

AIR CONCENTRATIONS OF PCDD/Fs IN VICINITY OF MUNICIPAL WASTE INCINERATORS

Meng-Hung Lin, Wen-Chao Ho, and Fung-Chang Sung

Institute of Environmental Health, China Medical University College of Public Health, Taichung 40402, Taiwan.

Introduction

Taiwan is a small island with the 2nd highest density of population in the world. Among 21 counties, there are 25 incinerators built in service for the thermal treatment of municipal wastes¹. Approximately 90% of municipal waste is disposed primarily by incineration.

Pollution emissions from these incinerators are of great concern among residents living near these facilities, particularly the concern with the exposure to dioxins. Municipal trash combustion is an important source of dioxins in the ambient^{2, 3}. Taiwan Environmental Protection Administration (EPA) has funded to survey the potential exposure of dioxins for residents living near the incinerators. This article pooled survey data on dioxins in air samples from the 19 incinerators to estimate the overall correlation of PCDD/Fs concentrations in the air by the dispersion model near the incinerators.

Methods

The Taiwan EPA conducted the survey in 1999-2003 with the survey protocol adopted from the USEPA suggested model of Gaussian atmospheric dispersion^{4, 5}. Samples were collected from 4 zones. Zone A is considered as the center of emission plume from the incinerators based on the wind direction. Zones B and C are considered as affected emission of side streams and zone D the background. The data were obtained from Taiwan EPA. In order to verify the dispersion model, we estimated the correlations of PCDD/Fs in the air concentrations between zone A and zones B, C, and D using regression. Because of the PCDD/Fs levels were not in normal distribution, the data were transferred into log values for the model calculation.

Results and discussion

The average concentrations in the air sample ranged from 0.90 ± 2.52 in samples collected from zones D to 19.1 ± 45.4 fgTEQ/m³ in samples from zones A, with median concentrations ranged from 0.03 to 0.45 fgTEQ/m³, respectively. The average value in zones A samples was 21.2 times greater than that in zones D samples, or 2.2 times greater than that in zones B and 5.7 times greater than that in zones C. These results indicated that the plume center had the highest PCDD/Fs level in the air samples and the background had the lowest levels.

Figure 1 shows the regression of PCDD/Fs in air samples between zone A and zones B, C, and D using the concentrations in zones A as the reference. The regression lines for the levels in zones B, C, and D had significant correlations with that in zones A. The correlations with the zone A were similar and well explained. The coefficients show that the PCDD/Fs concentrations in zone B had a greater correlation with the zone A, indicating the wind stream carry higher amount of PCDD/Fs to zones B than to zones C. The significant correlation between zone A and C indicating PCDD/Fs in the background area air were still associated with the emission of the incinerators.

Conclusion

The dispersion model designed for air sample collection for measuring PCDD/Fs concentrations in the emission from the municipal waste incinerators is appropriate.

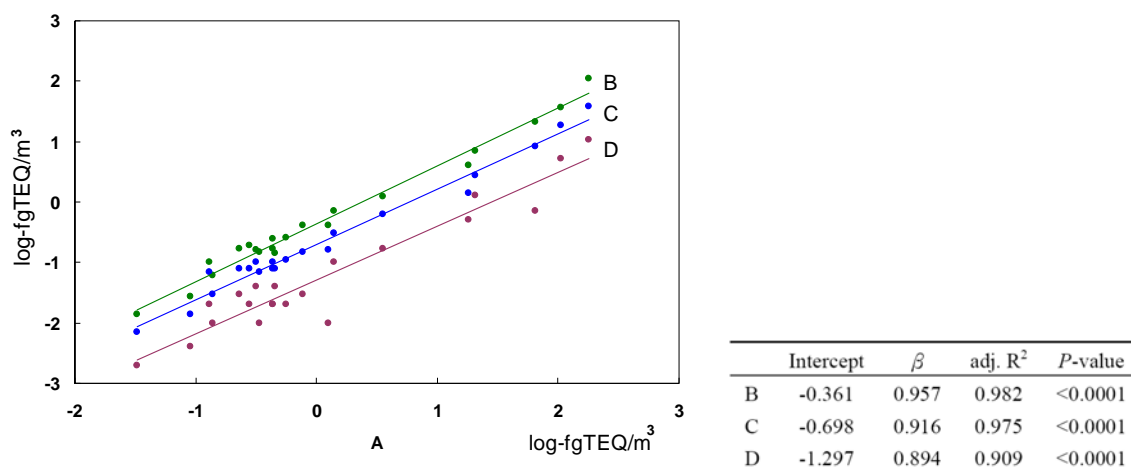


Figure 1. PCDD/Fs levels in air sample collected by dispersion model in zones B, C, and D associated with zone A, plume center.

References

1. Taiwan EPA. <http://www.epa.gov.tw/ch/SitePath.aspx?busin=4177&path=4327&list=4327>
2. Evans R. G., Shadel B. N., Roberts D. W., Clardy S., Jordan-Izaguirre D., Patterson D. G. and Needham L. L. *Chemosphere* 2000; 40: 1063-74.
3. Lee C. C., Chen H. L., Su H. J., Guo Y. L. and Liao P. C. *Chemosphere* 2005; 59: 1465-74.
4. USEPA. User's Guide for the Industrial Source Complex (ISC2) Dispersion Model (EPA 450/4-92-008b). Research Triangle Park, NC: US EPA. 1992.

5. Sivacoumar R., Bhanarkar A. D., Goyal S. K., Gadkari S. K. and Aggarwal A. L. *Environ Pollut* 2001; 111: 471-7.