Appendix 6.1

Dispersion Model Results

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Table A6.1.1 Release Inventory

Substance	Waste Incineration Directive 2000/76/EC Emission Limit (mg/Nm^3 except where stated)[1]		Measured Release Concentration[1,2] (mg/Nm^3 except where stated)	Release Rate (grams per second)			Release Rate (annual)	
	Half Hour Limit (peak)	24 Hour or Sampling Period Limit (average)		WID Limit (peak)	WID Limit (average)	Measured	WID Limit (average)	Measured
Particulate matter	30	10	0.9	1.67	0.56	0.050	18 T per year	1577 kg per year
Volatile Organic Compounds	20	10	0.8	1.11	0.56	0.044	18 T per year	1402 kg per year
Hydrogen chloride	60	10	0.9	3.3	0.56	0.050	18 T per year	1577 kg per year
Hydrogen fluoride	4	1	0.06	0.22	0.056	0.0033	1800 kg per year	105 kg per year
Sulphur dioxide	200	50	5.4	11.1	2.8	0.30	88 T per year	9461 kg per year
Oxides of nitrogen	400	200	78	22	11.1	4.3	350 T per year	137 T per year
Cadmium and thallium	None	0.05	0.0006	n/a	0.0028	0.000033	88 kg per year	1.05 kg per year
Mercury	None	0.05	0.0003	n/a	0.0028	0.000017	88 kg per year	0.53 kg per year
Lead/chromium/copper/ manganese/nickel/arsenic/ antimony/cobalt/vanadium	None	0.5	0.021	n/a	0.028	0.00117	880 kg per year	37 kg per year
Dioxins and furans	None	0.1 ngTEQ/Nm^3	0.0025 ngTEQ/Nm^3	n/a	5.6×10^{-9}	1.39×10^{-10}	0.18 g TEQ per year	0.00044 g TEQ per year
Carbon monoxide	100	50	15	5.6	2.8	0.83	88 T per year	26 T per year
Ammonia	None	None	10	n/a	n/a	0.56	n/a	18 T per year
Polycyclic Aromatic Hydrocarbons	None	None	0.00025	n/a	n/a	0.000014	n/a	0.44 kg per year

Note 1: Concentrations normalised to 11% oxygen, 273K, dry

Note 2: Concentration measured at the MVR Hamburg plant. These concentrations are considered likely to be achievable at the proposed Four Ashes facility, but should not be taken to be indicative of the Best Available Techniques (BAT) for this facility. Dispersion modelling was carried out using Waste Incineration Directive limits to ensure that the design would be satisfactory under any emissions limits which may be applied.

Table A6.1.2 Stack Details

Parameter	Value for Flue 1	Value for Flue 2	Value Used in Model to Represent Combined Flue	Unit
Value for inclined stack option				
Easting	392312	392312	392312	metres
Northing	308434	308434	308434	metres
Effective vertical velocity at actual conditions (8.5% oxygen, 9% moisture, 125^{o}C)	9.8	9.8	9.8	m/s
Value for vertical stack option				
Easting	392333	392333	392333	metres
Northing	308421	308421	308421	metres
Velocity at actual conditions (8.5% oxygen, 9% moisture, 125^{o}C)	10.3	10.3	10.3	m/s
Value for inclined stack and vertical stack options				
Stack discharge diameter	2.1	2.1	2.97	metres
Temperature	125	125	125	^{o}C
Volume flow (8.5% oxygen, dry, 0^{o}C)	80000	80000	160000	Nm^{3}/hour
Volume flow (11% oxygen, dry, 0^{o}C)	100000	100000	200000	Nm^{3}/hour
Volume flow (11% oxygen, dry, 0^{o}C)	27.8	27.8	55.6	Nm^{3}/sec
Moisture (by volume)	9%	9%	9%	
Moisture (by mass)	5.6%	5.6%	5.6%	
Volume flow at actual conditions (8.5% oxygen, 9% moisture, 125^{o}C)	128600	128600	257100	m^{3}/hour
Volume flow at actual conditions (8.5% oxygen, 9% moisture, 125^{o}C)	35.7	35.7	71.4	m^{3}/sec

Emissions of Metals

The Waste Incineration Directive sets an aggregate limit on a group of nine metals. Emissions of individual metals are well below the aggregate limit set for the group of nine metals. For the assessment of these metals, the proportion of each metal in the measured emissions of this group was estimated. The dispersion modelling study was then carried out by assuming that each metal was released at the aggregate emission concentration limit multiplied by the proportion of the metal in the measured group emissions. This is a conservative approach, because in practice, the aggregate measured emissions of the group of nine metals is much lower than the limit set in the Waste Incineration Directive.

Some of the nine metals were detected in emissions from the Hamburg facility. The levels of other metals in this group were so low that they were not detected in emissions from the Hamburg facility. The observed proportion of each metal in emissions from the process was evaluated by firstly adding the average concentration of the nine metals, where a value was reported. Secondly, for substances which were detected, the expected proportion was calculated by dividing the average measured concentration of that metal by the sum of the average measured concentrations. Thirdly, for substances which were not detected, the proportion was calculated by dividing the detection limit for that metal by the sum of the average measured concentrations added to the detection limit for that metal.

Table A6.1.3 Proportion of Metals Present in Emissions

Metal	Measured Emissions Concentration (µg/m^3)	Detection Limit for Non-detected Substances (µg/m^3)	Maximum Observed Proportion of Group
Antimony	0 (not detected)	<1	24%
Arsenic	0.7		22%
Lead	0.6		19%
Chromium (as VI)	0 (not detected)	<1	24%
Cobalt	0 (not detected)	<1	24%
Copper	0 (not detected)	<2	38%
Manganese	0.7	0.7	22%
Nickel	1.2	1.2	38%
Vanadium	0 (not detected)	<4	56%
Total	**3.2**		

Thus, for example, emissions of antimony were assumed to be present at 24% of the emission limit for the group of nine metals. Because a worst-case approach was adopted for each substance individually in this calculation, the assumed proportion of each metal present in emissions to air from the facility adds up to more than 100%.

Representation of Process Buildings

Table A6.1.4 Representation of Process Buildings

Parameter	Value	Units
Easting of centre point	392370	Metres
Northing of centre point	308339	Metres
Building length	158	Metres
Building width	91.4	Metres
Building height	42	Metres
Angle between building length and north	121	Degrees