Appendix F: Air Quality Neutral Assessment

Environmental Statement

Volume III

Air Quality Neutral Assessment

1. INTRODUCTION

The London Plan[1] includes a policy relating to 'air quality neutral development' and aims to bring forward developments that are air quality neutral or better and that do not degrade air quality in areas where EU limit values (or air quality objectives) are not currently achieved.

The Air Quality Neutral Planning Support[2]) was published in April 2014 to accompany the 2014 publication of the GLA's Sustainable Design and Construction SPG[3]. It provides specialist consultants with a methodology to undertake an 'air quality neutral' assessment, as well as emission benchmarks for buildings and transport, against which the predicted values for the considered development will be compared.

With regards to emissions from road traffic and energy plants, the current assessment approach most widely adopted for developments in London is to calculate the change in pollutant concentrations, for the pollutants nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). Through the application of physical mitigation (stacks, catalysts, particle traps or ventilation systems) the concentration of pollutants that receptors are exposed to can be controlled so that the effect is not significant. However, the emitted pollutants contribute to the background pollutant concentration in London as a whole and in combination are helping to maintain pollutant concentrations higher than legislation requires. To address this, the air quality neutral approach compares the amount of pollutant(s) emitted against a benchmark value, with the aim of minimising the mass of pollutant emitted, instead of targeting the ambient concentration of the pollutant.

In accordance with the GLA's Sustainable Design and Construction SPG[3], an air quality neutral assessment has been undertaken using the latest information about the Proposed Development. The methodology and emission factors are taken from the Air Quality Neutral Planning Support[2].

2. OPERATIONAL ROAD TRAFFIC EMISSIONS

The air quality neutral assessment for the road traffic associated with the Proposed Development compares the road traffic related emissions against calculated benchmark values which are based upon land use, the number of anticipated trips per year, and the average distance travelled per trip, in accordance with the Air Quality Neutral[2].

The Total Benchmarked Transport Emissions for the Proposed Development are calculated using default NO_x and PM_{10} emission factors per square metre or dwelling, which have been determined for the different land use classes, and for each of the three areas within London, as defined in the guidance.

[1] Mayor of London (2011), The London Plan (Consolidations with alterations since 2004): The Mayor of London's Spatial Development Strategy, Greater London Authority.
[2] Air Quality Consultants and Environ (2014), Air Quality Neutral Planning Support Update: GLA 80371.
[3] Mayor of London (2014), Sustainable Design and Construction – Supplementary Planning Guidance, Greater London Authority.

The emission factors are multiplied by the number of dwellings for the Proposed Development in order to obtain the Transport Emissions Benchmarks for NO_x and PM_{10}, as presented in Table 1.

TABLE 1: CALCULATION OF BENCHMARKED TRANSPORT EMISSIONS

Land Use	Quantity	NO_x Transport Emission Benchmark	Total NO_x Transport Emissions Benchmark
A1 – A4	7,000 m^2 GFA	249 g/m^2/annum	1,743 kg/annum
C3	2,900 dwellings	1,553 g/dwelling/annum	4,504 kg/annum
Total NO_x Benchmarked Transport Emissions			**6,247 kg/annum**
Land Use	**Quantity**	**PM_{10} Transport Emission Benchmark**	**Total PM_{10} Transport Emissions Benchmark**
A1 – A4	7,000 m^2 GFA	42.9 g/m^2/annum	300.3 kg/annum
C3	2,900 dwellings	267 g/dwelling/annum	774.3 kg/annum
Total PM_{10} Benchmarked Transport Emissions			**1,075 kg/annum**

The Total Transport Emissions of NO_x and PM_{10} are then calculated for the Proposed Development. The predicted number of vehicle trips per year is multiplied by the average distance travelled per trip to obtain the total average distance travelled per year for the Proposed Development, as shown in Table 2.

TABLE 2: CALCULATION OF TOTAL AVERAGE DISTANCE TRAVELLED PER YEAR FOR EACH LAND-USE CATEGORY

Land Use	Quantity	Number of vehicle trips per year	Average distance travelled per trip (km/trip)	Average distance travelled per year (km/year)
A1	3,000 m^2 GFA	737,201*	-0.62*	-452,879
A2 – A4	4,000 m^2 GFA	n/a	n/a	0
C3	2,900 dwellings	2,269,554*	5.86*	13,304,016
Total Average Distance travelled per year (km/year)				**12,851,137**

***** Value provided by the transport consultant for the Proposed Development.

Emission factors for NO_x and PM_{10} for three areas of London (the Central Area Zone (CAZ), Inner and Outer London) are presented in the guidance document. Emission factors for Outer London have been selected in this assessment.

Emission factors sourced from the guidance for NO_x and PM_{10} are multiplied by the total average distance travelled per year to obtain the Total Transport Emissions, as set out in Table 3.

TABLE 3: CALCULATION OF TOTAL TRANSPORT EMISSIONS			
Land Use	**Total Average Distance travelled per year (km/annum)**	**NO_x Transport Emission Factor (gNO_x/vehicle-km)**	**Total NO_x Transport Emissions (kg)**
A1, C3	12,851,137	0.3530	4536
Total NO_x Transport Emissions			**4536**
Land Use	**Total Average Distance travelled per year (km/annum)**	**PM_{10} Transport Emission Factor (gPM_{10}/vehicle-km)**	**Total PM_{10} Transport Emissions (kg)**
A1, C3	12,851,137	0.0606	779
Total PM_{10} Transport Emissions			**779**

The Total Benchmarked Transport Emissions are then subtracted from the Total Transport Emissions, as presented in Table 4, to assess whether the Total Transport Emissions for the Proposed Development are within the benchmark.

TABLE 4: COMPARISON BETWEEN TOTAL TRANSPORT EMISSIONS AND BENCHMARED TRANSPORT EMISSIONS	
NO_x	
Total Transport Emissions (kg/annum)	4,536
Total Benchmarked Transport Emissions (Assessment Criteria) (kg/annum)	6,247
Difference (kg/annum)	**-1,711**
PM_{10}	
Total Transport Emissions (kg/annum)	779
Total Benchmarked Transport Emissions (Assessment Criteria) (kg/annum)	1,075
Difference (kg/annum)	**-296**

As the total Benchmarked Transport Emissions (6,247 kg NOx / annum and 1075 kg PM_{10} / annum) are greater than the Total Transport Emissions (4,536 kg NOx / annum and 779 kg PM_{10} / annum), the development transport emissions are within the benchmark and no further mitigation will be required for this source of emissions when considered in isolation.

3. OPERATIONAL ENERGY PLANT EMISSIONS

The air quality neutral assessment for the proposed energy centre compares the energy related emissions against calculated benchmark values based upon floor space, land use and energy demand, in accordance with the Air Quality Neutral Planning Support[2].

The Total Benchmarked Building Emissions for the Proposed Development are calculated using the floor area for each land-use class, multiplied by default emission factors for each land-use category, as shown in Table 5. Only emissions of NO_x are

calculated as the energy plant of the Proposed Development will be fuelled using natural gas rather than oil or solid fuel.

TABLE 5: CALCULATION OF BENCHMARKED BUILDING EMISSIONS			
Land Use	**Gross Floor Area (m^2 GFA)**	**Building Emissions Benchmarks ($gNOx/m^2$/annum)**	**Benchmarked Emissions (kgNOx/annum)**
A1	3,000	22.6	68
A2 – A4	4,000	75.2	301
C3	276,604	26.2	7,247
D1 and D2 (as D2 (e))	3,000	284	852
Total Benchmarked Building Emissions			**8,468**

The Proposed Development includes the installation of three boilers and two CHP plants. As the boilers and CHP plants would be fuelled by natural gas, the main pollutant of concern would be emissions of oxides of nitrogen (NO_x).

The total annual building NO_x emissions from the development can be calculated from the energy centre data. Based upon an assumption of 100% working load and given annual average emission rates, this gives an equivalent Total Building NO_x Emission of 23,841 kg/annum.

The Total Benchmarked Building Emissions are then subtracted from the Total Building Emissions, as presented in Table 6 below, to assess whether the Total Building Emissions for the Proposed Development are within the benchmark.

TABLE 6: COMPARISON BETWEEN TOTAL BUILDING EMISSIONS AND BENCHMARED BUILDING EMISSIONS	
Oxides of Nitrogen (kg/annum)	
Total Building Emissions	23,841
Total Benchmarked Building Emissions (Assessment Criteria)	8,468
Difference	**15,373**

As the Total Benchmarked Building Emissions (8,468 kg NOx / annum) are lower than the Total Building Emissions (23,841 kg NOx / annum), the building emissions are not within the benchmark. Therefore, further mitigation should be considered at the detailed design stages to reduce NOx emissions further or opportunities to off-set NOx emissions off-site identified. However, if seasonal and diurnal profiles for CHP plants and boilers operation are taken into consideration, it is possible that the total building emissions are reduced by 30%.

4. MINIMUM EMISSIONS STANDARDS FOR SOLID BIOMASS AND CHP PLANT

It is noted that in addition to the achievement of benchmark emissions, the London Plan states that new development proposals should meet the minimum standards outlined in the SPG[3]. Emission standards are provided for:

- individual gas boilers;
- communal gas boilers;
- solid biomass boilers; and
- Combined Heat and Power (CHP) plants.

Plant proposed within developments are to comply with these standards, in addition to the development meeting the overall 'air quality neutral' benchmarks. Where meeting these emission standards still does not allow the air quality neutral benchmarks to be met, further reduction or offsetting measures would be required.

Where individual and/or communal gas boilers are installed in commercial and domestic buildings they should achieve a NOx rating of <40 mgNOx/kWh.

To deliver both reductions in carbon dioxide emissions and improve air quality a tiered approach has been developed for solid biomass boilers and CHP plant in the thermal input range 50kWth – 20MWth. This approach is based upon differentiation according to the baseline air quality in the area of development and will be dependent upon whether or not the development falls into the two tiers defined in Table 7:

TABLE 7: BASELINE AIR QUALITY AND DEFINITION OF TIERED APPROACH

Band	Applicable Range	
	Baseline Annual Mean NO_2 and PM_{10}	Baseline 24-Hour Mean PM_{10}
Band A	> 5% below national objective	> 1-day less than national objective
Band B	Between 5% below or above national objective	1 day below or above national objective

For Band B, the category in which the Proposed Development falls, the emission standards in Table 8 are target minimum standards. If an assessment indicates that significant air quality effects may occur even when meeting the emission standards, additional measures (such as stack height increase, enforcement of more stringent standards etc.) should be considered in order to produce an acceptable level of impact.

TABLE 8: EMISSION STANDARDS FOR SOLID BIOMASS BOILERS AND CHP PLANT IN THERMAL INPUT RANGE 50KWTH TO LESS THAN 20MWTH FOR DEVELOPMENT IN BAND B[A]

Combustion Appliance[B]	Pollutant / Parameter	Emission Standard at Reference O_2 (mg/Nm^3)	Equivalent Concentration at 0% O_2 (mg/Nm^3)	Likely Technique Required to Meet Emissions Standard
Spark ignition engine (natural gas/biogas)[B]	NOx	95	125	SCR (lean burn engines) NSCR (rich burn engines)
Compression ignition engine (diesel/bio-diesel)[C]	NOx	400	526	SCR
Gas turbine[D]	NOx	20	71	Latest generation DLN burners and / or SCR
Solid biomass boiler < 1MWth input (including those involved in CHP applications)[E]	NOx	180	252	Modern boiler with staged combustion, automatic control and/ or SNCR
	PM	5	7	Fabric/ceramic filter
Solid biomass boiler ≥ 1MWth input (including those involved in CHP applications)[E]	NOx	125	175	Modern boiler with staged combustion, automatic control and/ or SNCR
	PM	5	7	Fabric/ceramic filter
All (stack heat release less than 1MW)[F]	Stack discharge velocity	10 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity
All (stack heat release greater than or equal to 1MW)[F]	Stack discharge velocity	15 ms^{-1}	N/A	Appropriate design of stack discharge diameter to achieve required velocity

Notes:

[A] All information in this table is reproduced from Table in Appendix 7 of Mayor of London (2014), Sustainable Design and Construction – Supplementary Planning Guidance, Greater London Authority.

[B] Combustion appliances operating less than 500 hours per annum are exempt from these standards

[C] Emission standard quoted at reference conditions 273K, 101.3kPa, 5% O_2, dry gas

[D] Emission standard quoted at reference conditions 273K, 101.3kPa, 15% O_2, dry gas

[E] Emission standard quoted at reference conditions 273K, 101.3kPa, 6% O_2, dry gas

[F] The stack heat release can be calculated as per equation (3) in the HMIP 1993 'Guidelines on Discharge Stack Heights for Polluting Emission. Technical Guidance Note D1 (Dispersion)' [4]

N.B. Stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls, 'China-man Hats')

Currently, the boilers' NO_X rating is 80mg/kWh, which is double the minimum standard and the CHP plants' NO_X emission concentration is 250mg/Nm3, is also double the

[4] http://laqm.defra.gov.uk/laqm-faqs/faq89.html

minimum standard for the air quality category of Band B. To meet these minimum emission standards, NO_X emissions from the energy centre will need to be halved. This reduction of emissions, together with seasonal and diurnal operation profiles, could result in the total building emissions to 35% of the calculated value, then the development building emissions would be within the benchmark and no further mitigation will be required for this source of emissions when considered in isolation.

5. SUMMARY

The Proposed Development's transport emissions are within 'air quality neutral' emissions benchmarks for transport. When the proposed energy plant meet the minimum standards required for the air quality category of Band B, the development building emissions will be within 'air quality neutral' emissions benchmarks for buildings, then the Proposed Development will meet the air quality neutral requirements.