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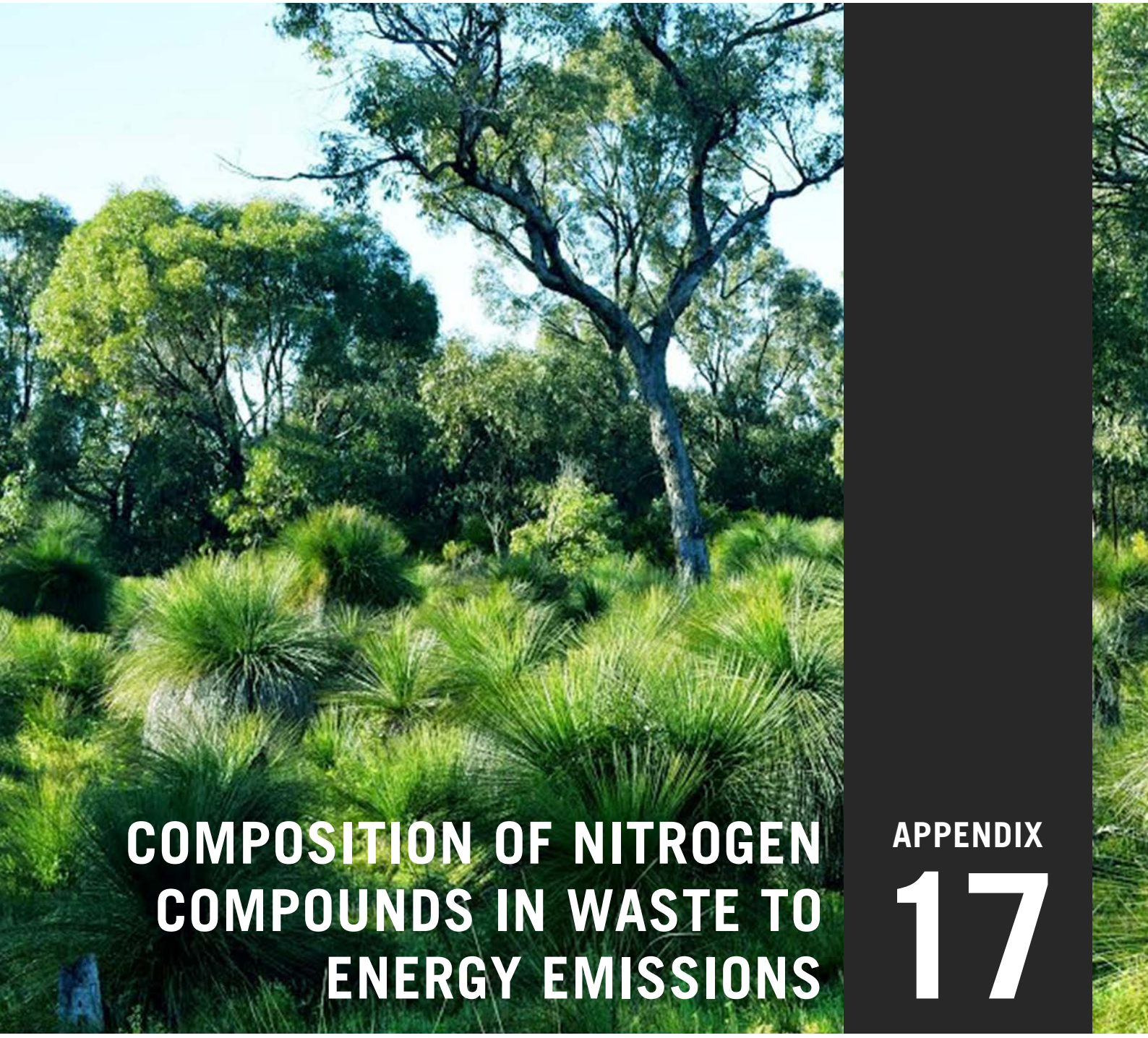

COMPOSITION OF NITROGEN COMPOUNDS IN WASTE TO ENERGY EMISSIONS

APPENDIX

17

APPENDIX 17: Composition of Nitrogen Compounds in Waste to Energy Emissions

Memo

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Composition of Nitrogen compounds in WtE-Emissions

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Background and Introduction

In all Waste-to-Energy plants, NOx emissions are limited. Common (EU) Emission Limit Value (ELV) is 200 mg/m^3_N @ 11% O_2 dry.
In many plants, NOx is measured as NO and calculated to NOx since NO_2 percentage is normally low.
NOx is often controlled by Ammonia water injection into the Post Combustion Chamber (SNCR process), so a certain Ammonia slip (not limited in EU-Regulation) occurs.
Furthermore, as a by-product of combustion or denitrification process, nitrous oxide may be released (not limited by EU regulation, but in focus since it is a strong greenhouse gas)

In one UK plant at two lines, all of the possible nitrogen components are measured continuously. The plant controls NOx by SNCR (Ammonia water injection) and other pollutions with a lime-based semi-dry FGT (presumption: no or only minor influence on nitrogen compounds).
The plant was commissioned 2013 and is in normal operation. CEMS data are available to HZI by daily data transfer called “Pamela”.

Results

Data from the year 2016 have been evaluated as daily average values. Days where the plant was out of service or in transition (start-up / stop mode) have been cut out. The number of evaluated days (plant in normal operation), the average value (= yearly average value), a calculated standard deviation as well as the minimum and maximum values are represented in the following table.

The values are given in ppm but are already referred to 11% O_2 dry.

UK plant Line 4								
		NO	NO_2	NOx	percentage NO_2		N_2O	NH_3
		ppm	ppm	ppm	%		ppm	ppm
number of values	(days)	343	343	343	343		343	343
Average	**(yearly)**	**93.8**	**0.8**	**94.6**	**0.9%**		2.2	2.6
Standard deviation		7.0	0.7	6.5	1.2%		0.6	0.9
Minimum value		49.1	0.1	56.4	0.1%		1.9	0.5
Maximum value		105.2	7.3	105.8	12.9%		11.0	5.8

UK plant Line 5								
		NO	NO_2	NOx	percentage NO_2		N_2O	NH_3
		ppm	ppm	ppm	%		ppm	ppm
number of values	(days)	342	342	342	342		342	342
Average	**(yearly)**	**97.3**	**0.5**	**97.9**	**0.6%**		1.7	4.1
Standard deviation		4.5	0.3	4.4	0.4%		0.3	2.5
Minimum value		56.6	0.0	58.4	0.0%		2.1	0.7
Maximum value		102.8	4.3	103.2	6.0%		5.7	15.0

Conclusion:

Percentage NO_2 of total NOx is less than 1%. It is useless to measure continuously NO_2 – better to put the set point of the NOx-controller 1% lower.

Nitrous oxide emissions are at low level, effort for continuous measurement is not justified.

Note that this data show – according to the table above – some daily NOx values exceeding the limit of 200 mg/m^3_N @ 11% O_2 dry (conversion factor ppm to mg/m^3 = 2.0525) – but according to EU regulation, NOx measurement has an uncertainty of 20%.
This 20% is deducted from the measured/calculated values (common practice in Europe), therefore all daily average values from both lines fulfil the legal requirements.