

# LEVELS IN ABIOTIC COMPARTMENTS

## THE STATUS OF SEDIMENT SAMPLES FROM GUANABARA BAY RIO DE JANEIRO: A CONTINUOUS STUDY CONSIDERING PCDD/F AND PCB'S CONTAMINATION

Gabriela Kernick Carvalhaes<sup>1</sup>, Paul Brooks<sup>1</sup>, Guilherme Carneiro Azevedo<sup>1</sup>, José André Teixeira Azevedo<sup>1</sup>, Mauro Cesar Silva Machado<sup>1</sup> and Ruth Stringer<sup>2</sup>

<sup>1</sup>Analytical Solutions – Laboratory of Environmental Control, Rua Professor Saldanha, 115, Jardim Botânico, Rio de Janeiro, Brazil, 22461-220.

<sup>2</sup>Greenpeace Research laboratories, Department of Biological Sciences, University of Exeter, Exeter, UK.

### Introduction

The Guanabara Bay, Rio de Janeiro, has over 50 miles of shoreline and at least 12 major surface water inlets that introduce industrial and/or domestic waste. As part of a larger study to characterise the environmental condition of the waters and sediments within the Bay it is thought that a comprehensive evaluation of the condition of waters and sediments in the Bay and its many inputs would provide several benefits <sup>1</sup>. One effort has been the plantation of “mangue” trees to absorb part of the metals present in the water. Some boat industries, as well as a hospital and two research centers are located at the margins of the Guanabara Bay. These buildings, together with other polluted rivers opening into the Bay and the university itself may be, in part, responsible for the contamination of bay.

Sediment samples from the Guanabara Bay have been analysed for the presence of POPs according to modified US EPA methodologies. Thus, sample extracts were examined by gas chromatography-mass spectrometry (GC-HRMS) techniques for the PCBs and PCDD/Fs.

From the above it can be expected that the input of organic matter to the sediments of the Guanabara Bay derives from multiple sources, including natural bacterial, algae and higher plant matter, fossil fuels, domestic and industrial waste and untreated sewage.

This paper describes the identification and quantitation of sediment samples to polychlorinated dibenzodioxins and furans and PCB's..

### Methods and Materials

Sediment samples were collected from the Guanabara Bay at different locations (see Table 1) and extracted with methylene chloride and concentrated to 1 mL in a Kuderna Danish system.

For PCB determination, the extracts were eluted through a silica-sulphuric acid column, and the resulting extracts analysed by High Resolution mass Spectrometry. The PCDD/F content was determined in sediment samples, according to USEPA 8290 methods. Isotope dilution techniques were applied, and the samples were extracted in Soxhlet during 16 hours, followed by silica-acid column and finally florisil treatment. The final extract was also injected in a DB-5 MS column coupled to a Micromass Ultima which operated at 10,000 resolution.

**Table 1.** Description of samples collected from the Guanabara Bay, Rio de Janeiro, Brazil in August 2000.

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Sample number	Location	Coordinates
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1752E001	West (Rio São Joao de Meriti)	S	22°48.102'
		W	43°17.386'
1752E002	West (Rio Sarapui)	S	22°44.739'
		W	43°17.278'
1752E003	North-west (Rio Iguacu)	S	22°43.474'
		W	43°17.334'
1752E004	North	S	22°43.645'
		W	43°08.817'
1752E005	North-east	S	22°43.048'
		W	43°05.007'
1752E006	East	S	22°48.031'
		W	43°04.998'
1752E007	South east (near shipyards)	S	22°51.651'
		W	43°07.665'
1752E008	South west (near Snake Island Naval dockyard)	S	22°54.027'
		W	43°10.360'
1752E009	Central (east of Ilha do Governador)	S	22°48.536'
		W	43°10.281'
1752E010	West (near city center)	S	22°52.982'
		W	43°12.229'
1752E011	Central (south of Ilha do Governador)	S	22°50.001'
		W	43°12.785'
1752E012	West (near mouth of Rio Sao Joao de Meriti)	S	22°48.197'
		W	43°16.088'
1752E013	North west (near mouths of rivers in Sarapui)	S	22°46.021'
		W	43°12.602'
1752E014	North west (near mouth of Rio Iguacu)	S	22°44.906'
		W	43°14.333'

## Results and Discussion

In September 2001, in a preliminary study, PCDD/F were detected in three sediment samples ranging from 0.9 to 2.2 ng/g I-TEQ. PCDD/F and PCB levels are compatible to those reported in the preliminary report. The congener distribution for dioxins and furans is presented in figure-01.

The new investigation was performed using fourteen samples collected in August 2000 and these results are presented in Table 2, including PCB's levels.

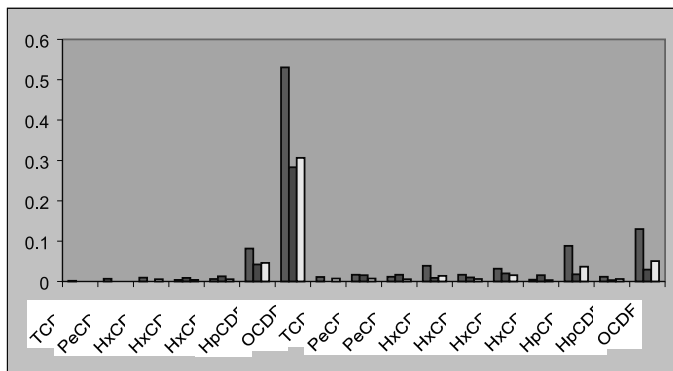
**Table 2.** The PCDD/F (ng/Kg) and PCB's (µg/Kg) total concentrations.

Analysis / Lab code	1752E001	1752E002	1752E003	1752E004	1752E005	1752E006	1752E007
PCDD/F	1436,980	842,140	30,130	70,800	12,400	31,210	181,870
PCB	1400,000	160,000	11,000	10,000	6,900	15,000	84,000
Analysis / Lab code	1752E008	1752E009	1752E010	1752E011	1752E012	1752E013	1752E014

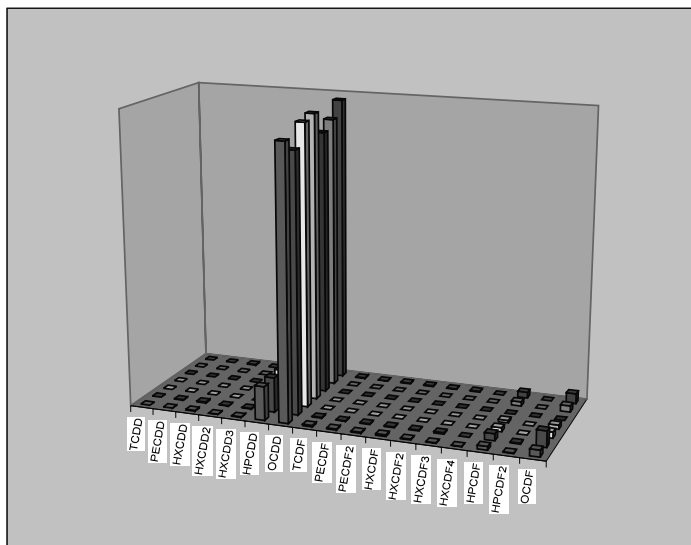
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PCDD/F	160,130	32,890	402,420	114,300	1555,940	81,300	317,410
PCB	130,000	30,000	70,000	28,000	420,000	20,000	72,000

The PCDD/F pattern found for the some of new sampling is presented in figure 2. All fourteen samples showed similar pattern as reported previously. This information can suggest that the source of PCDD/F contamination is independent from the location. Nevertheless, the amounts detected were quite different when different coordinates were considered.



**Figure 1.** PCDD/F congener distribution in sediment samples from preliminary study<sup>1</sup>.



**Figure 2.** PCDD/F congener distributions for sediment samples.

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## Conclusions

The second sampling of sediment samples from the Guanabara Bay showed similar results for PCDD/F and PCBs reported in previous studies. PCDD/F levels ranged from 12.4 to 1556 ng/kg while PCB levels ranged from 7.0 to 1400 µg/kg.

This sampling represents a wider area for a more complete study and can suggest that the same source of dioxin contamination can be expected for all Guanabara Bay area.

However, a more detailed study is needed considering industrial and domestic inputs, once several companies have their effluent being discharged in the Bay. Also, there are uncontrolled dumpsites very close to the shores and untreated sewage transferred directly to Guanabara Bay. Finally this study can show the importance of an environmental monitoring program involving significant areas.

## References

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3. Stringer, R.; Santillo, D.; Labunska, I. & Bridgen, K. - Pollution with organic tin compounds, organochlorines, hydrocarbons and metals in sediment samples from Guanabara Bay, Rio de Janeiro, Brazil, Greenpeace Technical note 22/00, 2000.