# EVALUATION OF PCDD/DF PATTERN AND CONCENTRATION DATA IN SOILS IN THE VICINITY OF A HAZARDOUS SOIL INCINERATION FACILITY

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## Introduction

Recupere Sol Inc. (RSI) has operated a thermal treatment facility in St. Ambroise, QC Canada since 1996. An environmental monitoring program has been established to assist in determining the impact, if any, of the facility operations on the surrounding environment. Polychlorinated Dioxin and Dibenzofuran (PCDD/DF) data for soil samples obtained in 1999, 2000 and 2001 from sampling stations in the vicinity of the facility were analysed by visual comparison and statistical methods. There was no significant difference in PCDD/DF homolog patterns and concentrations (in I-TEQ) between the stations located on the North-South Axis compared to the East-West Axis. Since the wind is almost completely along the East-West axis this tends to indicate that the PCDD/DF observed were not from the RSI stack. Principal Component Analysis (PCA) was also used to aid in the analysis of the homolog pattern data.

This paper describes the procedures used for the analysis of PCDD/DF emissions and soil monitoring data and the results of the analysis

## Results and Discussion

The locations of the soil sampling locations around the RSI facility are shown in Figure 1. The 12 stations (4001-4012) are arranged 3 per arm along the major directional axes. The prevailing wind for this area is almost exclusively East-West and therefore any impact from the RSI stack would be expected to be seen in elevated concentrations along this axis. The concentrations observed in these soils were in the typical range of rural soils for Canada.

The mean PCDD/DF homolog profile for the RSI emissions is shown in Figure 2. The mean PCDD/DF homolog profile observed in the soils is shown in Figure 3.

Principal Component Analysis (PCA) is a statistical technique which is used by researchers to reduce a large number of variables to a smaller number[1]. The PCA technique has been applied to a number of environmental issues including PCB and PCDD/DF[2, 3]. The PCA technique has been used to investigate PCDD/DF homolog profiles in ambient air near incinerators at other locations [4, 5].

In this study, PCA was used to evaluate similarities and differences in the PCDD/DF homolog profiles for soil and emissions samples. The PCA plot for the homolog profiles from the 400m sampling locations (1999, 2000 and 2001) and the RSI mean emissions is shown in Figure 4. Figure 4 is interpreted as indicating that the homolog profiles for the 400 m sampling locations are all similar (cluster 1) and this profile differs significantly from RSI emissions profile (cluster 2). The similar profile for all locations indicates a common source (or sources) for the PCDD/DF. Thus, the PCA result DOES NOT SUPPORT a hypothesis that the RSI stack is the major contributor of PCDD/DF in these soil samples. However, while the data analysis does allow the RSI stack to be ruled out as a source, the ‘similar source’ of the PCDD/DF in the soil samples cannot be clearly identified with the present data.

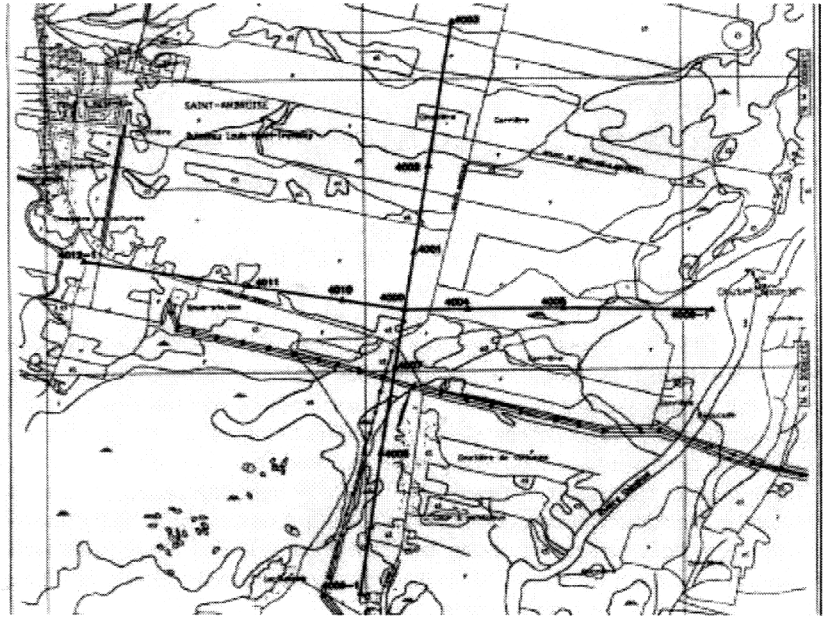

**Figure 1.** Environmental Monitoring Locations

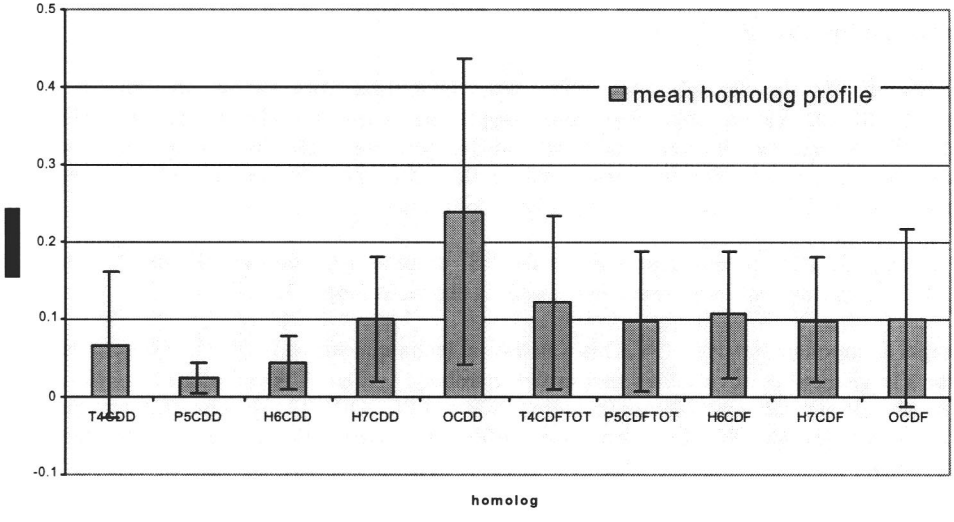


**Figure 2.** Mean PCDD/DF Ho molog Profile for RSI Emissions

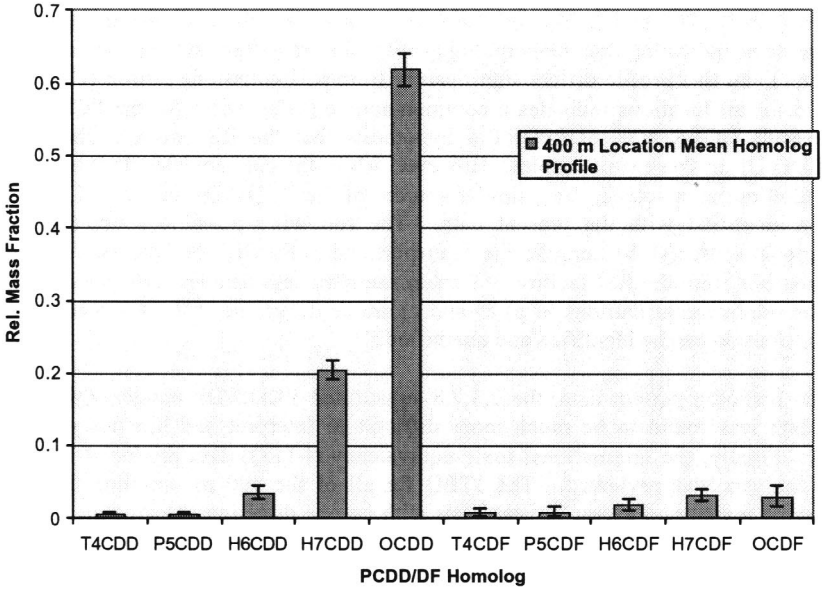


**Figure 3.** Mean PCDD/DF Homolog Profile for Soil at 400 m Monitoring Locations

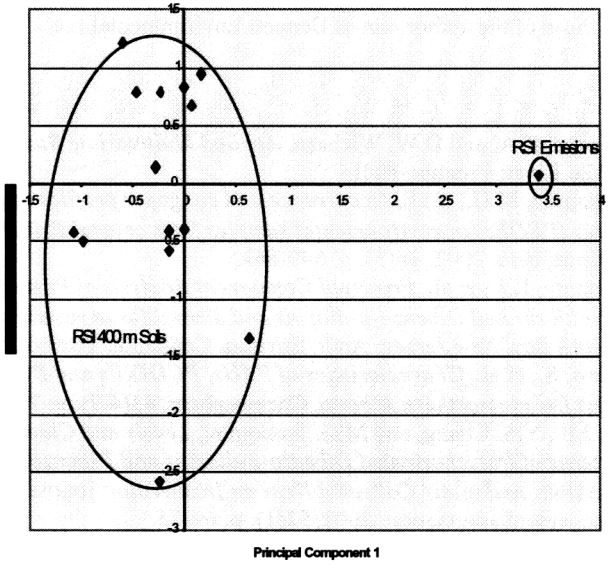


**Figure 4.** PCA Plot for PCDD/DF Homolog Profiles

The following possible source(s) were identified: a) Regional source(s), b) Long Range Transport and c) Fugitive or Process Vent (Soil handling area) emissions from the RSI facility. Further sampling and data analysis is required to determine what the relative contributions of a) b) and c) are or determine if there are additional sources whose contribution can be identified and quantified.

In addition to the homolog pattern data, the 2,3,7,8-substituted PCDD/DF congener data was reviewed. This data was found to be much more difficult to interpret and has not yet been subjected to PCA. Finally, the international toxic equivalency (I-TEQ) data produced from the 2,3,7,8-congener analysis was reviewed. The I-TEQ for all of the 400 m sampling locations fluctuated in the same manner on a year to year basis with no one direction showing an elevated concentration relative to another. This also supports the conclusion that the RSI stack is not the source.

**Disclaimer**

Although this work was performed under contract for Bennett Environmental Inc. the views and opinions are those of the author, not of Bennett Environmental Inc.

**References**

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