Assessment & Enhancement of Hydrocarbon Natural Attenuation using Biofilms

Karen Hampson, Simon Kelly & Brian Reid
School of Environmental Science
University of East Anglia, United Kingdom
K.Hampson@uea.ac.uk

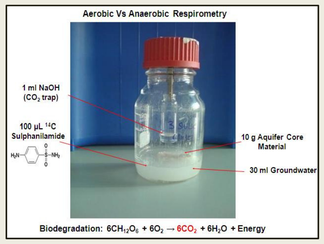
University of East Anglia

NATURAL ENVIRONMENT RESEARCH COUNCIL

Assessing Sulphanilamide Catabolic Activity in Boreholes at a Contaminated Site

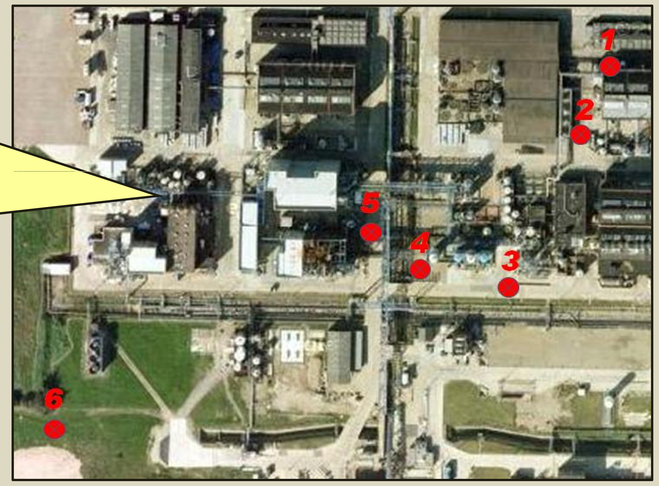
Six boreholes drilled to 18 m depth (*COMACCHIO MC305 Hollow Stem Auger Rig*)

1 m x 0.1 m core samples removed from 10 m depth and 2 L of groundwater collected



Aerobic & anaerobic flasks prepared and $^{14}CO_2$ recorded

Borehole	Contaminant Conc. (mg L^{-1})	Aerobic activity after 84d (%)	Anaerobic activity after 84d (%)	Water table (mbg)
1	263	54	40	7.8
2	171	9	15	7.8
3	3	11	28	5.8
4	3	43	41	5.8
5	3	48	46	6.5
6	0.3	16	19	4.7



Conclusions

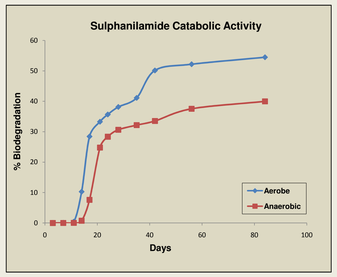
Significant levels of catabolic activity were observed in boreholes across the site

Some evidence that where sulphanilamide concentrations were higher catabolic activity was also higher

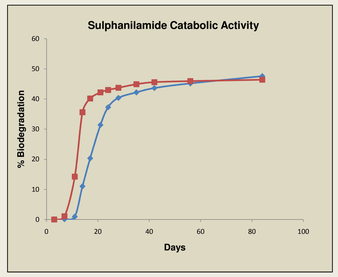
Difference in levels of catabolic activity under aerobic and anaerobic conditions only in high concentration borehole

But

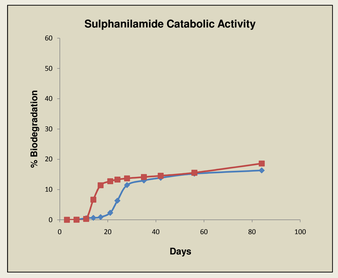
These measurements are obtained under laboratory conditions



Borehole 1
263 mg L^{-1} sulphanilamide in groundwater ~ 50% biodegraded



Borehole 5
3 mg L^{-1} sulphanilamide in groundwater ~ 45% biodegraded



Borehole 6
0.3 mg L^{-1} sulphanilamide in groundwater ~ 20% biodegraded

Development of In-Situ Sampler

1. Surrogate aquifer material

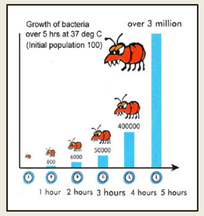
Expanded Perlite

Carbon Felt

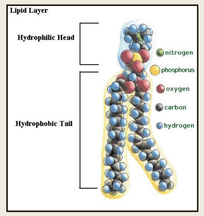
Pumice Stone

2. Material loaded with ^{13}C tracer & deployed in the field

3. Bio-film develops & ^{13}C assimilated into biomass



4. ^{13}C Lipid Extraction



Conclusions

Carbon felt & pumice appear most suitable

Issues outstanding

How much lipid mass is required for CSIA analysis

Will the in-situ data reflect the laboratory based microcosm data

5. Compound Specific Isotope Analysis
(Persuasive evidence of biodegradation if ^{13}C levels increase from ~1 ‰ (natural abundance) to ~ 10,000 ‰)