most moist release).

This has then been combined with the air from the fan operating at the design point taking ambient air to calculate the combined release parameters. The calculated profile of temperature, velocity, and moisture content, for the combined release can be found in Figure 2, Figure 4 and Figure 6. As shown the combined release has a much lower temperature during the winter months as cooler ambient air is mixed. However, in all instances the moisture content is significantly lower with the use of the ID fan as the ambient air has a lower moisture content than the flue gases from the press abatement system.

The model has been run with a time varying emission profile for the WESP stack both with and without the ID fan operating. This has initially only emissions from the WESP stack, but an additional analysis has been carried out to determine the effect on the total impact of emissions from the Facility.

Figure 1: Temperature – ID Fan Off

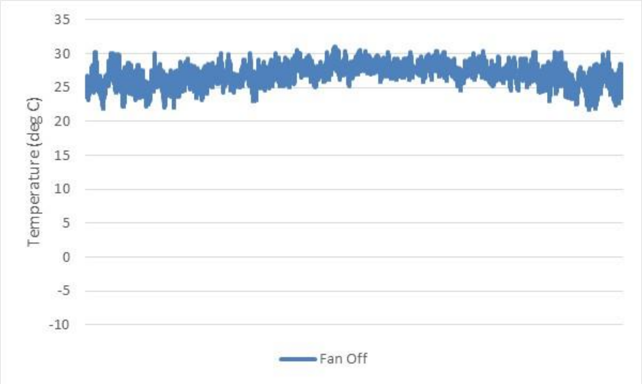


Figure 2: Temperature – ID Fan On

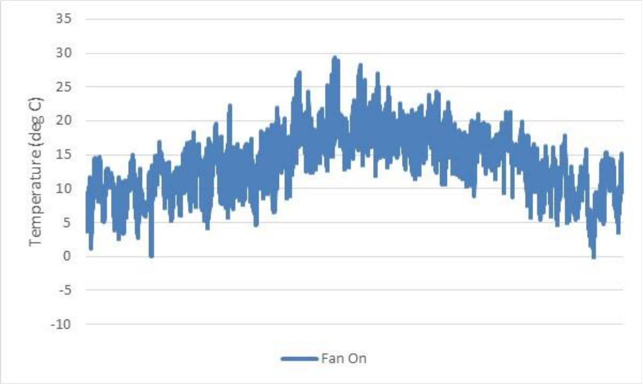


Figure 3: Velocity – ID Fan Off

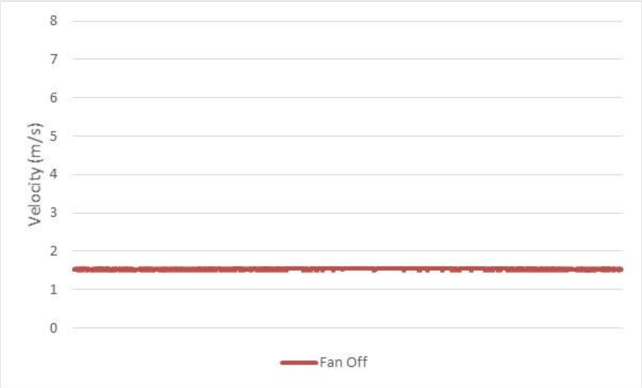


Figure 4: Velocity – ID Fan On

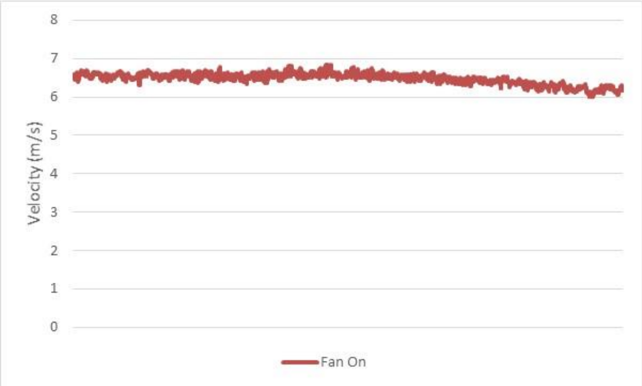


Figure 5: Moisture – ID Fan Off

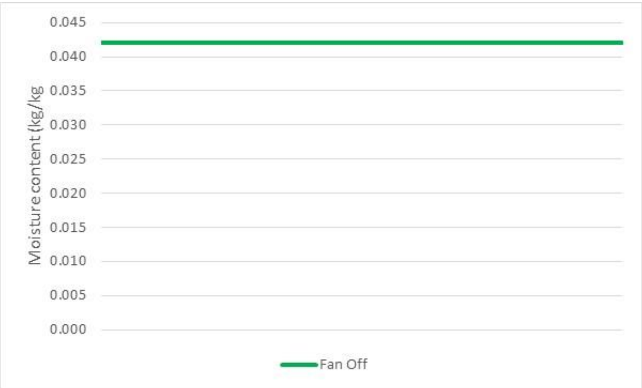
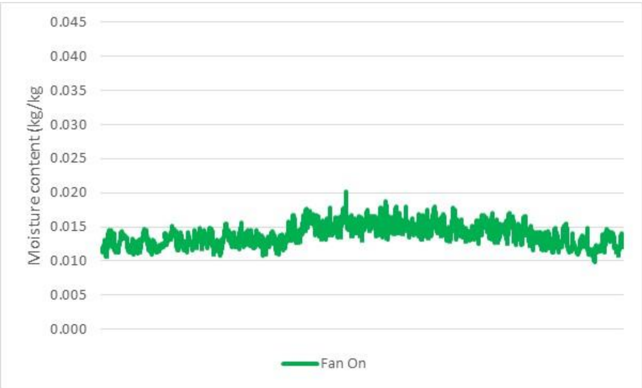


Figure 6: Moisture – ID Fan On



4 Analysis

The dispersion model has been run with a single year of weather data from Shawbury (2017), as used in the dispersion modelling to support the EP application. A comparison has been made between two scenarios - 'ID fan on' and 'ID fan off' - for the following:

1. The impact of pollutants; and
2. The impact on the visible plume.

4.1 Pollutants

The analysis has considered those pollutants which are released from the press abatement system, i.e. particulates (PM_{10}) and formaldehyde. The following figures contained in Appendix A present the results of the modelling:

- Figure 9: Annual Mean PM10 – WESP Only
- Figure 10: Annual Mean Formaldehyde – WESP Only
- Figure 11: Max 1-hour Mean Formaldehyde – WESP Only
- Figure 12: Annual Mean PM10 – Normal Operations
- Figure 13: Annual Mean Formaldehyde – Normal Operations
- Figure 14: Max 1-hour Mean Formaldehyde – Normal Operations

As shown for the ID fan off scenario, there is a small change in the impact of emissions when considering the emissions from the WESP stack in isolation. However, when taking into account all other sources on site, during normal operations, there is only a marginal difference with a slight increase in the impact of formaldehyde but the impact of PM_{10} is very similar between the ID fan on and ID fan off scenarios. In all instances, the impact can be described as 'not significant' at areas of relevant exposure to the short and long term AQALs.

4.2 Visible plume

Analysis has been carried out on the likelihood of a visible plume from the emissions from the WESP stack. The plume visibility module cannot take into account building downwash effects. However, the results can be used to demonstrate what the likely effect will be of switching the ID fan off, on the number and length of visible plumes.

This analysis has shown that although a high number of visible plumes are predicted to occur, generally these are short and dissipate within a short distance from the WESP stack. When operating the ID fan, 98% of the visible plumes are less than 5 m from the release point. When the ID fan is not operating, the number and length of the visible plume is predicted to increase. The distribution of the predicted number of visible plumes and lengths are shown in the following figures.

Figure 7: Histogram – Visible Plumes - Fan On

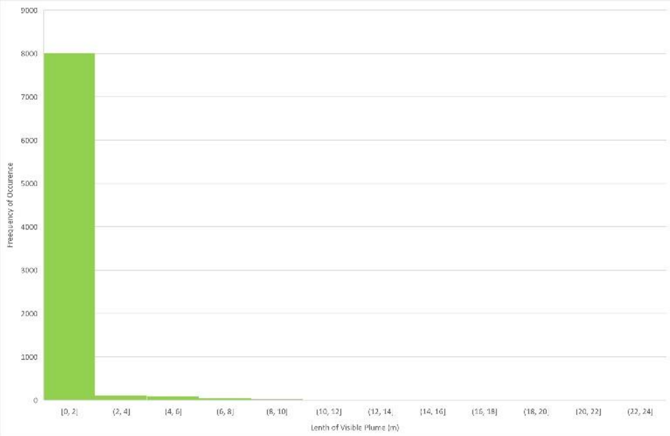
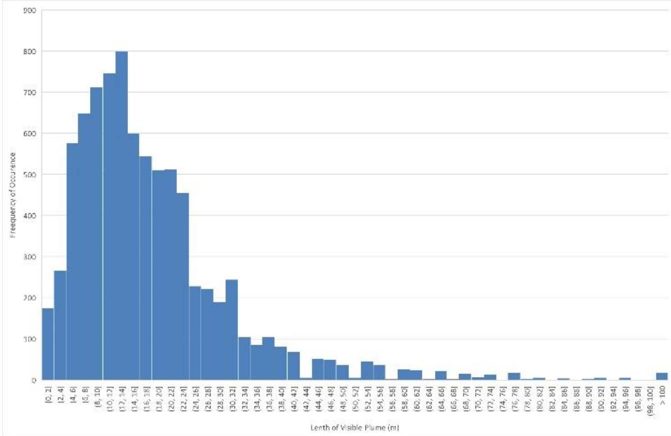


Figure 8: Histogram – Visible Plumes - Fan Off



As shown, there is a significantly greater number of visible plumes when the ID fan is not operating. However, the majority of these are short and would not extend significantly beyond the site boundary. At its closest point the site boundary is 40 m. The results from the modelling have been post-processed to understand the direction of each plume and position relative to the installation boundary. This has been calculated based on the distance to the installation boundary from the WESP for each wind direction.

Analysis of this shows that the majority of the plumes are within the installation boundary with only 12% of the plumes predicted to extend beyond the site boundary.

From its experience, Kronospan has reported that even with the ID fan operating there can be visible plumes and the use of the ID fan does not always minimise the visible plume and can sometimes exacerbate the situation. This could be as the ambient air and exhaust gases from the press abatement system are not mixing well within the WESP when the two air masses have very different parameters.

5 Conclusions

This analysis has shown that operating the ID fan from BAB 1 (without heat) to increase the velocity of the emissions from the press abatement system when releasing to atmosphere via the WESP has some benefit in terms of the dispersion of emissions and the likelihood of a visible plume. However, the operation of the ID fan will reduce the overall energy efficiency of the press abatement system.

The difference in the predicted ground level impact of emissions between the ID fan on and ID fan off scenario is marginal, and the overall impact of emissions would be described as 'not significant' at areas of relevant exposure to the short and long term AQALs.

The release from the press abatement system is moist and as such a visible plume would occur. Operating the ID fan with ambient air (no heating) would reduce the temperature of the release when combined, but the moisture content of the flue gases would also reduce. This means that the plume is less likely to be visible when the ID fan is operating. The visible plume is not greatly affected by the velocity of the release but more by the dilution effect of mixing ambient air, within the WESP stack, with the flue gases from the press abatement system.

Despite the modelling predicting a very different occurrence of visible plumes with the ID fan operating, Kronospan has reported that the use of the fan does not always minimise the visible plume and can sometimes exacerbate the situation. This could be as the ambient air and exhaust gases from the press abatement system are not mixing well within the WESP when the two air masses have very different parameters.

Analysis of the likely plume lengths shows that most plumes from the WESP stack would be fairly short. Whilst a visible plume would occur and potentially more frequent with the fan switched on there are other sources of visible plumes on site.

To conclude, there is a marginal benefit to the visible plume and ground level impacts of pollutants as a result of operating the ID fan. However, the operation of the ID fan reduces the energy efficiency of the press abatement system.

We trust that the information contained within this Technical Note is sufficient to enable NRW to progress with the determination of the EP application for the Facility. If NRW has any questions on the information contained within this Note, please feel free to contact Rosalind.

Yours sincerely

FICHTNER Consulting Engineers Limited

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Appendices

A Summary of monitoring data

Table 1: Press Abatement System Monitoring – Key Parameters

Date	Temperature (°C)	Moisture content (%)
21/02/2019	30.0	3.85
30/04/2019	35.0	3.35
01/08/2019	40.5	5.20
24/09/2019	33.0	3.62
04/03/2020	33.0	4.18
27/08/2020	30.3	6.53
20/11/2020	33.3	5.94

B Figures

Figure 9: Annual Mean PM_{10} – WESP Only

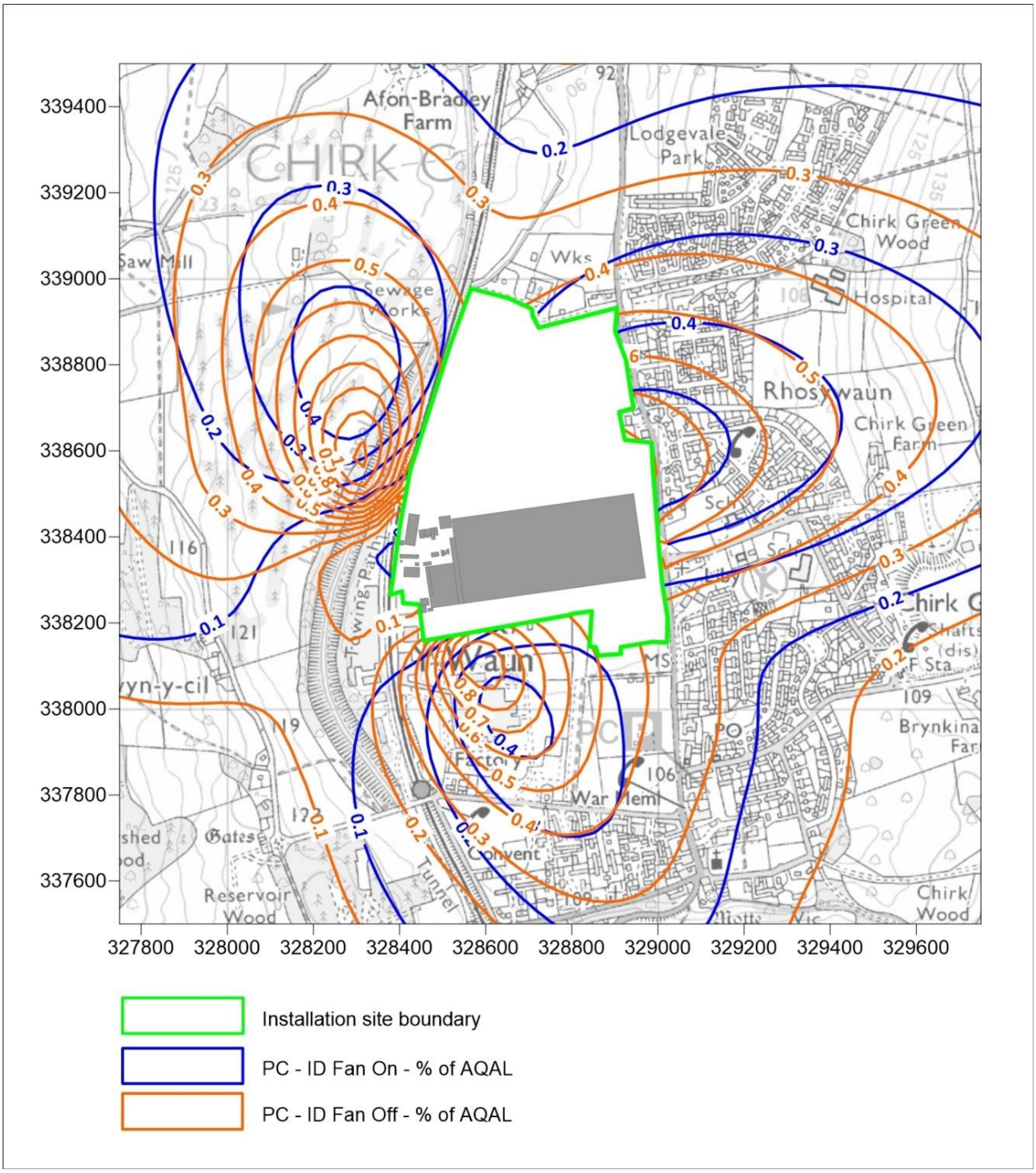

Figure 10: Annual Mean Formaldehyde – WESP Only

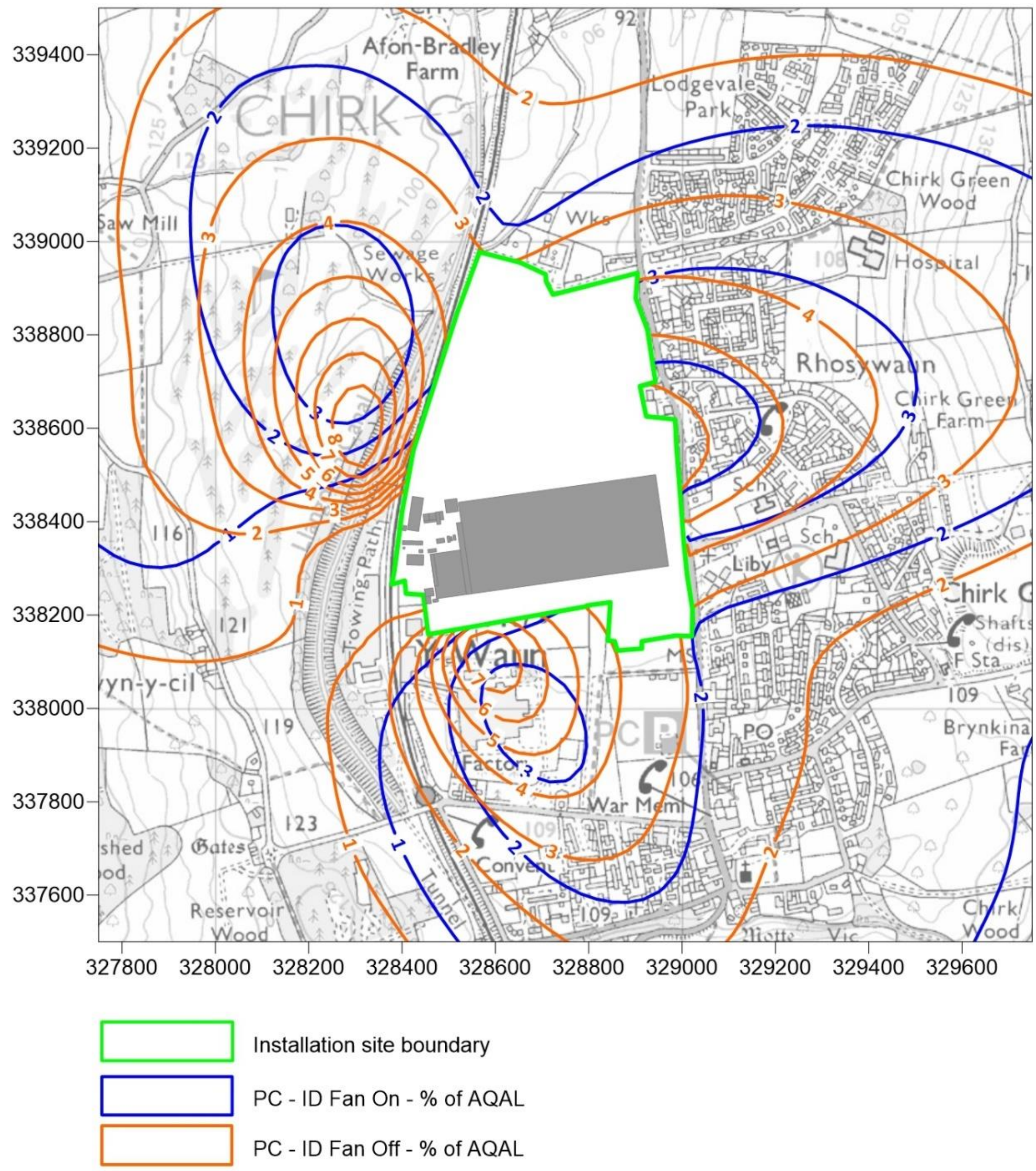

Figure 11: Max 1-hour Mean Formaldehyde – WESP Only

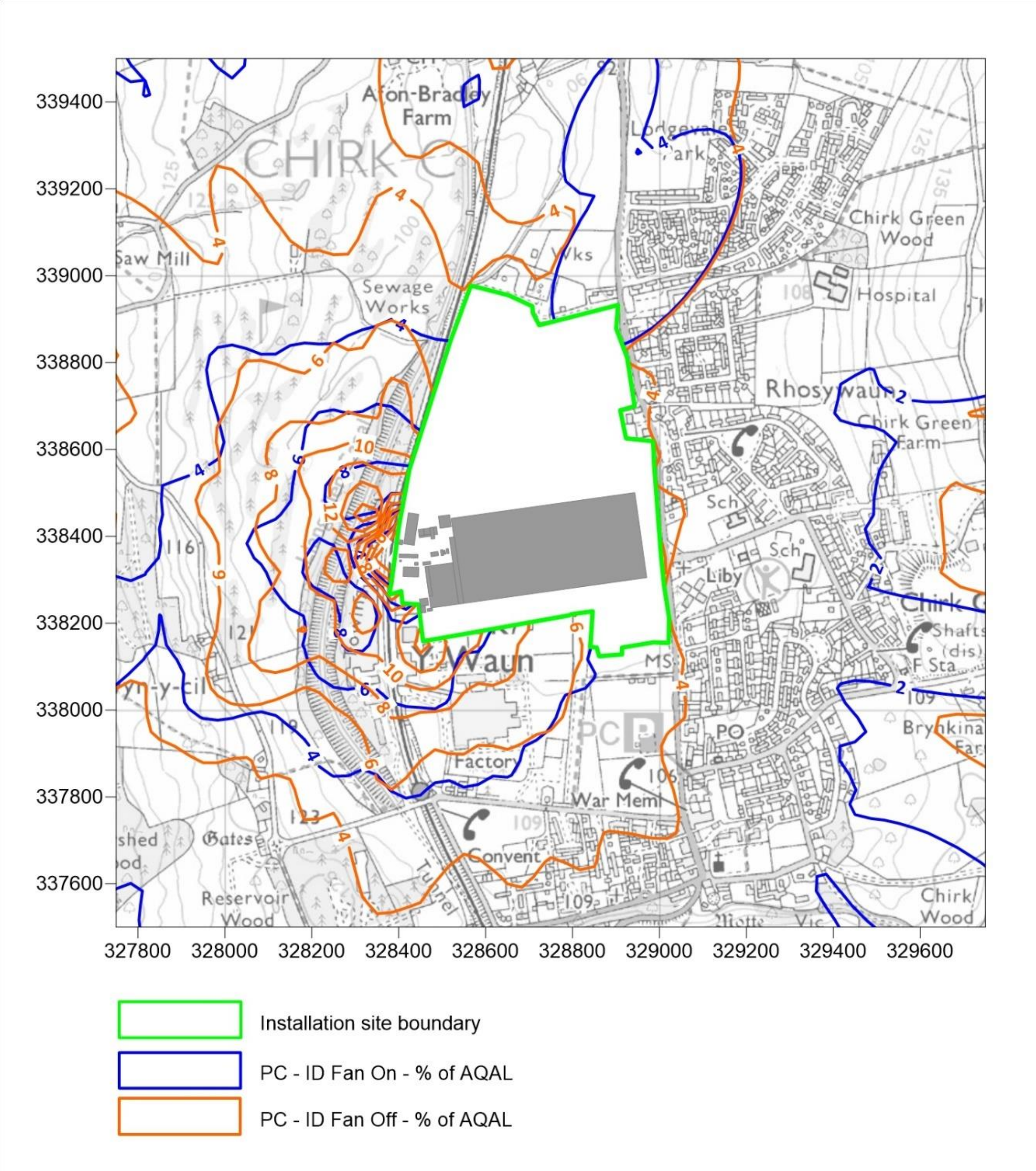

Figure 12: Annual Mean PM_{10} – Normal Operations

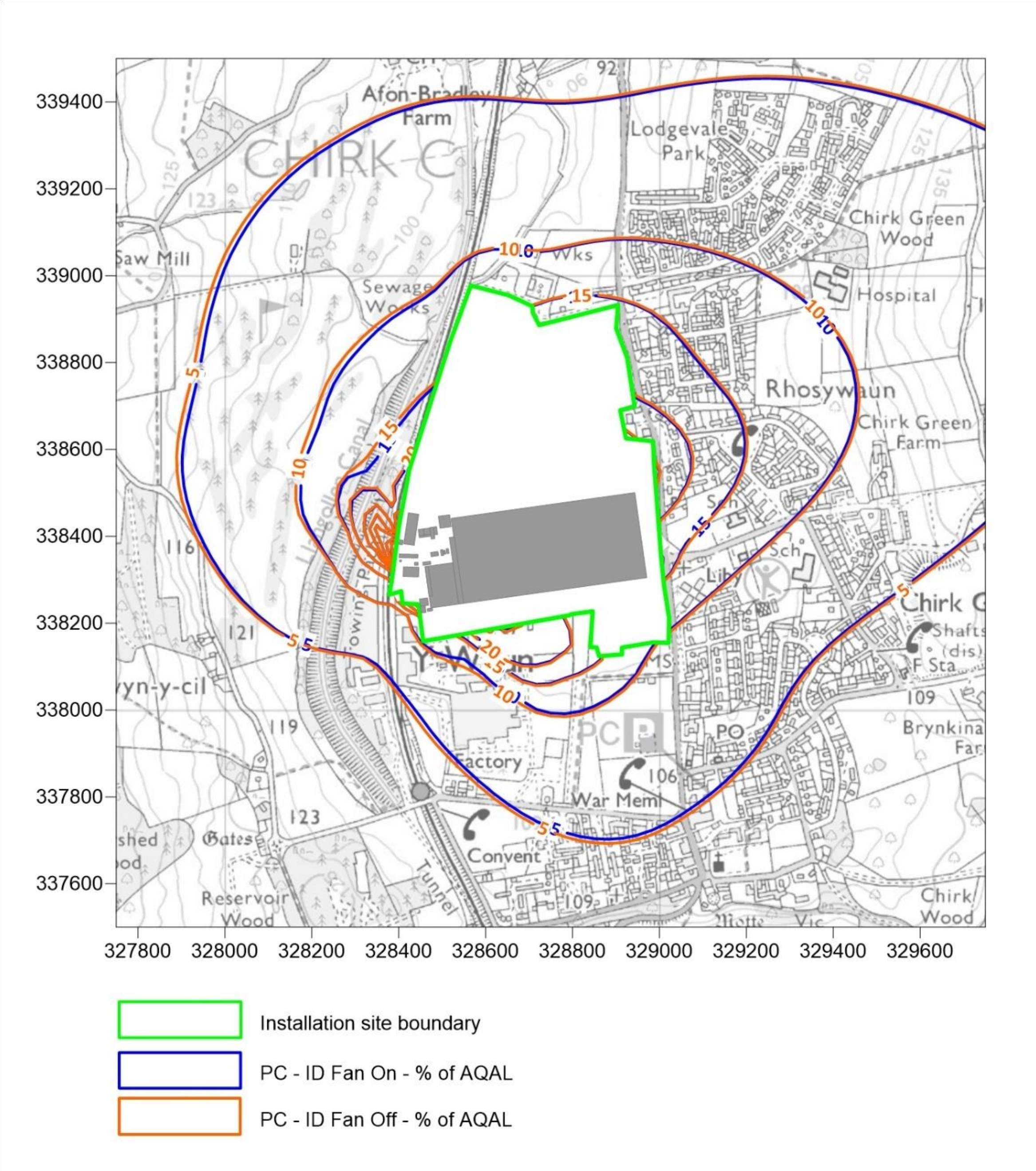

Figure 13: Annual Mean Formaldehyde – Normal Operations

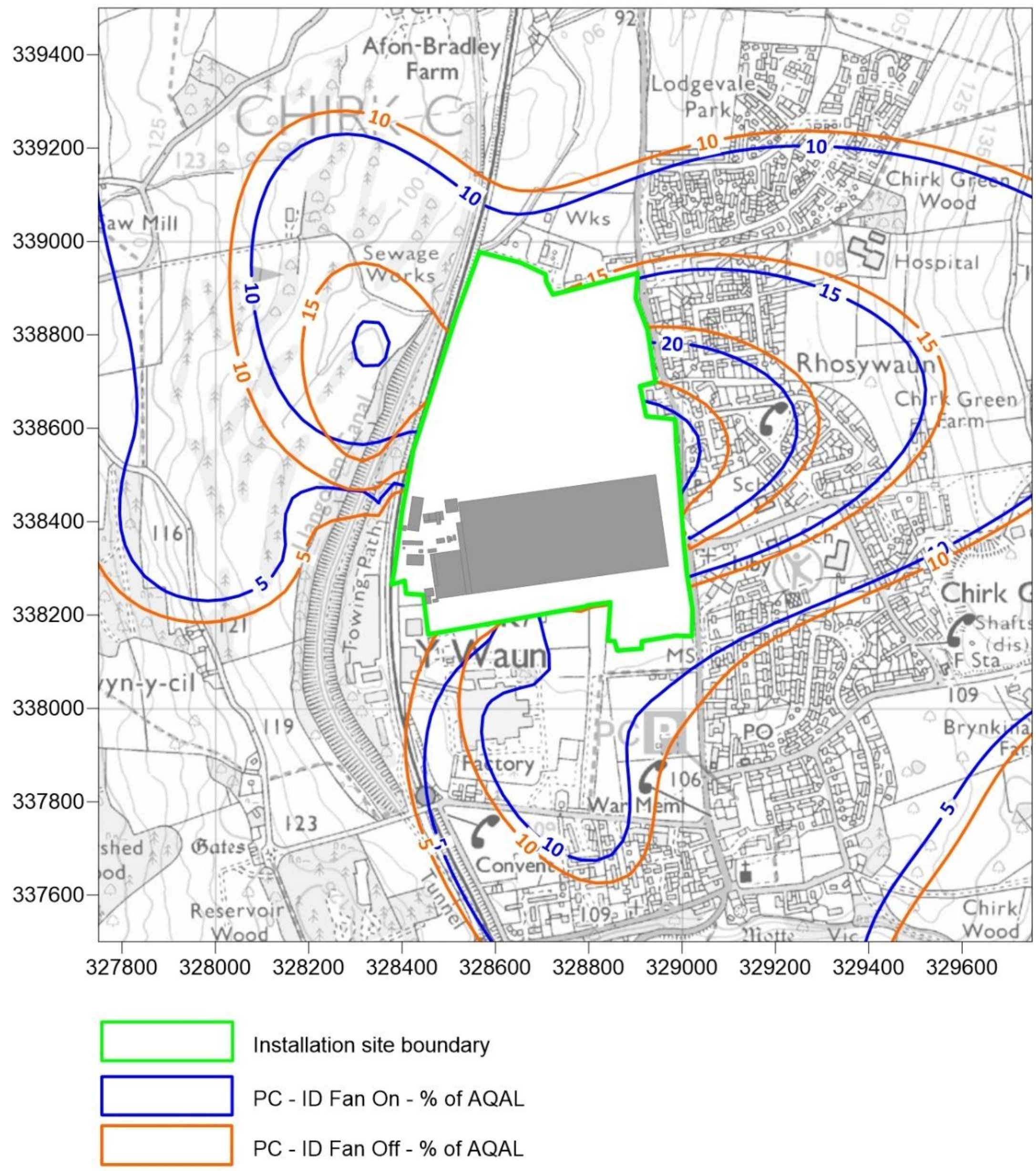

Figure 14: Max 1-hour Mean Formaldehyde – Normal Operations