

# FORMATION AND SOURCES I -POSTER

## UNCONTROLLED DUMPSITES: A POTENTIAL PCDD/F SOURCE IN BRAZIL

Gabriela Kernick Carvalhaes , Paul Brooks , Carla Gama Marques ,  
Guilherme Carneiro Azevedo , José André Teixeira Azevedo , Mauro Cesar Silva Machado

Analytical Solutions – Laboratory of Environmental Control, R. Professor Saldanha 115 , Jardim Botânico , Rio de Janeiro , Brazil , 22461-220

### Introduction

Ribeirão Preto City, in the State of São Paulo, Brazil, is entirely dependent on the water stored in sands of the Botucatu Formation of the Paraná Basin. Despite this, a large dumpsite (sanitary landfill), now abandoned, was located near the city, in the recharge area of the aquifer. It is estimated that 600,000 tons of domestic, industrial and hospital refuses were dumped there in a large pit left by the exploitation of sands and clay<sup>1</sup>. The purpose of this investigation was to appraise environmental problems caused by the dumpsite and to propose solutions. Besides conventional hydrogeologic studies, physical and chemical parameters were determined using both low and high resolution GC/MS techniques in the leachate of each of the 18 monitoring wells and 10 water supply wells. This study concentrates on the results from the determination of polychlorinated dibenzodioxins and furans in the leachate samples using high resolution GC/MS.

During the operation of the dumpsite, several types of materials were dumped, such as tires, rubber residues , residues from metal and plastic industries, wood and medicaments ; resulting on a totally uncontrolled dump site. Because of the long period of its operation, the government decided to close this dumpsite. However, the high amount of material, the main problem, was finally reduced after burning the content of the pit. As expected, no control was applied to this operation and the mixture of different types of materials were burned in open air. At that time, no control or monitoring was made for the evaluation of the emissions and particulate material generated. Thus, this study is based on the analysis of concentrated leachate, obtained through monitoring wells.

The pit was excavated in low permeability Cenozoic sediments. However, the land had no geological isolation, consequently, the leachate formed was easily transferred to the soil and later to aquifers present 12 m below the surface. In some areas, the pit was deep enough to open a small "window" in the underlying sand formation, thus providing a preferential site for leachate percolation. The possibility of a gradient formation on the PCDD/F concentration was also evaluated for samples collected in the "window" area and the remaining ones.

The aquifer water was found contaminated by the leachate. It was concluded that the aquifer is being contaminated by the leachate, however, the danger to the city of Ribeirão Preto is extremely remote, since (1) the water is flowing in the opposite direction; (2) the leachate reaches the aquifer highly diluted by meteoric waters; and (3) the dilution increases in the aquifer by diffusion.

# FORMATION AND SOURCES I -POSTER

## Methods and Materials

Samples were taken from the monitoring wells, built in several places inside the total area of the dumpsite. Figure 1 shows the distribution of some of the wells, located in one of the pits used for garbage disposal.

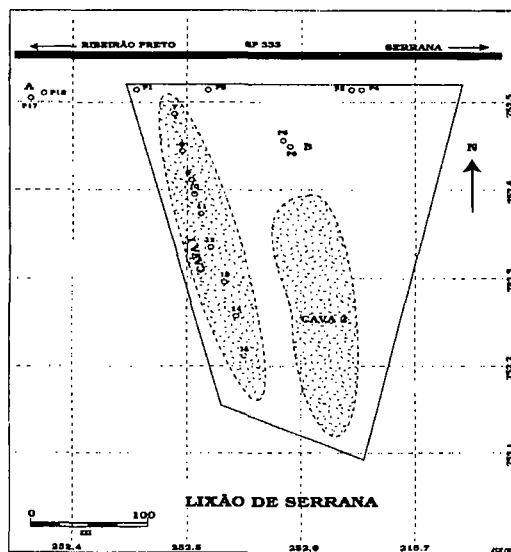


Figure 1. Some of the monitoring wells used for PCDD/F monitoring

All leachates samples were taken using a liquid steel sampler, capable of taking over two liters of material. Liquid samples were then transferred to clean glass bottles and stored at 4 °C. According to the geophysical data, wells numbered as 12 and 13 are located in the area where the pit is deep enough to reach the aquifer, suggesting that those areas should be evaluated in this study representing the "window" area. Also, samples taken from wells number 8 and 9 could be considered as reference levels to the original composition of the leachate.

Data obtained from the government show that the area related to wells number 14 and 15 were, during the final period of the dumpsite operation, only used for medicament disposal. Those two areas were also sampled for comparison.

Finally, samples were processed according to USEPA 8290 protocols. Basically, one liter of each of the leachates was spiked with all seventeen  $^{13}\text{C}$  PCDD/F congeners and liquid-liquid extracted using dichloromethane as solvent. The extract was concentrated in a Kuderna Danish apparatus and cleaned using a silica-sulphuric acid column. The final extract was the eluted in a florisil column, spiked with  $^{13}\text{C}$  1,2,3,4-TCDD as a recovery standard and injected in a Gas Chromatograph coupled with a High Resolution Mass Spectrometer Micromass Ultima at 10,000 resolution.

# FORMATION AND SOURCES I -POSTER

## Results and Discussion

All samples collected in the dumpsite area showed low PCDD/F contamination. The results show that the leachate formed from the dumpsite is contaminated with dioxins and furans. The origin of this contamination is probably not unique, once no control was applied during the operation of the site. It is known that several types of materials, including residues from industrial plants, such as plastic and pesticides packages were widely disposed. The disposal of some pesticides containing hazardous material, which use had no restrictions during the period of operation, contributed to the percolation of hazardous compounds, including PCDD/F into the soil and leachate. Also the use of open air burning as an efficient procedure for volume reduction represents a potential source for dioxins and furans formation. Once no control was applied to this operation, ashes were not separated or any other procedure was considered to separate the material generated during burning operations. The levels of PCDD/F in leachate samples obtained are shown at table 1. The low amount found in the samples can be a result from several years of percolation activities to the soil, once the leachate is not concentrated in a separate area, as normally used in sanitary landfills.

Table 1 – Results from PCDD/F contamination in leachate samples

Well #	Area	PCDD/F content (pg/L)
8	General disposal	2,5
9	General disposal	1,1
12	Window to aquifer	1,1
13	Window to aquifer	1,3
14	Medicament Disposal	1,9
15	Medicament Disposal	12

It is important to consider that this work did not study the possibility of PCDD/F formation during the open air burning of the residues. The only reason for this fact is because the operation period of the dumpsite studied was from 1978 to 1989. Unfortunately the disposal of domestic waste together with a minor part of industrial waste is still a common practice in some countries as Brazil. The lack of adequate structure for waste disposal in some municipal waste areas opens a very strong opportunity to the use of non conventional activities such as open air burning. Probably the application of similar studies in controlled landfills, where the leachate is far more concentrated or the evaluation of the emissions formed during open air burning of uncontrolled landfills would show alarming results, indicating a totally not considered PCDD/F source in Brazil.

## References

1. Carvalhaes, G.K. *et al* , Avaliação de Impacto Ambiental-Lixão de Serrana CT PETROBRAS 125/97 (1997)