The odour impact of broiler chickens – comparison of the theoretical approach with field panel measurements according to EN16841-2

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Introduction

- Ordered by the Province of West-Flanders (Belgium)
- Odour impact study necessary (theoretica

- Based on emission factors
  - olfactometry
  - average values (no peaks into consideration)
- Broiler chickens
  - growth cycle
  - 6 or 7 weeks
  - significantly higher odour emissions

Introduction

- Theoretical approach
  - Very low odour impact
  - Mostly no odour problem
  - Permits very easily obtained

- Real life
  - Lots of complaints
  - Important odour impact (in function of growth cycle)

- **AIM**
  - Evaluate real odour impact
  - Based on sniffing measurements

Methodology

Experimental design

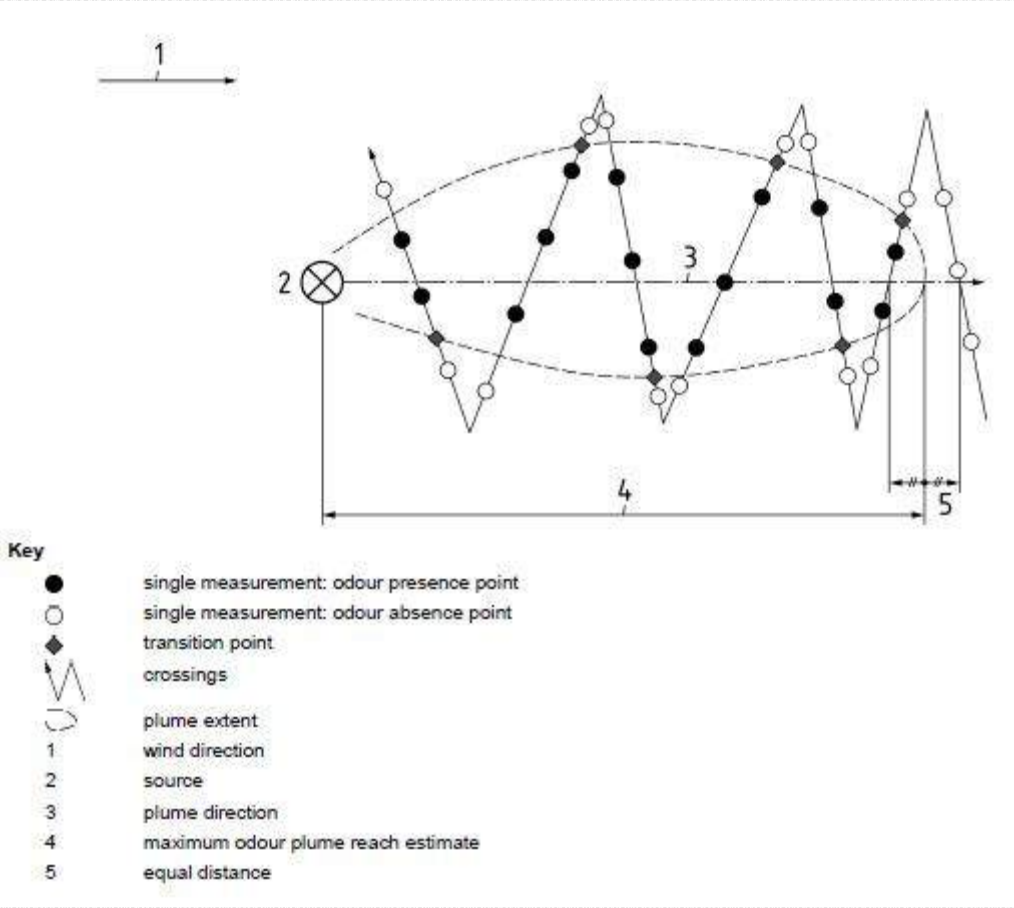
- 8 chicken farms
  - 4 “traditional” farms
  - 4 “low ammonia emitting” farms
    “*P-6.4 : heat exchanger*”
  - All-in/all-out
  - “free” location (no cross interference with other farms)

- 14 sniffing measurements / farm
  - In function of growth cycle
  - If possible, in function of season

Methodology

Sniffing measurements

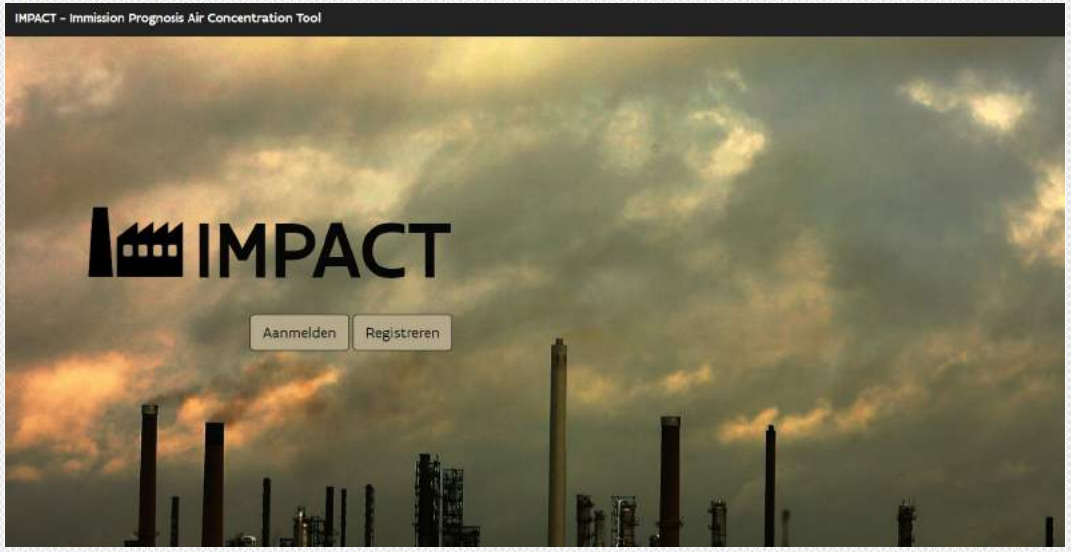
- Dynamic method
- Flemish code of Good Practice
- EN16481-2
- Two calibrated persons
- Meteorological conditions
  - Wind speed > 2 m/s and < 8 m/s
  - No rain / no fog
  - Variation wind direction < 20 °
  - Temperature > 0 °C



Methodology

Data processing and modelling

- Relevant source characteristics
  - Amount of animals
  - Ventilation rate / division
  - Temperature



- Flemish model IMPACT
  - Bi-gaussian dispersion formulas
  - Bultynck-Malet stability classes
  - Flat terrain
  - NO building downwash
  - Not the most performant model, but relationships between odour concentration and nuisance are established (dose-effect relationship)

Methodology

Data processing and modelling – 5 scenarii

1) Average emission factor – total data set

1) Average odour emission factor – discriminating stable type

1) Average odour emission factor – age (no distinction between stable type)

1) Average odour emission factor – distinction in age and stable type

1) Theoretical odour emission factor (i.e. 0.33 ou_E/s.animal)

Results

Average odour emission of each farm

id.	type	max. amount of animals	odour emission (su/s.animal)	ventilation rate (Nm^3/h.animal)
1	traditional	85 000	1.63	1.46
2	traditional	49 500	1.67	1.46
3	traditional	54 000	0.77	2.13
4	traditional	88 500	0.97	2.75
5	P-6.4	105 000	1.00	1.59
6	P-6.4	51 500	2.19	0.93
7	P-6.4	154 000	1.21	1.94
8	P-6.4	85 000	1.81	1.54

Centralised emission (dust)

Length ventilation

Theoretical value : 0.33 ou_E/s.animal !!!

Results

Emissions different scenarii

		odour emission factor (su/s.animal)	ventilation rate (Nm³/h.animal)
scenario 1		1.34 (1.22)	1.73 (1.84)
scenario 2			
traditional		1.22	2.01
P-6.4.		1.55 (1.34)	1.50 (1.69)
scenario 3			
	empty	0	0
	week 1	0.41 (0.43)	0.19 (0.19)
	week 2	0.61 (0.56)	0.76 (0.76)
	week 3	1.68 (1.52)	1.76 (1.81)
	week 4	2.16 (1.86)	2.81 (3.06)
	week 5	2.20 (1.97)	3.21 (3.33)
	week 6	2.33 (2.07)	3.34 (3.43)

		odour emission factor (su/s.animal)	ventilation rate (Nm³/h.animal)
scenario 4			
traditional			
	empty	0	0
	week 1	0.61	0.14
	week 2	0.56	0.84
	week 3	1.69	1.67
	week 4	2.40	3.85
	week 5	2.15	3.99
	week 6	1.15	3.43
P-6.4.			
	empty	0	0
	week 1	0.24 (0.26)	0.23 (0.24)
	week 2	0.71 (0.66)	0.76 (0.76)
	week 3	1.84 (1.54)	1.96 (2.12)
	week 4	2.07 (1.35)	2.21 (2.61)
	week 5	2.42 (1.91)	2.35 (2.41)
	week 6	4.06 (3.64)	3.20 (3.41)
scenario 5 (olfactometry)		0.33	2.40

Results

Reality check

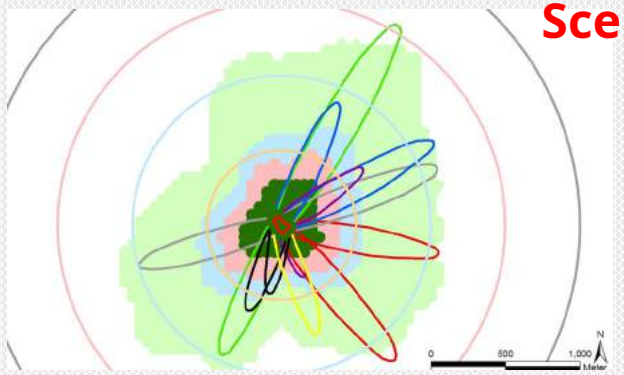
comparison individual plumes and 1 se/m^3-contour (as 98-P, long term impact modelling)

id.	amount of measurements	scenario 1	scenario 2	scenario 3	scenario 4	scenario 5
1	8	3	3	3	2	7
2	14	2	2	2	2	8
3	14	1	1	1	1	7
4	14	1	1	1	1	9
5	15	0	0	0	0	8
6	15	5	4	4	4	8
7	15	0	0	0	0	9
8	15	2	2	2	2	10

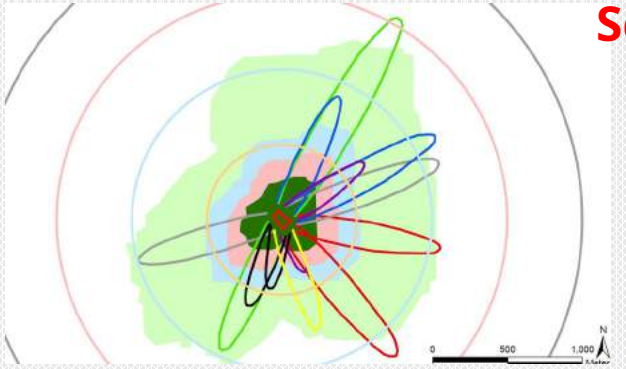
Results

Reality check – farm 4

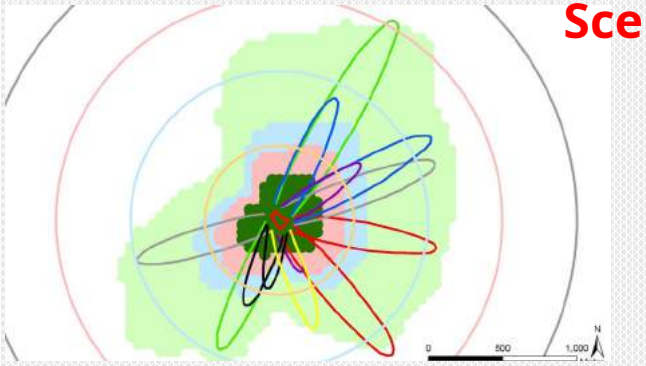
Scen 1



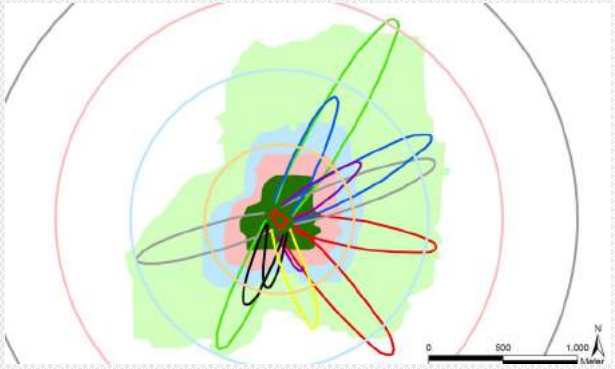
Scen 2



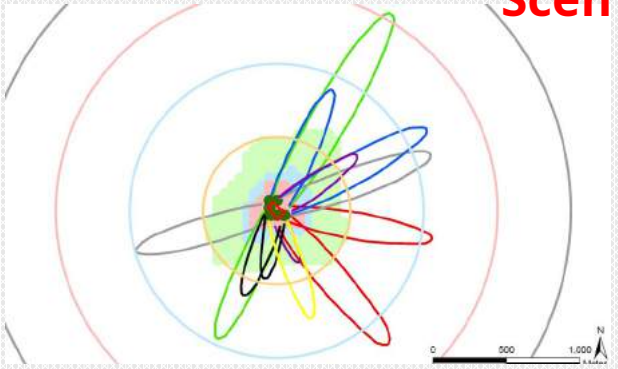
Scen 3



Scen 4

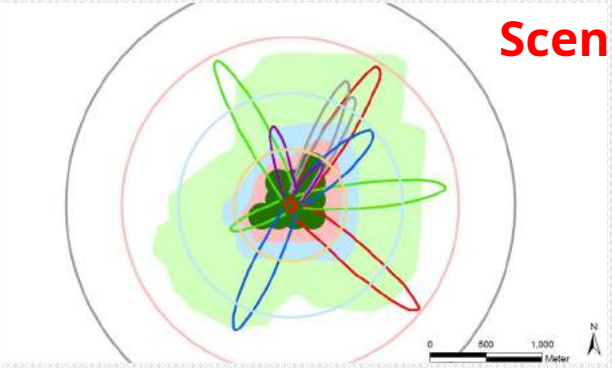


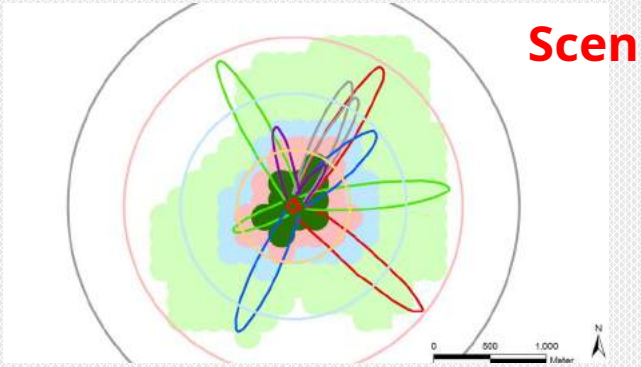
Scen 5

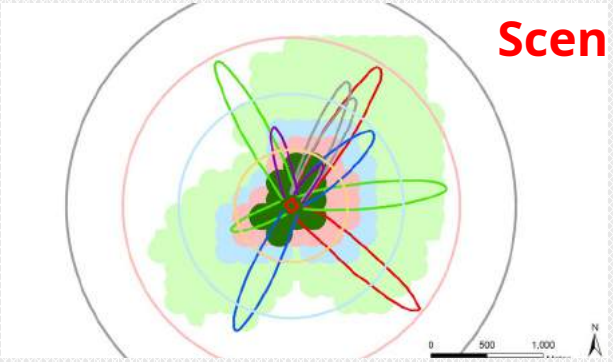


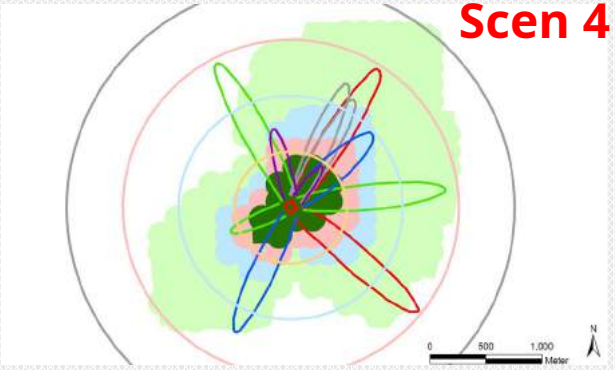
Results

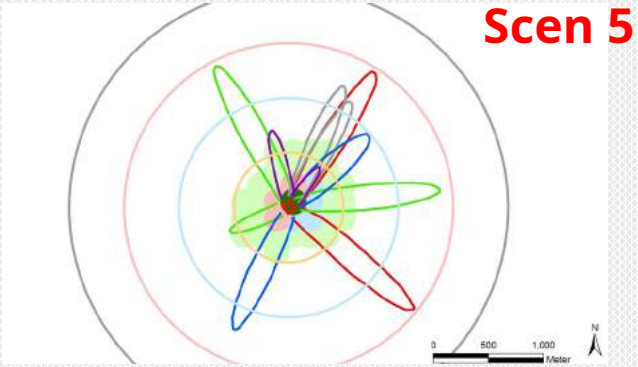
Reality check – farm 5











Conclusion

- Minor differences between the practical scenarii
- Theoretical approach ≠ practical evaluation
- Theoretical value major underestimation (factor 4)
- Meanwhile : politics decided to increase the theoretical value from 0.33 ou_E/s.animal to 0.57 ou_E/s.animal
  - Based on new olfactometric measurements
  - Still major underestimation

Questions?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