

FORMATION AND SOURCES: FIELD CASES

THREE YEARS OF DIOXIN MONITORING NEAR THE ATSUGI BASE IN JAPAN FOR CONCENTRATIONS IN PRE- AND POST-BAG FILTER INSTALLATION AND AFTER FACILITY CLOSURE

Yuji Horie

Green Blue Corporation, 5-4-11 Higashi Koujiya, Ohtaku, Tokyo 144-0033, Japan

Introduction

Ambient air monitoring for dioxins from an industrial waste incineration facility adjacent to the Atsugi base was conducted nearly continuously over the three years: 1999 through 2001. Twenty four-hour sampling was performed on 56 days during the period of 7/8-9/1/99, 386 days during the period of 3/12/00 to 4/1/01, and 97 days during the period of 4/2/01 to 12/14/01. Over the study periods, the incineration facility underwent an installation of the bag filters and closure of the facility. This Atsugi study provided a unique opportunity to determine the effect of bag filters on reducing dioxin emissions and the impact of the facility operation on the air quality in the surrounding area. The aims of this paper are to disseminate the information gained from the long term monitoring of dioxins near a source and to discuss a method for quantifying the air quality impact of the source through data analysis.

Outline of the Atsugi Study

The Atsugi base is a naval air facility of the U.S. navy provided by the government of Japan under the Japan-U.S. Security Treaty, and is located about 50km southwest of Tokyo. An industrial waste incineration facility adjacent to the south end of the base was said to be causing severe air pollution to the residential area of the Atsugi base. To study the problem, governments of Japan and the United States agreed to set up a Joint Monitoring (JM) program in 1999. The first JM was conducted for 56 days in the summer of 1999 at three monitoring sites in the base⁴. Some findings of this monitoring brought about an administrative recommendation to the facility by the Kanagawa Prefecture Government (KPG), which had jurisdiction over the facility. The facility started installing bag filters to its three incinerators in February 2000. The installation work was completed for the first two incinerators by the end of March 2000 and for the third one by the end of May 2000.

The second JM started on the 12th (actually the 11th, but here use sampling-end day) of March 2000 and continued until the 1st of April 2001⁵. This second JM was conducted at one site outside of the base and two sites inside the base. The two predominant directions of wind, southerly winds and northerly winds characterize the wind regime in the Atsugi base area. Relative to the facility and the wind regime, the site outside of the base (Site C) worked as an ideal southern receptor and the one in the base (Site B) worked as an ideal northern receptor. The second JM started near the end of the pre-installation period of bag filters, and covered nearly the entire period of post-bag filter installation.

The 3rd JM started on the 2nd of April 2001 and ended on the 8th of May 2001⁶. However, Japan MOE continued the monitoring until the 14th of December 2001. The facility was closed by the end of April 2001 and its dismantling was completed by the middle of December 2001. During the 3rd JM and the MOE study, ambient monitoring was performed every third day instead of every day monitoring, which was done in the first and second JM programs.

FORMATION AND SOURCES: FIELD CASES

Features of the Atsugi Study

Features of the Atsugi Study were of the long duration of the ambient dioxin monitoring around the industrial waste incineration facility, which was conducted by both the Japan-U.S. joint monitoring program and the local government, KPG. The JM lasted 539 days over the three periods, 7/12 to 9/1 in 1999, 3/12/00 to 4/1/01, and 4/2 to 12/14 in 2001. The KPG study lasted 429 days from 12/28/99 through 2/28/01. Since the JM program in particular bore both political and social implications, the implementation of the monitoring program was performed in accordance with Japanese methods^{1, 2, 3} and was done in independent and scientific manner as much as possible. Adequate numbers of quality control (QC) samples were taken to determine the accuracy of dioxin measurements in sampling and laboratory analysis, and to identify suspected measurement, if any. The QC samples included method blanks, laboratory control samples, double samplings, duplicate analyses, and travel blanks. The first two QC samples were analyzed routinely for every laboratory analysis batch while the last three QC samples were taken and analyzed for about 5% of the actual number of samples.

Results of the Joint Monitoring Study

The amount of data gathered in the Atsugi study was quite sizable. These data are tabulated in database and will be available upon request. Various data analyses and dispersion modeling were performed upon the data. Reported here are of the influencing wind analysis and the three-year comparison of observed dioxin concentrations at Site B. Influencing wind was defined for each monitoring site as the winds in selected wind sectors, which bring dioxin-laden plume from the facility to the monitoring site. Site B was the only site whose platform remained at the same location throughout the entire study period.

Table 1 shows mean dioxin concentrations at each of the six monitoring sites for various lengths of influencing wind duration per day. The duration was categorized into 5 ranges: 0, 1-6, 7-12, 13-18, 19-24 hours per day. This table was prepared for the data from the beginning of ambient air monitoring to the end of February 2001. Sites A, B, and C were of the Joint Monitoring and were started on the 8th of July 1999. Industrial, Hon-Tade, and residential sites were of KPG, and were started on the 28th of December 1999.

In the table, «Before Bag Filter (BF)» means a different period for the JM Sites A, B, C and for the KPG sites of Industrial, Hon-Tade, Residential. For the former, Before BF was the period of 7/8-9/1/99 while for the latter, it was the period of 12/28/99-3/31/00. «After BF» means the same period of 4/1/00-2/28/01 for both the JM and KPG sites. This table clearly indicates that the mean concentrations of all six monitoring sites increased with increasing duration of the influencing wind.

Of the six monitoring sites, only Site B kept the original location throughout the three years of the Atsugi study. Descriptive statistics of dioxin concentrations at this site were computed for the same 56 days of 7/8 to 9/1 in each of the three years, 1999, 2000, and 2001. Table 2 shows some results of the descriptive statistics.

In the first year of 1999, the extremely high concentration of 54 pg-TEQ/m³ was recorded while the average concentration during the 56 days was 6.6 pg-TEQ/m³, more than 10 times higher than the environmental quality standard of 0.6 pg-TEQ/m³ in annual average. In 1999, the facility did not have any bag filters in its three incinerators. By July 2000, all three incinerators were equipped with bag-filters. As a result, the maximum concentration dropped to 2.5 pg-TEQ/m³ (20 folds decrease), while the average concentration decreased to 0.52 pg-TEQ/m³ (over 10 folds decrease). In 2001 when the facility was dismantled, the maximum concentration was 0.36 pg-TEQ/m³, a mere 1/150 of that of 1999. The average concentration was 0.16 pg-TEQ/m³, 1/4 of the environmental quality standard and 1/40 of that of 1999.

FORMATION AND SOURCES: FIELD CASES

Table 1. Duration of influencing wind and mean dioxin concentration at each monitoring site.
(Influencing wind angle = 45 deg., and on operation-days only)

Duration (hrs/d)	Site A		Site B		Site C	
	Before BF	After BF	Before BF	After BF	Before BF	After BF
0hr.	0.28 (33)	0.20 (78)	0.28 (4)	0.27 (13)	0.22 (29)	0.22 (55)
1 ~ 6hrs.	1.13 (12)	0.20 (84)	1.3 (10)	0.31 (41)	0.34 (18)	0.35 (44)
7 ~ 12hrs.	- -	- -	3.9 (7)	0.46 (34)	- -	0.52 (40)
13 ~ 18hrs.	- -	- -	6.8 (7)	0.54 (22)	- -	0.74 (19)
19 ~ 24hrs.	- -	- -	14 (19)	0.64 (54)	- -	1.1 (6)

Duration (hrs/d)	Industrial District		River Hon-Tade		Residential Area	
	Before BF	After BF	Before BF	After BF	Before BF	After BF
0hr.	- -	0.27 (56)	- -	0.13 (55)	0.26 (9)	0.17 (84)
1 ~ 6hrs.	0.76 (14)	0.43 (48)	0.32 (10)	0.22 (45)	0.36 (56)	0.24 (71)
7 ~ 12hrs.	3.1 (27)	0.70 (40)	0.67 (32)	0.26 (45)	- -	0.28 (8)
13 ~ 18hrs.	2.4 (21)	1.0 (15)	0.65 (21)	0.42 (16)	- -	- -
19 ~ 24hrs.	- -	- -	- -	- -	- -	- -

Mean (# data)

Table 2. Comparison of dioxin concentrations during the same 56 days of 1999, 2000, and 2001
(Site B, July 8 to September 1)

Calendar Year Facility Condition	1999		2001		2001	
	Before Bag Filters	Ratio	After Bag Filters	Ratio	Dismantled	Ratio
No. of Data; Ratio to Base Yr.	56		56		19	
Mean	6.6	1	0.52	0.08	0.16	0.02
Maximum	54	1	2.5	0.05	0.36	0.01
Minimum	0.097	1	0.08	0.82	0.057	0.59
Std. Deviation	8.8	1	0.48	0.05	0.079	0.01

(Unit: pg-TEQ/m³)

Discussions and Conclusion

The Atsugi study was initiated by a bilateral agreement between the two governments. It provided a unique opportunity to study the impact of an industrial waste incinerator on the air quality in the immediate vicinity, only about 160 m to 1000 m from the facility. The facility was closed voluntarily by the end of April 2001 under the pressure from the findings of this study and the governments.

Byproducts of this study are the monitoring data of dioxins in ambient air and surface meteorology and the knowledge gained about the characteristics of dioxin concentrations in air and soil near an emission source. Many different analyses can be done using the data gathered during the Atsugi study, whose data are preserved in magnetic media and available upon request.

Acknowledgements

The author acknowledges Miss. Fukayama for preparing tables and graphs of this study.

FORMATION AND SOURCES: FIELD CASES

References

1. Hazardous Air Pollutant Measurement Method Manual for Dioxins and Coplanar PCBs, Japan Environment Agency, March 1999.
2. Air Environment Study Manual for Dioxins, Japan Environment Agency, May 2000.
3. Executive Summary, Assessment of the Health Risk of Dioxins: Re-evaluation of the Tolerable Daily Intake (TDI), World Health Organization (WHO), May 1998, Geneva, Switzerland.
4. U.S.-Japan Joint Monitoring: Soil and Ambient Air Sampling and Analysis - NAF Atsugi, Japan, U.S. Dept. of Navy, Japan Environmental Agency, and Ministry of Health and Welfare, February 2000.
5. The Second U.S.-Japan Joint Monitoring: Ambient Air Sampling and Analysis - NAF Atsugi, Japan, U.S. Dept. of the Navy and Japan Ministry of the Environment, September 2001.
6. The Third U.S.-Japan Joint Monitoring: Ambient Air Sampling and Analysis Data for April 1 through May 8, 2001, U.S. Dept. of the Navy and Japan Ministry of the Environment, December 2001.