OPTIMIZATION OF THE START-UP PROCEDURES IN A MUNICIPAL WASTE INCINERATOR– IMPACT ON THE EMISSIONS OF DIOXINS AND RELATED COMPOUNDS

Horst C. Gass[1], Michael Wilken[2], Karl Lüder[3]

1 MPU-Meß- und Prüfstelle Technischer Umweltschutz GmbH, Kolonnenstr. 26 , D-10829 Berlin (HC.Gass@MPU-GmbH.de)
2 MWC - Michael Wilken Consulting, Florastr. 8, D-12163 Berlin
3 MVB Müllverwertung Borsigstraße GmbH, Borsigstr. 6, D-22113 Hamburg

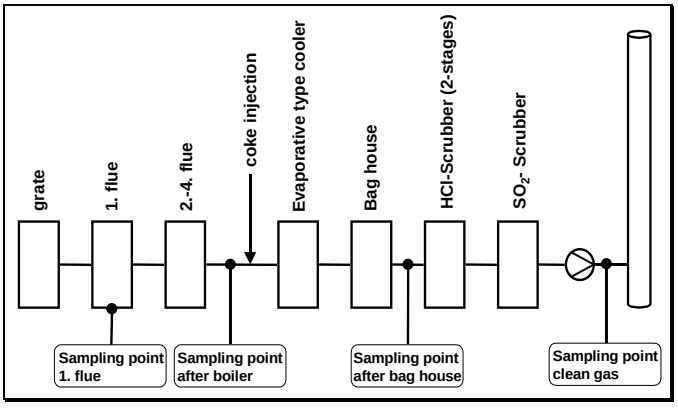
Introduction

In 2002 we reported about PCDD/F-emissions during the start-up of a municipal waste incinerator[1]. We could show that during the oil burner operation concentrations in the raw gas up to 250 ng I-TEQ/Nm³ could be detected, leading to a long lasting memory effect in the wet scrubber downstream and consequently in the clean gas as well.
Further measurements have been performed in the meantime during start-ups under modified operation conditions.

Methods and Materials

All measurements and analysis were performed according to EN 1948 with the exception that the sampling time was shortened and adjusted to the different phases of the start-up procedure. The detection limit was 0.001 ng I-TEQ/Nm³ for all 2,3,7,8-substituted isomers. All data are standardized to 273 K and 1013 hPa at 11% O_2 . A detailed plant description can be found in[2].

figure 1: plant scheme and sampling locations



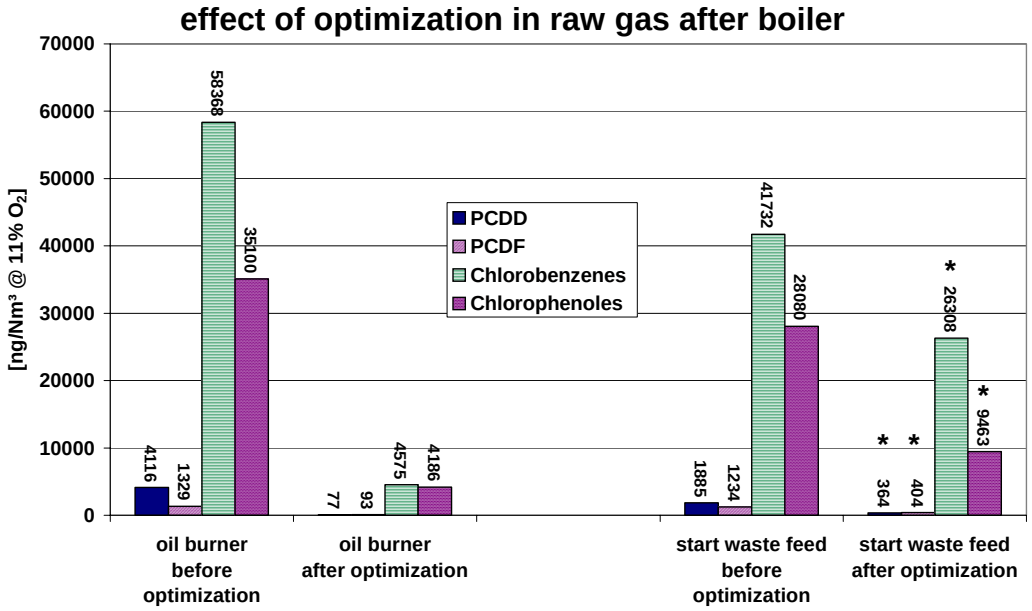
Results and Discussion

Due to the plant configuration the main reason for the downstream contamination of the cleaning system, especially of the wet scrubber unit, was identified as the lack of activated carbon injection during the oil burner phase. Because of the high oxygen level in this start-up phase the injection of activated carbon was stopped to avoid any ignitions. Therefore the observed high emissions from

the boiler passed more or less unchanged the bag house which is usually the key step to remove the PCDD/F. A significant portion of these PCDD/F is now stored on the inner surfaces of the whole cleaning system unit by adsorption and will be desorbed and released over a long period. Based on the permanent control measurements at the plant an estimation leads to an influence of one such start-up for roughly half a year concerning the mass flow of PCDD/F in the clean gas. Therefore an inert material with high adsorption capacity and no tendency to ignition (Desomix®) was used successfully during start-up with a drastic reduction of the PCDD/F levels at the bag house outlet and therefore a sustainable protection of the clean gas unit.
The second step was the optimization program to reduce the formation of PCDD/F in the boiler in order to reduce the overall emissions of PCDD/F and related compounds .
In order to find ways to reduce the formation of PCDD/F in this start-up period it was necessary to understand the process how, where and under which conditions these components could be formed. As a key factor for the formation of PCDD/F the soot of the oil burning was identified. The soot is disposed on all clean surfaces of the boiler which will be heated up very slowly during the whole start-up phase. And as the temperature increases also boiler zones which are usually in the hot temperature window of the boiler slowly pass the "formation window" for PCDD/F.

This explains also the much higher formation of PCDD leading to a PCDF/PCDD ratio at the boiler outlet of around 1 in this phase while under normal operation conditions ratios in the range of 8 – 12 are typical.[1] Also the evaluation of the chlorophenoles (ClP) and chlorobenzenes (ClB) which have been analyzed in some samples of the start-up procedure can support this attempt.

figure 2: effect of optimization in raw gas after boiler

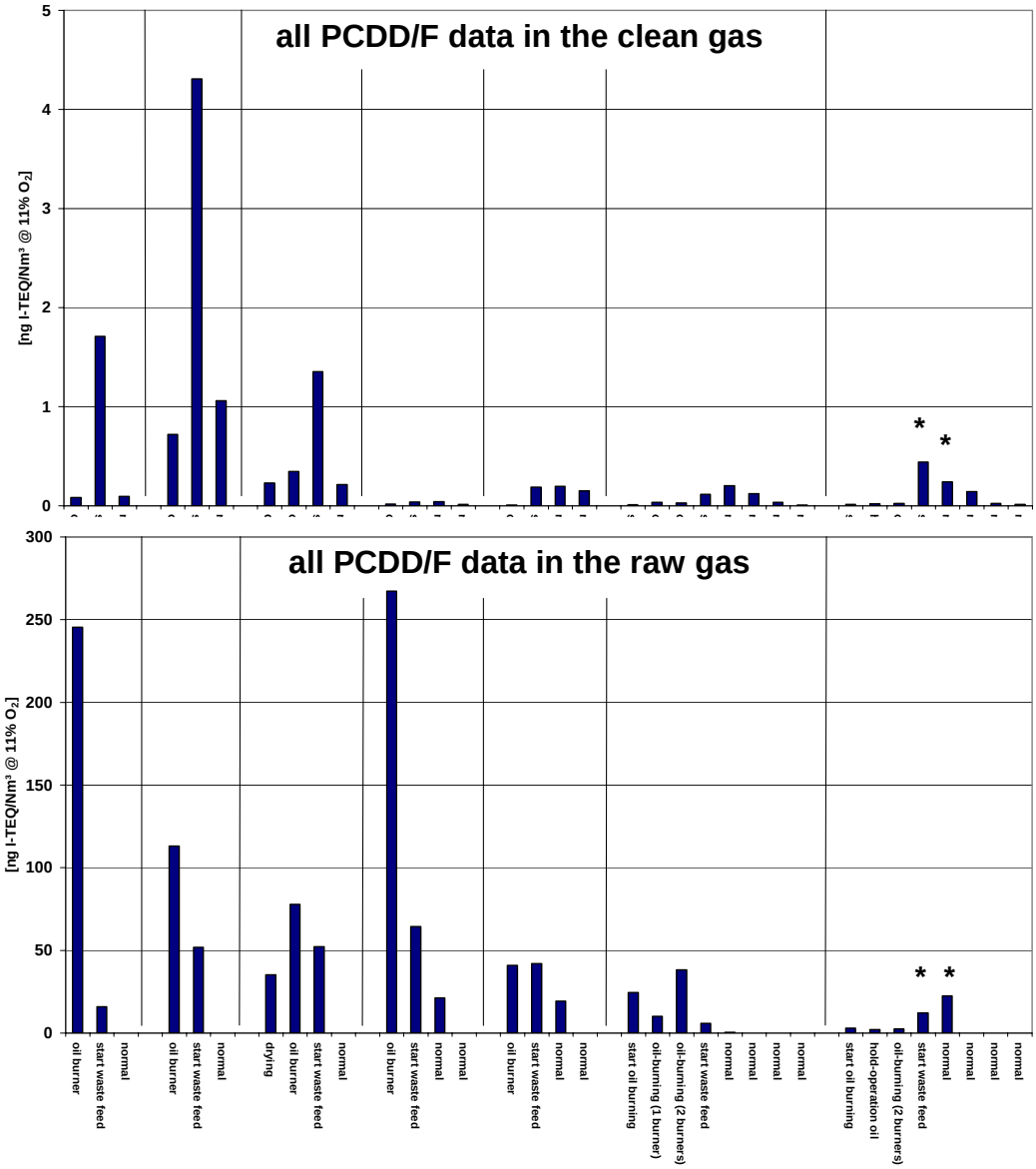


** disturbances due to high CO-levels*
This supports the observations that ClB and PCDF are most likely formed in the furnace while the ClP and PCDD are mainly formed in the cooling zone (boiler).[3,4]

The main target of the optimization program was to reduce the amount of soot formed by the oil burner which could be achieved by the following measures:

- Optimization of the burner for the start-up conditions
- filling the waste feeder with waste to avoid leakage air
- reduction of the primary and secondary air supply
- manual control and regulation of the air and fuel supply by strictly controlling the CO-level

figure 3: all PCDD/F data in raw and clean gas



** disturbances due to high CO-levels*

Conclusions

From the described optimization program at a MWI during start-up phase following conclusions could be drawn:

- Primary measures with strictly controlling of the CO level helped to reduce the formation and the inventory of soot in the boiler and consequently the formation of PCDD/F and related compounds significantly.

- With injection of an inert material in front of the first cleaning step a drastic reduction of the PCDD/F levels at the bag house outlet and therefore a sustainable protection of the clean gas unit could be realized.

Together with the use of an activated carbon injection the optimization of the cold start-up phase resulted in a sustainable reduction of the stack gas emissions of PCDD/F down to the range of normal operation even in the start-up phase.

Acknowledgement

The authors would like to thank MVB staff for providing the necessary data.

References

1. Gass H.C., Lüder K., Wilken M.; PCDD/F-Emissions during cold start-up and shut-down of a municipal waste incinerator, Organohalogen Compounds 56, (2002), 193-196
2. Gass H.C., Jager E., Menke D., Lüder K. , Long Term Study of Minimization of the PCDD/PCDF-Emission of a Municipial Solid Waste Incinerator in Germany; Organohalogen Compounds Vol. 36, 175-178, 1998
3. Hunsinger H., Jay K., Vehlow J.; Formation and destruction of PCDD/F inside a grate furnace; Chemosphere, Vol. 46, (2002), 1263-1272
4. Blumenstock M., Zimmermann R., Schramm K.-W., Kettrup A., Identification of surrogate compounds for the emission of PCDD/F (I-TEQ value) and evaluation of their on-line real-time detectability in flue gases of waste incineration plants by REMPI-TOFMS mass spectrometry; Chemosphere 42 (2001), 507-518