



EnviroMail No. 60 Update and re-release

July 2013

## Analysis of PBDE Flame Retardants to Meet NEPM Category A (Residential) Land Use.

### INTRODUCTION

Polybrominated diphenyl ethers (PBDEs) are both persistent and increasingly common in the environment. These chemicals are typically used as flame retardants in textiles, plastics and electronic products such as televisions and computer equipment. There are 209 possible PBDE congeners that vary in the degree of bromination from mono- to fully brominated decabromodiphenyl ether. The congeners can be classed as homologous groups, each grouping carrying the same number of bromine atoms.

Commercial mixtures used as flame retardants consist of mixtures of BDE congeners. Earlier products used consisted of congeners with between four and nine bromines (commercial PentaBDE and commercial OctaBDE) and a later product consisting, almost exclusively of Deca-bromodiphenyl ether. Deca BDE proves to be of concern because of the potential to de-brominate in the environment to one of the lower, more readily assimilated BDEs.

PBDEs can often find their way into food supplies, dust, soil and sediment. Similarities between PBDEs and polychlorinated biphenyl (PCB) compounds include their tendency to persist in the environment and to bio-accumulate in adipose tissues.

The main routes of human exposure to PBDEs appear to be ingestion of contaminated foods and inhalation of contaminated dust. Measurable levels of PBDEs have been found in fish, meats, dairy products, eggs, and vegetables. Higher levels of PBDEs are found more often in fish than in other food sources.

### METHOD INFORMATION

ALS METHOD CODE:  
EP064

INSTRUMENTATION:  
GC/MS

LIMITS OF REPORTING (Soils only):  
MonoBDE (Br1) to NonaBDE (Br9): 0.05 to 0.2 mg/kg,  
DecaBDE (Br10): 0.2 mg/kg  
\* Sum of PBDE (Br1 to Br9): 0.05 mg/kg  
\* Sum of PBDE (Br1 to Br10): 0.05 mg/kg

*\*Note: ALS adopts the lowest LOR of the contributing components as the LOR of the sum.*

METHOD REFERENCE:  
In-House/USEPA 1614

### NEPM AND PBDES

Given their persistence and tendency to bio-accumulate the Stockholm Convention on Persistent Organic Pollutants has expanded the list of Annex A chemicals (Elimination) to include constituents of the Penta-BDE and Octa-BDE commercial mixtures. In the absence of a comprehensive set of human health risk data, the 2013 NEPM revision has applied a similar guideline to PCBs. The new NEPM, Schedule B1, Table 1A(1) specifies a value of 1 mg/kg for "PBDE Flame Retardants (Br1 to Br9)" for Residential A land use.

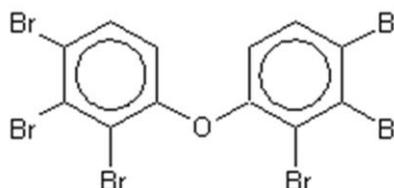
Typically, PBDE analysis focuses on a number of individual congeners at very low levels with samples extracted, cleaned up and analysed by gas chromatography high resolution mass spectrometry (HRGCMS). These analyses are in the same class as dioxin and PCB congener analysis with matching costs.

### ALS METHOD EP064 – PBDES BY CAPILLARY GC/MS

The routine analysis of PBDE compounds is challenging due to the high molecular weights and boiling points of the higher brominated congeners. This requires configuration of an instrument with a specialist column and running conditions (see figure 1 below) and where warranted a specialist sample clean-up is performed.

ALS has offered NATA accredited GCMS analysis for PBDE congeners for over a year. This analysis reports summed Br1 to Br9, Br1 to Br10 concentrations as well as aggregated concentrations for homologous congeners (Br1, Br2, Br3, etc).

Whilst the guideline does not specifically include DecaBDE, the reporting of the additional sum (Br1 to Br10) and individual homologue concentrations can aid in source characterisation of detected PBDEs and may benefit risk assessment where there is potential for degradation of DecaBDE to lower mass PBDE's.



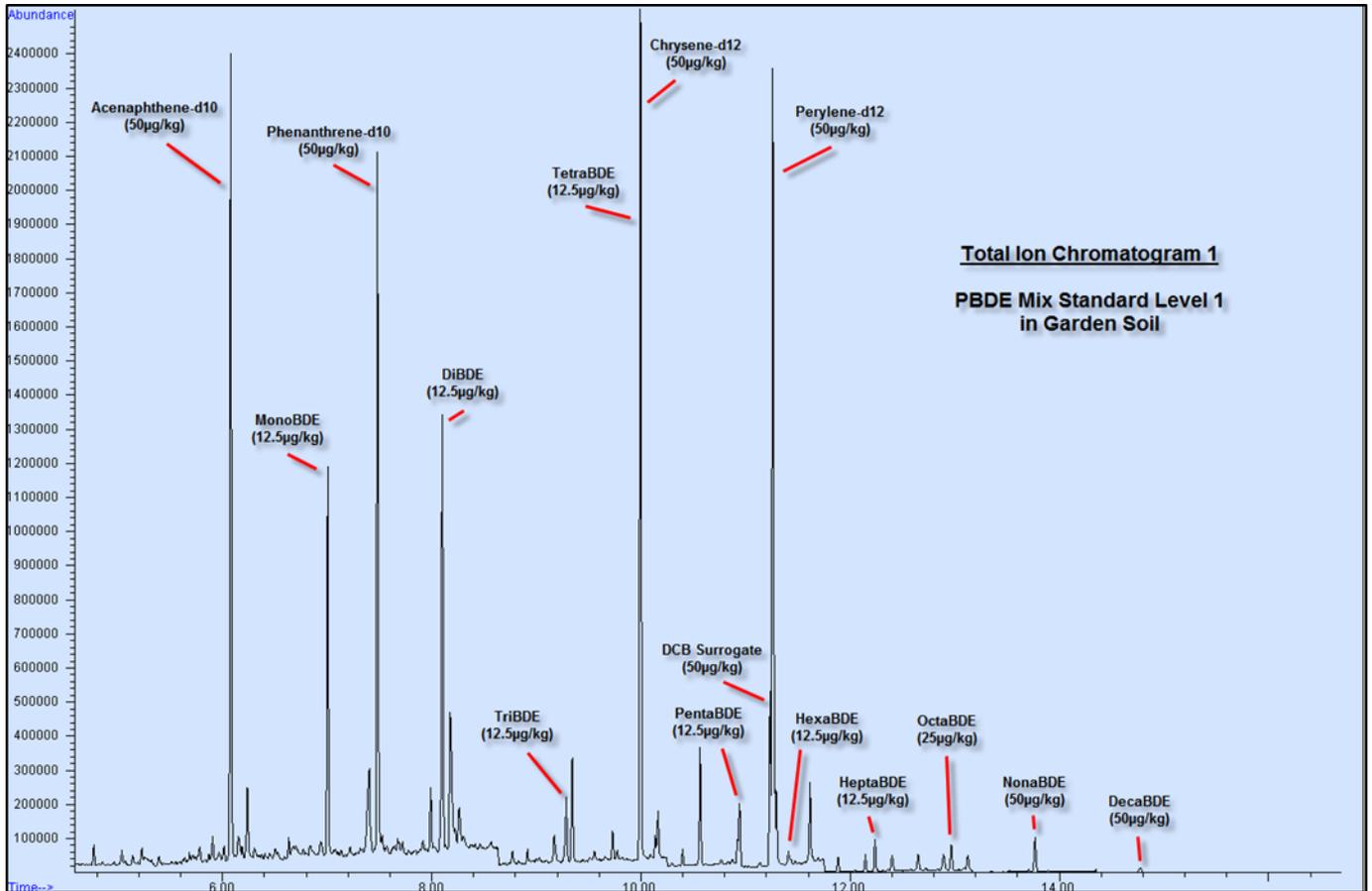
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## FIGURE 1:

Chromatogram of PBDE Congeners. The boiling points of the target congeners increase with increased bromination. Note that the more brominated the congeners are, the lower the proportion that volatilises and ends up on the analytical column. This is seen as reduced peak size for the heavier compounds relative to concentration.



## GENERAL SAMPLING REQUIREMENTS

The method requires no specialist sampling and preservation and utilises a sample collected in a standard soil jar used for routine analysis at ALS. Samples should be submitted preferably at <math>4^{\circ}\text{C}</math> and must be provided in a separate 150ml jar if submitted to a laboratory other than ALS Sydney.

ALS also provides trace level PBDE analysis in waters through international sister operations upon request.

## HOLDING TIMES

14 days (plus 40 days from extraction).

## REFERENCE

Risk Management Strategies for the Management of Polybrominated Diphenyl Ethers (PBDEs), Environment Canada, Chemicals Sectors Directorate Environmental Stewardship Branch, August 2010.

For further information please contact ALS Sydney, the Technical Manager or your local ALS team.

Brisbane, Sydney, Melbourne (Springvale), Perth, Newcastle, Roma, Darwin, Adelaide, Townsville, Mackay, Gladstone, Wollongong, Nowra, Mudgee  
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