

# Formation and Sources P18

## PCDF/D Emission from a Municipal Solid Waste Incinerator during Co-combustion of Automotive Shredder Residues

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### Introduction

There is currently activity of legislators in various European countries to enforce and draft legislation, to achieve higher recovery and/or recycling quota and thereby reducing the amount of automotive shredder residues (ASR). Thus, a measurement program has been set up to document the technical feasibility and the environmental consequences for the co-combustion of ASR with municipal solid waste (MSW). This program is part of a larger initiative of the Association of Plastic Manufacturers in Europe (APME) and the American Plastics Council (APC) with the same objective.

The following companies/institutes have been involved in this program: S. Preuer, Würzburg: ASR preparation; Fachhochschule Würzburg and Zweckverband Abfallwirtschaft Raum Würzburg, Würzburg: physical characterization of ASR; Martin GmbH für Umwelt- und Energietechnik, Munich: combustion; Noell GmbH, Würzburg: Emission control; GfA GmbH, Münster, Institut Fresenius, Taunusstein, and Forschungszentrum Karlsruhe: taking and analyzing samples; Dow Europe S.A., Horgen: project leadership. This publication presents the results obtained by GfA, Münster, HCl analysis by Noell, Würzburg, and PCDF/D analysis of boiler ash by Forschungszentrum Karlsruhe.

### Experimental Methods

The line of the Municipal Solid Waste Incinerator (MSWI) where the test program took place, has a maximum of 12.5 Mg/h at 8.4 GJ/Mg. MSW, industrial waste (in low concentration), and sewage sludge are incinerated during normal operation. The line is equipped with an air pollution control system, consisting of flue gas cooler, cyclone reactor, separate activated carbon addition, spray absorber, fabric filter, and catalytic reduction of NO<sub>x</sub>. Emission testings of that plant was done extensively during a large scale test with packaging plastics in 1993/94 [1,2].

The test program was performed during the following operating conditions of the MSWI:

Sampling date	Operating state	Name
June 17th, 1997	normal operation without ASR addition	A0
June 18th, 1997	approx. 20 wt % ASR (c/f)* addition	B
June 19th, 1997	approx. 30 wt % ASR (c/f)* addition	C
June 20th, 1997	approx. 20 wt % ASR (c)* addition	D
July 1st, 1997	normal operation without ASR addition	A1
July 2nd, 1997	normal operation without ASR addition	A2
July 3rd, 1997	normal operation without ASR addition	A3
July 4th, 1997	normal operation without ASR addition	A4

\* approx. 60/40 weight fraction of ASR coarse fraction (c) and fine fraction (f)

\*\* only ASR coarse fraction

The raw gas before cyclone, the clean gas before stack, and the boiler ash were sampled in parallel in each case over a period of 6 hours on each day mentioned above.

Further details about the MSWI, the combustion conditions, the ASR characterization, the sampling techniques, and the analytical methods are described elsewhere [3].

### Results and Discussion

As shown in Figure 1 the CO, NO<sub>x</sub>, SO<sub>2</sub>, HCl, and dust concentrations in the raw gas before cyclone are not influenced by the co-combustion of ASR (comparing the MSWI operating states A0-A4 with B, C, and D) in a significant sense.

The same situation is to be observed in Figure 2 for the PCDF/D concentrations in the boiler ash and the raw gas before cyclone as well as in the clean gas before stack.

This conclusion can be drawn, too, if one considers earlier measurements with and without additional plastic waste. The window of operation for the PCDF/Ds in the raw gas lies between 1.3 and 6.5 ng I-TE/m<sup>3</sup>. No plant modification has been done since that time on the grate, furnace and boiler section. Other parts of the plant like the emission control devices have been extensively improved to meet the regulations of the 17th BImSchV. The furnace section did already comply with the temperature and residence time required of the 17th BImSchV in 1993.

### References

- [1] F.E. Mark in "Recycling and Recovery of Plastics", Hanser Publishers, Munich, Vienna, New York, ed. by J. Brandrup, M. Bittner, W. Michaeli, and G. Menges, 1996, 831-848.
- [2] W. Funcke, A. Hovemann, C. Philipp, F.E. Mark, G. Kerber, and H. Dresch, *Organohalogen Compounds* 1995, 23, 461-466.
- [3] F.E. Mark, M.M. Fisher, and K.A. Smith: "Energy Recovery from Automotive Shredder Residue through Co-combustion with Municipal Solid Waste". APME, Technical Report in preparation.

Fig. 1 CO, NO<sub>x</sub>, SO<sub>2</sub>, HCl, and dust concentrations [mg/m<sup>3</sup>] in the raw gas before cyclone during normal MSWI operation (white bars) and ASR co-combustion (black bars)

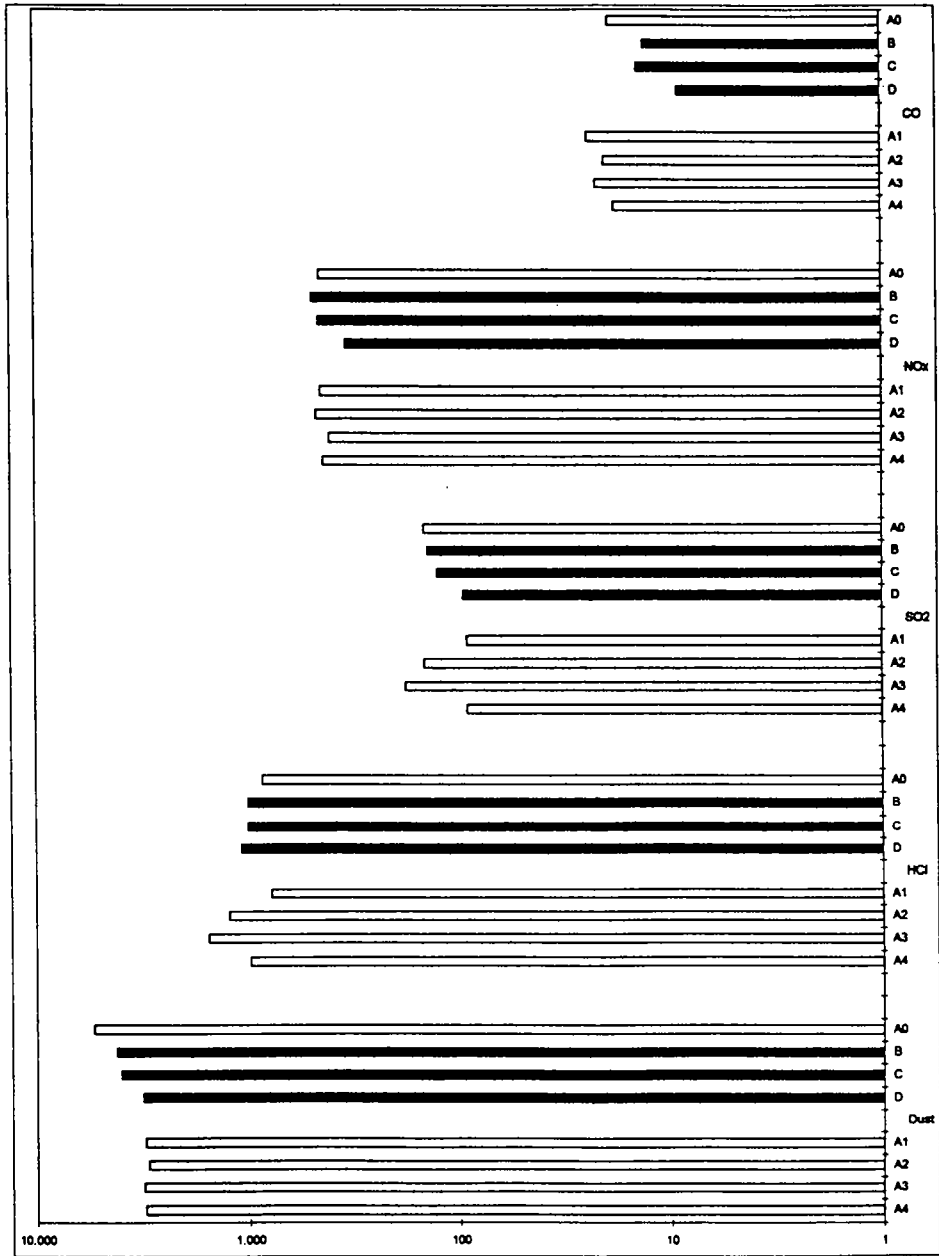


Fig. 2 PCDF/D concentrations in the boiler ash [ $\mu\text{g I-TE/kg}$ ] as well as in the raw gas before cyclone and clean gas before stack [ $\text{ng I-TE/m}^3$ ] during normal operation (white bars) and ASR co-combustion (black bars); a=not analysed

