TEMPORAL TRENDS OF ATMOSPHERIC PCDDs/PCDFs LEVELS IN THE NORTHEASTERN UNITED STATES

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Introduction

This paper summarizes the results of ambient air monitoring for polychlorinated dibenzodioxins and dibenzofurans (PCDDs/PCDFs) conducted from 1993 to 1998 at six sites in the State of Connecticut located in the northeastern U.S.[1,2] Two sites were located in urban/industrial areas (Hartford, Bridgeport), three sites were located in mostly suburban areas (Bristol, Wallingford, Preston), and one site was located in a remote area (Mohawk Mountain).

The monitoring program met a statutory mandate (Connecticut General Statutes 22a-240a) to characterize ambient PCDDs/PCDFs levels in the vicinity of resources recovery facilities (RRFs) in Connecticut. Each year, monitoring occurred over 30-day continuous periods during each of four seasons. Results demonstrate that the average levels and individual measurements at all sites were well below the Connecticut Ambient Air Quality Standard of 1 pg/m^3 annual average, defined as toxic equivalents (EPA 1987) in the Regulations of Connecticut State Agencies.

The data set generated during the study period provides a basis for evaluating temporal trends of atmospheric PCDDs/PCDFs levels at the various sites employed for the program. To accomplish this, seasonal data from each site as total tetra through octa PCDDs/PCDFs were subjected to regression analysis. Results showed a statistically significant (95 confidence level) downward trend during wintertime at four of the six sites evaluated over the nominal four-year study period. Other seasons showed similar statistically significant downward trends at one or two sites.

Long Duration Monitoring Approach

The long duration approach,[3,4] based upon EPA Method TO-9, EPA Method 8290 and a CT DEP-sponsored method validation program, was developed and implemented to accomplish two primary objectives: Extend the temporal coverage to 30 days per quarter from several sequential 48-hour periods while simultaneously reducing the number of required samples, and, provide enhanced method sensitivity through increased sample volume (approximately 7,000 m^3). This improved the likelihood of PCDDs/PCDFs detection and decreased the frequency of "non-detects" often reported when using the shorter duration 48-hour sampling sessions.

Seasonal windows during which ambient air monitoring occurred were defined as winter (December, January, February); spring (March, April, May); summer (June, July, August); and fall (September, October, November).

Samples were collected according to the following schedule:

PHASE 1 (1993/1994)	Fall 1993, Winter 1994, Spring 1994, Summer 1994
PHASE 2 (1995)	Winter 1995, Spring 1995, Summer 1995, Fall 1995
PHASE 3 (1996/1997)	Spring 1996, Summer 1996, Fall 1996, Winter 1997, Spring 1997
PHASE 4 (1997/1998)	Summer 1997, Fall 1997, Winter 1998, Spring 1998.

Results and Discussion

Temporal trends in the atmospheric PCDDs/PCDFs burden were evaluated on a season-specific basis over an approximate four-year period from Fall 1993 through Winter 1998 at six air monitoring sites located within the State of Connecticut. This evaluation relied upon review of graphical representations of data and regression analysis.

Figure 1, Figure 2, Figure 3 and Figure 4 graph the total ambient PCDDs/PCDFs burden (pg/m^3) measured at each of the six monitoring locations during winter, summer, spring and fall, respectively, over a four-year period. In each figure, the x-axis plots time (e.g., year) and the y-axis plots total ambient PCDDs/PCDFs burden (summation of the tetra- through octa- congener class sums) in units of pg/m^3. Data from each site were subjected to a simple regression analysis to further evaluate the data set for trends. The regression analysis was performed with time (x-axis) as independent variable and total PCDDs/PCDFs burden (y-axis) as dependent variable.

Results from the regression analysis, summarized in Table 1, show a statistically significant (95% confidence level) downward trend during wintertime at four of six sites. A similar downward trend was shown at three sites for spring, and at one site each for summer and fall.

Acknowledgement

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References

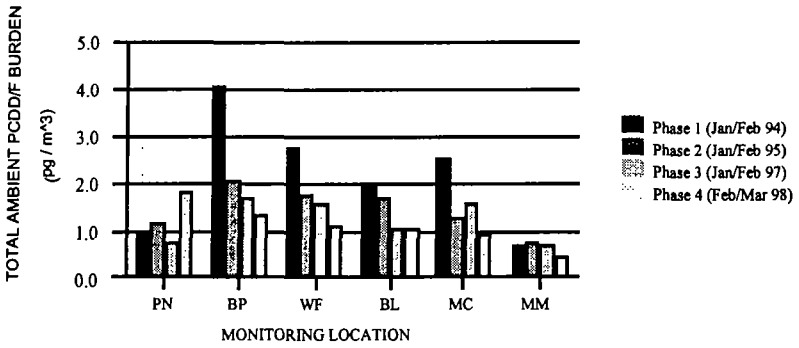
[1]. "Ambient Monitoring for PCDDs/PCDFs In Connecticut – Fall 1993 through Summer 1994," ENSR Document No. 6350-008-500-R1, September 1995.

[2] "Ambient Monitoring for PCDDs/PCDFs In Connecticut – 1995 Program," ENSR Document No. 6350-009-500, September 1996.

[3] Maisel, B., G. Hunt, L. Scarfo. "Long Duration Measurement of PCDDs/PCDFs in Ambient Air." Presented at the Fifteenth International Conference on Chlorinated Dioxins and Related Compounds (Dioxin '95), Edmonton, Alberta, August 1995.

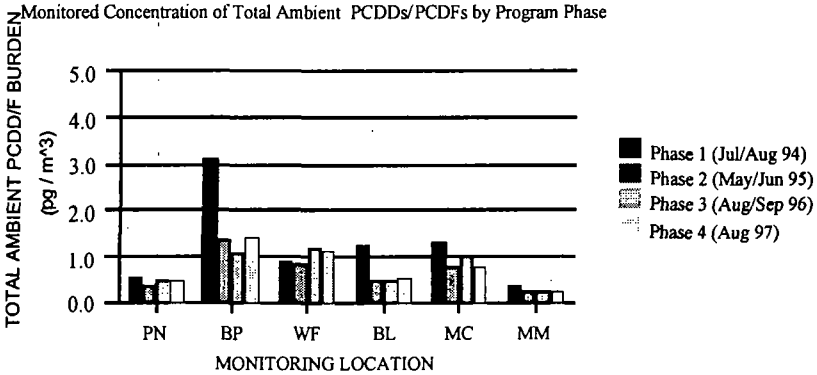
[4] Maisel, B. "Long Duration Measurement of PCDDs/PCDFs in Ambient Air – Method Performance Data." Presented at the Seventeenth International Conference on Chlorinated Dioxins and Related Compounds (Dioxin '97), Indianapolis, IN, August 1997.

FIGURE 1 - WINTERTIME DATA
Monitored Concentration of Total Ambient PCDDs/PCDFs by Program Phase



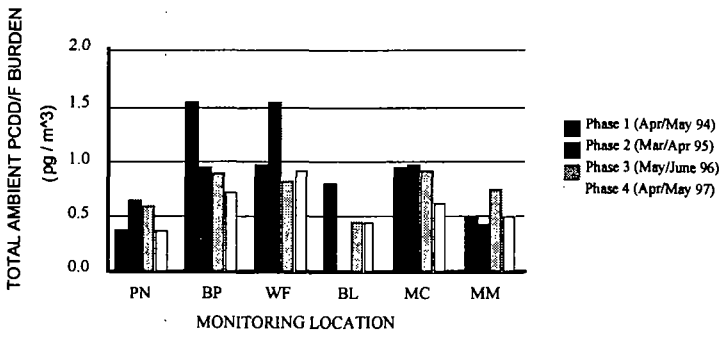
PN - Preston BP - Bridgeport; WF - Wallingford; BL - Bristol; MC - Mid-Connecticut; MM - Mohawk Mt
Note: Total PCDD/Fs represent summation of monitored tetra-octa congener class values.

FIGURE 2 - SUMMERTIME DATA
Monitored Concentration of Total Ambient PCDDs/PCDFs by Program Phase



PN - Preston; BP - Bridgeport; WF - Wallingford; BL - Bristol; MC - Mid Connectivut; MM - Mohawk Mt
Note: Total PCDD/Fs represent summation of monitored tetra-octa congener class values.

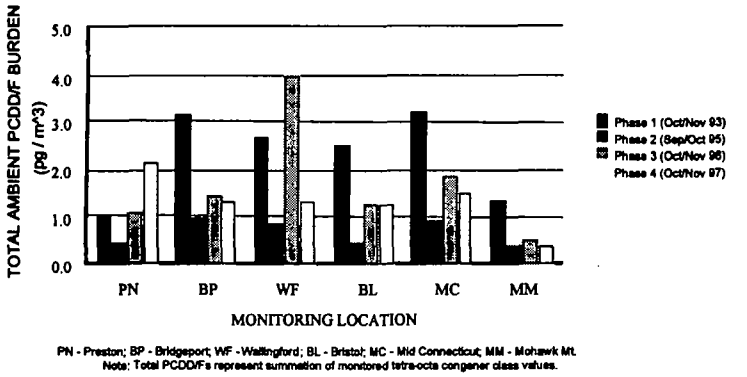
FIGURE 3 - SPRINGTIME DATA
Monitored Concentration of Total Ambient PCDDs/PCDFs by Program Phase



PN - Preston; BP - Bridgeport; WF - Wallingford ; BL - Bristol; MC - Mid Connecticut; MM - Mohawk Mt
Note: Total PCDD/Fs represent summation of monitored tetra-octa congener class values.

FIGURE 4 - FALL DATA

Monitored Concentration of Total Ambient PCDDs/PCDFs by Program Phase



PN - Preston; BP - Bridgeport; WF - Wallingford; BL - Bristol; MC - Mid Connecticut; MM - Mohawk Mt.
Note: Total PCDD/Fs represent summation of monitored tetra-octa congener class values.

TABLE 1. CONNECTICUT DEP - AMBIENT DIOXIN DATABASE EVALUATION STATISTICAL ANALYSIS OF TEMPORAL TRENDS

Parameter: Total Ambient PCDDs/PCDFs (pg/m^3)

SITE	WINTER			SPRING			SUMMER			FALL		
	m	r2	Trend?	m	r2	Trend?	m	r2	Trend?	m	r2	Trend?
MOHAWK MT.	-0.048	0.62	NO	0.030	0.73	NO	-0.038	0.09	YES	-0.250	0.77	YES
BRISTOL	-0.257	0.96	YES	-0.120	0.52	YES	-0.213	0.88	NO	-0.290	0.34	NO
BRIDGEPORT	-0.575	0.74	YES	-0.240	0.55	YES	-0.543	0.84	NO	-0.460	0.64	NO
PRESTON	0.123	0.25	NO	0.001	0.02	NO	-0.010	0.00	NO	0.239	0.32	NO
WALLINGFORD	-0.349	0.83	YES	-0.080	0.53	NO	0.103	0.12	NO	-0.100	0.02	NO
MID-CONNECTICUT	-0.300	0.61	YES	-0.110	0.40	YES	-0.128	0.69	NO	-0.340	0.49	NO

Key: m = slope of regression line; Trend = presence (yes) or absence (no) of a statistically significant trend at the 95% confidence level.