Appendix 8.5

Sensitivity Assessment of Modelling Input Parameters

APPENDIX 8.5

8.5.1 Sensitivity assessment of modelling input parameters

The sensitivity of the modelling results to variations in the model input parameters was investigated. The key parameters which are likely to influence the air dispersion modelling algorithms are outlined below:

- Volume Flow Variations
- Meteorological Station
- Surface roughness
- Urban boundary layer options / rural option
- Land Use Characterisation

8.5.2 Volume Flow

The influence of changes to volume flow on the ambient ground level concentration has been investigated as shown in Table A8.14. Results show that changing the volume flow from 100% of the maximum volume flow to 75% of the maximum volume does not change the ambient concentration by a significant margin. At 75% of the maximum volume, ambient concentrations are between 6% higher and 4% depending on the pollutant and averaging period.

Table A8.14 Ambient Ground Level Concentrations At 75% Of Maximum Volume Flow & Compared To 100% Of Maximum Concentrations

Compound / Averaging Period	Emission Rate (g/s)	Process Contribution (mg/m^3)	Predicted Env. Conc. (PEC) (mg/m^3)	Limit Value (mg/m^3)	Process Contribution Relative To Limit Value (%)	100% Volume Flow – 75% Volume Flow
NO_2 (1-Hr)	**17.58**	21.9	41.9	200	20.95%	0.25%
NO2 (24-Hr)	**8.79**	2.6	22.6	50	45.20%	0.00%
NO2 (Ann)	**8.79**	0.51	10.51	40	52.55%	0.10%
SO2 (1-Hr)	**8.79**	40.53	46.53	350	13.29%	-3.76%
SO2 (24-Hr)	**2.20**	4.26	10.26	50	20.53%	4.36%
SO2 (Ann)	**2.20**	0.40	3.40	20	16.98%	-0.06%
PM10 (24-Hr)	**0.44**	2.03	23.93	45	53.17%	3.58%
PM10 (Ann)	**0.44**	0.08	10.08	20	50.40%	-0.01%
PM2.5 (24-Hr)	**0.44**	2.03	18.53	25	74.11%	6.44%
PM2.5 (Ann)	**0.44**	0.08	6.08	10	60.79%	-0.02%
CO (8-hr)	**6.59**	25.06	1925.06	10000	19.25%	-0.04%
CO (24-hr)	**6.59**	19.45	719.45	4000	17.99%	0.33%
Benzene (Ann)	**0.44**	0.08	1.08	3.4	31.74%	-0.07%
HCl (1-hr)	**2.64**	15.57	19.97	800	2.50%	-0.22%
HCl (Ann)	**0.44**	0.08	2.28	20	11.40%	-0.01%
HF (1-hr)	**0.176**	1.04	1.68	160	1.05%	-0.07%

Compound / Averaging Period	Emission Rate (g/s)	Process Contribution (mg/m^3)	Predicted Env. Conc. (PEC) (mg/m^3)	Limit Value (mg/m^3)	Process Contribution Relative To Limit Value (%)	100% Volume Flow – 75% Volume Flow
HF (Ann)	**0.044**	0.01	0.33	16	2.05%	0.00%
PCCD/PCDFs	**4.4 ng/s**	0.66 fg/m^3	23 fg/m^3	n/a	n/a	n/a
Hg (Ann)	**0.0022**	0.40	8.40	1	0.8%	0.00%
Cd (Ann)	**0.0022**	0.40	1.40	0.005	27.9%	-0.23%
As (Ann)	**0.000145**	0.03	1.03	0.006	17.2%	-0.02%
Ni (Ann)	**0.00290**	0.50	9.50	0.02	47.5%	-0.07%
PAH	**0.000044**	7.91	257.91	0.001	25.8%	-0.02%

8.5.3 Meteorological Station

The influence of the meteorological station on the ambient ground level concentration has been investigated. For the detailed modelling Cork Airport (2020 – 2024) and the onsite station (2007) were used. As part of the sensitivity assessment Roches Point data (2020 – 2018) was also modelled to determine the sensitivity of this parameter to the modelled concentration (Roches Point is an automated station which does not record cloud cover and thus Cork Airport cloud cover was substituted for the missing data). As shown in Table A8.15, changing the meteorological station leads to small increase in the maximum one hour (as a 99.97^{97h}%ile) and a small decrease in the 95.1^{th}%ile of 24-hour means and annual average compared to the onsite station in 2007.

8.5.4 Surface Roughness

The influence of surface roughness on the ambient ground level concentration has been investigated. For the detailed modelling the surface roughness for the rural boundary layer option was selected which is representative of the area as outlined in Table A8.1. As part of the sensitivity assessment surface roughness of 0.001 and 1.0 were also modelled to determine the sensitivity of this parameter to the modelled concentration. As shown in Table A8.15, changing the surface roughness to 1.0 which is representative of an urban area leads to an increase in the annual average concentration, 95.1^{th}%ile of 24-hour means and 99.97^{th}%ile of one hour means. Reducing the surface roughness to 0.001 leads to a small increase in the maximum one hour (as a 99.97^{th}%ile) and a small decrease in the 95.1^{th}%ile of 24-hour means and annual average.

8.5.5 Land Use Characterisation

The influence of the land use characterisation near the facility on the ambient ground level concentration has been investigated. For the detailed modelling, land use characterisation was undertaken as outlined in Table A8.15 based on the location of the facility at an urban / rural interface. As part of the sensitivity assessment modelling assuming solely a rural character (0-360°) consisting of grasslands was also modelled to determine the sensitivity of this parameter to the modelled concentration. As shown in Table A8.15 assuming that the land use surrounding the facility is entirely grasslands leads to a decrease in the annual average concentration, 95.1^{th}%ile of 24-hour means and 99.97^{th}%ile of one hour means relative to the predicted level (base case). Table A8.15 also shows that the scenario where the urban boundary layer was used (instead of the default rural boundary layer) leads to a small increase in the maximum one hour (as a 99.97^{th}%ile) and a small decrease in the 95.1^{th}%ile of 24-hour means and annual average (relative to the base case).

8.5.6 Average / Wet Bowen Ratio Comparison

The influence of the Bowen ratio (which characterises the available surface moisture) on the ambient ground level concentration has been investigated. For the detailed modelling, an average Bowen ratio was selected based on the rainfall totals for Cork. As part of the sensitivity assessment modelling assuming higher rainfall pattern (wet) was undertaken to determine the sensitivity of this parameter to the modelled concentration. As shown in Table A8.15, the effect of changing the Bowen ratio from average to wet is a small decrease in the 95.1th%ile of 24-hour means and annual average.

Table A8.15 Dispersion Model Results – Sensitivity Study (Based on Ringaskiddy Onsite data 2007)

Pollutant / Scenario	Mean Background ($\mu g/m^3$)	Averaging Period	Process Contribution NO_2 ($\mu g/m^3$)	Predicted Emission Concentration ($\mu g/Nm^3$)	Standard ($\mu g/Nm^3$)	Ringaskiddy Facility emissions as a % of ambient limit value
NO_2 / Default (Varying Surface Roughness as shown in Table A8.1, Rural Boundary Layer, Average Bowen ratio, Land Use as shown in Table A8.1)	10	Annual Mean	0.43	10.43	20	52%
	20	95.1th%ile of 24-hr means	2.3	22.3	50	45%
	20	99.97th%ile of 1-hr means	20.9	40.9	200	20%
NO_2 / Roches Point 2020 - 2024	10	Annual Mean	0.35	10.35	20	52%
	20	95.1th%ile of 24-hr means	1.82	21.82	50	44%
	20	99.97th%ile of 1-hr means	21.7	41.7	200	21%
NO_2 / Surface Roughness 0.001	10	Annual Mean	0.30	10.3	20	52%
	20	95.1th%ile of 24-hr means	1.72	21.72	50	43%
	20	99.97th%ile of 1-hr means	23.6	43.6	200	22%
NO_2 / Surface Roughness 1.0	10	Annual Mean	0.62	10.62	20	53%
	20	95.1th%ile of 24-hr means	3.39	23.39	50	47%
	20	99.97th%ile of 1-hr means	29.0	49.0	200	25%
NO_2 / Rural Option (All grassland)	10	Annual Mean	0.34	10.34	20	52%
	20	95.1th%ile of 24-hr means	1.89	21.89	50	44%
	20	99.97th%ile of 1-hr means	19.2	39.2	200	20%
NO_2 / Urban Boundary Layer	10	Annual Mean	0.34	10.34	20	52%
	20	95.1th%ile of 24-hr means	1.66	21.66	50	43%
	20	99.97th%ile of 1-hr means	29.1	49.1	200	25%
NO_2 / Bowen Ratio - Wet	10	Annual Mean	0.33	10.33	20	52%
	20	95.1th%ile of 24-hr means	1.78	21.78	50	44%
	20	99.97th%ile of 1-hr means	20.9	40.9	200	20%