planning
transport
design
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APPENDIX 5.2: Air Quality – Stack Height Determination

Wheelabrator Kemsley Generating Station (K3) and Wheelabrator Kemsley North (WKN) Waste to Energy Facility DCO

S42 Draft ES **PINS ref: EN010083**

Appendix 5.2: Stack Height Determination

A stack height determination has been undertaken to establish the height at which there is minimal additional environmental benefit associated with the cost of further raising the stack. The Environment Agency removed their detailed guidance, Horizontal Guidance Note EPR H1 [1], for undertaking risk assessments on 1 February 2016; however, the approach used here by RPS is consistent with that EA guidance which required the identification of *"an option that gives acceptable environmental performance but balances costs and benefits of implementing it."*

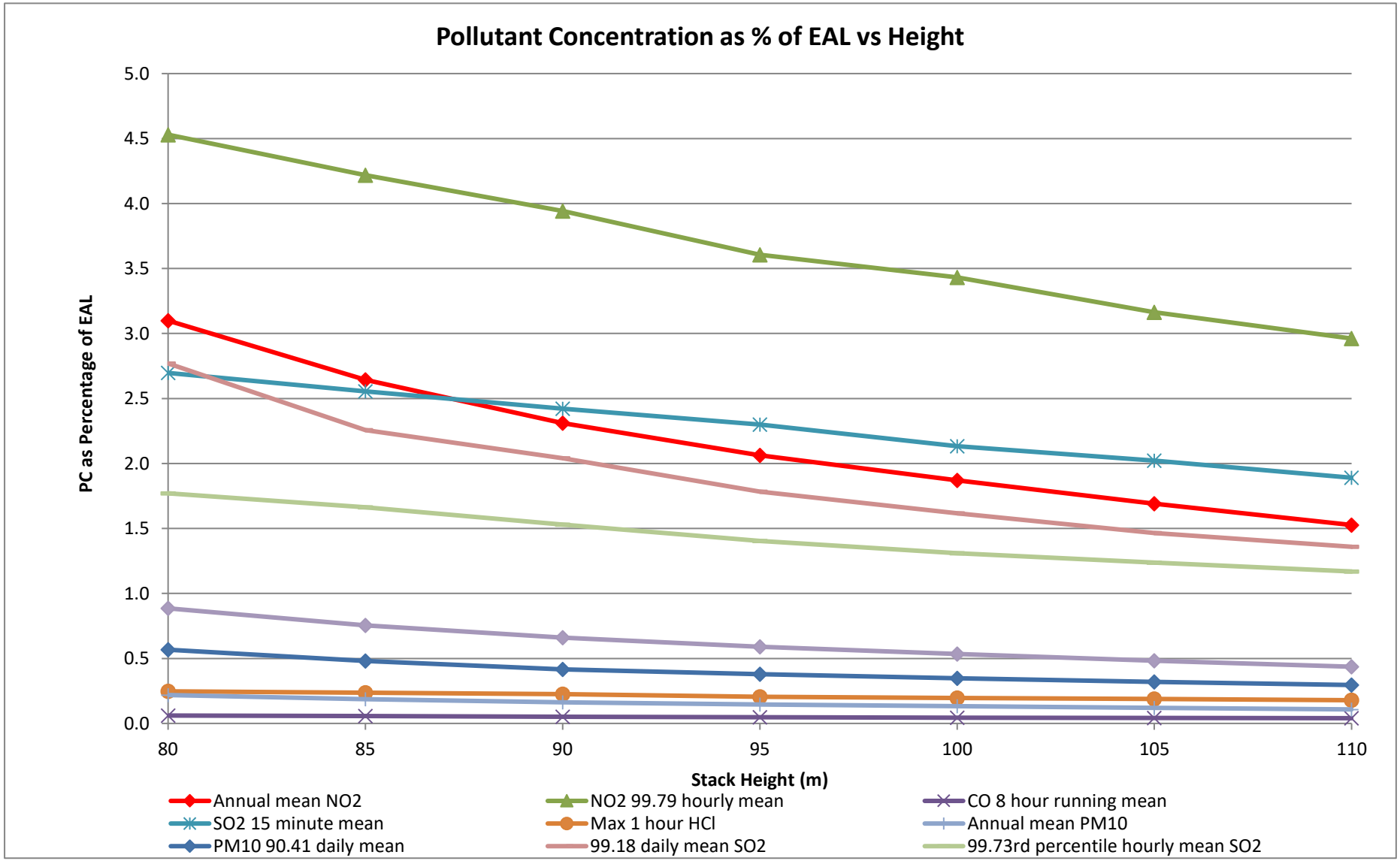
The emissions data used in the stack height determination are summarised in Chapter 5: Air Quality, Section 5.3. Simulations have been run using ADMS 5 to determine what stack height is required to provide adequate dispersion/dilution and to overcome local building wake effects.

The stack height determination considers ground level concentrations over the averaging periods relevant to the air quality assessment, together with the full range of all likely meteorological conditions through the use of five years of hourly sequential meteorological data from Gravesend. The model was run for a range of stack heights between 80 m to 110 m, at 5 m increments.

The dispersion modelling for the purposes of stack height determination assumed a domain of 20 km by 20 km centred on the proposed development and with a grid spacing of 200 m. Results have been reported for the location where the highest concentration is predicted. This is considered a robust and conservative approach.

The predicted Process Contributions (PCs) as a percentage of the relevant Environmental Assessment Level (EAL) have been plotted against height in Graph 5.2.1 (at long-term emission limits) and Graph 5.2.2 (at short-term emission limits) to indicate if there is a height beyond which the benefit from further increases in stack height are dimished. The PCs as a percentage of the relevant EALs are provided in Table 5.2.1 and Table 5.2.2 respectively.

Graph 5.2.1: Maximum Predicted Process Contribution as Percentage of EAL vs Stack Height at Long-term IED Limits



Graph 5.2.2: Maximum Predicted Process Contribution as Percentage of EAL vs Stack Height at Short-term IED Limits

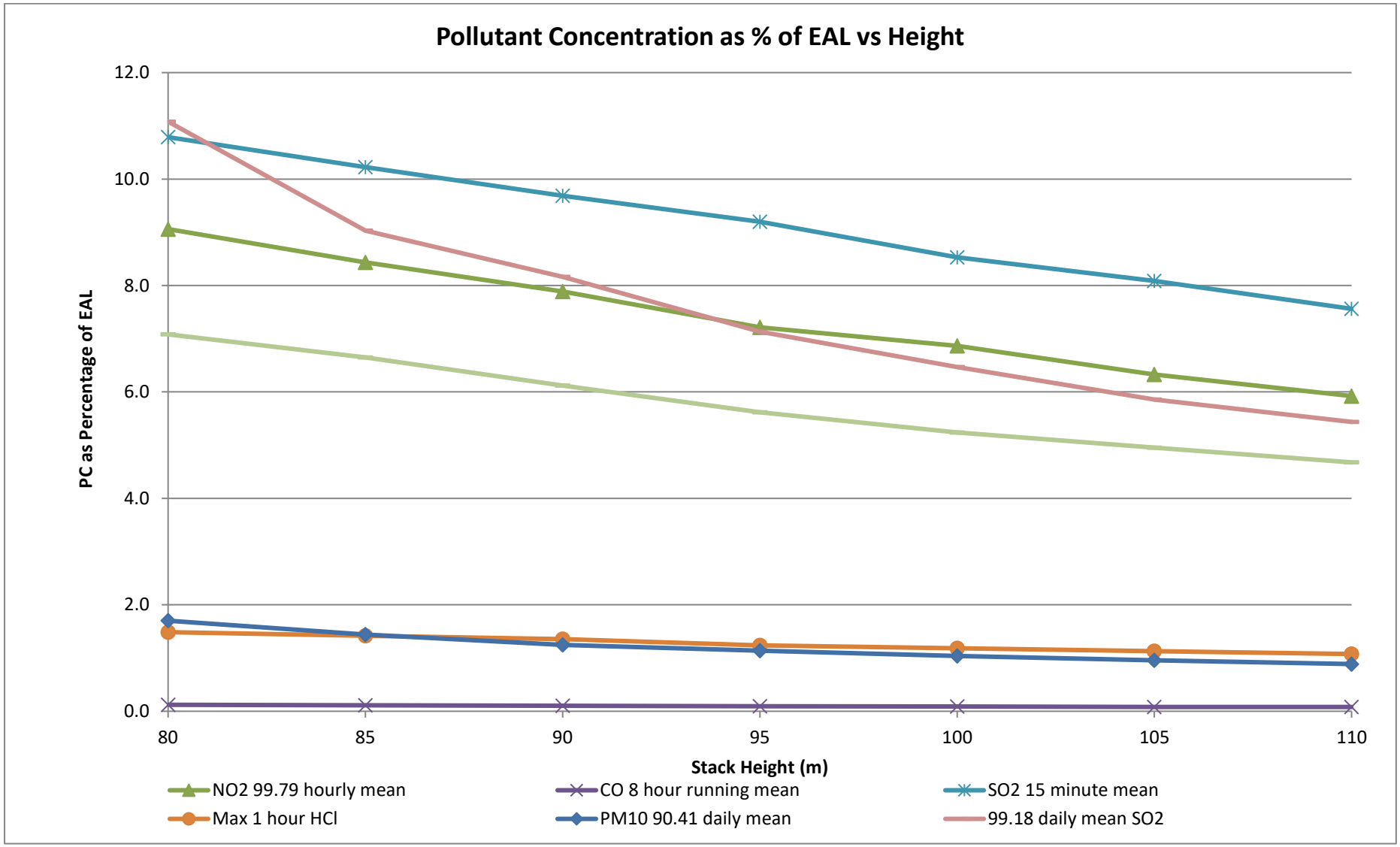


Table 5.2.1 Maximum Predicted Process Contributions as a Percentage of the Relevant EAL at each Stack Height Modelled – Long-term IED Concentration Limits

	Percentage of Environmental Assessment Level (%)									
Environmental Assessment Level ($\mu g.m^{-3}$)	**40**	**50**	**750**	**50**	**350**	**10000**	**40**	**200**	**125**	**266**
Height (m)	**Annual-mean PM_{10}**	**90.41st percentile daily mean PM_{10}**	**Maximum hourly HCl**	**Annual mean SO_2**	**99.73rd percentile hourly mean SO_2**	**Maximum 8-hour running CO**	**Annual mean NO_2**	**99.79th percentile NO_2**	**99.18th percentile daily mean SO_2**	**99.9th percentile 15-minute mean SO_2**
80	0.2	0.6	0.2	0.9	1.8	0.06	3.1	4.5	2.8	2.7
85	0.2	0.5	0.2	0.8	1.7	0.06	2.6	4.2	2.3	2.6
90	0.2	0.4	0.2	0.7	1.5	0.05	2.3	3.9	2.0	2.4
95	0.1	0.4	0.2	0.6	1.4	0.05	2.1	3.6	1.8	2.3
100	0.1	0.3	0.2	0.5	1.3	0.04	1.9	3.4	1.6	2.1
105	0.1	0.3	0.2	0.5	1.2	0.04	1.7	3.2	1.5	2.0
110	0.1	0.3	0.2	0.4	1.2	0.04	1.5	3.0	1.4	1.9

Cells are shaded grey where the predicted process contribution is above 1% of EAL for long-term average periods and 10% for short-term average periods.

Table 5.2.2 Maximum Predicted Process Contributions as a Percentage of the Relevant EAL at each Stack Height Modelled – Short-term IED Concentration Limits

	Percentage of Environmental Assessment Level (%)						
Environmental Assessment Level ($\mu g.m^{-3}$)	**50**	**750**	**200**	**10000**	**350**	**125**	**266**
Height (m)	**90.41st percentile daily mean PM_{10}**	**Maximum hourly HCl**	**99.79th percentile NO_2**	**Maximum 8-hour running CO**	**99.73rd percentile hourly mean SO_2**	**99.18th percentile daily mean SO_2**	**99.9th percentile 15-minute mean SO_2**
80	1.7	1.5	9.1	0.12	7.1	11.1	10.8
85	1.4	1.4	8.4	0.11	6.6	9.0	10.2
90	1.2	1.4	7.9	0.10	6.1	8.2	9.7
95	1.1	1.2	7.2	0.09	5.6	7.1	9.2
100	1.0	1.2	6.9	0.09	5.2	6.5	8.5
105	1.0	1.1	6.3	0.08	5.0	5.9	8.1
110	0.9	1.1	5.9	0.08	4.7	5.4	7.6

Cells are shaded grey where the predicted process contribution is above 10% for short-term average periods.

Discussion

The results in Table 5.2.1 indicate that there are no heights below 110 m at which the impacts can be screened-out as insignificant based on the PC alone when the plant is operating at long-term IED concentration limits as the maximum predicted PC for annual-mean NO_2 is above 1% at all heights.

The ambient annual-mean NO_2 concentration adopted for the assessment is 31.7 $\mu g.m^{-3}$. When the maximum predicted PC at 80m for the annual-mean NO_2 is added to the ambient NO_2 concentration, the total Predicted Environmental Concentration (PEC) is 32.9 $\mu g.m^{-3}$ at 80m. This is below the EAL of 40 $\mu g.m^{-3}$ for NO_2. On that basis, and according to the EA guidance, the impacts would not be considered significant at 80 m or above.

The results in Table 5.2.2 indicate that the PC is above 10% of the EAL for heights below 90m.

Based on the results of the detailed stack height modelling and using professional judgement, an acceptable stack height for the assessment of the WKN Proposed Development is considered to 90 m and the detailed modelling undertaken in this report assumes a 90 m high stack.

It should be noted that this is based on the information available to date. The stack height may be subject to change and may increase as the detailed design for the WKN Proposed Development continues to evolve. The stack height will be confirmed as part of the formal submission to PINS in spring 2019.

References

1 Environment Agency (2010) Environmental Permitting Regulations (EPR) – H1 Environmental Risk Assessment, Annex K