Appendix 8A: Air Quality Assessment

APPENDIX 8A – AIR QUALITY ASSESSMENT

8A.1 Introduction

8A.1.1 This Technical Appendix supplements Chapter 8: Air Quality and describes the additional details for the construction dust assessment and dispersion modelling of point source emissions from the operational Proposed Development, as summarised in the main chapter.

8A.2 Construction Phase - Demolition and Construction Dust Assessment

8A.2.1 The following four potential activities have been screened as potentially not insignificant, based on the nature of construction activities proposed:

- enabling demolition works (including coal stockyard structure demolition and on-site crushing and screening);
- earthworks (soil stripping, spoil movement and stockpiling;
- construction (including on-site concrete batching); and
- trackout (HGV movements on unpaved roads and offsite mud on the highway).

Magnitude Definitions

8A.2.2 The magnitude of effects for the potential dust emissions is categorised as detailed in Table 8A.1 below

Table 8A.1: Definition of magnitude of demolition and construction activities

Magnitude	Demolition	Earthworks	Construction	Trackout
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete) on-site crushing and screening, demolition activities >20 m above ground	Site area >1 ha, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles at once, bunds >8 m high, total material moved >100,000 t	Total building volume >100,000 m^3, on-site concrete batching, sandblasting	>50 HDV (>3.5 t) peak outward movements per day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	Total building volume 20,000-50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground	Site area 0.25-1 ha, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles at once, bunds 4-8 m high, total material moved 20,000-100,000 t	Total building volume 25,000-100,000 m^3, potentially dusty materials e.g. concrete, on-site concrete batching	10-50 HDV (>3.5 t) peak outward movements per day, moderately dusty surface material (e.g. high clay content), unpaved road length 50-100 m

Magnitude	Demolition	Earthworks	Construction	Trackout
Small	Total building volume <20,000 m^3, construction material with low potential for dust (e.g. metal/timber), demolition activities <10 m above ground, demolition during wetter months	Site area <0.25, large grain soil type (e.g. sand), <5 heavy earth moving vehicles at once, bunds <4m high, total material moved <20,000 t	Total building volume <25,000 m^3, low dust potential construction materials e.g. metal/ timber	<10 HDV (>3.5 t) peak outward movements per day, surface material low dust potential, unpaved road length <50 m

Sensitivity of Receptors

8A.2.3 The assessment of demolition and construction dust has been made with respect to the receptor and area sensitivity definitions as outlined in Tables 8A.2-4 below. Sensitivity definitions have been made with reference to the IAQM guidance; receptors beyond 100 m are defined as low sensitivity; ecological receptors have been screened out as there are none within the 500 m screening distance.

Table 8A.2: Receptor sensitivity to demolition and construction dust effects*

Potential dust effect	Human perception of dust soiling effects	PM_{10} health effects
High sensitivity	Enjoy a high level of amenity; appearance/ aesthetics/ value of property would be diminished by soiling; receptor expected to be present continuously/ regularly; e.g. residential/ museums/ car showrooms/ commercial horticulture	Public present for 8hours per day or more, e.g. residential, schools, car homes
Moderate sensitivity	Enjoy a reasonable level of amenity; appearance/ aesthetics/ value of property could be diminished by soiling; receptor not expected to be present continuously/ regularly; e.g. parks/ places of work	Only workforce present (no residential or high sensitivity receptors) 8-hours per day or more
Low sensitivity	Enjoyment of amenity not reasonably expected; appearance/ aesthetics/ value of property not diminished by soiling; receptors are transient / present for limited period of time; e.g. playing fields, farmland, footpaths, short term car parks* and roads - *subject to typical usage, could be high sensitivity	Transient human exposure, e.g. footpaths, playing fields, parks

*Ecological effects have been screened out as no sensitive ecological receptors are present within 500 m of the Site

Table 8A.3: Sensitivity of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Moderate	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Distance measured from source to receptor; for trackout, receptor distance measured from roadside (up to 50 m), up to 500 m from Site exit

Table 8A.4: Sensitivity of the area to human health impacts

Receptor sensitivity	Number of receptors	Distance from the source (m)				
		<20	<50	<100	<200	<350
High (annual mean PM_{10} concentration 24-28µg/m^3)	>100	High	Medium	Low	Low	Low
	10-100	High	Medium	Low	Low	Low
	1-10	Medium	Low	Low	Low	Low
High (annual mean PM_{10} concentration <24µg/m^3)	>100	Medium	Low	Low	Low	Low
	10-100	Low	Low	Low	Low	Low
	1-10	Low	Low	Low	Low	Low
Moderate	>10	High	Medium	Low	Low	Low
	1-10	Medium	Low	Low	Low	Low
Low	>1	Low	Low	Low	Low	Low

Distance measured from source to receptor; for trackout, receptor distance measured from roadside (up to 50 m), up to 500 m from Site exit

Risk Definitions

8A.2.4 The potential risks from emissions from unmitigated demolition and construction activities have been defined with reference to the magnitude of the potential emission and the sensitivity of the highest receptor(s) within the effect area, as summarised in Table 8A.5 below.

Table 8A.5: Classification of risk of unmitigated impacts

Area of sensitivity to activity	Magnitude		
	Large	Medium	Small
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible

Area of sensitivity to activity	Magnitude		
	Large	Medium	Small
Earthworks			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

Assessment of Demolition and Construction Dust

Receptor Identification

8A.2.5 Ecological receptors have been screened out of the assessment as there are no sensitive receptors within 2km of the Proposed Development.

Table 8A.6: Identification of receptors for construction dust assessment

ID	Receptor name	Approx. distance (m) from Site boundary[1] or exit	Within screening distance?	Receptor sensitivity to dust and particulates
1	Chapel Haddlesey	500[b]	No	High
2	Chapel Haddlesey	50[b]	**Yes**	High
3	Eggborough [2]	600[d]	No	High
4	Kellington	2,000[a]	No	High
5	West Haddlesey	2,000[a]	No	High
6	Gallows Hill	160[a]	**Yes**	High
7	Hensall	650[a]	No	High
8	Temple Hirst	1,700[a]	No	High
9	Springfield Farm	600[a]	No	High
10	Hazelgrove Farm, caravan park	520[a]	No	High
11	Properties, Roall Lane	200[a]	**Yes**	High
12	Properties, Roall Water Works	<25[d]	**Yes**	High
13	Roall Hall Farm	400[a]	No	High
14	Roall Manor Farm	600[a]	No	High
15	Eggborough Sports & Social Club	<20[a]	**Yes**	High
16	East View, Eastfield House, E. Haddlesey	500[c]	No	High
17(T)	PRoW, A19-Tranmore Lane-	<20[d]	Yes	Low

ID	Receptor name	Approx. distance (m) from Site boundary[1] or exit	Within screening distance?	Receptor sensitivity to dust and particulates
	cricket pitch			
18(T)	PRoW, Gallows Hill-Eggborough Ings	<20[a]	Yes	Low
19	Gallows Hill (2)	300[a]	**Yes**	High
20	Myrtle Grange Farm	1,000[a]	No	High
21	Temple Farm	1,200[a]	No	High
22(T)	PRoW, Hazel Old Lane	<20[a]	Yes	Low
23	AQMA, M62	4,900[a]	No	High
24	AQMA, New Street, Selby	9,300[a]	No	High
25	Haddlesey Manor, E. Haddlesey	200[c]	**Yes**	High
26	Manor Cottages, E. Haddlesey	100[c]	**Yes**	High
27	Lodge Farm, Fox Lane	<20[c]	**Yes**	High
28	Burn Lodge Farm	<20[c]	**Yes**	High
29	Top House Farm	100[c]	**Yes**	High
30	Blossom Hill	200[c]	**Yes**	High
31	Gateforth Grange	400[c]	No	High

1. Boundary for key demolition and construction works, which includes
    a. Proposed Power Plant Site;
    b. proposed cooling water connections;
    c. gas pipeline routes; and
    d. Site exits;
2. Excludes borehole pipework areas to south-west of main development site (existing, limited works expected over short time scale) – receptor sensitivity judged to be low
3. PRoW = Public Right of Way

8A.3 Point Source Emissions – Operation Phase

Dispersion Model Parameters

8A.3.1 The Emissions Inventory modelled for the assessment of impacts from the operational Proposed Development is detailed in Chapter 8: Air Quality and the additional model input parameters are provided in the sections below.

NO_x to NO_2 Conversion – Combustion Plant

8A.3.2 Emissions of nitrogen oxides from industrial point sources are typically dominated by nitric oxide (NO), with emissions from combustion sources typically in the ratio of nitric oxide to nitrogen dioxide of 9:1. However, it is nitrogen dioxide that has specified NAQS objectives due to its potential impact on human health. In the ambient air, nitric oxide is oxidised to nitrogen dioxide by the ozone present, and the rate of oxidation is dependent on the relative concentrations of nitric oxide and ozone in the ambient air.

8A.3.3 For the purposes of detailed modelling, and in accordance with Environment Agency technical guidance it is assumed that 70% of emitted nitric oxide is oxidised to nitrogen dioxide in the

long term and 35% of the emitted nitric oxide is oxidised to nitrogen dioxide in the local vicinity of the site in the short-term.

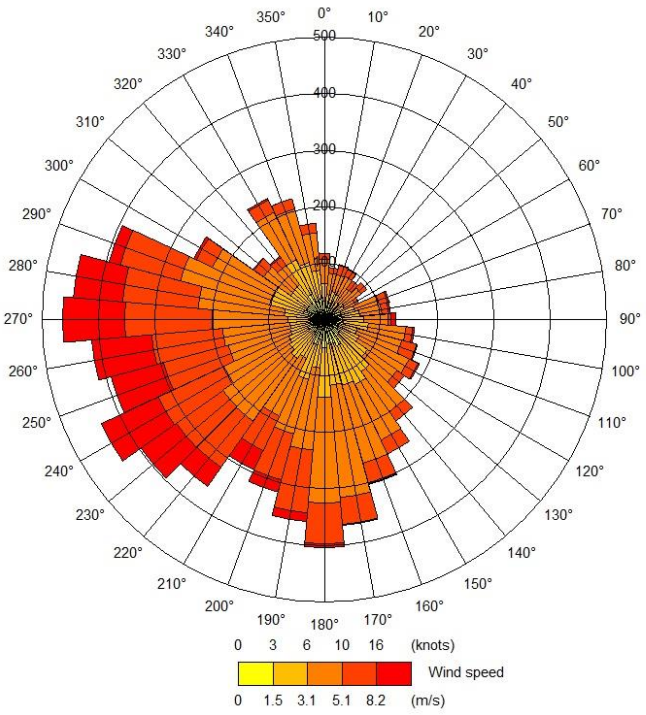
Meteorological Data

8A.3.4 Actual measured hourly-sequential meteorological data is available for input into dispersion models, and it is important to select data as representative as possible for the site that is modelled. This is usually achieved by selecting a meteorological station as close to the site as possible, although other stations may be used if the local terrain and conditions vary considerably, or if the station does not provide sufficient data.

8A.3.5 The meteorological site that was selected for the assessment is Church Fenton, located approximately 14 km north-west of the Proposed Power Plant Site, at a flat airfield in a principally agricultural area, and therefore a surface roughness of 0.2 m (representative of agricultural areas - minimum) has been selected for the meteorological site.

8A.3.6 The modelling for this assessment has utilised 5 years of meteorological data for the period 2008-2012, with 2011 providing the worst-case results, and therefore this year has been used to generate the reported results provided in Chapter 8: Air Quality. The sensitivity of the model results to the data from the five meteorological years is provided in the Sensitivity Analysis in this Appendix. The wind rose for Church Fenton in 2011 is provided in Plate 8A.1 below.

Plate 8A.1: Windrose, Church Fenton 2011



Buildings and Terrain

8A.3.7 The presence of buildings or structures near to the emission points can have a significant effect on the dispersion of emissions. The wind field can become entrained into the wake of buildings, which causes the wind to be directed to ground level more rapidly than in the

absence of a building. If an emission is entrained into this deviated wind field, this can give rise to elevated ground-level concentrations. Building effects are typically considered where a structure of height greater than 40 % of the stack height is situated within 8-10 stack heights of the emissions source.

8A.3.8 Buildings associated with the Proposed Development that are considered to be of sufficient height and volume to potentially impact on the dispersion of emissions from the CCGT stacks include the turbine buildings and HRSG buildings; for the peaking plant stacks it is the peaking plant building and HRSG buildings. At this stage, the air quality assessment is conservatively based on the maximum (worst-case) building dimensions of the Rochdale Envelope, as outlined in Chapter 4: The Proposed Development. In reality, the building dimensions may be smaller than the ones used in the assessment, and this would be expected to reduce the significance of building impacts on the dispersion of emissions from the main stack and therefore reduce the maximum predicted ground level concentrations; the results presented in Chapter 8: Air Quality are therefore considered to be conservative with respect to building effects. The sensitivity of the model results to the building dimensions is provided in the Sensitivity Analysis in this Appendix.

8A.3.9 The exact positions of the (up to) three CCGT stacks has been fixed such that while the final building sizes may change around the stacks, they will remain as a fixed point. Under the Rochdale Envelope being applied, the building dimensions could vary up to the maxima specified in Chapter 4: The Proposed Development but the stack locations will remain unchanged. Similarly the emission point from the stacks is fixed in height against Ordnance Datum, as outlined in paragraph 8A.3.17.

8A.3.10 Parameters representing the buildings included in the model are shown in Table 8A.7 and a plan showing the worst-case buildings used in the ADMS simulations is illustrated in Plates 8A.2-4 below.

8A.3.11 The existing coal-fired power station buildings may not be demolished before the Proposed Development becomes operational, therefore the sensitivity of the model results to the presence of existing power station buildings is provided in this Appendix. The buildings incorporated within the sensitivity simulation are also shown in Table 8A.7.

Table 8A.7: Buildings incorporated into the modelling assessment

Building	Building centre grid reference (x,y)	Height (m)	Length (m)	Width (m)	Angle [1]
Design scheme A: Single-shaft					
HRSG 1	457586, 423822	50	63	28	119
Turbine hall 1	457650, 423794	30	76	76	119
HRSG 2	457637, 423913	50	63	28	119
Turbine hall 2	457702, 423886	30	76	76	119
HRSG 3	457687, 424004	50	63	28	119
Turbine hall 3	457751, 423977	30	76	76	119
Design scheme B: Multi-shaft and Single-shaft					
HRSG1	457586, 423905	50	63	28	119
Turbine hall 1	457650, 423794	30	76	76	119
HRSG2	457643, 423923	50	63	28	119
HRSG3	457665, 423960	50	63	28	119

Building	Building centre grid reference (x,y)	Height (m)	Length (m)	Width (m)	Angle [1]
Turbine hall 2-3	457697, 423905	30	49	134	119
Peaking plant and black start buildings					
Peaking plant building	457541, 423986	30	64	102	119
Black start building	457500, 423910	30	35	54	119
Model sensitivity to existing power station buildings incorporating:					
Existing boiler house, coal bunker	*457743, 424345*	*60*	*221*	*76*	*29*
Existing turbine house	*457685, 424377*	*36*	*217*	*45*	*29*
Existing natural draught cooling towers	*457688, 424789* *457804, 424725* *457919, 424658* *458035, 424596*	*115*	*88*	*(circular)*	

1. Angle of building length to north

Plate 8A.2: Buildings simulation, design scheme A

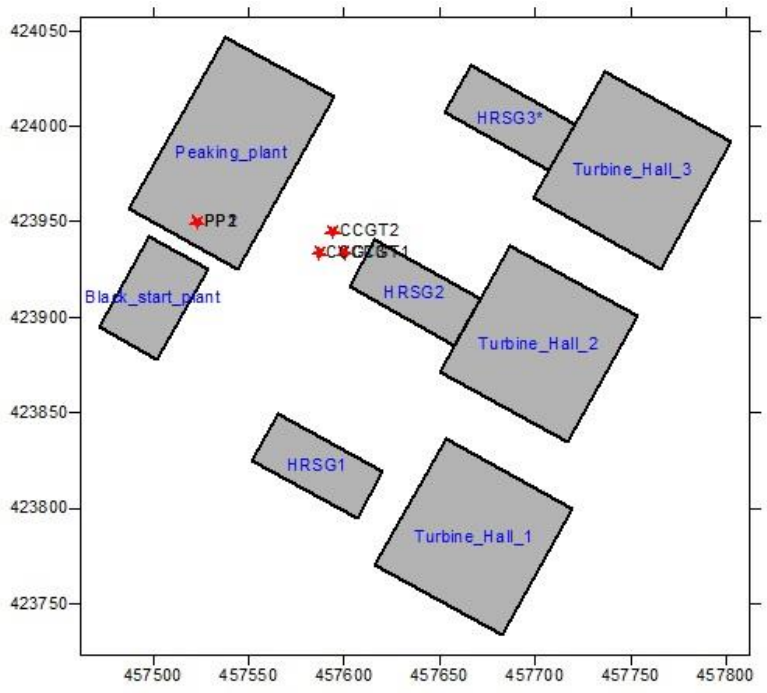


Plate 8A.3: Buildings simulation, design scheme B

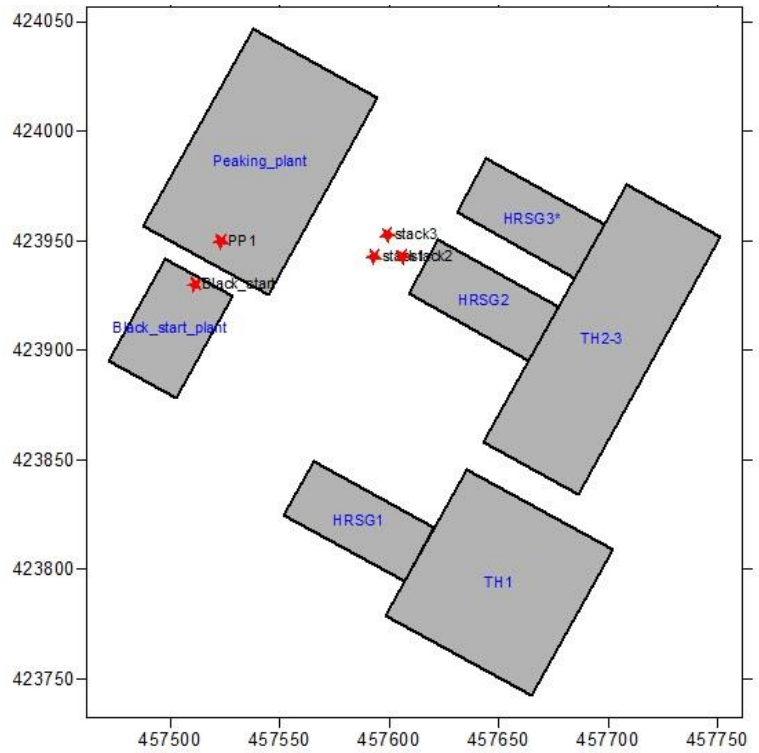
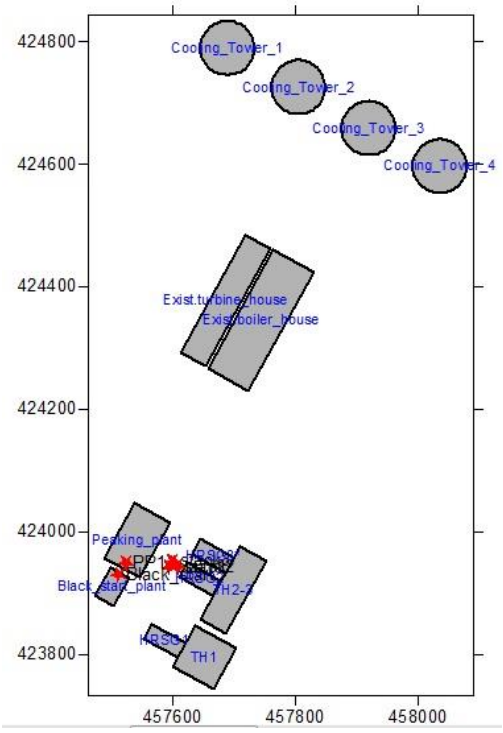


Plate 8A.4: Buildings simulation, design scheme B with existing coal-fired power station buildings



8A.3.12 The Proposed Power Plant Site is situated to the east and south-east of the existing coal-fired power station buildings. The local area upwind and downwind of the Proposed Power Plant Site is flat, and predominantly agricultural to the north, east and south; Eggborough Sports and Leisure Complex are located to the north-west. A surface roughness of 0.2 m, corresponding to the minimum value associated with agricultural areas, has therefore been selected to represent the local terrain. The sensitivity of the model results to surface roughness is provided in this Appendix.

8A.3.13 Site-specific terrain data has not been used in the model, as typically terrain data will only have a marked effect on predicted concentrations where hills with gradient of more than 1 in 10 are present in the vicinity of the source, which is not the case at the Proposed Power Plant Site.

Other Surface Parameters

8A.3.14 The dispersion model can incorporate additional site-specific parameters relating to surface effects on dispersion of emissions. These include:

- surface albedo – the ratio of reflected to incident shortwave solar radiation, in particular this is affected by ground snow cover;
- minimum Monin-Obukhov length – this is a measure of atmospheric stability not represented by meteorological data and allows for urban heat-island effects, typically associated with large towns and cities;
- Priestly-Taylor parameter – representing surface moisture that can evaporate.

8A.3.15 The dispersion site (the Site) is considered to be similar to the meteorological site (Church Fenton) with respect to the above characteristics, because of the similar locations of the sites within predominantly rural, agricultural areas and the lack of heat islands such as large towns. The model has been run assuming the meteorological site and dispersion site surface parameters are the same.

Modelled Domain and Receptors

8A.3.16 The main model results have been based on a grid extending 2 km from the point source with a grid resolution output at 40 m intervals from the source. The nearest sensitive receptor to the source is located approximately 200 m from the source, therefore this resolution is considered conservative and appropriate. Discrete receptor locations, including ecological receptors, up to 15 km from the Proposed Development have also been included in the model, as detailed in Section 8.4 of Chapter 8: Air Quality, including a receptor (22) at the location of maximum long-term and short-term off-site process contribution (PC), which coincides with a Public Right of Way; therefore the maximum predicted off-site PC is not affected by the grid resolution selected in the model. Ecological receptor grid references have been determined through identification of the nearest receptor boundary to the Proposed Development. Modelled receptor locations are shown in Figure 8.1 (Environmental Statement Volume II).

Stack Height Determination

8A.3.17 The proposed stack height has been optimised following screening modelling using conservative emission parameters, followed by detailed dispersion modelling and assessment to identify the appropriate stack height. A screening stack height range between 75-90 m was

selected based on typical CCGT plant stack heights. Stack heights of 75-90 m were modelled with refined emission parameters during the design development, and stack heights of 80 m and 90 m were formally consulted upon in January/ February 2017. Feedback from public consultation (which included consideration the air quality and visual effects of 80 m and 90 m stacks) indicated that 90 m stacks were preferred; therefore a height of 90 m above ground level has been selected. The maximum long-term NO_2 PCs at receptors for the 80 m and 90 m stacks are shown below for comparison.

Table 8A.8: Maximum long term nitrogen dioxide PC at receptor with main plant stack height

Main plant stack height	Annual mean PC at HH receptor /NAQS	Magnitude of change	Effect	Annual mean PC at Eco receptor /CL	Magnitude of change	Effect
90	4.9%	Low	Negligible adverse	1.4%	Very low	Negligible adverse
80	6.4%	Medium	Minor adverse	1.5%	Low	Negligible adverse

8A.3.18 The selected 90 m stack height has been incorporated into the plant design and fixed within the DCO for the purposes of the air quality assessment. This has been referenced to Ordnance Datum (mAOD) such that a fixed emission release point of 99.9 mAOD has been used in the DCO, even if there are changes in the plant detailed design within the Rochdale Envelope assessed.

8A.3.19 The optimum peaking plant stack height of between 45-60 m was also assessed, with consideration of the nearby buildings up to 50 m in height. The maximum off-site short-term PC decreased by only 2% of AQS (<5µg/m^3) with a reduction in peaking plant stack height from 60 m to 45 m, and short-term PC decrease of 0.1% of the AQS with a reduction in stack height from 50 m to 45 m. The maximum off-site short-term PC with 45m peaking plant stack heights was below the insignificance threshold (10% of the AQS) and therefore, with the limited benefit observed from a higher stack, a stack height of 45 m (54.9 mAOD) has been selected for the peaking plant .

Likely Impacts and Effects

8A.3.20 The predicted impacts from the worst case scenario assessed and based on conservative assumptions as outlined in Chapter 8 are presented in Tables 8A.9 to 8A.13.

Assessment of Operational Point Source Emissions – Human Health Receptors

Table 8A.9: Maximum long term nitrogen dioxide predicted concentrations at human health receptors

Receptor ID	Annual mean nitrogen dioxide PC (µg/m^3)	Magnitude of change	2022 Nitrogen dioxide baseline[1] (µg/m^3)	Annual mean PEC/ NAQS	Effect
1	0.3	Very low	13.9	35%	Negligible adverse
2	0.3	Very low	13.9	36%	Negligible adverse
3	0.2	Imperceptible	17.7	45%	Negligible adverse
4	0.1	Imperceptible	15.5	39%	Negligible adverse
5	0.2	Imperceptible	13.7	35%	Negligible adverse
6	2.0	Low	15.6	44%	Negligible adverse
7	0.8	Low	15.6	41%	Negligible adverse
8	0.7	Low	15.5	41%	Negligible adverse
9	0.1	Imperceptible	16.3	41%	Negligible adverse
10	0.1	Imperceptible	16.3	41%	Negligible adverse
11	0.1	Imperceptible	15.6	39%	Negligible adverse
12	0.1	Imperceptible	15.6	39%	Negligible adverse
13	0.1	Imperceptible	14.6	37%	Negligible adverse
14	0.1	Imperceptible	15.6	39%	Negligible adverse
15	0.3	Imperceptible	16.1	41%	Negligible adverse
16	0.5	Very low	14.2	37%	Negligible adverse
17	0.1	Very low	16.1	41%	Negligible adverse
18	2.5	Medium	14.8	43%	Minor adverse
19	1.6	Low	15.6	43%	Negligible adverse
20	1.0	Low	15.6	41%	Negligible adverse
21	0.8	Low	14.2	38%	Negligible adverse
22	3.1	Medium	16.1	48%	Minor adverse
23	0.1	Imperceptible	21.3	53%	Negligible adverse
24	0.2	Imperceptible	17.1	43%	Negligible adverse

Notes: 1. 2022 Baseline assumed to be as 2013 background as a worst-case; PC= process contribution; PEC=predicted environmental concentration (PC + background).

Assessment of Operational Point Source Emissions - Ecological Receptors

Table 8A.10: Maximum daily mean NO_x predicted concentrations at ecological receptors

Receptor ID	2013-15 NOx short-term baseline (µg/m^3)	Daily mean NO_x PC (µg/m^3)	Daily mean PC/ Critical Level	Magnitude of change	Daily mean PEC/ Critical Level	Effect
E1	38.2	2.2	2.9%	Imperceptible	54%	Negligible adverse
E2	43.5	3.8	5.1%	Imperceptible	63%	Negligible adverse
E3	40.5	1.7	2.3%	Imperceptible	56%	Negligible adverse
E4	44.8	2.8	3.8%	Imperceptible	64%	Negligible adverse
E5	45.4	2.4	3.2%	Imperceptible	64%	Negligible adverse
E6	37.5	1.8	2.4%	Imperceptible	52%	Negligible adverse
E7	31.0	2.2	3.0%	Imperceptible	44%	Negligible adverse
E8	36.1	2.1	2.7%	Imperceptible	51%	Negligible adverse
E9	39.5	3.6	4.8%	Imperceptible	57%	Negligible adverse
E10	40.0	5.1	6.8%	Imperceptible	60%	Negligible adverse
E11	32.7	5.6	7.5%	Imperceptible	51%	Negligible adverse
E12	27.3	2.3	3.0%	Imperceptible	39%	Negligible adverse

Short-term baseline assumed to be twice the annual average baseline; EA short-term significance criteria: Insignificant / imperceptible<10% of short-term Critical Level;

Table 8A.11: Maximum annual mean NO_x predicted concentrations at ecological receptors

Receptor ID	2013-15 annual mean NO_x baseline ($\mu g/m^3$)	Annual mean NO_x PC ($\mu g/m^3$)	Annual mean PC/ Critical Level	Magnitude of change	Annual mean PEC/ Critical Level	Effect
E1	19.1	0.3	0.9%	Imperceptible	64%	Negligible adverse
E2	21.7	0.4	1.4%	Very low	74%	Negligible adverse
E3	20.3	0.1	0.5%	Imperceptible	68%	Negligible adverse
E4	22.4	0.1	0.3%	Imperceptible	75%	Negligible adverse
E5	22.7	0.1	0.2%	Imperceptible	76%	Negligible adverse
E6	18.8	0.2	0.8%	Imperceptible	63%	Negligible adverse
E7	15.5	0.2	0.6%	Imperceptible	52%	Negligible adverse
E8	18.1	0.2	0.8%	Imperceptible	61%	Negligible adverse
E9	19.8	0.3	1.0%	Imperceptible	67%	Negligible adverse
E10	20.0	0.3	1.2%	Very low	68%	Negligible adverse
E11	16.3	0.2	0.6%	Imperceptible	55%	Negligible adverse
E12	13.6	0.3	1.0%	Imperceptible	46%	Negligible adverse

Long-term significance criteria: Insignificant / imperceptible<1% of long-term Critical Level;

Table 8A.12: Maximum predicted nutrient nitrogen deposition to land at ecological receptors

ID	Receptor name (Critical Load Class: most sensitive species)	Critical Load (kg N/Ha/Yr)	2013 Baseline (kg N/Ha/ Yr) [as %lower CL)	Annual mean PC (kg N/Ha /Yr)	PC/ Critical Load (lower)	Magnitude of change	Annual mean PEC/ Critical Load (lower)	Effect descriptor
E1	Burr Closes (Low and medium altitude hay meadows)	20-30	20.0 [100%]	0.04	0.2%	Imperceptible	100%	Negligible adverse
E2	Eskamhorn Meadows (Low and medium altitude hay meadows)	20-30	17.8 [89%]	0.06	0.3%	Imperceptible	89%	Negligible adverse
E3	Went Ings Meadows (Low and medium altitude hay meadows)	20-30	17.6 [88%]	0.02	0.1%	Imperceptible	88%	Negligible adverse
E4	Forlorn Hope Meadow (Low and medium altitude hay meadows)	20-30	19.6 [98%]	0.01	0.1%	Imperceptible	98%	Negligible adverse
E5	Brockadale (Meso- and eutrophic Quercus woodland)	15-20	31.8 [212%]	0.02	0.1%	Imperceptible	212%	Negligible adverse
E6	Humber Estuary (Fixed coastal dunes with herbaceous vegetation)	8-10	18.9 [237%]	0.03	0.4%	Imperceptible	237%	Negligible adverse
E7	Skipwith Common (Northern wet heath: Erica tetralix)	10-20	18.2 [182%]	0.02	0.3%	Imperceptible	182%	Negligible adverse
E8	Thorne Moor (Raised and Blanket Bogs)	5-10	14.6 [293%]	0.03	0.7%	Imperceptible	293%	Negligible adverse

1. PC/Critical Load <1% is described as insignificant or 'imperceptible'
2. E9-E12 have no published data on the Critical Loads for nutrient nitrogen deposition therefore these are not included in the table above.

Table 8A.13: Maximum predicted acid deposition to land at ecological receptors

ID	Receptor name (Critical Load Class: most sensitive species)	Critical Load (keq N/Ha/Yr)	Critical Load (keq S/Ha/Yr)	Total Background (N:S keq/ha/yr)	Process contribution of N to Acid Deposition[1]	PEC N Deposition (<CLMinN?)	PC / Critical Load (CLMaxN)	PEC / Critical Load (CLMaxN)	Effect descriptor
E1	Burr Closes (Low and medium altitude hay meadows)	0.44-1.25	0.81	1.43:0.39	0.003	1.433 (>CLMinN)	0.2%	146%	Negligible adverse
E2	Eskamhorn Meadows (Low and medium altitude hay meadows)	0.44-2.00	1.56	1.27:0.38	0.004	1.274 (>CLMinN)	0.2%	83%	Negligible adverse
E3	Went Ings Meadows (Low and medium altitude hay meadows)	0.44-2.80	1.57	1.26:0.41	0.001	1.261 (>CLMinN)	<0.1%	60%	Negligible adverse
E4	Forlorn Hope Meadow (Low and medium altitude hay meadows)	0.44-1.26	0.82	1.40:0.47	<0.001	1.401 (>CLMinN)	<0.1%	149%	Negligible adverse
E5	Brockadale (Meso- and eutrophic Quercus woodland)	0.14-1.75	1.57	2.27:0.53	0.001	2.271 (>CLMinN)	<0.1%	160%	Negligible adverse
E6	Humber Estuary (Fixed coastal dunes with herbaceous vegetation)	0.22-0.64	0.42	1.35:0.39	0.003	1.353 (>CLMinN)	0.4%	271%	Negligible adverse
E7	Skipwith Common (Northern wet heath: Erica tetralix)	0.64-0.82	0.16	1.30:0.40	0.002	1.302 (>CLMinN)	0.2%	208%	Negligible adverse
E8	Thorne Moor (Raised and Blanket Bogs)	0.32-0.46	0.14	1.04:0.30	0.003	1.043 (>CLMinN)	0.5%	291%	Negligible adverse

3. PC/Critical Load <1% is described as insignificant or 'imperceptible'
4. Sulphur contribution from Proposed Development assumed to be zero
5. E9-E12 have no published data on the Critical Loads for nutrient nitrogen deposition therefore these are not included in the table above.

Effects of Potential SCR Use

8A.3.21 As outlined in Chapter 8, the plant has been designed to allow for the potential use of Selective Catalytic Reduction (SCR) abatement equipment for the control of nitrogen oxide emissions, should that be necessary to maintain compliance with the revised BAT Reference document (BRef) conclusions expected to be published in autumn 2017. As outlined in the Chapter, the need to achieve tighter nitrogen oxide emissions from a high efficiency CCGT is currently not established and the regulatory position on compliance with the revised BRef nitrogen oxide achievable emission levels is being established by the Environment Agency. Therefore the air quality assessment for the Proposed Development includes an assessment of effect at current Emission Limit Values as prescribed in the Industrial Emissions Directive, and also at the tighter achievable emission levels outlined in the draft revised BRef. Use of SCR also gives rise to emissions of ammonia used in that process and the effect of ammonia emissions on environmental receptors is therefore presented in Tables 8A.14 to 8A.17.

8A.3.22 The tables present an assessment of the process contribution arising from the use of SCR and also the combined effect when added to the current background levels. Please note that for many ecological receptors, the current background levels already exceed the published Critical Levels or Critical Loads for nitrogen or acid deposition.

Table 8A.14: Maximum predicted ammonia concentration associated with potential SCR use, at human health receptors

Receptor	Pollutant	PC ($\mu g/m^3$)	PC/NAQS	PC as % of headroom	Effect
22 (T)	Ammonia (1-hour mean)	16	<1%	<1%	Negligible adverse
6	Ammonia (annual mean)	0.2	<1%	<1%	Negligible adverse

Table 8A.15: Maximum predicted ammonia concentration associated with potential SCR use, at ecological receptors

Receptor ID	2013-15 NH_3 baseline ($\mu g/m^3$)	Habitat specific Critical Level ($\mu g/m^3$)	Annual mean NH_3 PC ($\mu g/m^3$)	Annual mean PC/ Critical Level	Magnitude of change	Annual mean PEC/ Critical Level	Effect
E1	2.2	3	0.02	<1%	Very low	79%	Negligible
E2	1.8	3	0.03	1%	Very low	61%	Negligible
E3	1.7	3	0.01	<1%	Very low	57%	Negligible
E4	1.8	3	0.01	<1%	Very low	62%	Negligible
E5	1.9	1	<0.01	<1%	Very low	190%	Negligible
E6	2.3	3	0.02	<1%	Very low	77%	Negligible
E7	2.0	1	0.01	1%	Very low	200%	Moderate adverse
E8	1.2	1	0.02	2%	Low	125%	Major adverse
E9	2.3[1]	3	0.02	<1%	Very low	79%	Negligible
E10	2.3[1]	3	0.02	<1%	Very low	79%	Negligible

Receptor ID	2013-15 NH_3 baseline ($\mu g/m^3$)	Habitat specific Critical Level ($\mu g/m^3$)	Annual mean NH_3 PC ($\mu g/m^3$)	Annual mean PC/ Critical Level	Magnitude of change	Annual mean PEC/ Critical Level	Effect
E11	1.8[2]	3	0.01	<1%	Very low	62%	Negligible
E12	2.3	3	0.02	<1%	Very low	76%	Negligible

1. Based on baseline for E1;
2. Based on baseline for E4;
3. Critical load of 1µg/m^3 for habitats with lichens / bryophytes; 3µg/m^3 for all higher plants

Table 8A.16: Potential use of SCR impacts on nutrient nitrogen deposition to land at ecological receptors

ID	Receptor name (Critical Load Class: most sensitive species)	Critical Load (kg N/Ha/Yr)	2013 Baseline (kg N/Ha/ Yr) [as %lower CL)	Annual mean PC (kg N/Ha /Yr) [NO_x : NH_3][1]	PC/ Critical Load (lower)	Magnitude of change	Annual mean PEC/ Critical Load (lower)	Effect descriptor
E1	Burr Closes (Low and medium altitude hay meadows)	20-30	20.0 [100%]	0.18 [0.03:0.15]	0.9%	Imperceptible	101%	Negligible adverse
E2	Eskamhorn Meadows (Low and medium altitude hay meadows)	20-30	17.8 [89%]	0.30 [0.04:0.26]	1.5%	Low	90%	Minor adverse
E3	Went Ings Meadows (Low and medium altitude hay meadows)	20-30	17.6 [88%]	0.09 [0.01:0.08]	0.5%	Imperceptible	88%	Negligible adverse
E4	Forlorn Hope Meadow (Low and medium altitude hay meadows)	20-30	19.6 [98%]	0.06 [0.01:0.05]	0.3%	Imperceptible	98%	Negligible adverse
E5	Brockadale (Meso- and eutrophic Quercus woodland)	15-20	31.8 [212%]	0.03 [0.01:0.03]	0.2%	Imperceptible	212%	Negligible adverse
E6	Humber Estuary (Fixed coastal dunes with herbaceous vegetation)	8-10	18.9 [237%]	0.17 [0.02:0.15]	2.2%	Low	238%	Major adverse
E7	Skipwith Common (Northern wet heath: Erica tetralix)	10-20	18.2 [182%]	0.13 [0.02:0.11]	1.3%	Very low	183%	Minor adverse
E8	Thorne Moor (Raised and Blanket Bogs)	5-10	14.6 [293%]	0.17 [0.02:0.15]	3.4%	Low	295%	Major adverse

1. [Relative N contributions from NO_x :NH_3]
2. PC/Critical Load <1% is described as insignificant or 'imperceptible'

Table 8A.17: Potential use of SCR impacts on predicted acid deposition to land at ecological receptors

ID	Receptor name (Critical Load Class: most sensitive species)	Critical Load (keq N/Ha/Yr)	Critical Load (keq S/Ha/Yr)	Total Background (N:S keq/ha/yr)	Process contribution of N to Acid Deposition[1] [NO_x : NH_3]	PEC N Deposition (<CLMinN?)	PC / Critical Load (CLMaxN)	PEC / Critical Load (CLMaxN)	Effect descriptor
E1	Burr Closes (Low and medium altitude hay meadows)	0.44-1.25	0.81	1.43:0.39	0.012 [0.002:0.011]	1.442 (>CLMinN)	1.0%	147%	Minor adverse
E2	Eskamhorn Meadows (Low and medium altitude hay meadows)	0.44-2.00	1.56	1.27:0.38	0.021 [0.003:0.018]	1.291 (>CLMinN)	1.1%	84%	Negligible adverse
E3	Went Ings Meadows (Low and medium altitude hay meadows)	0.44-2.80	1.57	1.26:0.41	0.007 [0.001:0.006]	1.267 (>CLMinN)	0.2%	60%	Negligible adverse
E4	Forlorn Hope Meadow (Low and medium altitude hay meadows)	0.44-1.26	0.82	1.40:0.47	0.002 [0.001:0.003]	1.404 (>CLMinN)	0.3%	149%	Negligible adverse
E5	Brockadale (Meso- and eutrophic Quercus woodland)	0.14-1.75	1.57	2.27:0.53	0.002 [<0.001:0.002]	2.272 (>CLMinN)	0.1%	160%	Negligible adverse
E6	Humber Estuary (Fixed coastal dunes with herbaceous vegetation)	0.22-0.64	0.42	1.35:0.39	0.012 [0.002:0.011]	1.362 (>CLMinN)	1.9%	273%	Major adverse
E7	Skipwith Common (Northern wet heath: Erica tetralix)	0.64-0.82	0.16	1.30:0.40	0.009 [0.001:0.008]	1.309 (>CLMinN)	1.1%	208%	Moderate adverse
E8	Thorne Moor (Raised and Blanket Bogs)	0.32-0.46	0.14	1.04:0.30	0.012 [0.002:0.010]	1.052 (>CLMinN)	2.6%	293%	Major adverse

1. PC/Critical Load <1% is described as insignificant or 'imperceptible'
2. Sulphur contribution from Proposed Development assumed to be zero, [relative N contributions from NO_x :NH_3]
3. E9-E12 have no published data on the Critical Loads for nutrient nitrogen deposition therefore these are not included in the table above.

Sensitivity Analysis

Dispersion Model Parameters

8A.3.23 The assessment has been based on a number of conservative assumptions relating to the alternative design schemes and defined emission parameters to establish the worst-case impacts presented in the Rochdale Envelope approach, as described in the main chapter. The dispersion model parameters have also been varied to determine the sensitivity of predicted results to these effects, including:

- Five years' meteorological data;
- Buildings representation – variation in height; with and without existing power station buildings; and
- Surface roughness, including variable surface roughness over the modelled domain.

8A.3.24 The maximum predicted concentration of NO_2 at the worst-affected human health receptors associated with the variable input parameters are shown as the percentage of reported values used in the effects significance assessment.

Table 8A.18: Point Source Dispersion Model Sensitivity Analysis

Model Input variable	Annual mean NO_2 PC (as % of reported PC at worst-affected human health receptors)
Meteorological data (5-year min-max)	49% - 100% (R6 – Gallows Hill)
Meteorological data (5-year average)	78% (R6)
Buildings representation (+/-5m maximum height)	115% (+5 m); 88% (-5 m); (R6)
Buildings representation (including existing power station buildings)	100% (R6)
Surface roughness representation (variable, including Eggborough at 0.5m)	99% (R3 - Eggborough); 101% (R6)

8A.3.25 Receptor R6 has been selected to represent the worst-affected residential receptor from process contributions.

8A.3.26 The main uncertainty associated with the model is considered to be meteorological data, with a variation of 49% in the PC; this is equivalent to an overall uncertainty associated with the long-term PC at the worst-affected receptor of -1.3 µg/m^3 (-3% of the AQS).

8A.3.27 The effect of representation of buildings within the dispersion model has been assessed, with 12-15% variation in long-term PC at the worst-affected receptor determined for a variation of 5m in the HRSG buildings (50 m). The inclusion of existing power station buildings (Table 8A.7) within the model did not change the predicted PC at the worst-affected receptor.

8A.3.28 Surface roughness representation within the model has been assessed with the inclusion of variable surface roughness across the grid, with the area covering Eggborough residential area represented by a surface roughness of 0.5 m (corresponding to parkland/ open suburbia), and the remaining area by a surface roughness of 0.2 m (corresponding to agricultural areas -

minimum). The variation resulted in 1% change in the predicted PC at the worst-affected receptor and at the modelled Eggborough receptor.

8A.3.29 The overall worst-case input parameters have been used to generate the PCs used in this assessment. Application of the above sensitivity results to PCs does not adversely alter the predicted effects significance assessment.

Selection of Ambient Concentration Data

8A.3.30 The assessment has used Defra background monitoring data to estimate the existing ambient concentrations. The assessment results have also been reviewed with the inclusion of primary diffusion tube monitoring data obtained from the four-month survey (Table 8.14), and the worst-case diffusion tube data from SDC AQMA, to determine the sensitivity of results to the selection of ambient concentration data. The use of primary diffusion tube data does not change the reported effect at the worst-case assessed receptors, therefore the selected baseline data is considered to be representative.

Table 8A.19: Sensitivity Analysis, Ambient Concentration Data Selection

Receptor	Monitor location (Site Type)	Annual mean NO_2 PC/ NAQS	AC based on diffusion tube data (µg/m^3)	Annual mean PEC/ NAQS	Change in reported effect?
2 (Chapel Haddlesey)	2 (R)	0.8%	22.0	56%	No (negligible adverse)
3 (Eggborough)	1 (B)	0.4%	19.1	48%	No (negligible adverse)
6 (Gallows Hill)	3 (B)	4.9%	16.6	46%	No (negligible adverse)
22 (Hazel Old Lane)	4 (B)	7.7%	15.5	46%	No (minor adverse)
24 (Selby AQMA)	S7b (R)	0.4%	55.9	140%	No (negligible adverse)

(R) = roadside; (B) = background