Appendix 7-4: Sensitivity Testing

Appendix 7-4 Sensitivity Testing

This Appendix outlines results of sensitivity tests which were undertaken for the odour emissions assessment from air traffic movements (ATMs) and impacts from the energy centre.

Odour Sensitivity Calculations

Odour impacts associated with ATMs and fuel farm emissions have been calculated based on the methodology outlined by Winther et al (2006)[1]. The study outlines that an odour emission rate of 57 Odour Units (OUe) per mg of hydrocarbon (HC) can be applied to ATMs and this assumption has been considered in the assessment reported in Chapter 7. The study also outlines that this factor is within the range of 23 OUe/mgHC to 110 OUe/mgHC which has been identified in other studies of airport odour. This Appendix provides odour impacts using all three emissions factor values (23 OUe/mgHC,57 OUe/mgHC and 110 OUe/mgHC) and applying them to modelled HC emissions.

Odour impacts based on the derived factors have been calculated to determine the possible extent of odour impacts in the Current Receiving Environment and Principal Assessment. As described in Chapter 7, it is considered likely that odour from aviation fuel will certainly be unacceptable at concentrations of 6 OU_E/m^3, and possibly unacceptable at >3 OU_E/m^3 subject to the sensitivity of the receptor. It is considered that odour concentrations of <3 OU_E/m^3 are likely to be acceptable. A perceptible odour impact of 1 OU_E/m^3 has the potential to result in a significant effect on amenity, where that impact causes total odour concentrations to exceed 3 OU_E/m^3.

Predicted odour concentration results based on 23 OUe/mgHC are presented in Table 1.

Table 1: Summary of Predicted Odour Concentrations using an Odour Emissions Factor of 23 OUe/mgHC

Receptors that Experience a Future Receiving Environment Phase Concentration that is:	Number of receptors	
	Permitted Operation	Proposed Operation
98th Percentile of Hourly Odour Concentrations <1.5 OUe/m3	89	89
98th Percentile of Hourly Odour Concentrations 1.5 OUe/m3 to <3 OUe/m3	0	0
98th Percentile of Hourly Odour Concentrations 3 OUe/m3 to <6 OUe/m3	0	0
98th Percentile of Hourly Odour Concentrations >6 OUe/m3	0	0
Maximum 98th Percentile of Hourly Odour Concentrations Predicted (OUe/m3)	0.7	0.7

Assuming that aviation fuel may be considered moderately offensive by some receptors, no sensitive receptors were predicted to experience an odour concentration of >3 OUe/m^3 in the 2029 Permitted Operation. No sensitive receptors are predicted to experience an odour concentration of >3 OUe/m^3 in the 2029 Proposed Operation when applying a factor of 23 OUe/mgHC, nor is any sensitive receptor predicted to experience an odour concentration between 1.5 OUe/mgHC and 3 OUe/mgHC. The maximum odour concentration at a residential property in the 2029 Proposed Operation is 0.3 OUe/m^3.

Odour results based on 57 OUe/mgHC are presented in Table 2**Error! Reference source not found.**.

[1] Winther M, Kousgaard U and Oxbol A (2006), Calculation of odour emissions from aircraft engines at Copenhagen Airport. Sci Tot Env, 366, 218-232.

Table 2: Summary of Predicted Future Receiving Environment Odour Concentrations using an Odour Emissions Factor of 57 OUe/mgHC

Receptors that Experience a Future Receiving Environment Phase Concentration that is:	Number of receptors	
	Permitted Operation	Proposed Operation
98th Percentile of Hourly Odour Concentrations <1.5 OUe/m^3	86	83
98th Percentile of Hourly Odour Concentrations 1.5 OUe/m^3 to <3 OUe/m^3	3	6
98th Percentile of Hourly Odour Concentrations 3 OUe/m^3 to <6 OUe/m^3	0	0
98th Percentile of Hourly Odour Concentrations >6 OUe/m^3	0	0
Maximum 98th Percentile of Hourly Odour Concentrations Predicted (OUe/m^3)	1.7	1.9

Assuming that aviation fuel may be considered moderately offensive by some receptors, no sensitive receptors were predicted to experience an odour concentration of >3 OUe/m^3 in the 2029 Permitted Operation. No sensitive receptors are predicted to experience an odour concentration of >3 OUe/m^3 in 2029 Proposed Operation, when applying a factor of 57 OUe/mgHC. Three receptors are predicted to experience an odour concentration between 1.5 OUe/mgHC and 3 OUe/mgHC under the 2029 Permitted Operation and six receptors are predicted to experience an odour concentration between 1.5 OUe/mgHC and 3 OUe/mgHC under the 2029 Proposed Operation. The maximum odour concentration at a residential property with the 2029 Proposed Operation is 1.9 OUe/m^3.

Odour results based on 110 OUe/mgHC are presented in Table 3.

Table 3: Summary of Predicted Future Receiving Environment Odour Concentrations using an Odour Emissions Factor of 110 OUe/mgHC

Receptors that Experience a Future Receiving Environment Phase Concentration that is:	Number of receptors	
	Permitted Operation	Proposed Operation
98th Percentile of Hourly Odour Concentrations <1.5 OUe/m^3	73	67
98th Percentile of Hourly Odour Concentrations 1.5 OUe/m^3 to <3 OUe/m^3	15	16
98th Percentile of Hourly Odour Concentrations 3 OUe/m^3 to <6 OUe/m^3	1	6
98th Percentile of Hourly Odour Concentrations >6 OUe/m^3	0	0
Maximum 98th Percentile of Hourly Odour Concentrations Predicted (OUe/m^3)	3.2	3.6

Assuming that aviation fuel may be considered moderately offensive by some receptors, one sensitive receptor is predicted to experience an odour concentration of >3 OUe/m^3 in the 2029 Permitted Operation. Six sensitive receptors are predicted to experience an odour concentration of >3 OUe/m^3 in the 2029 Proposed Operation when applying a factor of 110 OUe/mgHC. 15 receptors with the Permitted Operation, and 16 receptors with the Proposed Operation are predicted to experience an odour concentration between 1.5 OUe/mgHC and 3 OUe/mgHC. The maximum odour concentration at a residential property with the Proposed Order is 3.6 OUe/m^3, which is in exceedance of the 3 OUe/m criteria used to consider the effect of odour impacts, based on the precautionary 110 OUe/mgHC emission concentration.

Energy Centre Emissions Sensitivity Testing

For the assessment reported in Chapter 7 of the Environmental Impact Assessment Report, modelling of air quality impacts from energy centres has been undertaken using a meteorological year of 2025, to maintain consistency with the road traffic emissions assessment (see Appendix 7-1). Additional tests have been undertaken and are reported in this appendix to consider how interannual variation in meteorological conditions can affect the potential long-term and short-term NO_2 contributions from the energy centre emissions. The annual mean NO_2 has been modelled for meteorological years 2019 to 2023 from the same meteorological station used in the assessment for 2025, as described in Chapter 7.

The sensitivity test also considers the short-term NO_2 contribution of the energy centre emissions against the hourly mean NO_2 National Air Quality Standard. In the assessment reported in Chapter 7, the short-term impact is considered by comparing annual mean concentrations against well-known proxy values that TII guidance suggests can indicate an exceedance of the short-term new EU Limit Values.

The results of the sensitivity test are presented in Table 4. They demonstrate that there is limited variation between the five meteorological years considered, for both long-term and short-term averaging periods. They also demonstrate the limited contribution of energy centre emissions to short-term concentrations of NO_2 for both Permitted Operation and Proposed Operation, accounting for less than 2% of the hourly mean air quality standard at the worst-affected receptor considered within the model.

Table 4: Interannual variation in Energy Centre NO_2 Contributions at worst affected receptor locations

Averaging Period	2019		2020		2021		2022		2023	
	Permitted Operation	Proposed Operation	Permitted Operation	Proposed Operation	Permitted Operation	Proposed Operation	Permitted Operation	Proposed Operation	Permitted Operation	Proposed Operation
Maximum Energy Centre Contribution at any Receptor (µg/m^3)										
Long-term	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Short-term	2.8	3.1	2.9	3.2	2.9	3.2	2.9	3.2	2.9	3.2