

Increased fuel flexibility and performance for boilers with challenging fuels

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14.09.2020

Increased fuel flexibility and performance for boilers with challenging fuels

- Calderys
- E.ON
- Energiforsk
- Falu Energi & Vatten
- Högskolan Väst
- Kanthal
- MH Engineering
- Mälarenergi
- RISE IVF
- RISE KIMAB
- Stockholm Exergi
- Valmet
- Vattenfall
- *Energimyndigheten*

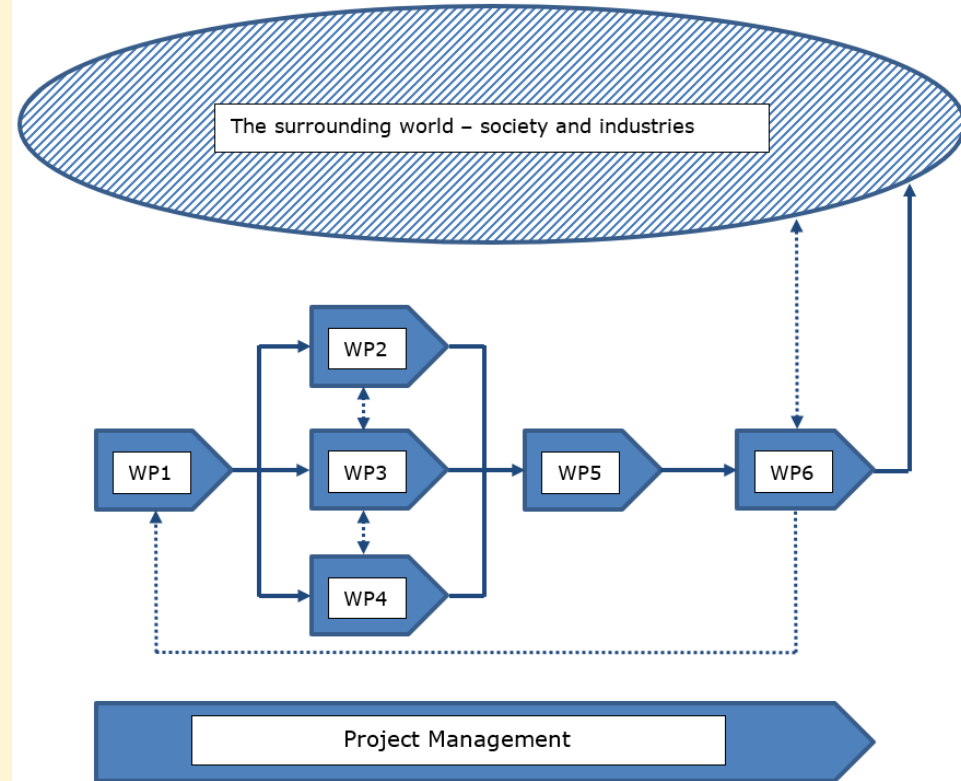
Background

- Biomass-based fuels often imply an elevated risk of corrosion caused by chlorides and alkali metals
- Recycled wood and waste often contains paint, plastics and metals
 - This results in high content of heavy metals (e.g. Pb and Zn) and chloride causing increased corrosion



Contents

- WP1 – Challenges and possibilities
- WP2 – Performance of cooled metallic parts
- WP3 – Performance of uncooled metallic parts
- WP4 – Refractories
- WP5 – Excellence in performance
- WP6 – Co-operation and communication

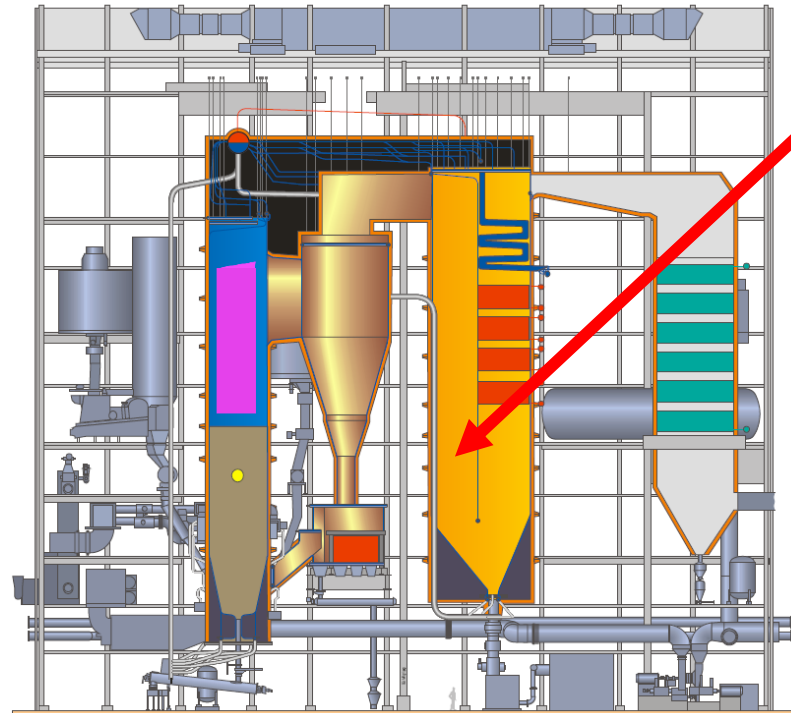


Performance of cooled metallic parts

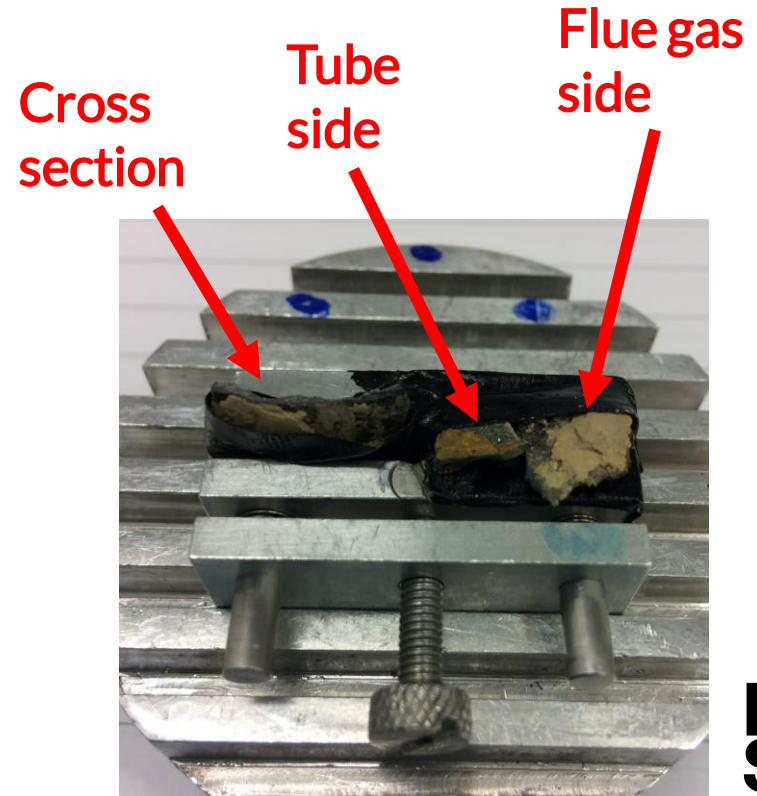
- Material performance will be investigated by metallographic evaluation of selected materials
- Field exposure of test materials has been made by a project FECRALCLAD with which this project collaborates
 - Investigation of field exposed materials has been started
- Performance of ordinary material is investigated as well

Performance of cooled metallic parts

- Oxide/deposit flakes
- Mälarenergi P6
- Empty Pass



Empty pass (Mälarenergi)



Empty pass (Mälarenergi) – Cross section



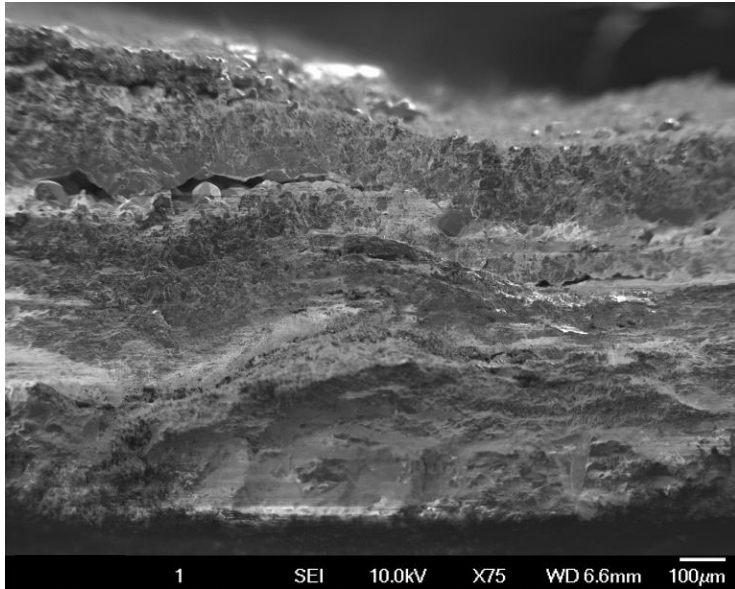
Tube side



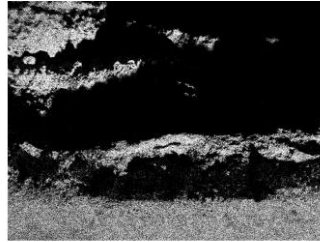
Flue gas side

Empty pass (Mälarenergi) – Cross section

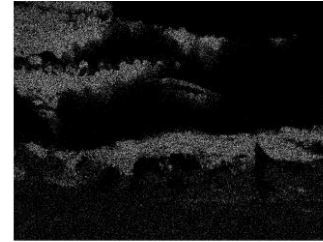
Tube side



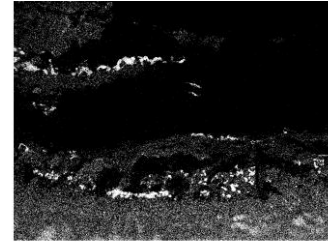
Flue gas side



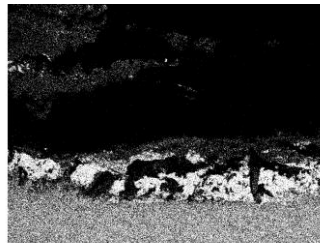
O Ka1



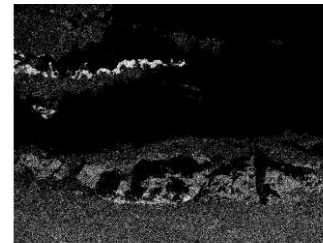
Fe Ka1



Zn La1_2 Na?



Pb Ma1 S?



K Ka1

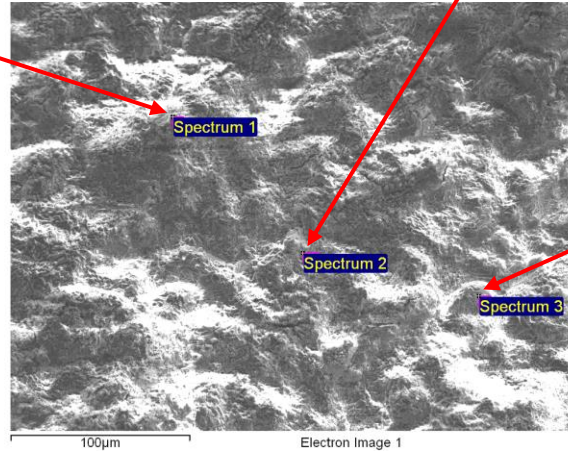


Cl Ka1

Empty pass (Mälarenergi) – Tube side



FeOx
Cl
Pb



FeOx
Cl

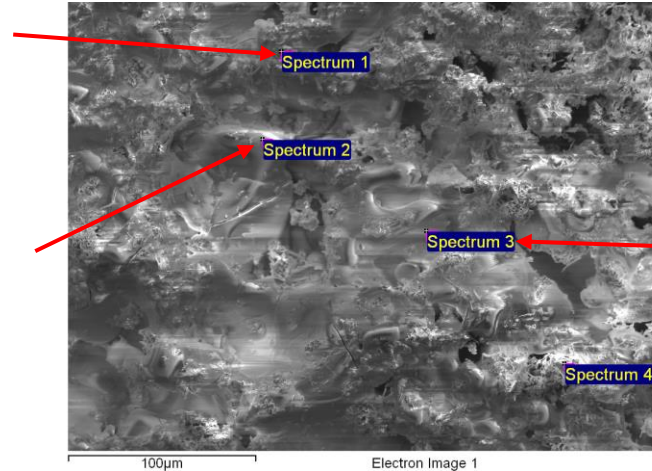
FeOx
Cl

Empty pass (Mälarenergi) – Flue gas side



Cl
Pb
K

Cl
Pb
K



FeOx
Ni
Ca

Performance of uncooled metallic parts

- Many components other than tubing, and that are mostly uncooled, such as cyclone vortex finder, supports, hangers, plates, refractory anchors and nozzles, frequently experience short life.
- Being uncooled these parts operate at a high temperatures giving intrinsically different challenges compared to cooled parts, as e.g. condensed phases in the deposits are expected to be different.

Performance of uncooled metallic parts

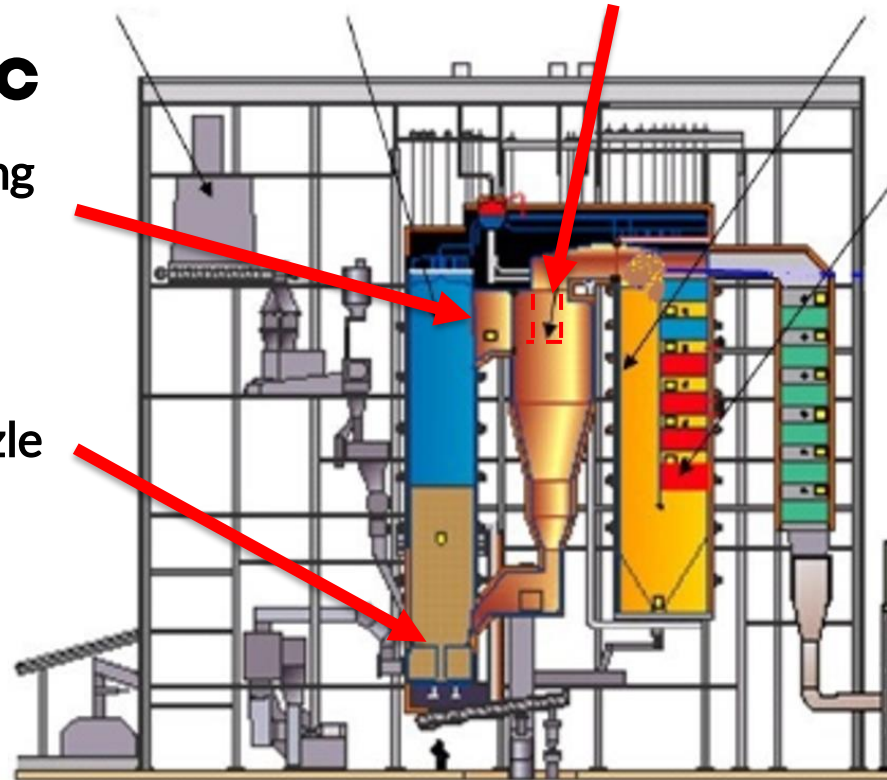
Samples from:

- Händelö P14
- Mälarenergi P6

Studding

Air nozzle

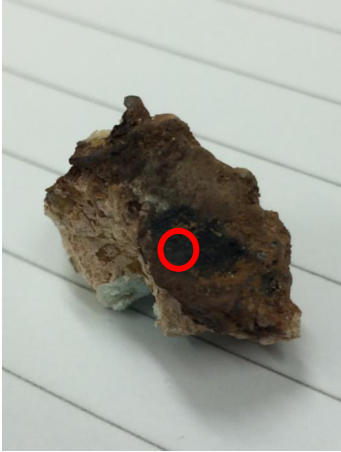
Vortex finder



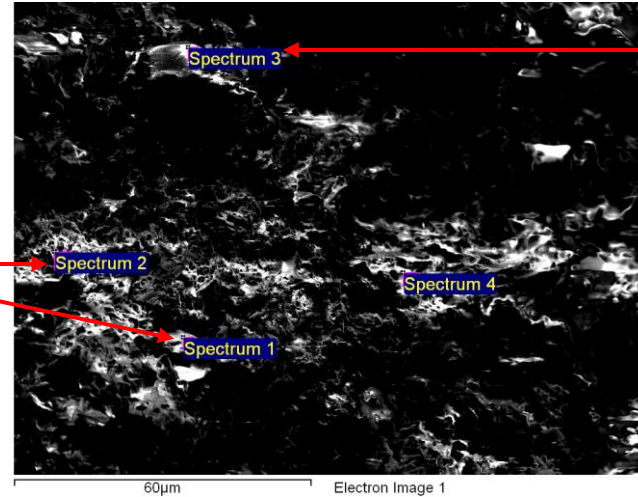
Studding from cyclone inlet (Händelö P14)



Studding from cyclone inlet (Händelö P14)



FeOx
Na
S
Ni



FeOx
Na
S
Ca
Ni

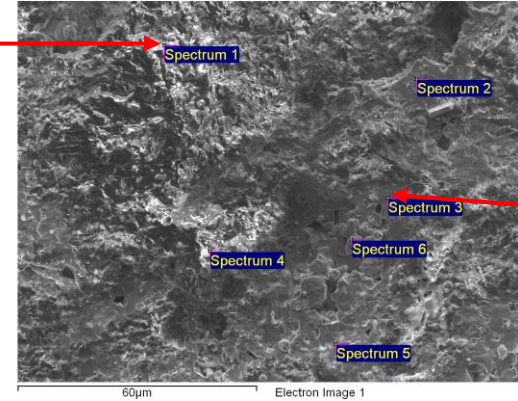
Vortex finder (Händelö P14)



Vortex finder (Händelö P14)



CrOx
Si

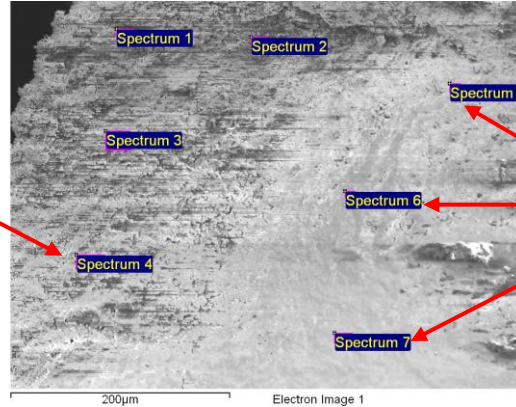


FeOx
Ni
Zn

Vortex finder (Händelö P14)



Fe
O
Ca
Na
K
Zn



Ca
Ti
O

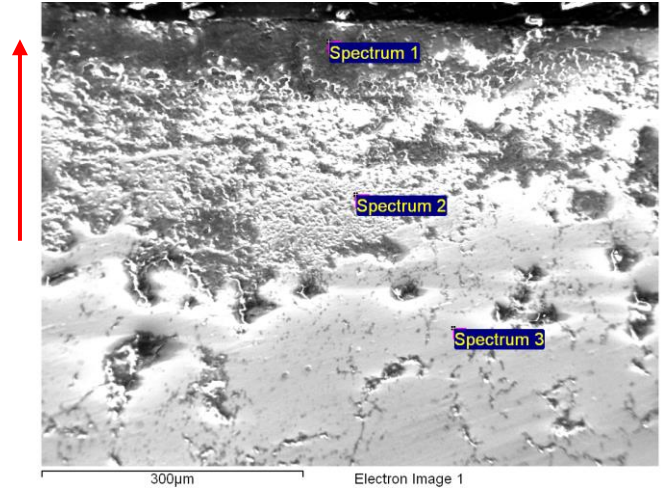
Vortex finder (Mälarenergi P6)



Vortex finder (Mälarenergi P6)



Increasing
Cr content



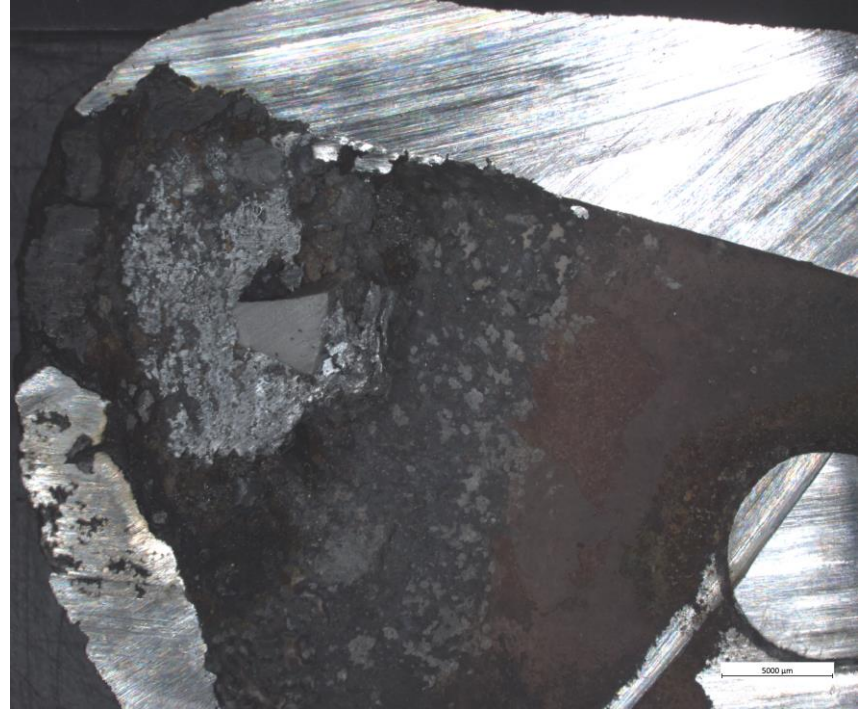
Primary air nozzles (Händelö P14)



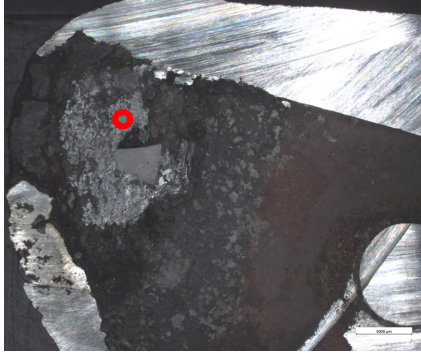
Primary air nozzles (Händelö P14)



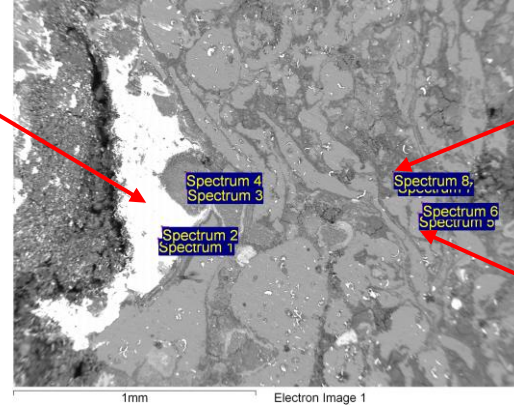
Primary air nozzles (Händelö P14)



Primary air nozzles (Händelö P14)



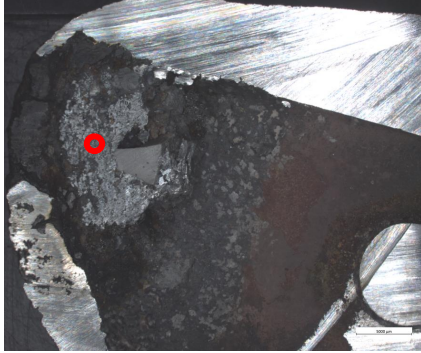
High Pb



Al
O

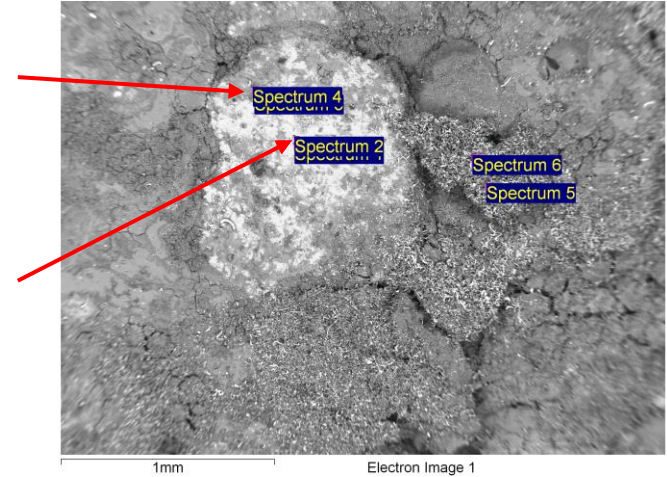
High Al

Primary air nozzles (Händelö P14)



Al
Zn
O

Al
Zn



Refractories

- Example of challenges encountered

Calderys is acknowledged for providing the image



XRF analysis at site (Händelö P14)

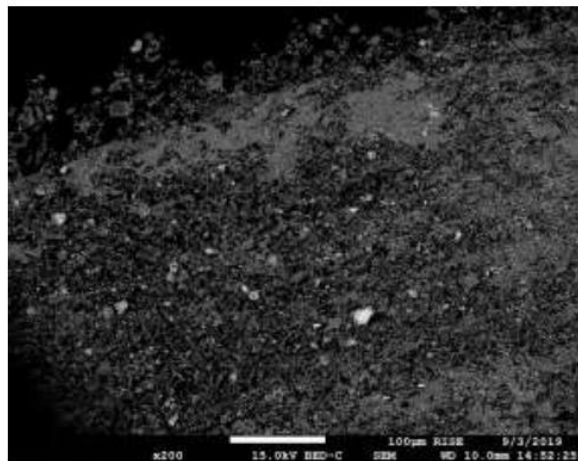
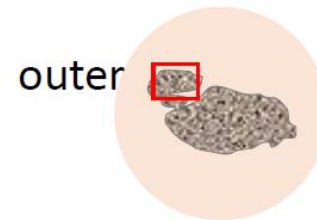


Specimen preparation

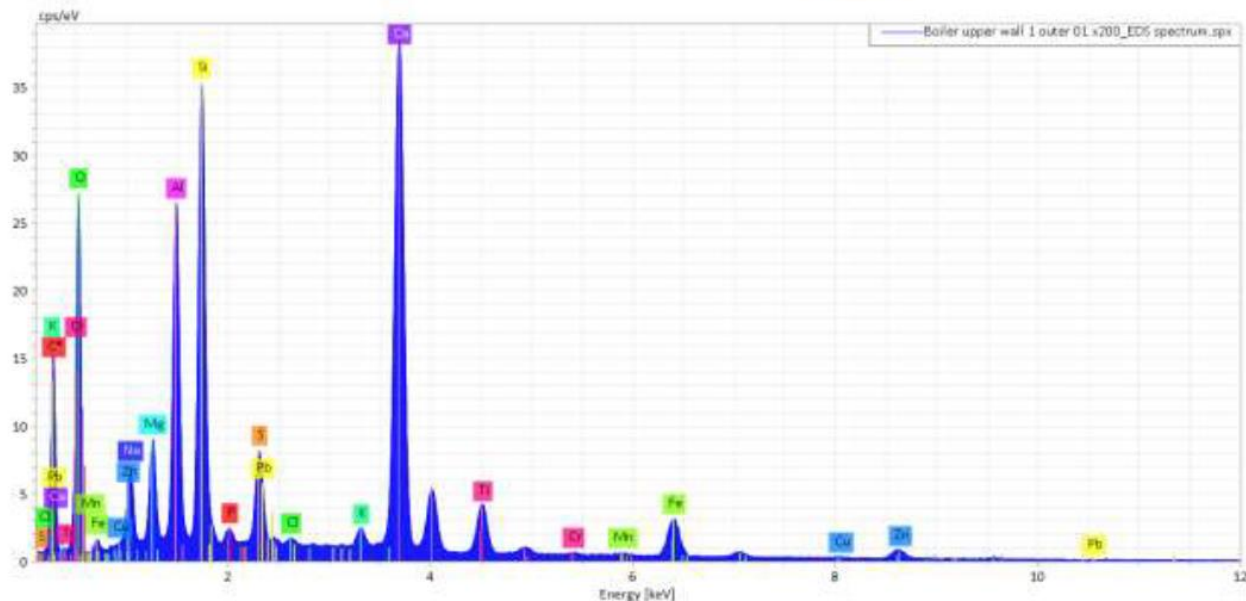
- Cross section through the wall thickness of the boiler lining
- Water free mechanical grinding and polishing
- First test, specimen: Cyclone inlet wall 1



Elemental analysis wall, outer



outer



Major elements found: Ca, Si, Al, O, Mg, Fe, S, Na, Zn

A large, light red dotted grid pattern covers the left half of the slide, extending from the top to the bottom and from the left edge to the center.

Thank you for listening!