Air Quality Technical Note for Non-Material Change

Thurrock Flexible Generation Plant

For Thurrock Flexible Generation Limited

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Quality Management

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Appendices

1 Introduction

1.1 This technical note details the air quality assessment undertaken to consider the impacts for a non-material change (NMC) to the Thurrock Flexible Generation Plant DCO ("DCO").

1.2 An air quality assessment was undertaken in 2020 to support the DCO application for up to 48 gas-fired engines each with an individual stack that would run for up to 4,000 hours per year.

1.3 The scheme has been revised to include 96 gas-fired engines routed in pairs through 48 stacks that would run for 1,500 hours per year as a five year average. Following advice from the Environment Agency, the modelling assumes that the engines will run for up to 2,250 hours in a single year.

1.4 This air quality assessment for the NMC covers evaluation of the impacts of the stack emissions on the local area and provides a comparison with the predicted concentrations and conclusions with the air quality assessment submitted to support the DCO application.

2 Assessment Methodology

Model Inputs

Meteorological Data

2.1 The most important meteorological parameters governing the atmospheric dispersion of pollutants are wind direction, wind speed and atmospheric stability as described below:

- Wind direction determines the sector of the compass into which the plume is dispersed.
- Wind speed affects the distance that the plume travels over time and can affect plume dispersion by increasing the initial dilution of pollutants and inhibiting plume rise; and
- Atmospheric stability is a measure of the turbulence of the air, and particularly of its vertical motion. It therefore affects the spread of the plume as it travels away from the source. New generation dispersion models, including ADMS, use a parameter known as the Monin-Obukhov length that, together with the wind speed, describes the stability of the atmosphere.

2.2 For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of sites where the required meteorological measurements are made.

2.3 The year of meteorological data that is used for a modelling assessment can have a significant effect on source contribution concentrations. Dispersion model simulations have been performed using five years of data from Gravesend, between 2013 and 2017. The Gravesend meteorological station was closed in 2018 so this is the most recent data available.

2.4 Wind roses have been produced for each of the years of meteorological data used in this assessment and are presented in Figure 1.

Stack Parameters and Emissions Rates used in the Model

2.5 The NMC would enable the installation of “up to 96 gas reciprocating engines”. This technical note therefore assumes 96 engines, combined into 48 stacks with 2 flues per stack. The emissions characteristics for each stack modelled are provided in Table 2.1. This is considered a reasonable worst case for the NMC (the “NMC Case”). The NOx mass emission rate for each stack in the NMC Case has been derived from the limit value in the MCPD. This is provided in Table 2.2.

Table 2.1 Stack Characteristics (per Stack)

Parameter	Unit	Stack
Stack height	m	20
Number of stacks	-	96
Effective internal diameter (individual flues)*	m	0.87
Efflux velocity	$m.s^{-1}$	30.66
Efflux temperature	^{o}C	351
Actual volumetric flow	$Am^3.s^{-1}$	18.2
Oxygen by (dry) volume	%	10.5
Water by volume	%	10.1
Normalised volumetric flow (dry, 0^0C, 5% O_2)	$Nm^3.s^{-1}$	4.7
NO_x Emission Concentration (dry, 0^0C, 5% O_2)*	$mg.Nm^{-3}$	250

*Flue is D shaped but assumed to be circular to include in the model. Effective diameter calculated from stack area of D shaped flue.

*The emission concentration complies with the Medium Combustion Plant (MCP) Directive limit of 95 mg Nm^{-3} (dry, 0^oC, 15% O_2) for new natural gas engines.

Table 2.2 Mass Emissions (per Stack) of Released Pollutant

Pollutants	Mass Emission Rate ($g.s^{-1}$)
NO_x	1.181

Time Varying Emissions

2.6 The gas engines will only operate during peak demand. For the purposes of assessing the air quality impacts for the NMC Case, modelling has been undertaken for a worst case scenario assuming that the 96 gas engines operate for 2,250 hours per year which represents the largest total number of operational hours considered as part of this assessment. If 96 engines were deployed, the site would on average only operate for a maximum of 1,500 hours year.

Surface Roughness

2.7 The roughness of the terrain over which a plume passes can have a significant effect on dispersion by altering the velocity profile with height, and the degree of atmospheric turbulence. This is accounted for by a parameter called the surface roughness length.

2.8 A surface roughness length of 0.5 m has been used within the model to represent the average surface characteristics across the study area. This surface roughness length is typical of parkland and open suburbia. This is unchanged from the original DCO assumptions.

Building Wake Effects

2.9 The movement of air over and around buildings generates areas of flow circulation, which can lead to increased ground level concentrations in the building wakes. Where building heights are greater than about 30 - 40% of the stack height, downwash effects can be significant. Table 2.3 sets out the dimensions of the building included within this assessment.

Table 2.3: Dimensions of Building Included Within the Dispersion Model

Building	x	y	Height (m)	Length (m)	Width (m)	Angle (º) from North
1	566140	176482	15	101	63	107
2	566291	176461	15	155	70	103
3	566373	176496	15	47	69	103
4	566149	176637	10	75	139	107
5	566142	176565	10	58	114	106
6	566102	176510	15	65	25	105
7	566351	176465	15	18	40	105
8	566377	176786	4.2	73	17	107
9	566408	176777	4.2	73	17	107
10	566436	176769	4.2	73	17	107
11	566351	176699	4.2	73	17	107
12	566382	176690	4.2	73	17	107
13	566410	176681	4.2	73	17	107
14	566366	176747	6.5	9	16	107
15	566340	176660	6.5	9	16	107
16	566369	176651	6.5	9	16	107
17	566399	176642	6.5	9	16	107
18	566395	176738	6.5	9	16	107
19	566426	176729	6.5	9	16	107

Receptors

2.10 The air quality assessment predicts the impacts at locations that could be sensitive to any changes. For assessing human-health impacts, such sensitive receptors should be selected where the public is regularly present and likely to be exposed over the averaging period of the objective. LAQM.TG22 [1] provides examples of exposure locations and these are summarised in Table 2.4.

Table 2.4: Example of Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual-mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the buildings façades), or any other location where public exposure is expected to be short-term.
Daily-mean	All locations where the annual-mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expect to be short-term.
Hourly-mean	All locations where the annual and 24 hour mean would apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access

2.11 In addition, the effects of the proposed development have been assessed at the façades of local existing receptors. All human receptors have been modelled at a height of 1.5 m, representative of typical head height. The locations of these discrete receptors are listed in Table 2.5 and illustrated in Figure 2. These are the same receptors modelling the air quality assessment for the DCO application.

Table 2.5: Modelled Sensitive Receptors

Receptor ID	Description	X(m)	Y(m)
1	Fort Road	565364	176620
2	Sandhurst Road	565234	176294
3	School	563917	176252
4	Gateway Academy	564255	177812
5	Gravel Pit Cottages	567414	177570
6	Princess Margaret Rd	568507	177407
7	Walnut Tree Farm	566713	177540
8	The Green	566062	177921

Receptor ID	Description	X(m)	Y(m)
9	West Street	564727	174466
10	Milton School	565429	174069
11	Royal Pier Road	565057	174392
12	West Tilbury Hall	566066	177709
13	Cooper Shore	566322	177515
14	R1	557439	179107
15	R2	557597	181084
16	R3	561350	180920
17	R4	563478	180584
18	R5	563560	180866
19	R6	564894	181056
20	R7	563889	179678
21	R8	563101	177478
22	R9	563399	176576
23	R10	563911	176123
24	R11	564314	175875
25	R12	564434	175856
26	R13	565181	176256
27	R14	565039	176156
28	R15	565339	176504
29	R16	564701	175973
30	R17	564617	175897
31	R18	562008	180949
32	R19	563904	176281
33	R20	560604	180416
34	R21	560035	179870
35	R22	556895	179284
36	R23	555379	179902
37	R24	558144	183519
38	R25	567446	182119
39	R26	558009	184058
40	R27	563778	179720
41	16/01232/OUT (Proposed Development)	567251	177967

Receptor ID	Description	X(m)	Y(m)
42	18/00664/CONDC (Proposed Development)	567931	178212
43	16/00412/OUT (Proposed Development)	565034	178056
44	15/00379/OUT (Proposed Development)	564844	178304
45	16/01475/SCR (Proposed Development)	567622	179079
46	GR/17/674 (Proposed Development)	564174	172500
47	20141214 (Proposed Development)	564292	172307

Note: Receptors have been modelled at 1.5m above ground level, representative of typical head height

2.12 The AQS NO_2 objectives for all the different averaging periods apply at the façades of the modelled residential and school receptors.

2.13 Ecological receptors are considered in Appendix A.

NO_x to NO_2 Assumptions

2.14 The NOx emissions will typically comprise approximately 90-95% nitrogen monoxide (NO) and 5-10% nitrogen dioxide (NO_2) at the point of release. The NO oxidises in the atmosphere in the presence of sunlight, ozone and volatile organic compounds to form NO_2, which is the principal concern in terms of environmental health effects. The Environment Agency advises [2] that:

"For combustion processes where no more than 10% of nitrogen oxides are emitted as nitrogen dioxide, you can assume worst case conversion ratios to nitrogen dioxide of:

35% for short-term average concentrations

70% for long-term average concentrations"

2.15 These ratios have been used in the assessment.

Modelling of Long-term and Short-term Emissions

2.16 Long-term (annual-mean) NO_2 has been modelled for comparison with the relevant annual mean objectives.

2.17 For short-term NO_2, the objective is for the hourly-mean concentration not to exceed 200 $\mu g.m^{-3}$ more than 18 times per calendar year. As there are 8,760 hours in a non-leap year, the hourly-mean concentration would need to be below 200 $\mu g.m^{-3}$ in 8,742 hours, i.e. 99.79% of the time. Therefore, the 99.79th percentile of hourly NO_2 has been modelled.

Significance Criteria

2.18 The on-line Environment Agency online guidance entitled *'Environmental management – guidance, Air emissions risk assessment for your environmental permit'* [2] provides details for screening out substances for detailed assessment. In particular, it states that:

"To screen out a PC for any substance so that you don't need to do any further assessment of it, the PC must meet both of the following criteria:

- *the short-term PC is less than 10% of the short-term environmental standard*
- *the long-term PC is less than 1% of the long-term environmental standard*

If you meet both of these criteria you don't need to do any further assessment of the substance.

If you don't meet them you need to carry out a second stage of screening to determine the impact of the PEC."

2.19 It continues by stating that:

"You must do detailed modelling for any PECs not screened out as insignificant."

2.20 It then states that further action may be required where:

"your PCs could cause a PEC to exceed an environmental standard (unless the PC is very small compared to other contributions – if you think this is the case contact the Environment Agency)

The PEC is already exceeding an environmental standard"

2.21 The EA online guidance 'Environmental permitting: air dispersion modelling reports' [3] states:

"For a detailed modelling assessment PCs are insignificant where they are less than:

- *10% of a short-term environmental standard*
- *1% of a long-term environmental standard*

At the detailed modelling stage there are no criteria to determine whether:

- *PCs are significant*
- *PECs are insignificant or significant*

You must explain how you judged significance and base this on the site specific circumstances."

2.22 On that basis, the results of the detailed modelling presented in this report have been used as follows:

- The effects are not considered significant if the short-term PC is less than 10% of the short-term Environmental Assessment Level (EAL) or the PEC is below the EAL; and

- The effects are not considered significant if the long-term PC is less than 1% of the long-term EAL or the PEC is below the EAL.

2.23 This is the same criteria applied in the DCO application.

3 Baseline Air Quality Conditions

Overview

3.1 The background concentration often represents a large proportion of the total pollution concentration, so it is important that the background concentration selected for the assessment is realistic. National Planning Practice Guidance and EPUK/IAQM guidance highlight public information from Defra and local monitoring studies as potential sources of information on background air quality.

3.2 A detailed review of baseline conditions was undertaken as part of the Air Quality Assessment for the DCO application. The background air quality was characterised by drawing on information from the following sources:

- Defra maps [4], which show estimated pollutant concentrations across the UK in 1 km grid squares;
- published results of local authority Review and Assessment (R&A) studies of air quality, including local monitoring and modelling studies; and
- The results of the Tilbury 2 Air Quality Assessment (Tilbury2 Project Team, 2017); and
- The results of the RPS project specific nitrogen dioxide (NO_2) monitoring study undertaken in 2018.

3.3 Modelling of cumulative developments was also undertaken for the 2020 Environmental Statement to derive a cumulative baseline concentration. This included the following cumulative developments:

- Tilbury 2
- Lower Thames Crossing
- Tilbury Green Power Biomass plant
- Tilbury Peak Reserve plant (gas engines x 14)
- Thames Enterprise Park Energy Centre (EfW and gas engines)
- Gateway Energy Centre (CCGT x 2, Auxiliary Boilers x 2)
- Purfleet Regeneration Centre Energy Centre (Boilers x 8, CHP x 2)

Review of Local Monitoring

3.4 The most recently measured annual-mean NO_2 concentrations for Thurrock Council and Gravesham Borough Council monitors used to establish baseline conditions are presented in Table 3.1. Data for 2020 and 2021 has not been included due to the impact of the COVID-19 pandemic.

Table 3.1: Monitored Annual-Mean NO_2 Concentrations

Monitor ID	Concentration (µg.m^{-3})								
	2013	2014	2015	2016	2017	Average (2013 to 2017)*	2018	2019	2022
Thurrock Council Monitors									
TILE	35.26	35.85	31.68	34.92	36.18	34.8	33.4	35.2	25.5
TL	37.13	35.56	30.55	35.68	35.81	34.9	32.9	34.8	24.7
TK4	32.79	31.05	29.50	31.51	30.1	31.0	-	-	-
TILD	38.08	33.90	31.12	36.85	37.15	35.4	35.0	35.1	22.4
TSR	31.88	27.17	27.39	28.05	29.02	28.7	26.8	28.5	20.9
Gravesham Borough Council Monitors									
GR13	45.2	42.5	40	37.5	44	41.8	47.1	46.1	37.6
GR62	34	29.7	29.2	30.2	31.2	30.9	30.7	30.8	24.8
GR90	37.2	31.5	28.6	30.5	31.2	31.8	-	-	-

*Used in 2020 ES chapter.

3.5 Data from 2013 to 2017 was used to inform the baseline concentrations used in the 2020 ES chapter. The table above shows that measured concentrations in 2022 are lower than measured in 2013 to 2017 indicating that background concentrations have decreased since the 2020 ES chapter. On that basis, the use of background concentrations from the 2020 ES chapter will be very conservative, given the reductions in concentrations at monitors of between ~10-37% since the ES assessment.

Assumed Background Concentrations

3.6 The background concentrations used in the assessment are set out in Table 3.2.

Table 3.2: Summary of Assumed Background Concentrations

Receptor ID	Receptor Name	Baseline Annual-Mean NO_2 Concentration (μg.m^{-3})	Data Source	Cumulative Annual-Mean Baseline Concentration (μg.m^{-3})
1	Fort Road	26.4	Project specific monitoring location 3	28.7
2	Sandhurst Road	26.4	Project specific monitoring location 3	31.1
3	School	34.0	Thurrock monitoring - Average of TILE, TL, TK4, TILD	35.7
4	Gateway Academy	28.7	Thurrock monitoring - TSR	30.4
5	Gravel Pit Cottages	18.0	Project specific monitoring location 5	19.9
6	Princess Margaret Rd	18.0	Project specific monitoring location 5	18.7
7	Walnut Tree Farm	18.3	Project specific monitoring location 4	20.5
8	The Green	18.3	Project specific monitoring location 4	19.4
9	West Street	41.8	Gravesham monitoring - GR13	42.4
10	Milton School	30.9	Gravesham monitoring - GR62	31.3
11	Royal Pier Road	31.8	Gravesham monitoring - GR90	32.3
12	West Tilbury Hall	18.3	Project specific monitoring location 4	19.4
13	Cooper Shore	18.3	Project specific monitoring location 4	19.5
14	R1	31.1	Tilbury2 Air Quality Assessment (Note: these concentrations are the predicted concentrations with Tilbury2 in place in 2020)	31.5
15	R2	27.6		27.9
16	R3	28.3		28.8
17	R4	26.9		27.6
18	R5	32.2		32.9
19	R6	26.9		29.8
20	R7	28.1		30.0
21	R8	28.9		30.4
22	R9	36.6		37.4
23	R10	30.6		31.4
24	R11	26.6		27.8
25	R12	26.1		27.4

26	R13	26.4		27.9
27	R14	26.8		28.4
28	R15	23.6		25.5
29	R16	25.8		27.4
30	R17	26.2		27.8
31	R18	24.1		24.6
32	R19	31.6		32.4
33	R20	23.5		23.9
34	R21	34.8		35.2
35	R22	24.8		25.2
36	R23	34.1		34.4
37	R24	28.5		28.8
38	R25	33.8		36.5
39	R26	22.6		22.8
40	R27	24.5		26.4
41	16/01232/OUT	18.0	Project specific monitoring location 5	21.1
42	18/00664/CONDC	29.9	Thurrock monitoring - ETRS	30.7
43	16/00412/OUT	18.3	Project specific monitoring location 4	19.8
44	15/00379/OUT	18.3	Project specific monitoring location 4	19.8
45	16/01475/SCR	29.9	Thurrock monitoring - ETRS	30.7
46	GR/17/674	22.4	Gravesham monitoring – GR75	23.8
47	20141214	38.6	Gravesham Monitoring – GR57	40.0

Note: (a) Short-term background data approximately equate to the 90th percentile, which is approximately equivalent to 2 x the annual mean.

4 Assessment of Operational-Phase Air Quality Impacts

Results of Stack Emissions Modelling

Short-term NO_2 Impacts

4.1 Table 4.1 summarises the short-term, predicted PCs at the discrete sensitive receptors and the shows the predicted PCs from the air quality assessment undertaken for the DCO application.

Table 4.1: Short-term Predicted NO_2 Concentrations ($\mu g.m^{-3}$) at Sensitive Receptors

Receptor	DCO Process Contribution (1 hour 99.79th percentile) $\mu g.m^{-3}$	Process Contribution (1 hour 99.79th percentile) $\mu g.m^{-3}$	Process Contribution as % of EAL	Cumulative AC $\mu g.m^{-3}$	Cumulative PEC $\mu g.m^{-3}$	Cumulative PEC as % of EAL
Fort Road	58.6	115.8	58	78.9	194.7	97
Sandhurst Road	49.4	110.9	55	86.8	197.7	99
School	29.0	63.2	32	85.0	148.2	74
Gateway Academy	26.6	57.8	29	73.7	131.6	66
Gravel Pit Cottages	47.3	107.2	54	51.3	158.5	79
Princess Margaret Rd	32.8	69.8	35	47.9	117.8	59
Walnut Tree Farm	75.7	147.2	74	53.6	200.8	100
The Green	48.0	105.4	53	52.1	157.6	79
West Street	23.9	52.9	26	98.3	151.2	76
Milton School	23.7	50.8	25	74.3	125.2	63
Royal Pier Road	26.7	55.0	28	77.4	132.4	66
West Tilbury Hall	56.6	118.5	59	52.4	170.9	85
Cooper Shore	72.9	145.7	73	52.3	198.0	99
R1	10.9	22.8	11	70.2	93.1	47
R2	10.4	24.2	12	62.0	86.2	43
R3	18.1	34.7	17	65.4	100.1	50
R4	17.3	35.7	18	65.3	101.0	51
R5	16.2	36.1	18	75.5	111.6	56
R6	17.8	41.6	21	69.8	111.4	56
R7	18.8	39.6	20	71.2	110.8	55
R8	19.1	41.8	21	74.5	116.3	58

Receptor	DCO Process Contribution (1 hour 99.79th percentile) µg.m-3	Process Contribution (1 hour 99.79th percentile) µg.m-3	Process Contribution as % of EAL	Cumulative AC µg.m-3	Cumulative PEC µg.m-3	Cumulative PEC as % of EAL
R9	24.1	51.9	26	88.6	140.5	70
R10	28.5	61.9	31	77.1	138.9	69
R11	32.4	68.6	34	70.7	139.3	70
R12	32.4	69.4	35	70.5	139.9	70
R13	47.2	108.9	54	80.6	189.5	95
R14	43.5	98.3	49	80.0	178.3	89
R15	56.4	116.2	58	75.1	191.2	96
R16	36.6	79.9	40	74.2	154.1	77
R17	35.4	74.2	37	72.6	146.8	73
R18	18.7	36.0	18	57.6	93.6	47
R19	28.9	62.5	31	77.9	140.4	70
R20	12.5	29.8	15	56.7	86.5	43
R21	12.3	30.1	15	79.1	109.2	55
R22	10.7	22.0	11	57.4	79.4	40
R23	9.7	21.1	11	74.6	95.7	48
R24	12.2	23.1	12	63.1	86.2	43
R25	12.9	29.1	15	82.5	111.5	56
R26	12.6	22.2	11	51.0	73.3	37
R27	17.9	38.1	19	63.8	101.9	51
16/01232/OUT	42.8	94.9	47	54.5	149.4	75
18/00664/CONDC	33.2	72.3	36	73.7	146.0	73
16/00412/OUT	32.4	71.3	36	52.6	123.9	62
15/00379/OUT	28.1	61.0	31	52.7	113.7	57
16/01475/SCR	26.9	55.2	28	73.2	128.4	64
GR/17/674	15.8	33.3	17	56.0	89.3	45
20141214	14.6	34.0	17	88.4	122.3	61

EAL for 1 hour 99.79th percentile (NO_2) is 200 µg.m-3.

4.2 The predicted PCs exceed 10% of the EAL but when the PC is added to the background concentration the PEC does not exceed 100% of the EAL. On that basis, the impacts for the NMC Case can be screened out as insignificant. This was also the case for the air quality assessment submitted for the DCO application.

4.3 The predicted PCs are higher than predicted in the air quality assessment for the DCO application however, this is based on the worst case assumption that all 96 engines will operate all year to ensure the worst case meteorological conditions were assessed. In reality the engines will run for up to 1,500 hours per year as a five year average and the probability of all engines running at the same time in the hours with the worst case meteorological conditions is extremely low. For the DCO application worst case, up to 48 engines were expected to run for up to 4,000 hours per year.

4.4 Regardless of the increased PCs, the PECs still do not exceed the EAL and the conclusions of remain unchanged from the DCO application and the short term impacts are still considered to be not significant even for this conservative assessment.

4.5 The baseline concentrations used in this assessment are assumed to be the same as used for the DCO application. This is conservative as background concentrations have decreased significantly as outlined in section 3.

Long-term NO_2 Impacts

4.6 Table 4.2 summarises the long-term maximum PC and PEC values at the selected discrete sensitive receptors. This assumes that the engines will run for 2,250 hours per year when in reality the 96 engines in the NMC Case would operate for a maximum of 1,500 hours per year as a five year average.

Table 4.2: Long-term Predicted NO_2 Concentrations ($\mu g.m^{-3}$) at Sensitive Receptors

Receptor	Process Contribution (1 hour 99.79th percentile) $\mu g.m^{-3}$	Process Contribution (1 hour 99.79th percentile) $\mu g.m^{-3}$	Process Contribution as % of EAL	Cumulative AC $\mu g.m^{-3}$	PEC $\mu g.m^{-3}$	PEC as % of EAL
Fort Road	3.6	4.3	11	28.7	33.0	82
Sandhurst Road	2.7	2.9	7	31.1	34.0	85
School	1.3	1.4	4	35.7	37.2	93
Gateway Academy	0.5	0.6	2	30.4	31.1	78
Gravel Pit Cottages	4.1	4.7	12	19.9	24.6	62
Princess Margaret Rd	2.3	2.9	7	18.7	21.6	54
Walnut Tree Farm	4.8	6.2	16	20.5	26.7	67
The Green	1.5	1.9	5	19.4	21.3	53
West Street	0.6	0.7	2	42.4	43.0	108
Milton School	0.5	0.5	1	-	-	-
Royal Pier Road	0.6	0.7	2	32.3	33.0	82
West Tilbury Hall	1.8	2.3	6	19.4	21.7	54
Cooper Shore	2.7	3.4	9	19.5	23.0	57

Receptor	Process Contribution (1 hour 99.79th percentile) µg.m-3	Process Contribution (1 hour 99.79th percentile) µg.m-3	Process Contribution as % of EAL	Cumulative AC µg.m-3	PEC µg.m-3	PEC as % of EAL
R1	0.2	0.2	0	-	-	-
R2	0.1	0.2	0	-	-	-
R3	0.2	0.3	1	-	-	-
R4	0.3	0.4	1	-	-	-
R5	0.3	0.4	1	-	-	-
R6	0.5	0.6	1	-	-	-
R7	0.4	0.5	1	-	-	-
R8	0.4	0.5	1	-	-	-
R9	0.9	1.1	3	37.4	38.5	96
R10	1.2	1.3	3	31.4	32.8	82
R11	1.1	1.3	3	27.8	29.1	73
R12	1.2	1.3	3	27.4	28.7	72
R13	2.4	2.7	7	27.9	30.6	77
R14	2.0	2.2	6	28.4	30.6	76
R15	3.6	4.0	10	25.5	29.5	74
R16	1.4	1.6	4	27.4	29.0	73
R17	1.3	1.4	4	27.8	29.2	73
R18	0.3	0.3	1	-	-	-
R19	1.3	1.4	4	32.4	33.8	85
R20	0.2	0.3	1	-	-	-
R21	0.2	0.2	1	-	-	-
R22	0.2	0.2	0	-	-	-
R23	0.1	0.2	0	-	-	-
R24	0.2	0.2	0	-	-	-
R25	0.4	0.4	1	-	-	-
R26	0.2	0.2	0	-	-	-
R27	0.4	0.4	1	-	-	-
16/01232/OUT	3.5	4.1	10	21.1	25.2	63
18/00664/CONDC	2.3	2.5	6	30.7	33.3	83
16/00412/OUT	0.7	0.8	2	19.8	20.6	51
15/00379/OUT	0.6	0.7	2	19.8	20.5	51
16/01475/SCR	1.4	1.6	4	30.7	32.4	81
GR/17/674	0.3	0.3	1	-	-	-

Receptor	Process Contribution (1 hour 99.79th percentile) µg.m^{-3}	Process Contribution (1 hour 99.79th percentile) µg.m^{-3}	Process Contribution as % of EAL	Cumulative AC µg.m^{-3}	PEC µg.m^{-3}	PEC as % of EAL
20141214	0.3	0.3	1	-	-	-

EAL for annual-mean NO_2 is 40 µg.m^{-3}.

4.7 The predicted PCs exceed 1% of the EAL at some locations but when the PC is added to the background concentration the PEC does not exceed 100% of the EAL and the impacts can be screened out as not significant at all receptors except West Street.

4.8 At West Street, the PC is 2% of the EAL and the PEC is 108% of the EAL. The cumulative AC at West Street is 42.4 µg.m^{-3} which, as outlined in section 3.3 includes the contribution from several cumulative developments. The AC is derived from the five year average measured concentrations of 41.8 µg.m^{-3} at GR13 from 2013 to 2017 which is a conservative as background concentrations in the area have decreased. Table 3.1 shows that at monitor GR13, measured concentrations have decreased to 37.6 µg.m^{-3} in 2022. This is a reduction of 4.2 µg.m^{-3}. If the cumulative AC used for West Street is reduced by 4.2 µg.m^{-3}, the resulting PEC is 38.8 µg.m^{-3} which does not exceed 100% of the EAL. On that basis, the impacts can be screened out as insignificant.

Traffic Emissions

4.9 The EPUK & IAQM *Land-Use Planning & Development Control: Planning For Air Quality* document [7] provides the following threshold criteria for determining when an air quality assessment should be undertaken for sites outside an AQMA:

- an increase in annual average daily Light Duty Vehicle (LDV) flows by more than 100 within an AQMA or 500 outside an AQMA; or
- an increase in annual average daily Heavy Duty Vehicle (HDV) flows by more than 25 within an AQMA or 100 outside an AQMA.

4.10 The NMC Case will generate an additional 48 Heavy Duty Vehicles (HDVs) during the construction phase which is equivalent to 96 HDV movements. These additional movements are to install the additional 48 engines so will only occur once. When averaged across a year, the annual average daily HDV flow is 0.27 trips and therefore well below the threshold criteria.

4.11 The EPUK & IAQM continues by stating that *"If none of the criteria are met then there should be no requirement to carry out an air quality assessment for the impact of the proposed development on the local area, and the impacts can be considered to have insignificant effects."*

Significance of Effects

4.12 Based on the predicted concentrations, the effects on short term and long term concentrations (as well as traffic emissions) are deemed to be not significant, with no predicted exceedances of any objectives or standards at modelled discrete receptors.

5 Conclusions

5.1 This report details the air quality assessment undertaken to consider the impacts for an NMC to the Thurrock Flexible Generation Plant DCO.

5.2 This NMC Case air quality assessment covers evaluation of the impacts of the stack emissions on the local area and provides a comparison with the predicted concentrations and conclusions with the air quality assessment submitted to support the DCO application.

5.3 For human-health receptors, the predicted PCs for the revised scheme are higher than the PCs for the DCO application however, the impacts can still be screened out as insignificant.

5.4 For NOx at ecological receptors considered at Appendix A, the predicted PCs for the revised scheme are higher than the PCs for the DCO application however, the impacts can still be screened out as insignificant.

5.5 For nitrogen and acid deposition at ecological receptors, the predicted PCs for the revised scheme are lower than the PCs for the DCO application. This is mainly because the assessment undertaken for the DCO application assumed that the Selective Catalytic Reduction (SCR) would be used. The use of SCR has the potential to release ammonia (NH_3) emissions to air. The nitrogen component in the ammonia would increase the nitrogen deposition and acid deposition PCs. Therefore, by not using SCR (in the NMC case, a larger number of smaller engines would be subject to the Medium Combustion Plant (MCP) Directive and therefore not require SCR), the ammonia emissions are removed and the nitrogen deposition and acid deposition PCs are lower.

5.6 The original DCO assessment concluded there were no likely significant effects in respect of air quality as a result of the worst case for any sensitive human or ecological receptors. Using professional judgement, the resulting air quality effects on human and ecological receptors of the NMC case reported on above are considered to be ‘not significant’ overall. Therefore the conclusions for the NMC case remain unchanged from the conclusions of the assessment for the DCO application as the NMC case results in no likely significant effects (and no materially different likely significant effects given no likely significant effects resulted from the original DCO assessment).

Appendices

Appendix A: Impacts on Habitat Sites

A.1 This assessment considers the impact of the development on NO_X concentrations, nutrient nitrogen deposition and acid deposition at the following sites within 15 km of the proposed development. These are the same sites as assessed in the Air quality assessment submitted for the DCO application:

- Thames Estuary and Marshes Special Protection Area (SPA);
- North Downs Woodlands Special Area of Conservation (SAC);
- Basildon Meadows Site of Special Scientific Interest (SSSI);
- Canvey Wick SSSI;
- Chattenden Woods and Lodge Hill SSSI;
- Cobham Woods SSSI;
- Darenth Wood SSSI;
- Grays Thurrock Chalk Pit SSSI;
- Great Crabbles Wood SSSI;
- Halling to Trottiscliffe Escarpment SSSI;
- Hangmans Wood and Deneholes SSSI;
- Holehaven Creek SSSI;
- Mucking Flats and Marshes SSSI;
- Northward Hill SSSI;
- Pitsea Marsh SSSI;
- Shorne and Ashenbank Woods SSSI;
- South Thames Estuary and Marshes SSSI;
- Thorndon Park SSSI;
- Tower Hill to Cockham Wood SSSI;
- Vange and Fobbing Marshes SSSI;
- West Thurrock Lagoon and Marshes SSSI;
- Langdon Ridge SSSI;

- Broom Hill Local Wildlife Site (LWS);
- West Tillbury Hall LWS;
- Low Street Pit LWS;
- Lytag Brownfield LWS;
- Tilbury Centre LWS;
- Tilbury Marshes LWS; and
- Goshems Farm LWS.

Critical Levels

A.2 Critical levels are maximum atmospheric concentrations of pollutants for the protection of vegetation and ecosystems and are specified within relevant European air quality directives and corresponding UK air quality regulations. PCs and PECs of NOx have been calculated for comparison with the 30 $\mu g.m^{-3}$ annual-mean critical level. Background NO_x concentrations at each designated site have been derived from the UK Air Pollution Information System (APIS) database [5].

Critical Loads

A.3 Critical loads refer to the quantity of pollutant deposited, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge.

Critical Loads – Nutrient Nitrogen Deposition

A.4 Percentage contributions to nutrient nitrogen deposition have been derived from the results of the ADMS dispersion modelling. Deposition rates have been calculated using empirical methods recommended by the EA, as follows:

- The dry deposition fluxes of NO_2 ($\mu g.m^{-2}.s^{-1}$) have been calculated by multiplying the ground level NO_2 concentrations ($\mu g.m^{-3}$) by their deposition velocities. In this case, the habitats at the identified sites are all low level, mostly comprising grassland and saltmarshes, and the deposition velocities provided by the EA guidance for short habitats would be most appropriate. The deposition velocities for short habitats are 0.0015 $m.s^{-1}$.
- Wet deposition in the near field is not significant compared with dry deposition for N [6] and therefore for the purposes of this assessment, wet deposition has not been considered.
- The deposition flux of N in units of $kg.ha^{-1}.year^{-1}$ has been calculated from the dry deposition fluxes of NO_2 in units of $\mu g.m^{-2}.s^{-1}$, by multiplying the dry deposition fluxes by the standard conversion factors of 96.

A.5 Predicted contributions to nitrogen deposition have been calculated and compared with the relevant critical load range for the habitat types associated with the designated site. These have been derived from the APIS database.

Critical Loads – Acidification

A.6 The acid deposition rate, in equivalents keq.ha^{-1}.year^{-1}, has been calculated by multiplying the total N deposition flux (kg.ha^{-1}.year^{-1}) by a conversion factor of 0.071428. This takes into account the degree to which a chemical species is acidifying, calculated as the proportion of N within the molecule.

A.7 Predicted contributions to acid deposition have been calculated and compared with the minimum critical load function for the habitat types associated with each designated site as derived from the APIS database.

Significance Criteria

A.8 The PC and PEC of NO_x and N/acid deposition have been compared against the relevant critical level/load for the relevant habitat type/interest feature. Based on current Environment Agency guidelines [7] and the Institute of Air Quality Management Position Statement [8].

A.9 The following criteria have been used to determine if the impacts are significant:

- If the long-term PC does not exceed 1% of relevant critical level/load the emission is considered not significant; and
- If the long-term PC exceeds 1% but the resulting PEC is below 100% of the relevant critical level/load, the emission is not considered significant;

For local nature sites the EA online guidance states "*You don't need to calculate PEC for local nature sites. If your PC exceeds the screening criteria you need to do detailed modelling."*

Results

A.10 The ambient NOx concentrations have been obtained from APIS.

A.11 The predicted annual-mean NO_X concentrations are compared with the critical levels in Table A.1. The predicted nutrient N deposition rate and acid deposition rates is compared with cumulative PC from the air quality assessment undertaken for the DCO application in Table A.2 and Table A.3.

Table A.1 Predicted Annual-Mean NO_x Concentrations at Designated Habitat Sites

Site Name	Critical Level	DCO Cumulative PC	DCO Cumulative PEC	Cumulative PC	Cumulative PC/ Critical Level (%)	AC ($\mu g.m^{-3}$)	Cumulative PEC ($\mu g.m^{-3}$)	Cumulative PEC/ Critical Level (%)
Thames Estuary and Marshes SPA	30	2.2	23.9	2.8	9	18.5	21.3	71
North Downs Woodlands SAC		0.4	18.6	0.4	1	15.2	15.6	52
Basildon Meadows SSSI		1.1	23.3	0.9	3	15.2	16.2	54
Canvey Wick SSSI		0.9	24.3	1.0	3	20.2	21.1	70
Chattenden Woods and Lodge Hill SSSI		0.6	19.7	0.7	2	16.2	16.9	56
Cobham Woods SSSI		0.5	20.2	0.5	2	16.5	17.0	57
Darenth Wood SSSI		0.7	32.3	0.7	2	23.3	24.0	80
Grays Thurrock Chalk Pit SSSI		1.0	32.3	1.1	4	26.4	27.5	92
Great Crabbles Wood SSSI		0.5	24.5	0.5	2	19.1	19.6	65

Halling to Trottiscliffe Escarpment SSSI		0.4	16.7	0.4	1	14.4	14.8	49
Hangmans Wood and Deneholes SSSI		1.0	29.8	1.1	4	24.2	25.3	84
Holehaven Creek SSSI		1.0	30.7	1.1	4	20.5	21.6	72
Mucking Flats and Marshes SSSI		2.5	29.2	3.0	10	23.5	26.5	88
Northward Hill SSSI		0.6	18.1	0.7	2	15.3	15.9	53
Pitsea Marsh SSSI		0.7	21.0	0.7	2	19.0	19.7	66
Shorne and Ashenbank Woods SSSI		0.6	25.1	0.6	2	18.2	18.8	63
South Thames Estuary and Marshes SSSI		1.8	22.8	2.0	7	18.0	20.0	67
Thorndon Park SSSI		0.5	20.6	0.5	2	17.2	17.7	59
Tower Hill to Cockham Wood SSSI		0.4	25.2	0.5	2	18.9	19.3	64

Vange and Fobbing Marshes SSSI		1.0	21.1	1.0	3	19.3	20.4	68
West Thurrock Lagoon and Marshes SSSI		0.8	36.2	0.9	3	36.8	37.7	126
Langdon Ridge SSSI		0.9	21.1	0.9	3	18.7	19.7	66
Broom Hill LWS		10.0	-	11.4	38	-	-	-
West Tilbury Hall LWS		3.1	-	3.8	13	-	-	-
Low Street Pit LWS		8.9	-	10.5	35	-	-	-
Lytag Brownfield LWS		11.0	-	14.5	48	-	-	-
Tilbury Centre LWS		5.2	-	5.6	19	-	-	-
Tilbury Marshes LWS		9.6	-	4.3	14	-	-	-
Goshems Farm LWS		5.8	-	5.9	20	-	-	-

Table A.2 Predicted Nutrient N Deposition at Designated Habitat Sites

Site Name	DCO Cumulative PC	Cumulative PC (kgN.ha^{-1}.yr^{-1})
Thames Estuary and Marshes SPA	0.7	0.3
North Downs Woodlands SAC	0.1	0.1
Basildon Meadows SSSI	0.2	0.1
Canvey Wick SSSI	0.2	0.1
Chattenden Woods and Lodge Hill SSSI	0.2	0.1
Cobham Woods SSSI	0.1	0.1
Darenth Wood SSSI	0.2	0.1
Great Crabbles Wood SSSI	0.2	0.1
Halling to Trottiscliffe Escarpment SSSI	0.1	0.1
Mucking Flats and Marshes SSSI	0.8	0.3
Pitsea Marsh SSSI	0.2	0.1
Shorne and Ashenbank Woods SSSI	0.2	0.1
South Thames Estuary and Marshes SSSI	0.4	0.2
Thorndon Park SSSI	0.2	0.1
Tower Hill to Cockham Wood SSSI	0.1	0.1
West Thurrock Lagoon and Marshes SSSI	0.2	0.1
Langdon Ridge SSSI	0.3	0.2
Broom Hill LWS	3.0	1.2

West Tilbury Hall LWS	0.9	0.4
Low Street Pit LWS	2.7	1.1
Lytag Brownfield LWS	3.4	1.5
Tilbury Centre LWS	1.5	0.6
Tilbury Marshes LWS	1.8	0.4
Goshems Farm LWS	5.1	0.6

Table A.3 Predicted Acid Deposition at Designated Habitat Sites

Site Name	Interest Feature	DCO Cumulative PC (keq.ha^{-1}.yr^{-1})	Cumulative PC (keq.ha^{-1}.yr^{-1})
Thames Estuary and Marshes SPA	Charadrius hiaticula (Europe/Northern Africa - wintering) - Ringed plover (A137)	0.05	0.02
North Downs Woodlands SAC	Taxus baccata woods of the British Isles (H91J0)	0.01	0.01
	Asperulo-Fagetum beech forests (H9130)	0.01	0.01
	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) (H6210)	0.01	0.01
Basildon Meadows SSSI	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	0.01	0.01
Chattenden Woods and Lodge Hill SSSI	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	0.01	0.01

South Thames Estuary and Marshes SSSI	Anas querquedula - Garganey	0.03	0.01
	Numenius arquata - Curlew	0.03	0.01
Thorndon Park SSSI	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	0.01	0.01
Langdon Ridge SSSI	Broad-leaved, mixed and yew woodland (Crataegus monogyna - Hedra helix scrub)	0.02	0.01
	Broad-leaved, mixed and yew woodland (Fraxinus excelsior - Acer campestre - Mercurialis perennis woodland)	0.02	0.01
	Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus woodland)	0.02	0.01
	Fen, marsh and swamp (Juncus subnodulosus - Cirsium palustre fen meadow)	0.01	0.01
	Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland)	0.01	0.01
Broom Hill LWS	Acid grassland	0.22	0.08
West Tilbury Hall LWS	Acid grassland	0.07	0.03
Low Street Pit LWS	Acid grassland	0.19	0.08
Lytag Brownfield LWS	Acid grassland	0.24	0.10
Tilbury Centre LWS	Acid grassland	0.11	0.04

Interpretation of Results

A.12 The maximum annual-mean NO_X PC for the NMC case are slightly higher than the predicted PCs in the air quality assessment undertaken for the DCO application. However, when the most recent background concentrations are considered, the PECs are lower. This is because of improvements in air quality since the DCO application. The PECs do not exceed the critical level at all sites except West Thurrock Lagoon and Marshes and the impacts are still considered to be insignificant. The PEC exceeded the critical level at West Thurrock Lagoon and Marshes in the air quality assessment for the DCO.

A.13 At West Thurrock Lagoon and Marshes the PEC exceeds the CL and the project's ecologist advised:

"West Thurrock Lagoon and Marshes SSSI comprises an area of intertidal mudflats and lagoon with extensive salt marsh. In this location the maximum PC NOx is predicted to be 2% of the critical level. The PEC is predicted to be 12% at 37.7 $\mu g.m^{-3}$ at West Thurrock Lagoon and Marshes SSSI. The effect of NOx on flora at these concentrations is confined to those driven by changes in N availability and corresponding changes to growth rate, rather than any direct toxic effects (WHO, 2000); direct toxicity has only been reported at concentrations >100 $\mu g.m^{-3}$.

Given that the nitrogen regime of the intertidal habitats within the SSSI will be driven primarily by the influence of the marine environment in which they occur and, as such, are not considered sensitive to atmospheric nitrogen input to any great extent (as demonstrated by a high critical load of 20-30 $kgN.ha^{-1}.yr^{-1}$), it is considered highly unlikely that the exceedance of the critical level in these locations would have a significant effect on the SSSI."

A.14 On that basis, the NOx effects were not considered significant for the DCO application and are not considered to be significant for the NMC case.

A.15 The nitrogen deposition PCs and acid deposition PCs are lower than the PCs predicted during the DCO application. This is mainly because the assessment undertaken for the DCO application assumed that the Selective Catalytic Reduction (SCR) would be used. The use of SCR has the potential to release ammonia (NH_3) emissions to air. The nitrogen component in the ammonia would increase the nitrogen deposition and acid deposition PCs. Therefore, by not using SCR (in the NMC case, a larger number of smaller engines would be subject to the Medium Combustion Plant (MCP) Directive and therefore not require SCR), the ammonia emissions are removed and the nitrogen deposition and acid deposition PCs are lower.

A.16 On that basis, the conclusions of the air quality assessment undertaken for the DCO application are unchanged and the effects remain insignificant.

References

1 Mayor of London, 2019 London Local Air Quality Management Technical Guidance, 2019 (LLAQM.TG19)

2 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

3 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

4 Drawn from Defra Maps at http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

5 Air Pollution Information Systems, www.apis.ac.uk

6 Approaches to modelling local nitrogen deposition and concentrations in the context of Natura 2000 - Topic 4

7 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas

8 IAQM (2016) Use of a Criterion for the Determination of an Insignificant Effect of Air Quality Impacts on Sensitive Habitats