ODOURsim® Case Study

Aim

Develop a calibrated ODOURsim® model of a medium/large WwTW and derive 48hr profile and 98%ile yearly contour plots.

Introduction

ODOURsim® is an odour modelling software package that has been developed for accurately predicting odours from sewage works by determining the rate of generation at source. ODOURsim® can help produce far more accurate odour contour maps than current software and it is the only package to produce dynamic predictions demonstrating odour changes at different times of day. In addition, it can provide odour maps without expensive air quality determinations, using only the flow and quality of sewage and tank configurations.

Method

Wastewater sampling for TCOD, SCOD, Sulphide, pH, Temperature was carried out over a 48 hr period (2hrly composite samples).

Micrometeorological sampling (H_2S mapping using Jerome) was carried out over a 1 hour period on each of the wastewater sampling days.

Emission rates were back-fitted using the AERMOD model and H_2S mapping results.

An ODOURsim® 48hr input file was created from diurnal flow and load pattern sampling.

An ODOURsim® model of the site was built using process sizing information. The liquid-phase of the model was then calibrated to the measured wastewater characteristic trends over the first 24 hrs. The gas-phase of the model was calibrated to the emission rates derived from the first day of the micrometeorological study.

The ODOURsim® model was then run over the full 48hr period and a comparison of the emission rates from the identified sources with the second micrometeorological study carried out. This ensured validation of the model over the second 24hr period.

The results of the calibrated and validated 48hr ODOURsim® model run were used as inputs into the AERMOD model, and 48 1hour runs were performed to yield the emission contour plots for each hour of the 48hr period.

A wastewater input file was generated using the diurnal flow and load pattern and the 2004 wastewater influent flow.

The calibrated ODOURsim® model was then run for the 2004 period using the new wastewater input file.

The results from the ODOURsim® model were then inputted into the AERMOD model to yield the 98%ile contour plot for the 2004 period.

A similar AERMOD model was run using the AWS constant emission rates to yield the 98%ile contour plot for the 2004 period.

Results

Figures 1 and 2 below indicate the contour plots generated using AERMOD for the micrometeorological survey on the first day of sampling, and the plot for the calibrated emissions from ODOURsim®.



Figure 1 Micrometeorological Contour Plot Day1 (11:00)

The comparative fit between the measured H_2S concentrations (Jerome), and calibrated H_2S concentrations (ODOURsim® / AERMOD) is detailed in figure 3.



Figure 2 ODOURsim® Contour Plot Day 1 (11:00)

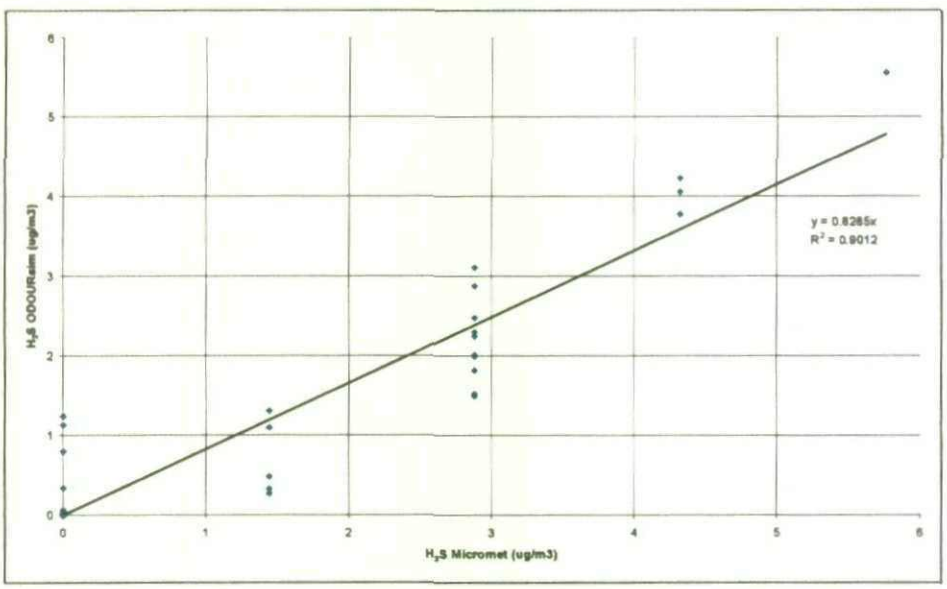


Figure 3 Micrometeorological vs ODOURsim® point values Day1

Figures 4 and 5 below indicate the contour plots generated using AERMOD for the micrometeorological survey on the second day of sampling, and the plot for the predicted emissions from ODOURsim®.



Figure 4 Micrometeorological Contour Plot Day2 (11:00)



Figure 5 ODOURsim® Contour Plot Day 2 (11:00)

The comparative fit between the measured H2S concentrations (Jerome), and predicted H2S concentrations (ODOURsim® / AERMOD) is detailed in figure 6.

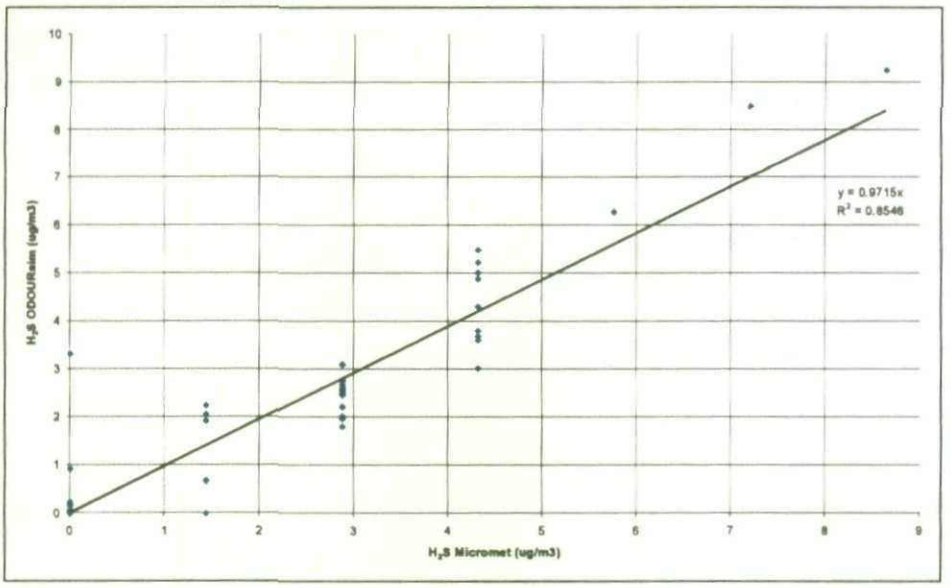


Figure 6 Micrometeorological vs ODOURsim® point values Day2

Figures 7 and 8 indicate the 98%ile contour plots for the calibrated and validated ODOURsim® model variable emission rates, and the constant AWS emission rates for the 2004 data period.

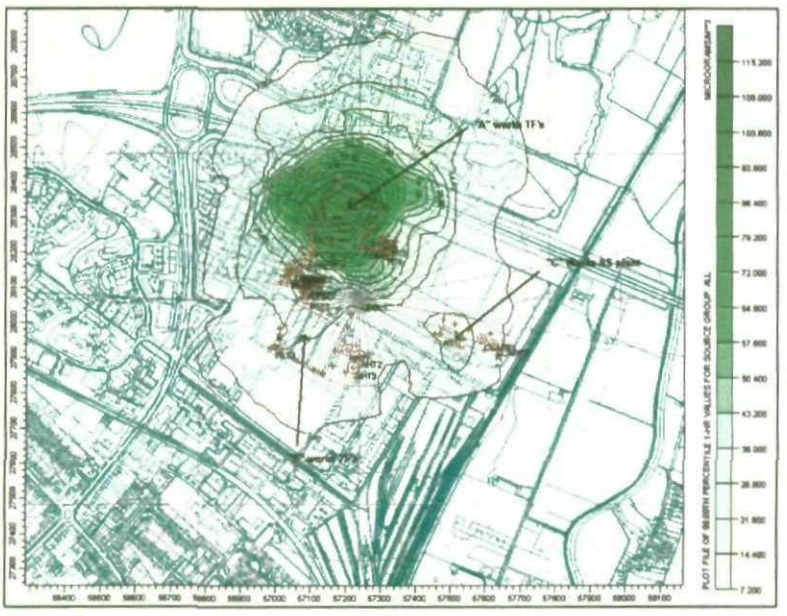


Figure 7 98%ile Contour Plot (2004) AWS constant emissions



Figure 8 ODOURsim® 98%ile Contour Plot (2004) variable emissions

Conclusions

A good fit between the calibrated ODOURsim® model and the micrometeorological measurements taken on site was observed. This indicates that the biological, chemical and physical equations used in the ODOURsim® model can accurately describe emissions from a WwTW for a given point in time.

The calibrated ODOURsim® model accurately predicted the emission rates for the identified sources for the validation measurements. This indicates that the biological, chemical and physical equations used in the ODOURsim® model, when calibrated, describe emissions from a WwTW over a period of time, with a good degree of confidence.

The comparison of the 98%ile contour plots for the constant emissions and the ODOURsim variable emission rates for 2004 indicate that the use of constant emission rates:

- Overestimates the odour impact from "A" works (north) filters.
- Overestimates the odour impact from "C" works (South East) AS plant.
- Underestimates the odour impact from Inlet and "B" works (south) filters.

The overall odour footprint for the works is greatly overestimated if constant emission rates are used.



Additional Information

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WATERINNOVATE
bringing innovation to market

Water Innovate Ltd. is run by a management team comprising John Catling (Executive Chairman), Dr Steve Callister (Managing Director) and Professor Tom Stephenson (Technical Director). Other key staff include Dr Pascal Harper (Product Manager, ODOURsim®), supported by six academic staff at the Cranfield University's School of Water Sciences – Professor Simon Judd, Dr Simon Parsons, Dr Bruce Jefferson, Dr Phil Longhurst, Dr Paul Jeffrey and Dr Elise Cartmell. For further details on Water Innovate please visit *www.waterinnovate.co.uk*

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