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

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www.wasterefinery.se
Three tests

- 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
Animal waste as fuel

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\textsuperscript{th} BFB
410°C
49 bar
Results
Bed ash

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

Ref

AW

0°

90°

180°

35
30
25
20
15
10
5
0

[g/m²/h]

Ref
RBT
AW

O
Zn
Pb
Cu
Na
K
Ca
Mg
Ti
Al
Si
P
S
Cl
Phosphorus

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

- Bone was passing through
- Rest found as Calcium phosphate
# Measured NOx-concentrations after the project

<table>
<thead>
<tr>
<th>Addition</th>
<th></th>
<th></th>
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<th></th>
<th></th>
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<tbody>
<tr>
<td><strong>Boiler 1</strong></td>
<td><strong>Boiler 2</strong></td>
<td>Date</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>AW+Ammonia NOx</td>
<td>60</td>
<td>65</td>
<td>mg/Nm$^3$ @ 11 % O$_2$</td>
<td>110904-110906</td>
<td></td>
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<td>AW NOx</td>
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<td>50</td>
<td>mg/Nm$^3$ @ 11 % O$_2$</td>
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<tr>
<td>Ammonia NOx</td>
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<td>50</td>
<td>mg/Nm$^3$ @ 11 % O$_2$</td>
<td>120109-120111</td>
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<td>4</td>
<td>mg/Nm$^3$ @ 11 % O$_2$</td>
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<tr>
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<td>mg/Nm$^3$ @ 11 % O$_2$</td>
<td>111105-111106</td>
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<tr>
<td>Ammonia NH$_3$</td>
<td>3</td>
<td>5</td>
<td>mg/Nm$^3$ @ 11 % O$_2$</td>
<td>120109-120111</td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

Reduced bed temperature gives:

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

Addition of animal waste gives:

- Less NOx – saves emissions and
- Reduces the need for anti-NOx

And in the same time a risk waste is destructed!