Odour Assessment

uses and limitations

Odour Assessment

- Odorous processes
- Methods and Techniques
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- Case Study 2
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- Case Study 4
- Conclusions

Odorous Processes

- Animal rendering, fish meal, metal casting;
- WwTW and ETPs;
- Landfill, MSW transfer stations, MRFs;
- Plastics, paint spraying, road coating,
- Agriculture pig and poultry ILUs
- IVC and windrow composting, AD;
- Animals feeds;
- Hot food and food processing.

Method

- by species e.g. ammonia, H_2S, xylene/toluene, mercaptan
- dynamic olfactometry - odour units
- In most cases, irrespective of method, environmental concentrations are too low to measure reliably at or beyond boundary fence.

Method

- In most cases irrespective of method, environmental concentrations are too low to measure reliably.
- In most cases it is therefore necessary to rely on emission estimates at source and rely on a dispersion model to predict odour concentrations at nearest receptors.

Measurement Techniques

- Odour units appropriate for most complex organic odours, but are grab sample ‘snap shots’, don’t always allow for process variability and are relatively costly. May require numerous samples to improve accuracy.

- Use proxy measurements . Advantages: allows continuous measurement of process variation. Limitation is that proxy species may only be 1/10th of total odour.

Source Types

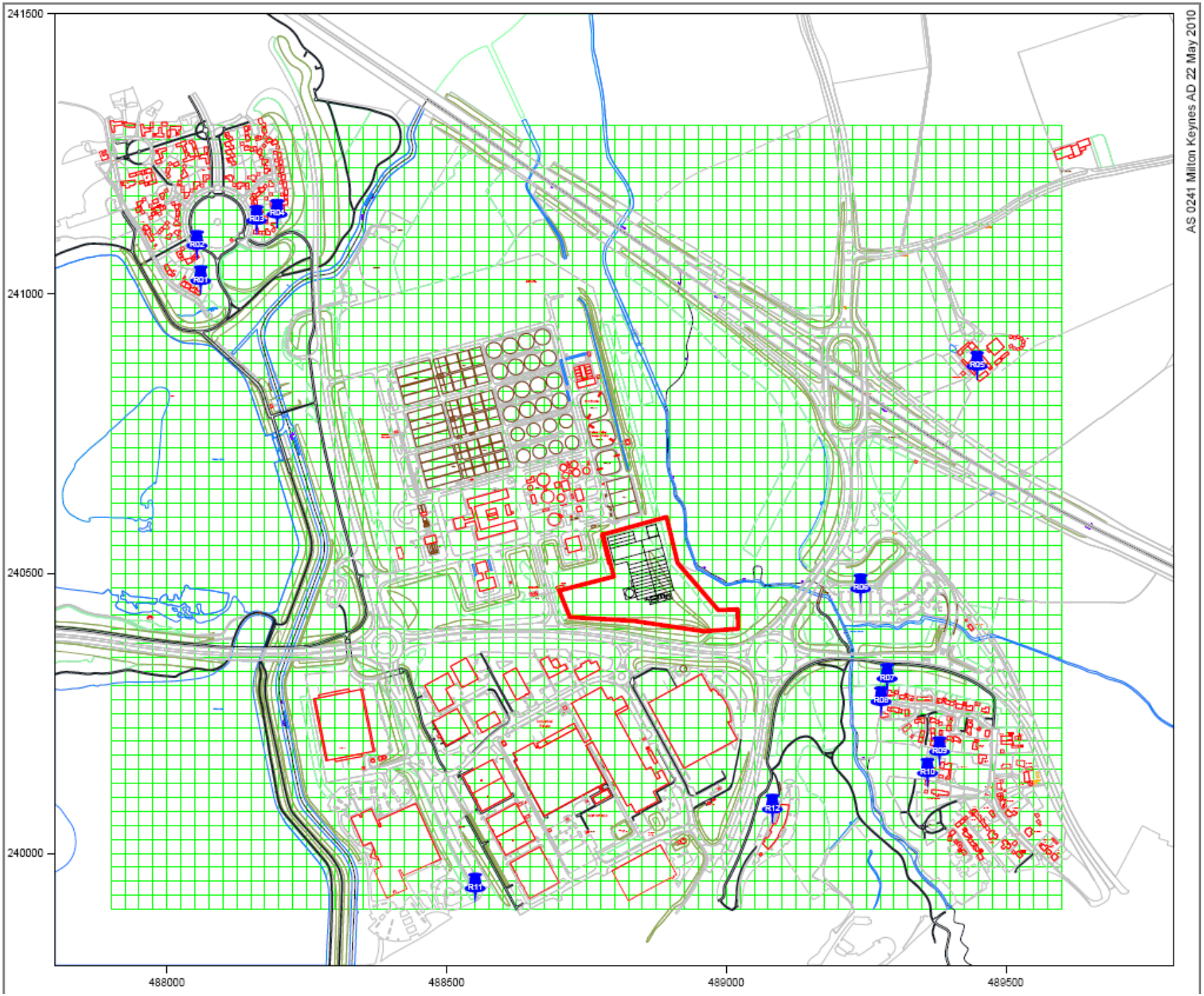
- Stacks and ducts
- Bio-filter bed surface
- Open tank
- Fugitive emission from open doors, stockpiles, landfill surface
- Tipping, excavation, turning

Difficulties in source quantification

- Measurement from stacks usually most robust, but need to take account of process variation, (start up-shutdown, batch processes etc.), measurement and sampling uncertainties;
- Condition and performance of OCU may also vary;
- Process loads through ETP typically vary diurnally;
- Biogenic variation – summer / winter may vary by factor of >10;
- ILUs – consider stage of flock;
- Short-term emissions, weekends etc.
- Major uncertainties may exist for fugitive emissions.

Case Study 1 - AD

- 35,000 tpa MSW kitchen waste
- Baseline odour – next to WwTW - No capacity in receiving environment
- Initial design proposed open bio-filter
- Propose design criterion - insignificance
- Residual odour 2,500 OU_E/m^3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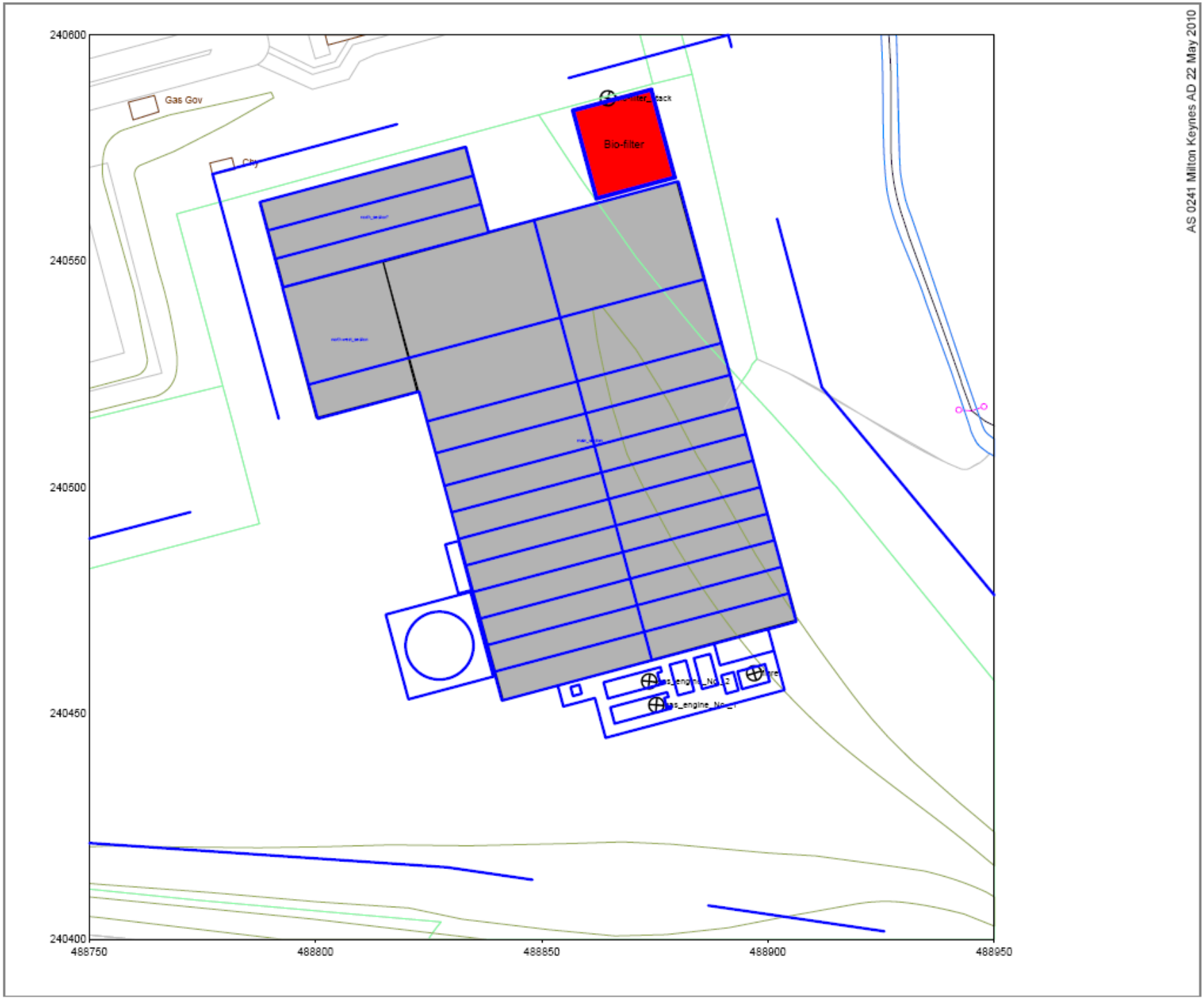
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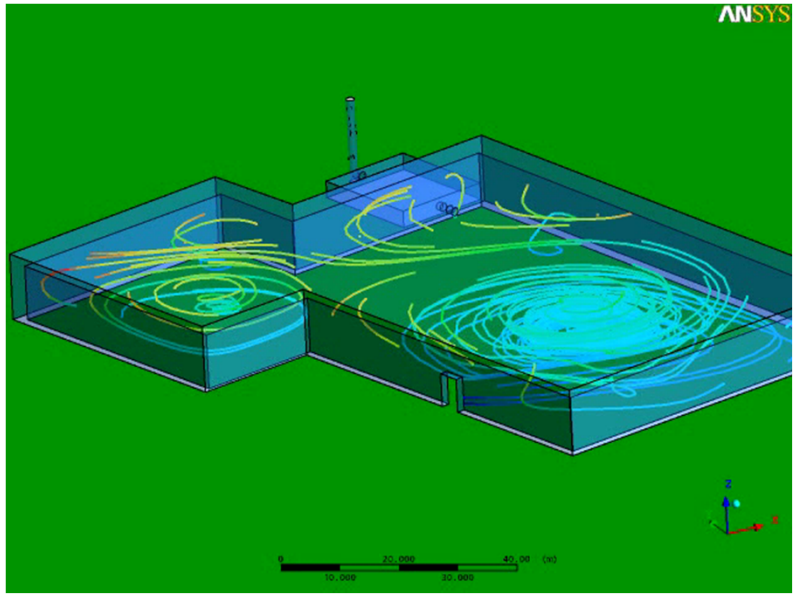
Case Study 1 – AD - Conclusions

- Final design based on medium odour abatement 2,500 OU_E/m^3 and covered bio-filter;
- 25m stack to reduce entrainment.
- Enclosed, contained process.
- Does not rely on high cost solutions.
- Can be effectively controlled by planning/PPC permit condition.

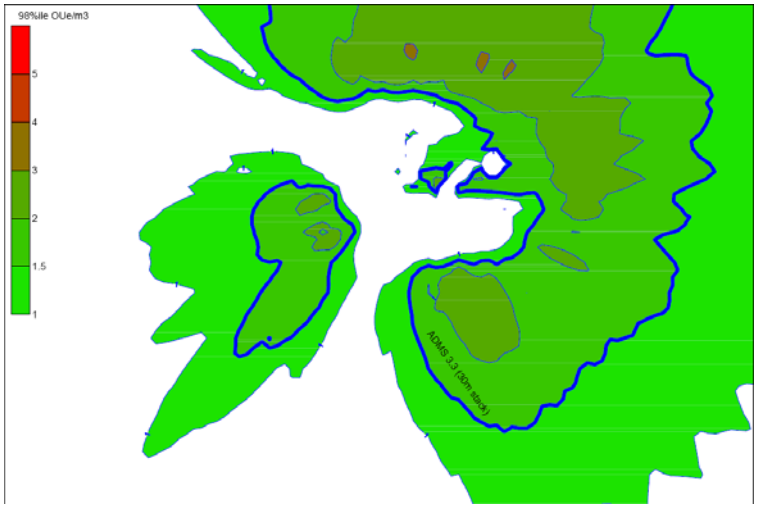


Case Study 2- Animal Rendering

- Existing process with proposed upgrade
- Initial source estimates for new thermal oxidiser assumed to be 1,500 $OU_E/m^{3,}$, based on supplier estimates
- Existing process buildings 12m to ridge.
- Odour predicted using ADMS and AERMOD
- 15m stack predicted to ensure odour < 1.5 OU_E/m^3 1 hour 98%ile at nearest receptor.

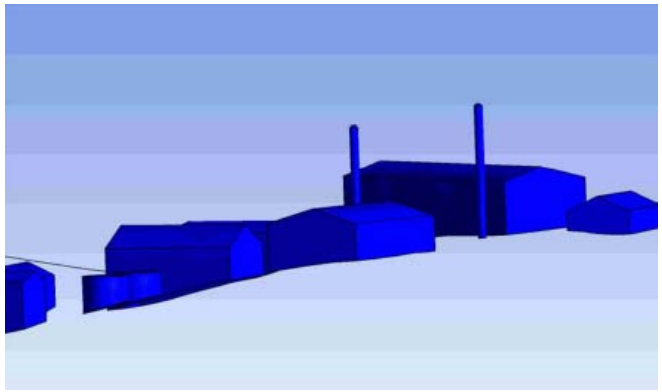
Case Study 2- Animal Rendering

- Supplier estimates were way too optimistic!
- Once built emissions were measured as ~8,000 OU_E/m^3
- Stacks were increased to height of 30m, based on results from ADMS.



Case Study 2- Animal Rendering

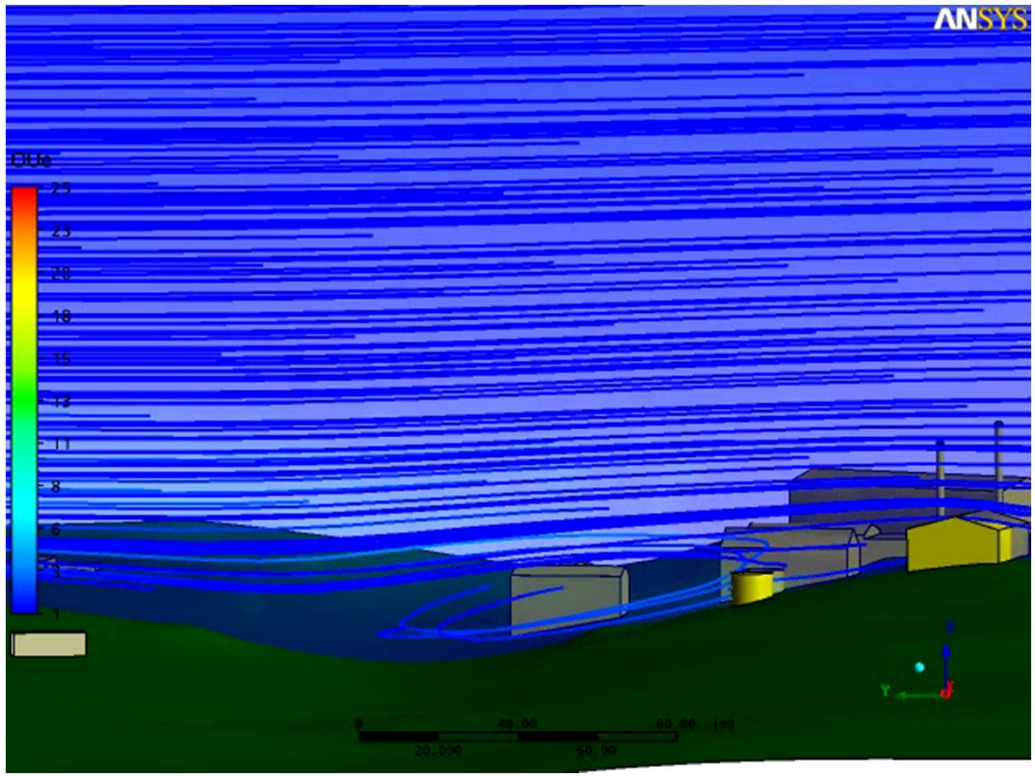
- That did not solve the problem. I seemed that both ADMS and AERMOD significantly underestimated dispersion, particularly for receptors to north suggesting use of alternative model.



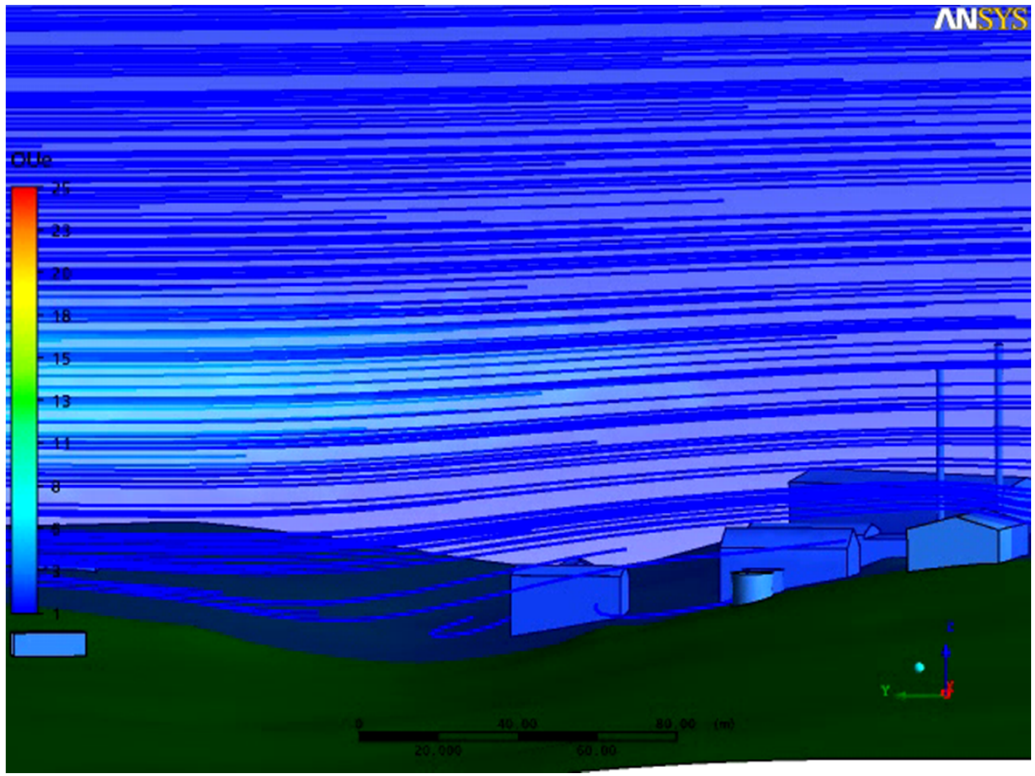
Model	R1 (south)	R2 (north)
AERMOD	<1	<1
CFX	6	20
AMDS 4	5	3

Units = OU_E/m^3 1 hour

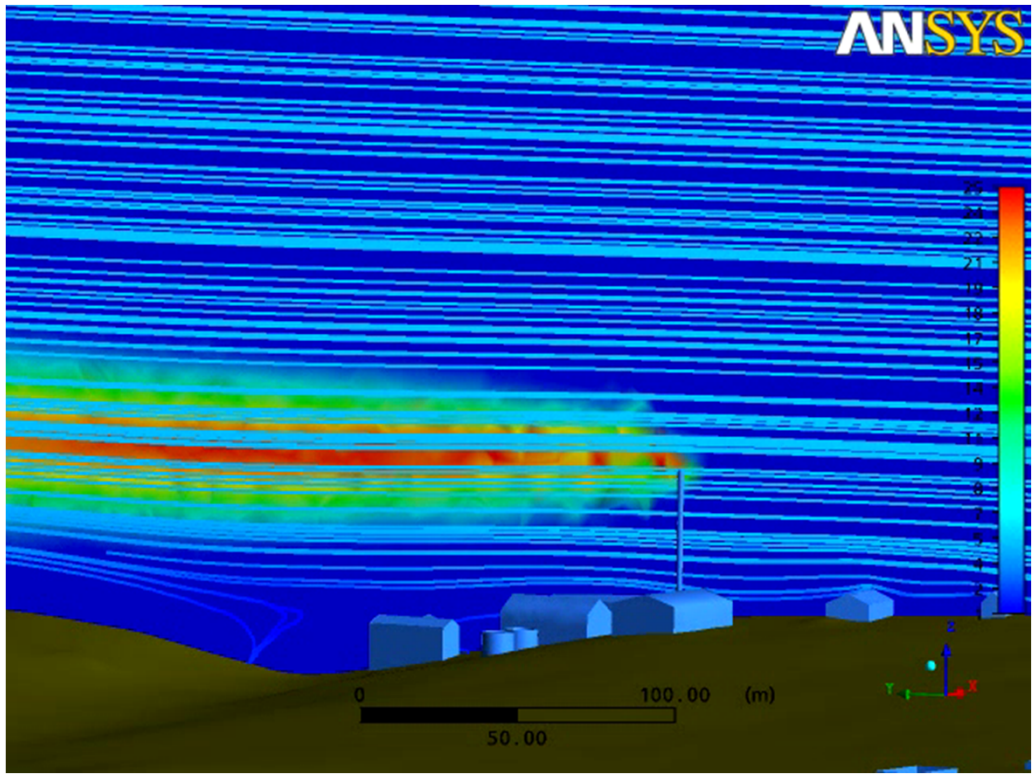
Dispersion from 30m stacks



Dispersion from 50m stacks



Dispersion from 50m stacks



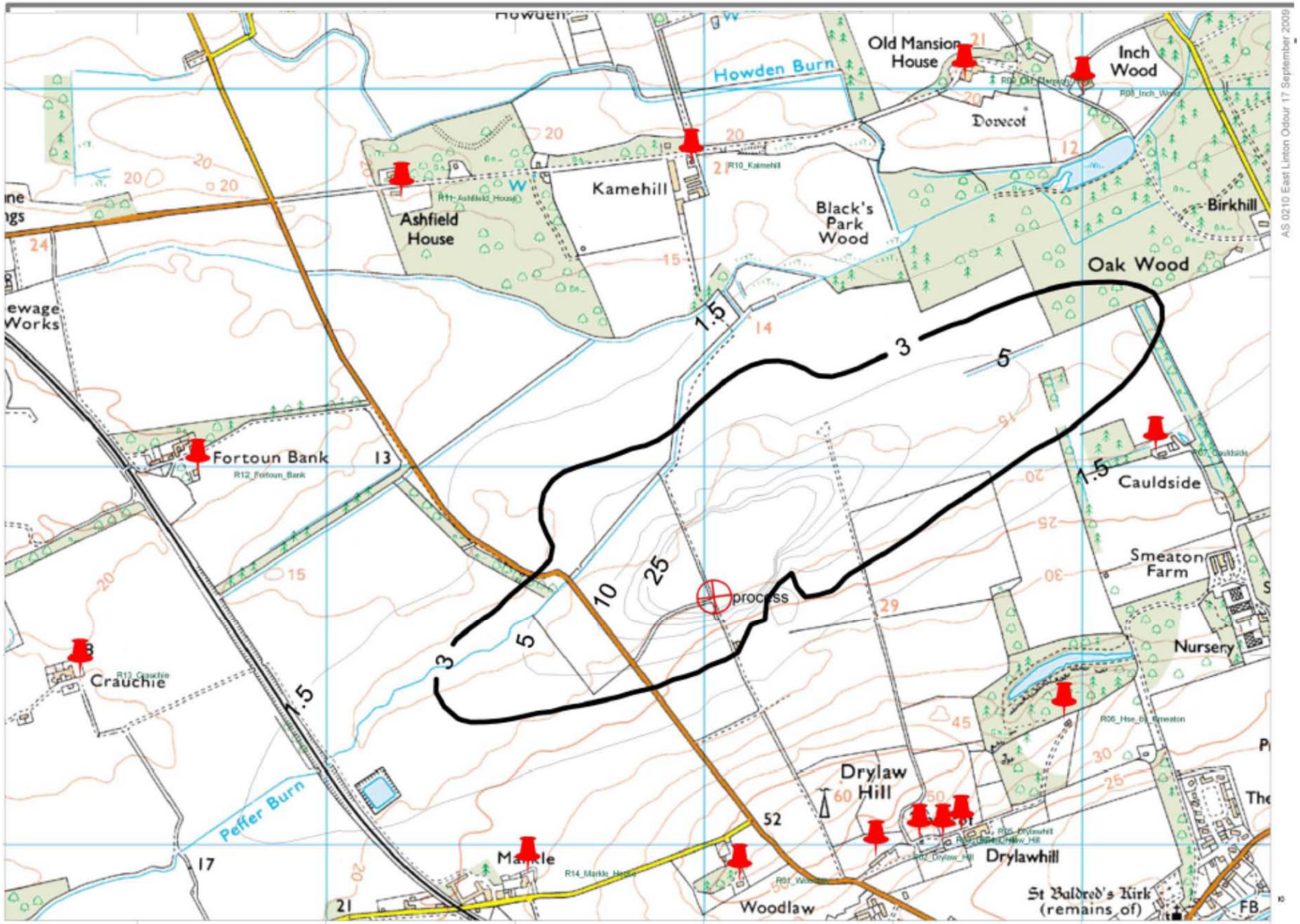
Case Study 2 – Conclusions

- Don’t be too optimistic about abatement plant performance –
- Allow some model headroom
- Combined effects of terrain and buildings may account for discrepancy between ADMS/AERMOD and CFD model
- 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.

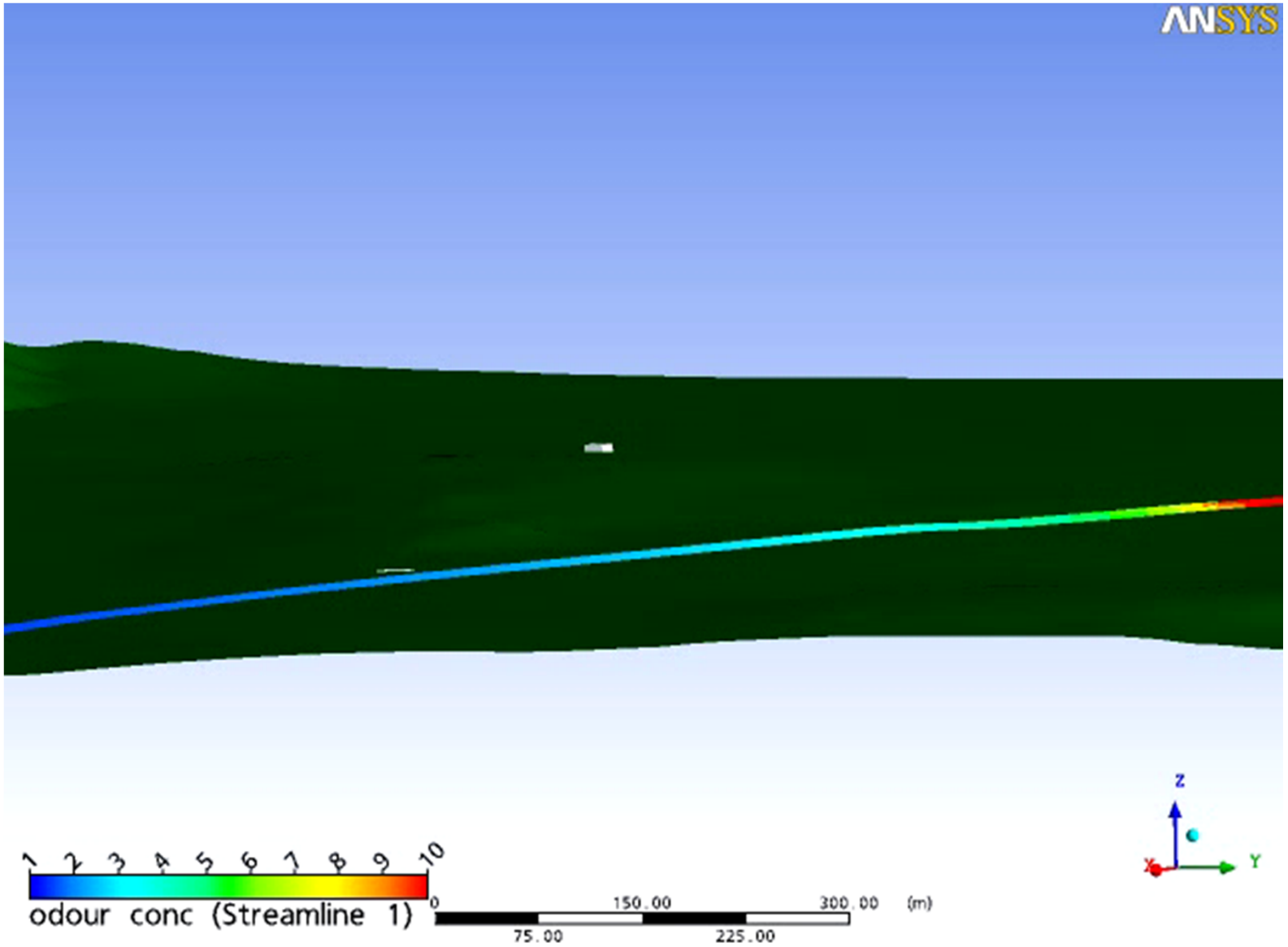
Case Study 3 – Garden Compost

- Existing small scale process with application for increased capacity from ~5,000 tpa to 20,000 tpa.
- Rural area with significant topographic effects.
- Odour emission estimates from windrows are indicative – estimates vary by > order of magnitude

Case Study 3 – Garden Compost



Case Study 3 – Garden Compost



Case Study 3 – Conclusions

- Odour Assessment (for this type of source) is indicative: – uncertainty in odour emission rates means that we can't be sure of extent of odour impact.
- Best approach is to use higher end emission estimates to minimise risk that assessment will underestimate impacts on amenity.
- Conservative approach can help identify capacity of the receiving environment: in this case by controlling the volume of material processed on site.
- Adopt cautious approach when relying on results from dispersion model that rely on critical model parameters e.g. terrain.

Case Study 4 – Landfill

- Existing MSW landfill in former sand and gravel quarry.
- Large area of capped completed land raise with unlined with basic engineering.
- Odour complaints from local residents (new build) near site boundary.
- Operator previously commissioned environmental monitoring at site boundary (at considerable expense) which was inconclusive.
- Odour on site clearly a problem: Large areas of uncovered waste; with large working areas.
- Odour sampling at source would require numerous samples at many different locations if quantitative approach to be adopted. The results would still be open to considerable uncertainty.

Case Study 4 – Landfill

- Existing grassed capped area free from fissures and no smell evident.
- Main odours from: temporary covered area and temporary capped areas. areas of daily cover and tipping of fresh waste less of an issue
- Quantifying odour from these surfaces could be sampled using a Lindwall box and analysis by dynamic olfactometry.
- Sampling and analytical methods expensive, time consuming and imprecise.
- The results from any sampling and subsequent dispersion modelling therefore subject to considerable uncertainty and may be inconclusive.
- Best solution to consider measures to reduce uncapped areas and amend working plan to reduce size of cells.

Conclusions

- Most robust source estimates are where both odour concentration and volume of release are known.
- Estimates for diffuse and fugitive releases subject to greater (and probably unknown) level of uncertainty.
- Dispersion models subject to uncertainty.
- Odour predictions can not be validated by direct measurement.

Conclusions

- Basis of current odour assessment criterion 1.5 OU_E/m^3 1 hour 98%ile is empirical standard.
- Most useful application for quantitative odour assessment is probably to help inform level of odour abatement for new process or to prioritise the strategy for odour mitigation at existing operation.
- Ultimately, the test is whether process or operation is causing offense or loss of amenity.