

# Examples of full scale tests on BFB WtE boilers with direct impact on the future operation of the facility

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# Three tests

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- Reference, Ref
- Reduced bed temperature, RBT
- Animal waste addition, AW



Waste fuel mix of:

- 80% Sorted industrial waste
- 20% Sorted household waste
- Bed temp 850°C



Bed temperature was reduced by means of:

- Flue-gas recirculation
- Water spraying of the fuel
- Reduced bed temperature from 850 to 720°C
- The same waste fuel mix



# Animal waste, AW

- Animal waste (carcasses and slaughter house byproducts) classified as “Risk of infection” and must be treated in a safe way
- Thermal treatment is an alternative
- Addition of 20% Animal waste to the waste fuel mix
- Bed temp decreased to 770°C



# Closed feeding system, AW



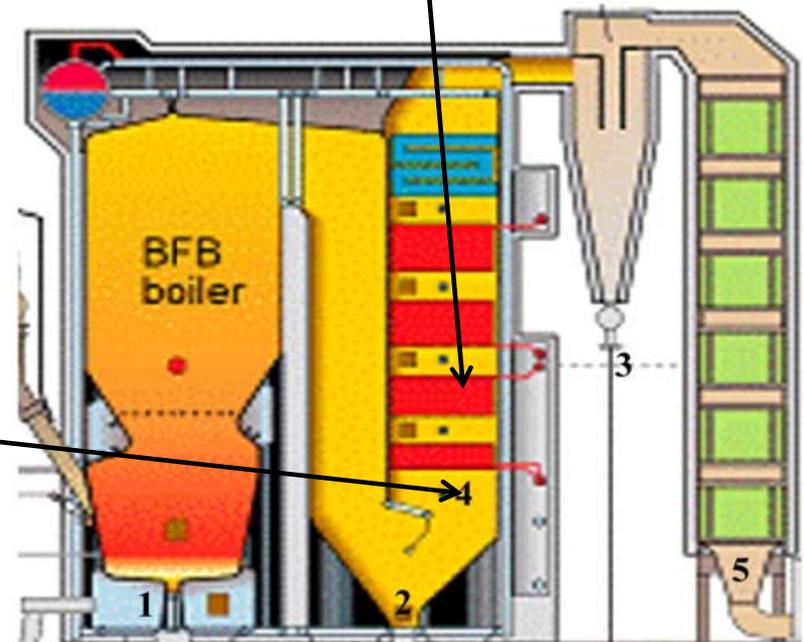
The largest differences between the “normal” waste mix and animal waste are:

- Increased moist
- Reduced heat value
- Increased amount of N, Ca and P
- Reduced concentration of Pb

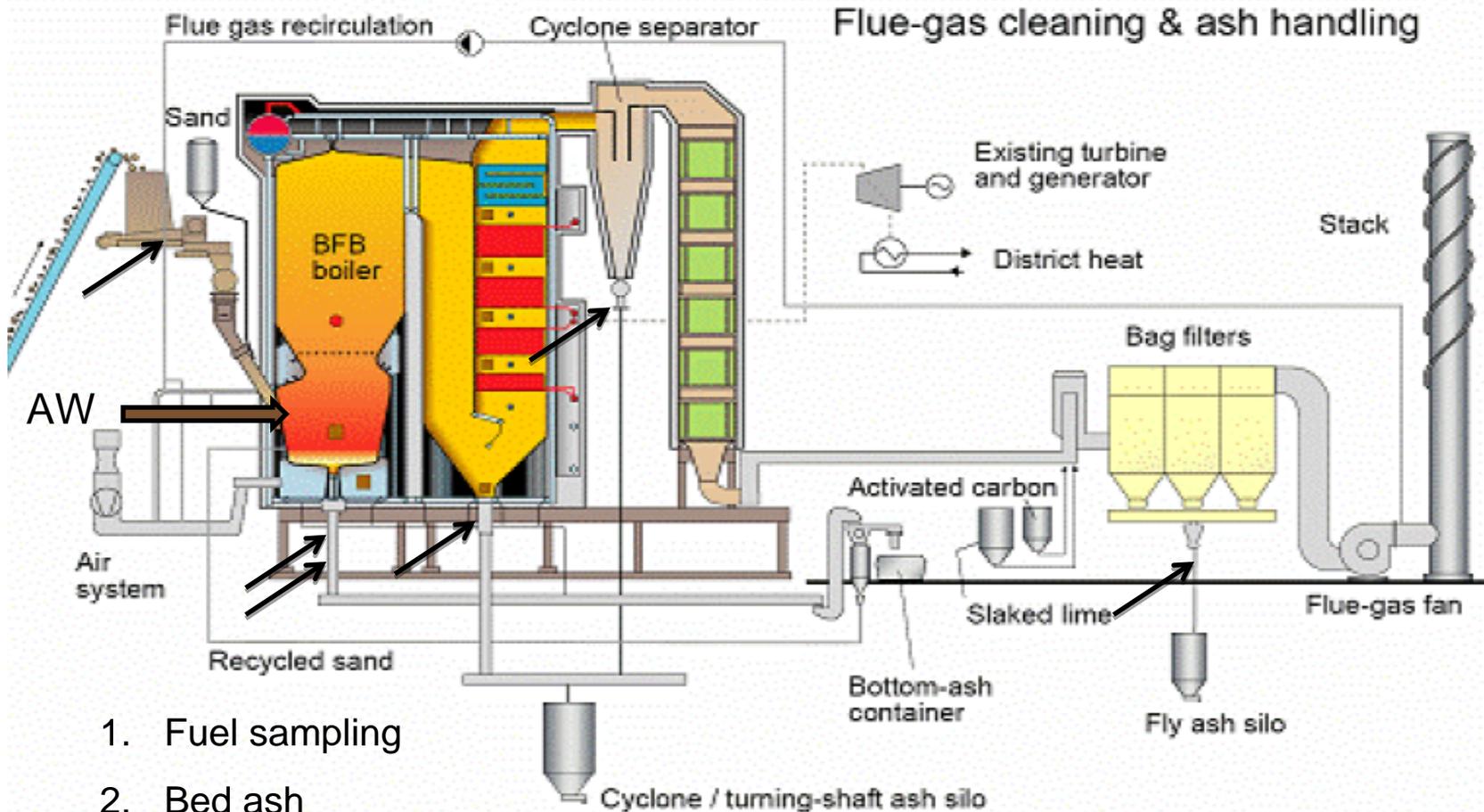


# Combustion tests

- Flue gas analysis
- Deposit analyses
- Fuel analyses
- Ash analyses



# Combustion tests



1. Fuel sampling
2. Bed ash
3. Return sand
4. Boiler ash
5. Cyclone ash
6. Filter ash

2\*20MW<sup>th</sup> BFB  
410°C  
49 bar

# Results

# Bed ash

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Reference, 850°C



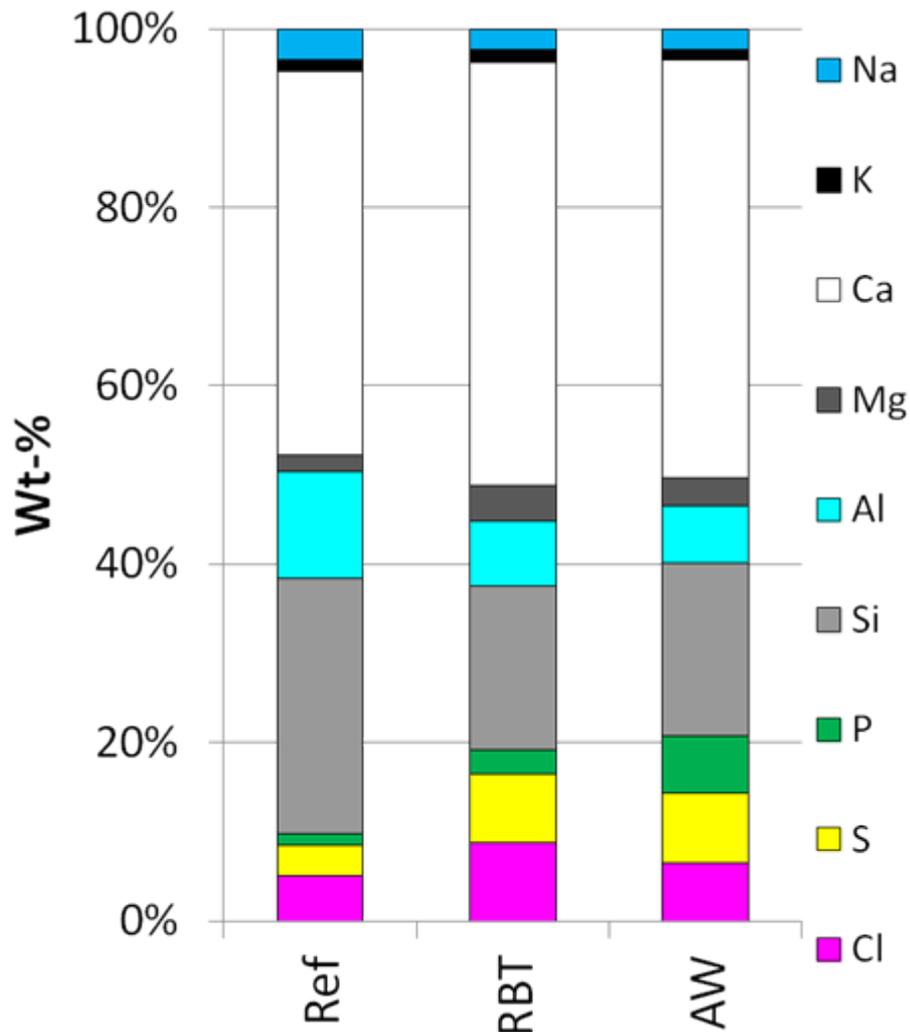
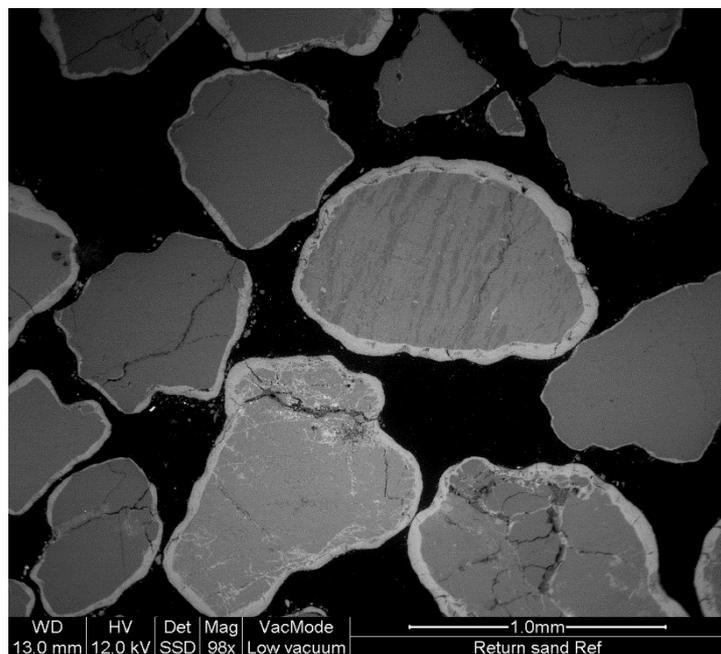
RBT, 720°C



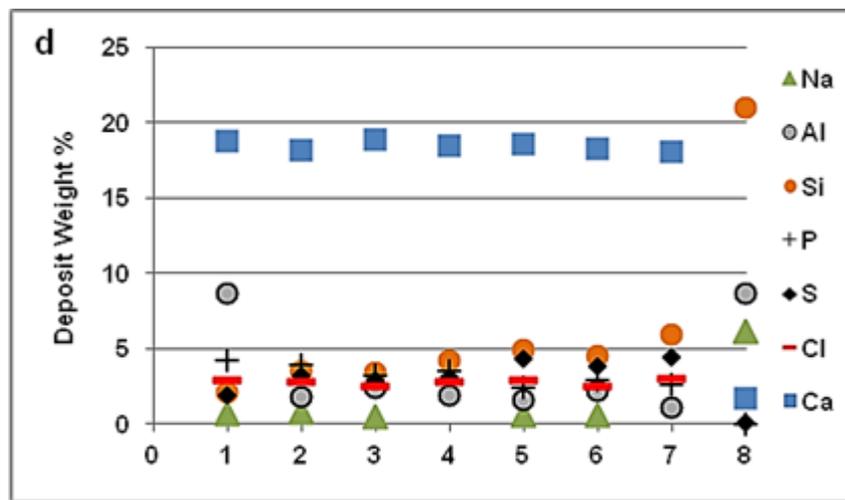
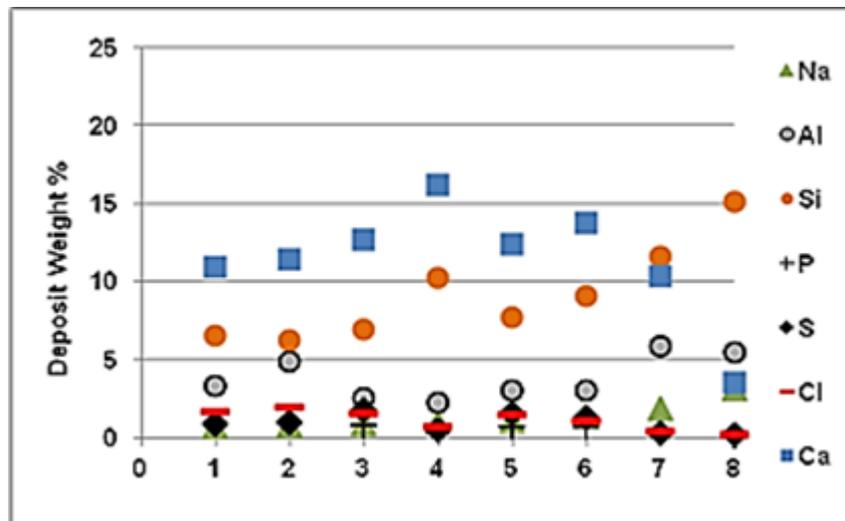
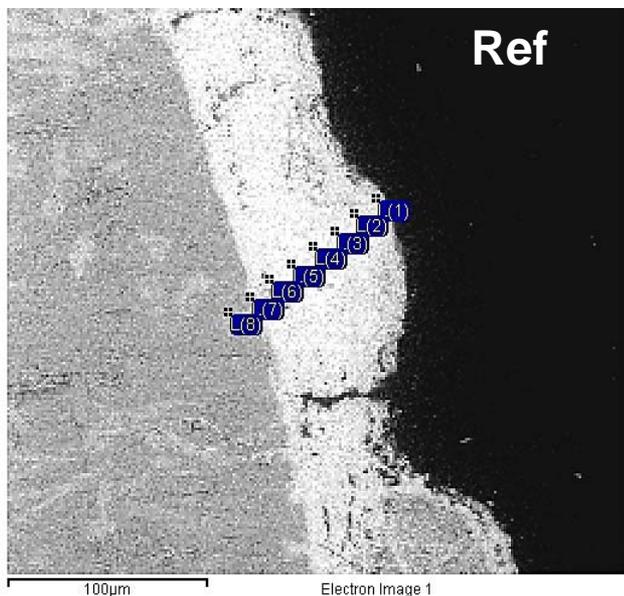
AW, 770°C



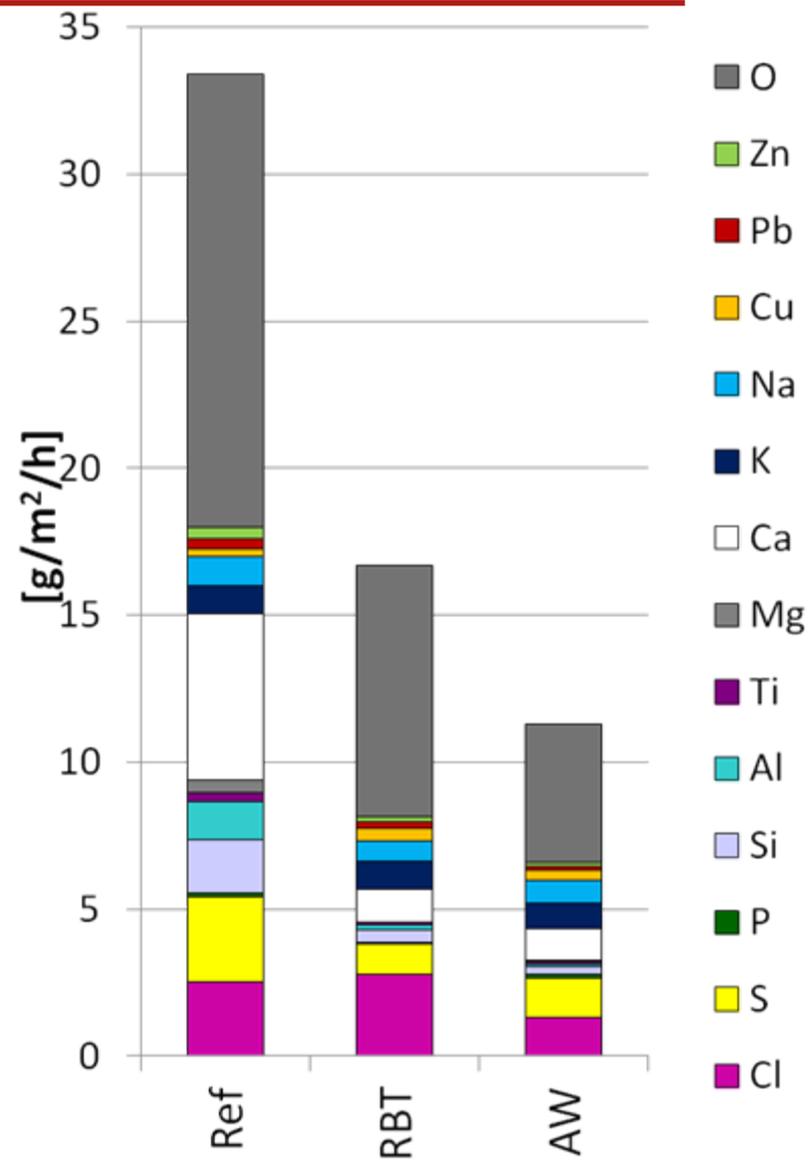
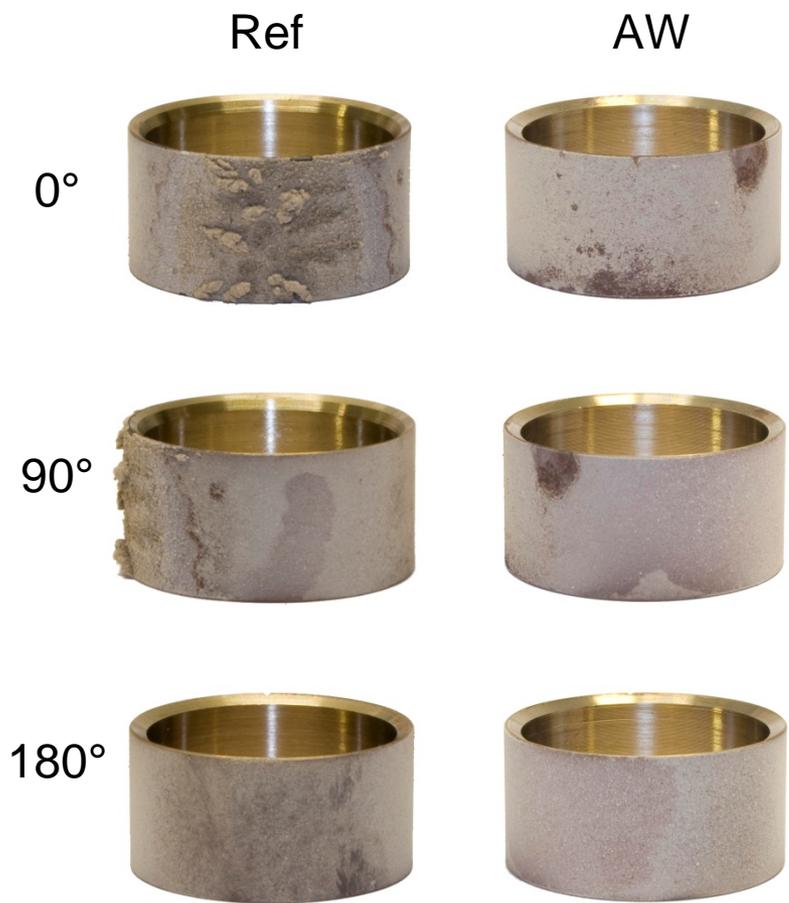
# Coatings on return sand particles



# SEM-EDX analysis of coatings on return sand particles



# Deposit formation

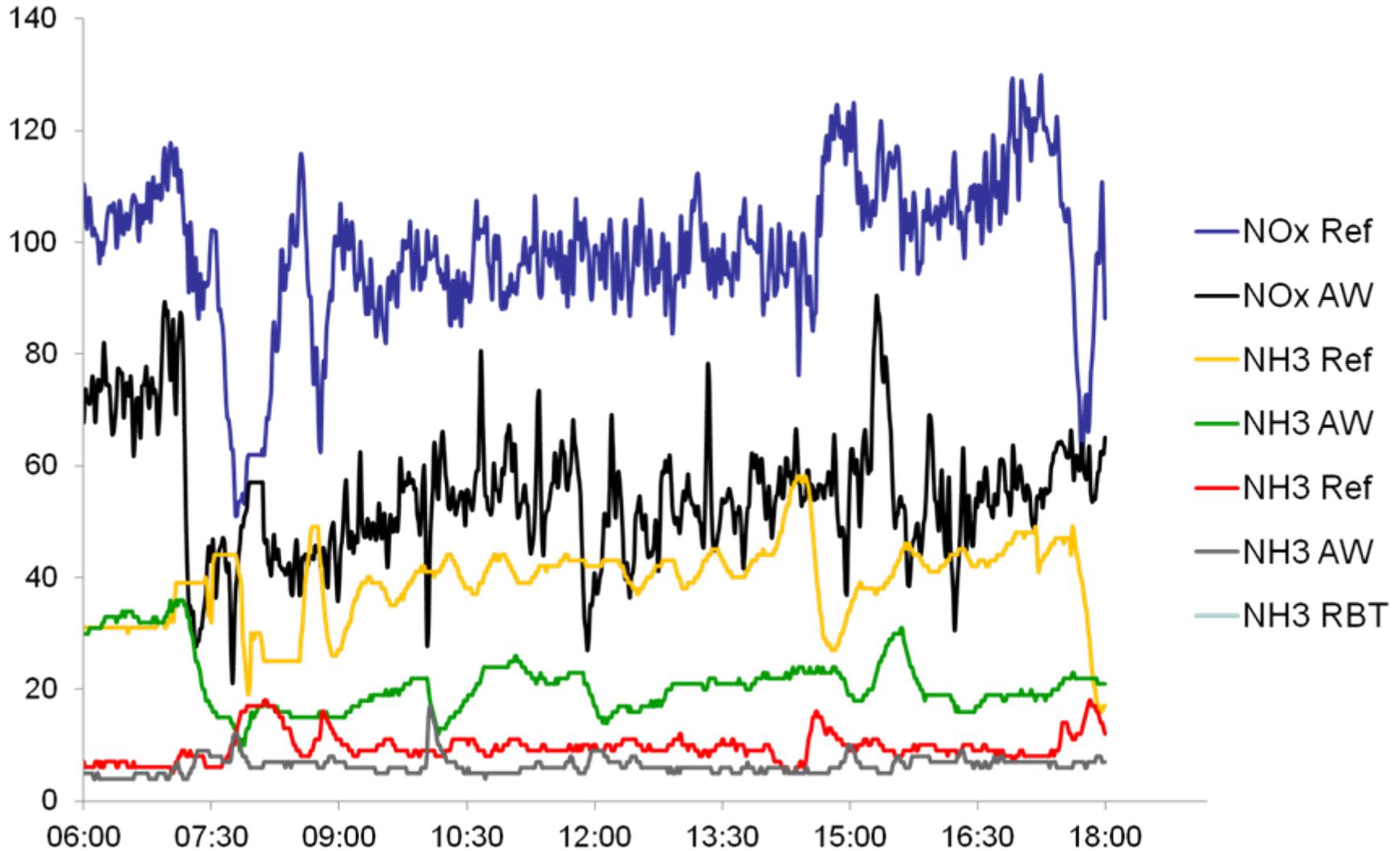


P in AW are found in bone- and soft-tissue

- Bone was passing through
- Rest found as Calcium phosphate



mg/m<sup>3</sup>n vid 11% O<sub>2</sub> alt I/h



# Measured NOx-concentrations after the project

| Addition   |                 | Boiler 1 | Boiler 2 |  | Date          |
|------------|-----------------|----------|----------|--|---------------|
| AW+Ammonia | NOx             | 60       | 65       | mg/Nm <sup>3</sup> @ 11 % O <sub>2</sub> | 110904-110906 |
| AW         | NOx             | 45       | 50       | mg/Nm <sup>3</sup> @ 11 % O <sub>2</sub> | 111105-111106 |
| Ammonia    | NOx             | 55       | 50       | mg/Nm <sup>3</sup> @ 11 % O <sub>2</sub> | 120109-120111 |
| AW+Ammonia | NH <sub>3</sub> | 3        | 4        | mg/Nm <sup>3</sup> @ 11 % O <sub>2</sub> | 110904-110906 |
| AW         | NH <sub>3</sub> | 3        | 2        | mg/Nm <sup>3</sup> @ 11 % O <sub>2</sub> | 111105-111106 |
| Ammonia    | NH <sub>3</sub> | 3        | 5        | mg/Nm <sup>3</sup> @ 11 % O <sub>2</sub> | 120109-120111 |

Reduced bed temperature gives:

- Less agglomeration – saves sand
- Less deposition – saves soot cleaning

Addition of animal waste gives:

- Less NO<sub>x</sub> – saves emissions and
- Reduces the need for anti-NO<sub>x</sub>

And in the same time a risk waste is destroyed!

# Partners

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