Oops, we got that wrong and that's not meant to happen

A cautionary tale

Background

- Long established process
- Several process buildings up to 12m high at ridge level
- Scattered residential receptors
- Process located on slope in river valley
- Regular odour complaints

Initial assessment using ADMS 3.2

- Proposed upgrading of abatement plant
- Stack height assessed mainly on basis of NO_x emissions, efflux 15m/s, 200°C
- Also considered residual odour assumed to be ~1,500 OU_E/m^3,
- Model included for terrain and building effects
- Predictions for range of stack heights
- Planning and visual constraints on stack height

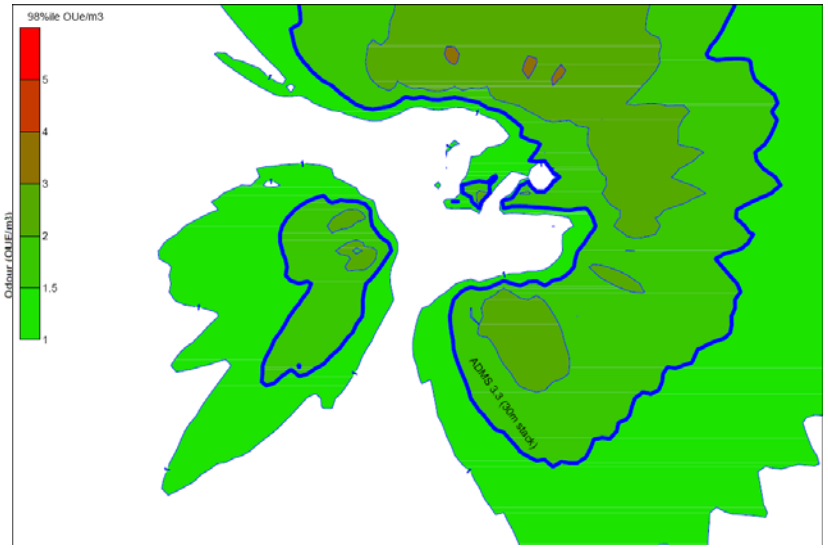
15m stack

Operational Impacts

- Substantial complaints
- Plumes now visible with plume grounding
- Operational measurement indicates emission concentrations ~8,000 OU_E/m^3
- Two stacks each with 105,000 OU_E/s

Revised assessment using ADMS 3.3

- Revised modelling with ADMS 3.3 using measured data
- Model includes for terrain and building effects
- Range of stack heights considered
- Planning and visual constraints on stack height
- Minimum 30m stack required to achieve <1.5 OU_E/m^3 98%ile



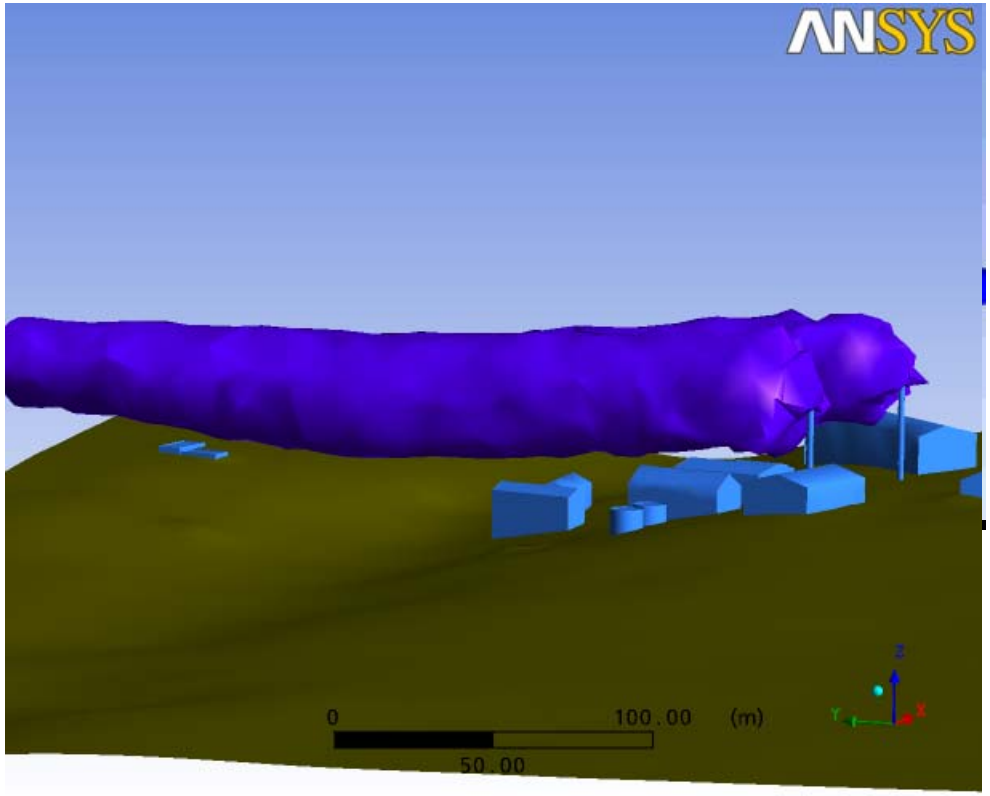
30m stack

Operational Impacts

- Stack heights increased to 30m
- partial entrainment on the leeward side of the building.
- Visible plume grounding remains issue
- Complaints unresolved
- Apparent discrepancy between observed and predicted plume behaviour
- CFD model used to consider problem

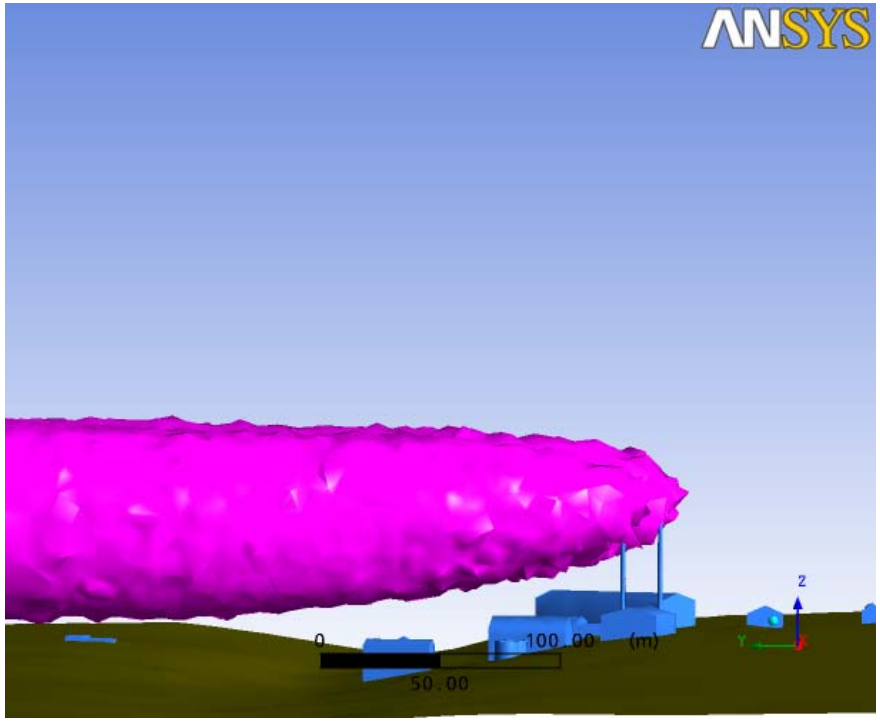
CFX

- Limited range of conditions considered
- Model provides better agreement with plume observations (than ADMS3)
- Predicts 6 OU_E/m^3 at receptor south of works
- Much higher results for receptor to north 20 OU_E/m^3



CFX

- Indicates stack height of 50m required to eliminate plume grounding



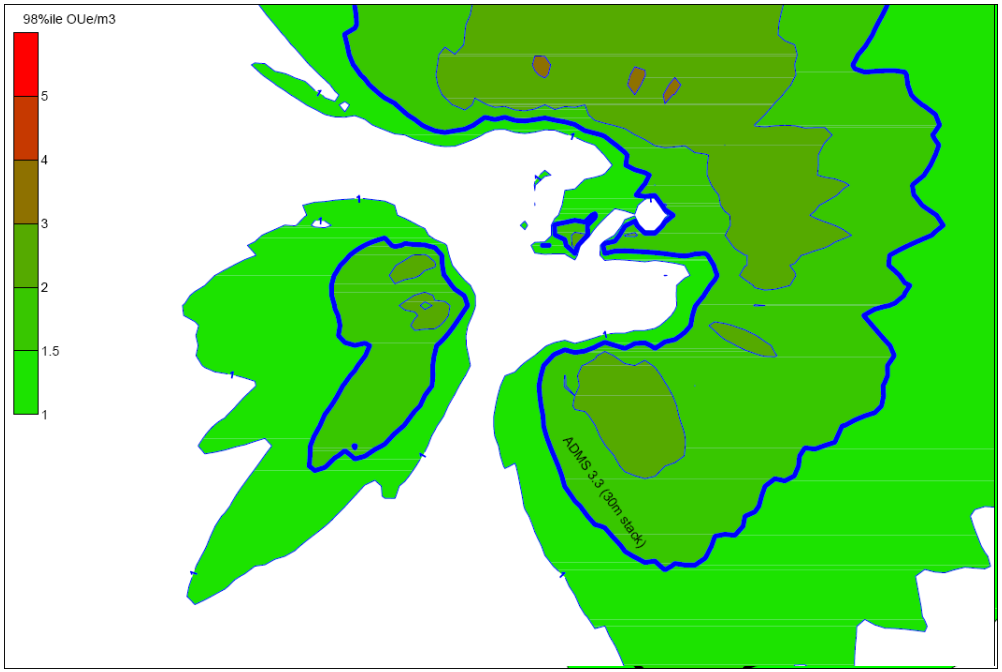
1.5 OU_E/m^3 isopleth

ADMS 4

- Significant change in predicted dispersion – at least for receptors south of works

Stack Height (m)	ADMS 3	ADMS 4
15	5	11
30	1	5

worst case OU_E/m^3 98%ile



30m stack

Model Comparison

- ADMS results give good agreement with CFX at receptors to south
- Significant difference between ADMS4 and CFX for receptors to north
- AERMOD appears to significantly under-predict

Model	R1 (south)	R2 (north)
AERMOD	<1	<1
CFX	6	20
ADMS 4	5	3

OU_E/m^3

Conclusions

- Don’t be too optimistic about abatement plant performance – and allow some model headroom
- ADMS 4 may be more robust than earlier versions. The main change seems to be building downwash effects.
- Combined effects of terrain and buildings may account for discrepancy between ADMS4 and CFX for R2 (to north)
- In cases where there are complex buildings it may be advisable to test worst case conditions using additional models, especially if combined with significant terrain effects.