

THREE YEARS OF DIOXIN MONITORING NEAR THE ATSUGI BASE IMPACT OF THE INCINERATION OPERATION ON CONCENTRATIONS IN ITS VICINITY

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Introduction

Ambient air monitoring for dioxins from an industrial waste incineration facility located adjacent to the Atsugi military base was conducted nearly continuously over the three years: July 1999 through December 2001. Twenty four-hour sampling was performed on 56 days in the first period⁴ in 1999, 386 days in the second period⁵ in 2000 and early part of 2001, and 97 days in the third period^{6,7} in the rest of 2001. During these three study periods, the incineration facility underwent changes of its operation including an installation of the bag filters and a closure of the facility. This Atsugi study provided a unique opportunity to determine the effectiveness of bag filters for reducing dioxin emissions from the facility operation and the impact of the facility operation on air quality in the surrounding area.

Methods and Materials

The Atsugi Study was characterized, beside of its long duration of ambient dioxin monitoring, by the involvement of Japan and the United States, namely, the Japan - U.S. joint monitoring (JM) program and the Kanagawa prefecture government (KPG). The JM lasted 539 days over the three periods, July 8 to September 1 in 1999, March 12, 2000 to April 1, 2001, and April 2 to December 14, 2001. The KPG study lasted 429 days from December 28, 1999 through February 28, 2001. The entire monitoring program was performed in accordance with the Japanese methods^{1,2} for dioxins and was done in an 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 measurements, if any.

JM set up three monitoring sites, A, B, and C, all inside the Atsugi base in the first study periods in 1999. In the second and third periods in 2000 and 2001, Site C was moved outside the base to a location in the Ayase Industrial Park (see Fig. 1). Sites A, B, and C used in the second and third study periods are shown in the figure. Site D was not used for continuous ambient monitoring, but was used for source monitoring by placing a sampler inside a visible smoke plume from the incineration facility. KPG set up three monitoring sites all outside the base. One of the KPG sites called "Industrial Site" was located only about 30 m apart from Site C.

Results of the Study

The data acquired in the Atsugi study was quite voluminous, including dioxin concentrations (both isomer specific concentrations and toxic equivalent quantity or TEQ concentrations), meteorological parameters, and incinerator operation data. Various data analyses and dispersion modeling were performed upon the acquired data. Reported here are of the influencing wind analysis. Influencing wind was defined for each monitoring site separately as the winds in selected wind sectors, which bring dioxin-laden plume from the facility to the monitoring site. Three different angles were used for defining the influencing wind, 90 degrees (four 22.5-degree sectors), 67.5 degrees (3 sectors), and 45 degrees (2 sectors). The most pronounced and consistent effects of the influencing wind upon downwind concentrations were found when the 45-degrees were used⁸.

Table 1 shows mean dioxin concentrations at each of the six monitoring sites for varying duration of the influencing wind a 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 start of ambient air monitoring at each site to the end of February 2001. Sites A, B, and C were of the JM program, which started on the 8th of July 1999. Industrial, Hon-Tade, and Residential sites were of the KPG study, which started on the 28th of December 1999.

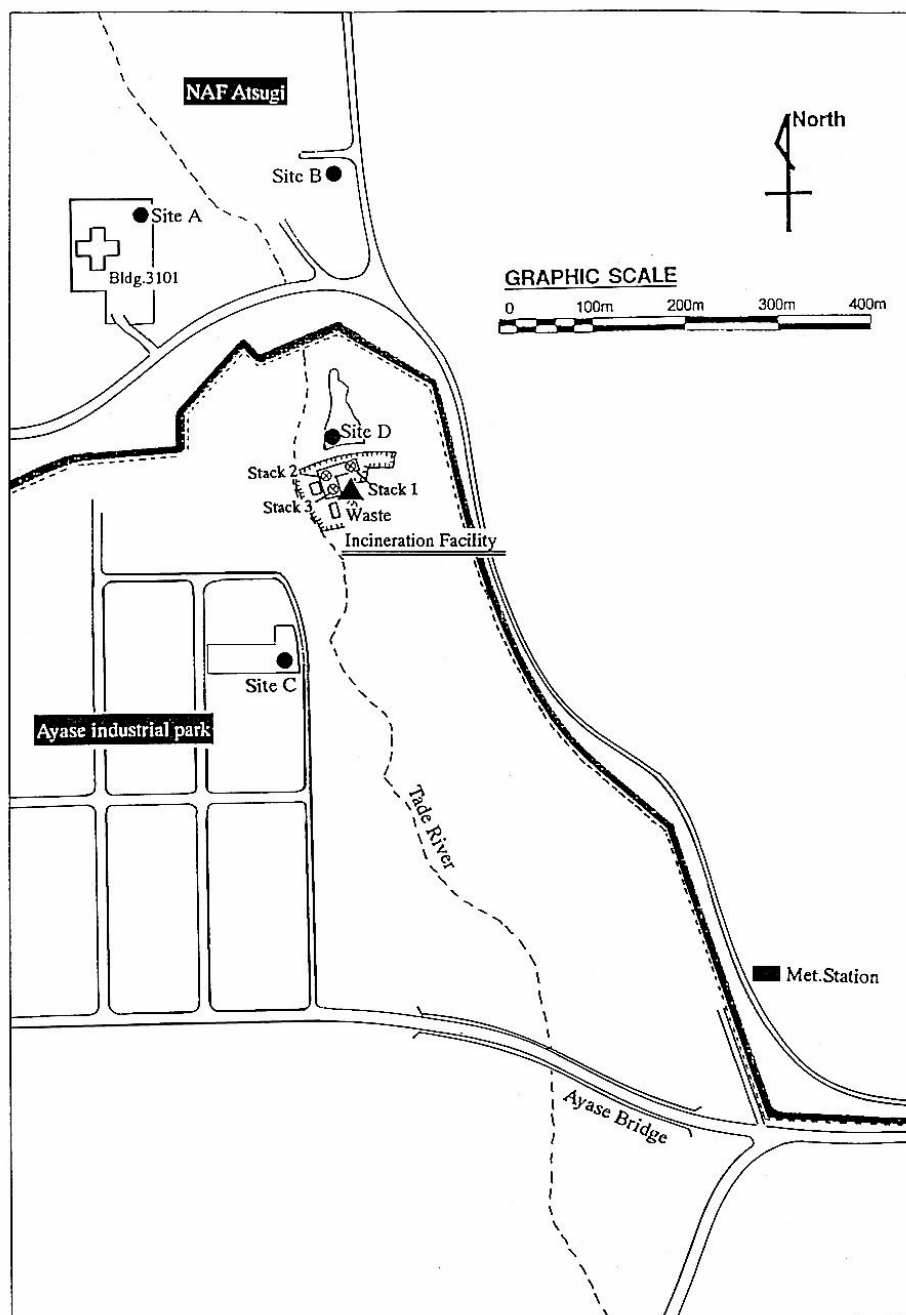


Figure 1. Locations of the Incineration Facility and the Monitoring Sites of JM.

In the table, "Before Bag Filter (BF)" means the period of 7/8/99 - 9/1/99 for the JM sites of A, B, C while for the KPG sites of Industrial, Hon-Tade, Residential, it means 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 at all six monitoring sites increased with increasing duration of the influencing wind. Of the six monitoring sites, only Site B remained at its initial location throughout the entire period of the Atsugi study. Descriptive statistics of dioxin concentrations³ at Site B were computed for the same 56-day period, i.e., 7/8 to 9/1 in each of the three years, 1999, 2000, and 2001.

Table 1. Duration of influencing wind and mean dioxin concentration at each monitoring site.
(Influencing wind angle = 45 deg., and on operation-days only) Unit: pg-TEQ/m³

Duration hours per day j	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 hours per day j	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.	- -	- -	- -	- -	- -	- -

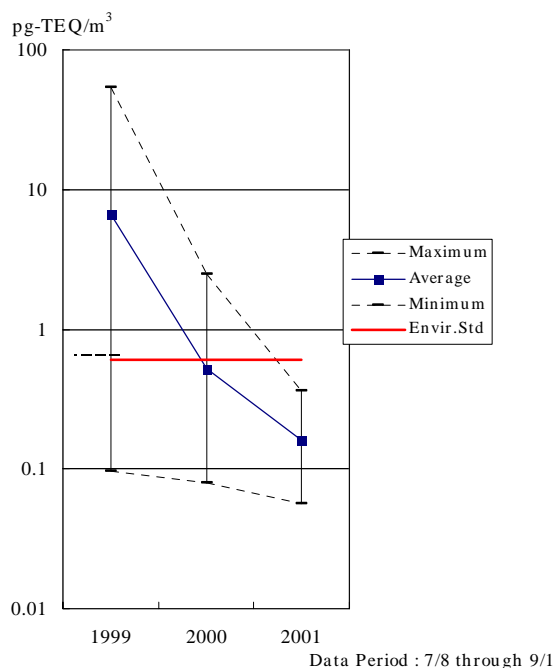
Note 1: The dioxin concentration includes coplanar PCBs..

Note 2: The numerals in parenthesis mean the number of days with valid data.

Note 3: "Before and After BF" means before and after the installation of bag filters.

Impact of the Incinerator on Ambient Dioxin Levels

Of the six monitoring sites used in the JM and KPG monitoring programs, only Site B kept its initial location throughout the three years of the Atsugi study. Figure 2 depicts the effects of the bag filter installation and the facility operation on the ambient air quality downwind of the incineration facility. In the first year of 1999 when the facility did not have any bag filters, the extremely high maximum concentration of 54 pg-TEQ/m³ and the average concentration of 6.6 pg-TEQ/m³ were recorded. By July 2000, bag filters were installed in all three incinerators. 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. Figure 2. Changes in ambient dioxin levels at Site B



Discussions and Conclusion

The Atsugi study was initiated by a bilateral agreement between the two governments, Japan and the United States. It provided a unique opportunity to study the impact of an industrial waste incinerator on 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 other factors.

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 the emission source. Many different analyses can be performed using the data acquired under the Atsugi study. The entire data were subjected to rigorous QC checks and were compiled in magnetic media. The data may be available for further analysis upon request.

Acknowledgements

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