

## Introduction

Over the past decade there has been growing concern about the effects of dioxins, and other compounds that have dioxin-like properties, upon wildlife and human health. Sediments are the eventual sink for these compounds and subsequently they are a source of potential exposure of dioxins and dioxin-like compounds, to aquatic organisms. To establish the occurrence of these compounds in UK estuarine sediments, samples were collected and screened using the Dioxin Responsive-Chemically Activated Luciferase eXpression (DR-CALUX<sup>®</sup>) assay.

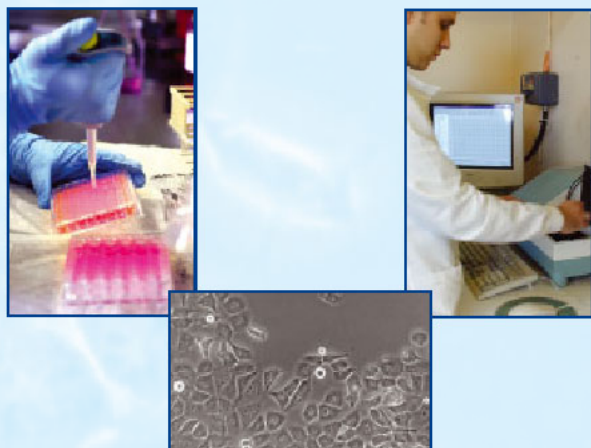


Figure 1: DR-CALUX cells and conducting the assay

## Approach

### The Biomonitoring Assay

The DR-CALUX<sup>®</sup> assay is a receptor-reporter gene assay (Figure 1). This assay measures the overall activity of compounds with a dioxin-like mode of action, as an alternative to prohibitively expensive high-resolution chemical analyses. The advantage of this approach is that it provides an overall integration of the potency of all dioxin-like compounds within the sample (Figure 2).

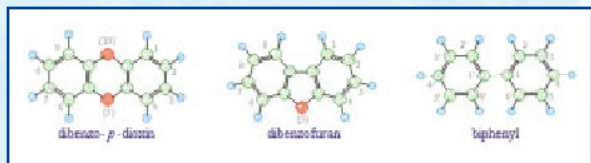


Figure 2: Some of the dioxin-like compounds detected by DR-CALUX<sup>®</sup> assay which are all coplanar and interact with the arylhydrocarbon Receptor (AHR)

### The Study

A spatial survey of 35 estuarine sediments from seven UK estuaries was performed. Sediment samples were extracted and then screened using the DR-CALUX<sup>®</sup> assay. The total extract was screened for all dioxin-like compounds present, and a cleaned-up extract was screened to detect only the most stable compounds. For some of the cleaned-up samples a comparison with targeted chemical analyses was conducted.

### Acknowledgements

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## Results and Discussion

The results of the DR-CALUX<sup>®</sup> biomonitoring are shown in Figure 3.

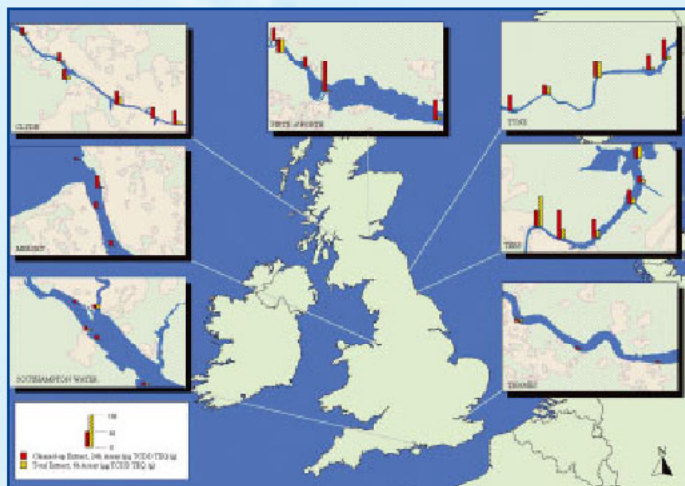


Figure 3: DR-CALUX\*TEQ mean values of extracts from sediments extracts from around the UK

Samples for the cleaned-up extracts ranged from 1pg TEQ bioassay g<sup>-1</sup> to 106pg TEQ bioassay g<sup>-1</sup>. The total extracts range from 0.03µg TEQ bioassay g<sup>-1</sup> to 100µg TEQ bioassay g<sup>-1</sup>.

The total values are around 6 orders of magnitude above the cleaned-up extracts. This is due to all dioxin-like compounds including metabolisable compounds (e.g. PAHs) being present within the total extracts.

A comparison of the targeted chemical analysis (HRGC-HRMS) of dioxins/furans and the DR-CALUX<sup>®</sup> assay is shown in Table 1.

Table 1: Comparison of sediment extracts analysed by DR-CALUX<sup>®</sup> and HRGC-HRMS (pg TCDDTEQ g<sup>-1</sup>)

Estuary site	TEQ bioassay	TEQ analytical	Unknown TEQs after accounting for dioxins/furans (% Unknown)
Tees 1	2	3.4	-1.4 (-70%)
Tees 2	73	18	55 (75%)
Forth 1	105	5	101 (95%)
Forth C	19	0.41	18.6 (98%)
Thames 1	1	0.67	0.33 (33%)

For four of the five samples for which the comparison was conducted there was some dioxin-like activity observed in the DR-CALUX<sup>®</sup> assay that was unaccounted for by dioxins/furans analysis. There are a number of other compounds that could be responsible for the unknown activity including the coplanar PCBs, brominated and fluorinated dioxins/furans, mixed halogenated dioxins/furans, polychlorinated naphthalenes (PCNs) and polychlorazobenzenes (PCABs).

## Conclusions

- The DR-CALUX<sup>®</sup> assay has been shown to be a useful tool in screening and assessing dioxin-like potency of sediments.
- DR-CALUX<sup>®</sup> provides a rapid and cost effective alternative to chemical analysis for regulatory or monitoring purposes.
- The full assessment of sediments would require further targeted chemical analysis, or bioassay-directed fractionation studies to fully identify the causative substances.