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Farm, Leigh

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1. Introduction

- 1.1. This technical note responds to comments from Staffordshire Moorlands District Council ([SMDC](#)) regarding the air quality assessment ([APS_P1251A_A1-1](#)) for the proposed biomass boiler installation at Tean Leys Farm, Tean Leys, Leigh, Stoke-on-Trent, Staffordshire, ST10 4NS ('the Proposed Development'). The original assessment, dated 13 November 2024, was submitted as part of planning application SMD/2024/0299 and evaluated air quality impacts.
- 1.2. Following the council's review, concerns were raised regarding the screening methodology and future air quality objectives ([AQOs](#)). The key comments include:
 - The assessment used two screening tools: the 'Biomass Emissions Screening Tool' and 'SCAIL-Combustion'. The council stated that 'SCAIL-Combustion' has not been validated for biomass boilers of this scale and its results should not be accepted.
 - The 'Biomass Emissions Screening Tool' determined that emissions of nitrogen dioxide ([NO₂](#)) and particulate matter ([PM₁₀](#) and [PM_{2.5}](#)) from the Proposed Development are below threshold values, suggesting that an exceedance of AQOs is unlikely. However, the assessment for long-term [PM_{2.5}](#) was based on existing AQOs and did not account for the 2040 target of 10 µg/m³. The council requested further consideration of this future standard.
- 1.3. This technical note addresses both comments, focusing on the validation of SCAIL-Combustion in Section 2, the consideration of the 2040 [PM_{2.5}](#) target in Section 3 and the conclusions in Section 4.

2. Response to concerns on the use of 'SCAIL-Combustion'

Screening tools used in the assessment

- 2.1. The air quality assessment ([APS_P1251A_A1-1](#)) utilised two screening tools:
 1. The 'Biomass Emissions Screening Tool', which determines a target emission rate for [NO₂](#), [PM₁₀](#) and [PM_{2.5}](#) based on stack parameters and background concentrations. It provides a basic pass/fail threshold comparison to assess the likelihood of exceeding the AQOs. However, it does not incorporate specific dispersion modelling, meaning it does not account for site-specific meteorological conditions, terrain effects, or receptor locations, which significantly influence real-world dispersion.
 2. 'SCAIL-Combustion', which evaluates emissions from combustion sources and predicts ground-level concentrations at sensitive receptors (human health receptors and ecological sites). While it does not estimate [PM_{2.5}](#) concentrations, its results for [NO₂](#), [PM₁₀](#), can be interpreted in line with AQOs.
- 2.2. Both screening tools have inherent limitations and using them in combination provides a more comprehensive assessment.

Validation of 'SCAIL-Combustion' for biomass boilers

- 2.3. 'SCAIL-Combustion' is a recognised screening tool for assessing emissions from combustion sources, including biomass boilers. A review of the SCAIL-Combustion User Guide (UK Centre for Ecology & Hydrology, 2023) confirms that the model is:
 - designed for combustion-related air quality screening. It assesses emissions from industrial and agricultural combustion sources, including biomass boilers. The tool estimates pollutant dispersion and deposition, making it directly applicable for this type of assessment.



- widely recognised for regulatory screening. The model aligns with the Industrial Emissions Directive (IED) and the Medium Combustion Plant Directive (MCPD) and is used under the Environmental Permitting (England and Wales) Regulations 2016 (UK Centre for Ecology & Hydrology, 2023).
- conservative. It includes a 'Conservative Mode', which assumes the highest pollutant concentrations by aligning receptor locations with the prevailing wind direction. This ensures a worst-case scenario assessment, meaning that if no exceedances are predicted, actual impacts are likely lower.
- meteorologically robust. The model uses data from 109 meteorological stations across the UK, ensuring site-specific accuracy. It applies a long-term dataset to predict realistic dispersion patterns.

Justification for the use of 'SCAIL-Combustion' in this assessment

2.4. Given the limitation of the 'Biomass Emissions Screening Tool', which provides only a basic pass/fail threshold comparison, 'SCAIL-Combustion' was used to provide an additional layer of assessment by evaluating emission dispersion and impacts at receptor locations. While 'SCAIL-Combustion' does not estimate PM_{2.5} concentrations, its results for NO₂, PM₁₀ were interpreted in line with the AQOs:

- For human health receptors, the impact descriptors from Table 6.3 of the EPUK & IAQM (EPUK/IAQM, 2017) guidance was applied to interpret 'SCAIL-Combustion' results ensuring compliance with AQOs. This approach was presented in Tables 6 and 7 of the air quality assessment (APS_P1251A_A1-1).
- For ecological receptors, where the Process Contribution (PC) exceeded the 1% screening threshold, a more detailed assessment using the dispersion model (e.g. ADMS-6 or AERMOD) would be required. However, in this case, the PC remained below the criterion, meaning no further detailed assessment was necessary, but this level of confirmation would not have been possible using only the 'Biomass Emissions Screening Tool'.
- Dismissing 'SCAIL-Combustion' contradicts technical guidance. Established air quality guidance recognises dispersion modelling as a valid approach for assessing biomass boiler impacts. Rejecting the 'SCAIL-Combustion' results disregards a widely accepted regulatory tool.

3. Consideration of the 2040 PM_{2.5} Target

3.1. The current AQO for PM_{2.5} in England is 25 µg/m³ (annual mean) while the statutory limit value is 20 µg/m³ (annual mean). The UK Government has set a future legally binding target of 10 µg/m³ by 2040 under the Environment Act 2021, with an interim target of 12 µg/m³ by 2028. Additionally, a population exposure reduction target of 35% by 2040 (compared to 2016-2018 baseline levels) has been established.

Review of Council-Specific Air Quality Targets

3.2. A review of SMDC's key air quality documents, including the 2023 Annual Status Report and Air Quality Action Plan (2019-2024), confirms that the council adheres to national air quality objectives and has not adopted any additional local targets for PM_{2.5} beyond statutory requirements. The assessment has therefore been conducted in alignment with these established regulatory thresholds.



Review of PM_{2.5} Screening Assessment

- 3.3. The 'Biomass Emissions Screening Tool' was used in the original assessment (APS_P1251A_A1-1) to estimate the likelihood of exceeding air quality objectives for NO₂, PM₁₀ and PM_{2.5}. The tool determined that emissions from the Proposed Development are below threshold values, indicating that an exceedance of current AQOs is unlikely. However, the tool is primarily designed to assess compliance with existing air quality objectives and does not explicitly model future targets.

Consideration of the 2040 PM_{2.5} Target

- 3.4. Although the 'Biomass Emissions Screening Tool' does not directly account for future air quality standards, an additional assessment was conducted using Scotland's stricter PM_{2.5} annual mean objective of 10 µg/m³, which is already in place. This matches the 2040 PM_{2.5} annual mean concentration target for England. This approach goes beyond the tool's intended function but provides further validation of compliance.
- 3.5. To test this, the location parameter was changed to Scotland, where the lower 10 µg/m³ target already applies. The results, presented in Figure 2, show that the target emission rate is adjusted to 0.0186 g/s. Despite this stricter threshold, the Proposed Development's emission rate (0.004 g/s), remains below the target emission rate. This confirms that even under the more stringent standard (10 µg/m³), compliance is maintained.
- 3.6. Figure 1 shows the original screening results for the rest of the UK, while Figure 2 shows the updated scenario using the stricter Scottish objective.

Figure 1: Biomass Emissions Screening Tool Results – 'PM_{2.5} Indiv Annual' (Rest of the UK)

PM _{2.5} Emissions from Biomass Combustion Stacks (Individual Installations) - Annual Mean	Additional Comments/Information																					
The target emissions of PM_{2.5} in g/s from biomass combustion source emissions are calculated for your given stack details. Greater emission rates may result in exceedance of the annual mean cap for PM_{2.5} in England, Wales and Northern Ireland or the annual mean objective in Scotland. The cap is 25 µg/m³ in England, Wales and Northern Ireland, whilst an objective of 10 µg/m³ applies in Scotland. Enter required information in Yellow Cells Resulting Emission in Red Bold <table><tr><td>Building height</td><td>5.18</td><td>m</td></tr><tr><td>Stack diameter</td><td>0.3</td><td>m</td></tr><tr><td>Stack height</td><td>7.9</td><td>m</td></tr><tr><td>Location</td><td>Rest of UK</td><td></td></tr><tr><td>PM_{2.5} Annual mean background concentration (include roadside contribution at relevant receptors)</td><td>6.6</td><td>µg/m³</td></tr><tr><td>Calculated Effective stack height</td><td>4.5</td><td>m</td></tr><tr><td>Target Emission Rate</td><td>0.0969</td><td>g/s</td></tr></table> If the maximum stack emission rate is less than the target above then it is not likely that either the cap or objective for PM_{2.5} will be exceeded. If your emissions are greater then please refer to LAQM.TG(16) for further advice.	Building height	5.18	m	Stack diameter	0.3	m	Stack height	7.9	m	Location	Rest of UK		PM _{2.5} Annual mean background concentration (include roadside contribution at relevant receptors)	6.6	µg/m ³	Calculated Effective stack height	4.5	m	Target Emission Rate	0.0969	g/s	
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PM _{2.5} Annual mean background concentration (include roadside contribution at relevant receptors)	6.6	µg/m ³																				
Calculated Effective stack height	4.5	m																				
Target Emission Rate	0.0969	g/s																				

Figure notes: Ambient background concentrations of PM_{2.5} have been defined using the national pollution maps published by Defra (2023).



Figure 2: Biomass Emissions Screening Tool Results – ‘PM_{2.5} Indiv Annual’ (Scotland)

PM _{2.5} Emissions from Biomass Combustion Stacks (Individual Installations) - Annual Mean		Additional Comments/Notes
The target emissions of PM_{2.5} in g/s from biomass combustion source emissions are calculated for your given stack details. Greater emission rates may result in exceedance of the annual mean cap for PM_{2.5} in England, Wales and Northern Ireland or the annual mean objective in Scotland. The cap is 25 µg/m³ in England, Wales and Northern Ireland, whilst an objective of 10 µg/m³ applies in Scotland.		
Enter required information in Yellow Cells Resulting Emission in Red Bold		
Building height	5.18 m	
Stack diameter	0.3 m	
Stack height	7.9 m	
Location	Scotland	
PM _{2.5} Annual mean background concentration (include roadside contribution at relevant receptors)	6.6 µg/m ³	
Calculated Effective stack height	4.5 m	
Target Emission Rate	0.0186 g/s	
If the maximum stack emission rate is less than the target above then it is not likely that either the cap or objective for PM_{2.5} will be exceeded. If your emissions are greater then please refer to LAQM.TG(16) for further advice.		

Figure notes: Ambient background concentrations of PM_{2.5} have been defined using the national pollution maps published by Defra (2023).

- 3.7. This additional analysis reinforces the conclusion that the Proposed Development will not lead to exceedances of future air quality standards. Even when applying a stricter regulatory framework, the emissions remain well within acceptable limits, further supporting the findings of the original assessment (APS_P1251A_A1-1).
- 3.8. It is important to note that this exercise extends beyond the tool’s intended scope, as the ‘Biomass Emissions Screening Tool’ was not designed to assess future objectives/targets. However, by using this approach as a final validation method, it is possible to confirm with confidence that the likelihood of significant impacts remains negligible.

4. Conclusion

- 4.1. The original assessment (APS_P1251A_A1-1) confirmed compliance with AQOs using both screening tools, ensuring a precautionary approach. ‘SCAIL-Combustion’ does not estimate PM_{2.5} but its results for NO₂ and PM₁₀ were interpreted using recognised methodology. The combined use of both tools provided a comprehensive assessment.
- 4.2. An additional test using Scotland’s stricter 10 µg/m³ AQO confirmed that the Proposed Development’s PM_{2.5} emission rate is well below the target rate, reinforcing compliance with the future (2040) PM_{2.5} target in England. While the ‘Biomass Emissions Screening Tool’ is not designed for future objectives, this validation confirms the risk is negligible and no further modelling is required.

5. Glossary

AQO	Air Quality Objectives
IED	Industrial Emissions Directive
MCPD	Medium Combustion Plant Directive



NO₂	Nitrogen Dioxide
PC	Process Contribution
PM₁₀ and PM_{2.5}	Particulate Matter
SMDC	Staffordshire Moorlands District Council

6. References

EPUK/IAQM. (2017). Land-Use Planning & Development Control: Planning For Air Quality.

UK Centre for Ecology & Hydrology. (2023). SCAIL-Combustion: User guide.



A1. Professional Experience

Kieran Laxen, MEng (Hons) MEnvSc MIAQM

Kieran is a Director and founder of Air Pollution Services and has 16 years' experience in the field of air quality. He has worked on hundreds of projects, including port schemes, road schemes, residential and commercial developments, industrial processes, energy from waste sites, infrastructure projects. Kieran is an active member of the IAQM committee (and a current Vice Chair), has led a number of air quality position statements and has been involved in developing IAQMs guidance. He has extensive experience of ambient air quality monitoring and dispersion modelling at sub-regional scales for planning and permit applications. He developed KALACO's meteorological data services, processing Met Office data and creating numerical weather prediction (NWP) data in a range of formats to suit different dispersion models. He has developed KALACO's in-house EMEP regional chemical transport model capability running regional models for Europe. He has completed a number of research projects for the regulators. He provided technical advice and co-ordinated stakeholder engagement for the selection and implementation of the dispersion model in JNCC's UK Air Pollution Assessment Service (UK APAS) and has carried out a review of observational and NWP data for use in modelling for the project with a clear understand of regulatory requirements. He has substantial experience in assessing air quality, dust and odour for planning applications, for a diverse range of developments, and supporting local authorities with their LAQM duties, such as AQMA and AQAP development.

Ellie Tsiarapa, MSc AMIEnvSc

Ellie is a Consultant at Air Pollution Services with several years' experience. She previously undertook pollution and bioaerosol research at the Air Quality Management Resource Centre (AQMRC). She has been involved in several EU and UK research projects, and also has experience in dispersion modelling. She holds an MSc in Environmental Consultancy from the University of the West of England (UWE) and has experience in preparing air quality and odour assessments for planning and permitting applications as well as support for local authorities. This has included residential, commercial and retail developments as well as power generation, waste and mineral facilities.