

COMPARATIVE STUDY OF PCDDs/DFs EMISSION AND ATMOSPHERIC ENVIRONMENT IN THE PRE- AND POST-RETROFITTING MSW INCINERATION PLANT (II)

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Introduction

A batch- operational MSW incinerator built approximately 20 years ago with the capacity of 30ton/8h × 4 units (Old Plant) was replaced with a new facility of 85t/24h × 3 units that complies with the "Guideline for controlling PCDDs/DFs in MSW Management- PCDDs/DFs Reduction Program-" (commonly known as the New Guideline) (New Plant). At the 20th International Symposium on Halogenated Environmental Organic Pollutants and POPs in 2000, we submitted a comparison report on PCDDs/DFs emission from the old and new plants, and the neighboring environment, both ambient air concentrations and atmospheric deposition^{1),2)}. We have undertaken a new follow-up study to compare the data from the old plant with those of latest measurement, approximately one year after the commissioning of the new plant. The main items measured were the soil and the pine needles. The following is the report on the data of PCDDs/DFs contamination in these specimens.

Method and Materials

Table 1, Fig. 1 and Fig. 2 show the outline of the facility used for the measurement. The old plant was shut down and the test-run of the new plant began in September 1998.

The sampling points start with the plants, the point immediately below the stack as the midpoint. They span east and west as the dominant wind direction, at 1km, 2km, and 5km, with a background spot at 10km west of the midpoint, for the total of 8 spots.

Table 1 Comparison of Old and New Plants

	Old Plant	New Plant
Throughput	30t/8h × 4 units = 120/day	85t/24h × 3 units = 255t/day
Furnace Type	Furnace with Stoker + Water Spray (1 system/2 furnaces)	Furnace with Stoker + Boiler (Power Generation)
Flue Gas Treatment	Multicyclone (1 system/2 furnaces) + EP (1 system/4 furnaces)	Quenching Chamber + BF (Activate Carbon Injection)
Stack Hight	55m	59m
Remarks		Wide-area treatment of MSW has been introduced.

The soil samplings were done on August 25, September 10 and 11, 1998 with the Old Plant (Old Measurement), and on November 12, 24 and 25, 1999 with the New Plant (New Measurement). Soil samples were collected at the epicenter of a point and four spots around it, at the depth of 5cm. These were then mixed to make a measurement.

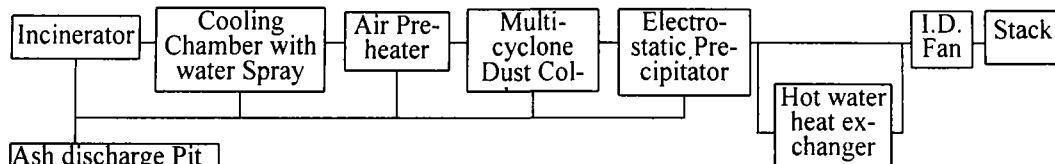


Fig.1 Old Plant Equipment Flow

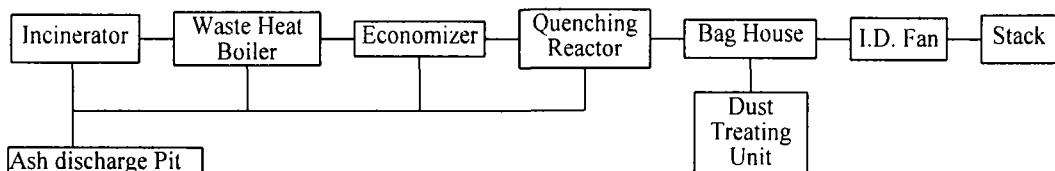


Fig.2 New Plant Equipment Flow

The analyses were based on the "Temporary Standard Manual for Measuring Dioxins in Soil" issued by Environmental Protection Agency, January '98.

The samplings of pine needles were carried out with the Old Plant on September 10 and 11, 1998 (Old Measurement), and on November 24 and 25, 1999 with the New Plant (New Measurement). The samples collected at the Old Measurement were second-year growth needles whereas first-year growth needles were collected at the New Measurement, as they were available then. The only exception was east-5km point where first-year and second-year growth needles were sampled, as both were available. The analyses were based on "Standard Manual for Measuring Dioxins for Waste Management" Ministry of Health and Welfare (Feb. '97). The TEQ values in this report were in accordance with WHO-TEF (1998).

Results and Discussion

1. Soil

Fig. 3 and **Fig. 4** display the result of Old Measurement and New Measurement, respectively, for PCDDs/DFs concentration.

PCDDs/DFs from the Old Measurement came to 130~16,000pg/g (1.3~270pg-TEQ/g) with a sharp spike near the plant and gradual decline with the distance. In general, the east side revealed higher values than the west side. The New Measurement resulted in 190~6,000pg/g (0.34~41pg-TEQ/g). As with the Old Measurement, the concentration peaked near the plant and decreased a little with distance.

The sharp spike near the plant can be attributed to the fact that the Old Plant had an outdoor ash handling unit that may have scattered particulates, the furnace operated intermittently and generated large amount of particulates at start up and shut down, and the dust-collecting EP had somewhat low efficiency. The drastic reduction in sum concentration there may be because of the retrofitting the Old Plant, and the subsequent changes of sampling points. Other sampling points reveal reduction in TEQ values in general. This may be due to the erosion of topsoil by rainfall and photodecomposition of PCDDs/DFs. Since the analysis of ambient air concentrations and

atmospheric deposition with the New Plant in operation showed little decline by distance¹⁾²⁾, long-term tests should be carried out to ascertain this trend in the soil contamination.

The concentrations at the west-2km point showed relatively high value, the highest among the New Measurement, whereas the TEQ values were comparatively low. This is because 1,3,6,8-T₄CDD and 1,3,7,9-T₄CDD were the major component. The values at the west-10km at Old Measurement, were 130pg/g (1.3pg-TEQ/g). These may be considered the background levels of this area.

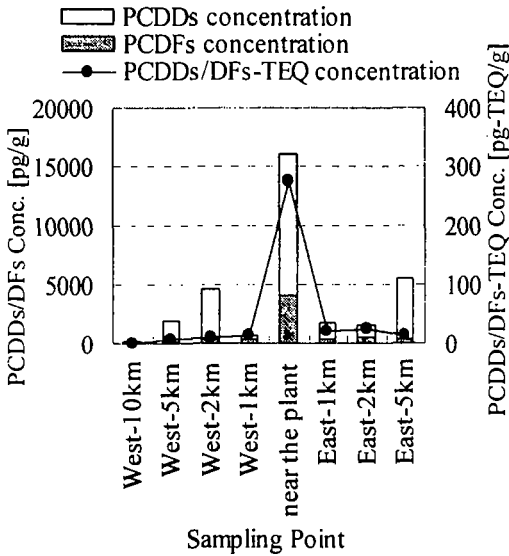


Fig. 3 PCDDs/DFs Concentration in Soil (Old Measurement)

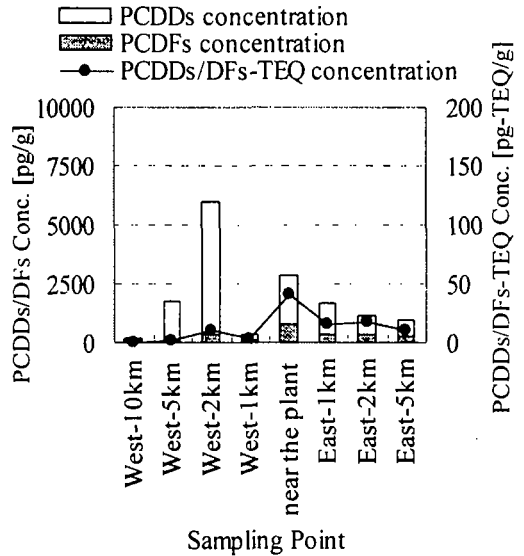


Fig.4 PCDDs/DFs Concentration in Soil (New Measurement)

2. Pine Needles

The PCDDs/DFs concentrations of pine needles are shown in Fig. 5 and Fig. 6. The samples for Old Measurement were second-year growth needles exposed to 18 months of Old Plant operation, whereas those of New Measurement were first-year growth needles presumably under roughly 7 months of New Plant operation.

The concentrations of Old Measurement were 310~3,500pg/g and the TEQ values were 4.5~63pg-TEQ/g. It also had a spike near the plant and declined with the distance. The New Measurement showed concentrations of 65~430pg/g (0.28~3.8pg-TEQ/g). Compared with the Old Measurement, the New Measurement values were 1/12~1/5 in concentration, and 1/30~1/9 in TEQ values. This is a huge reduction.

The second-year growth needles collected at the east-5km point had presumably been under the influence of roughly 5 months of Old Plant operation and 14 months of New Plant operation. The analysis this time showed the first-year growth needles to contain 99pg/g and 0.87pg-TEQ/g, whereas the second-year growth needles had 200pg/g and 1.7pg-TEQ/g. In both cases, the second-year growth needles had twice as much as the first-year growth needles.

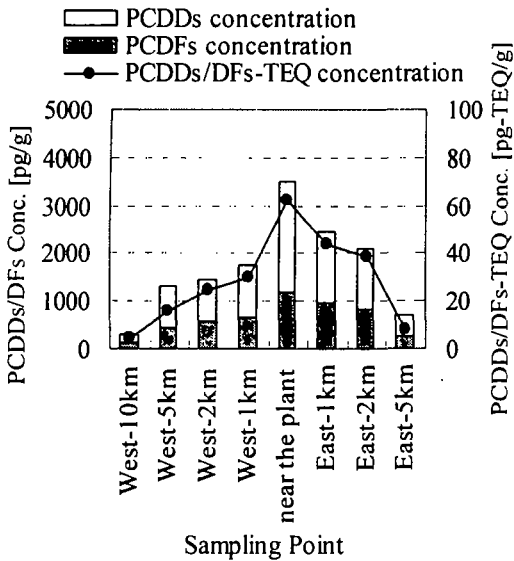


Fig. 5 Pine Needles PCDDs/DFs Concentration (Old Measurement)

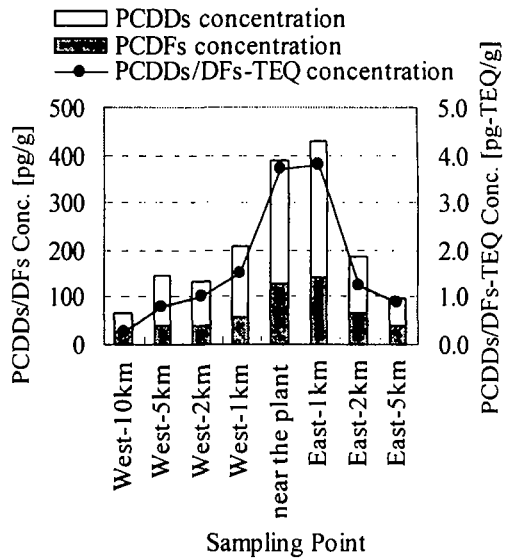


Fig. 6 Pine Needles PCDDs/DFs Concentration (New Measurement)

Conclusion

- 1) TEQ values of PCDDs/DFs in the soil of New Measurement generally shows decline, particularly near the plant.
- 2) The results of pine needles analysis also show significant decline, even considering the difference of samples in their ages.
- 3) The effect of stopping operation of the Old Plant and building the New Plant has been ascertained to a certain degree. Further studies are planned to look into the distance-related diminution by the repetitious monitoring of the air, soil and pine needles.

Acknowledgements

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References

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