

KME 508 - 708 - 718

Eldstadskorrosion – Hur forskning löste problemet

17-05-12 Pamela Henderson

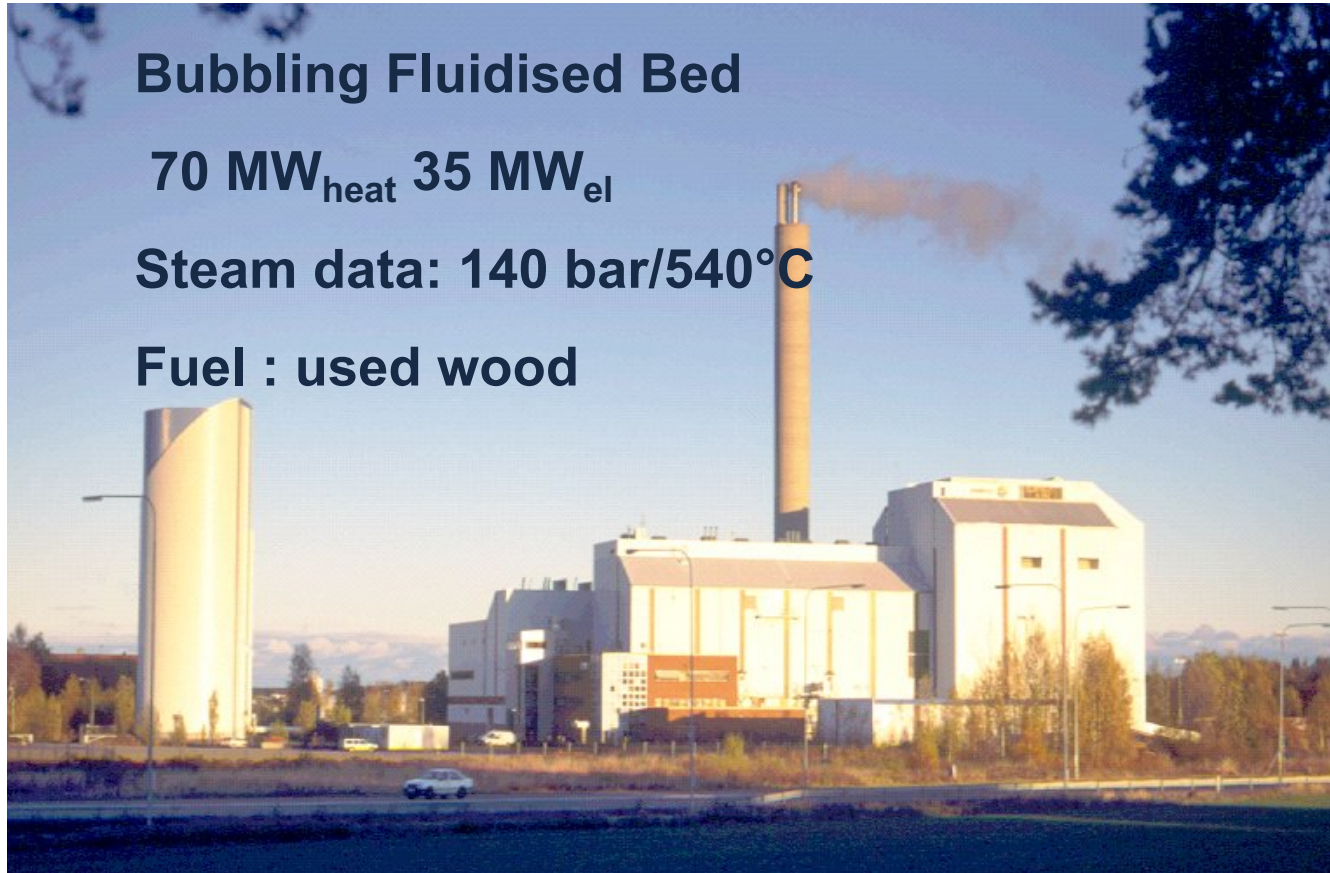
IDBÄCKEN LINE 3 (CHP) IN NYKÖPING

Bubbling Fluidised Bed

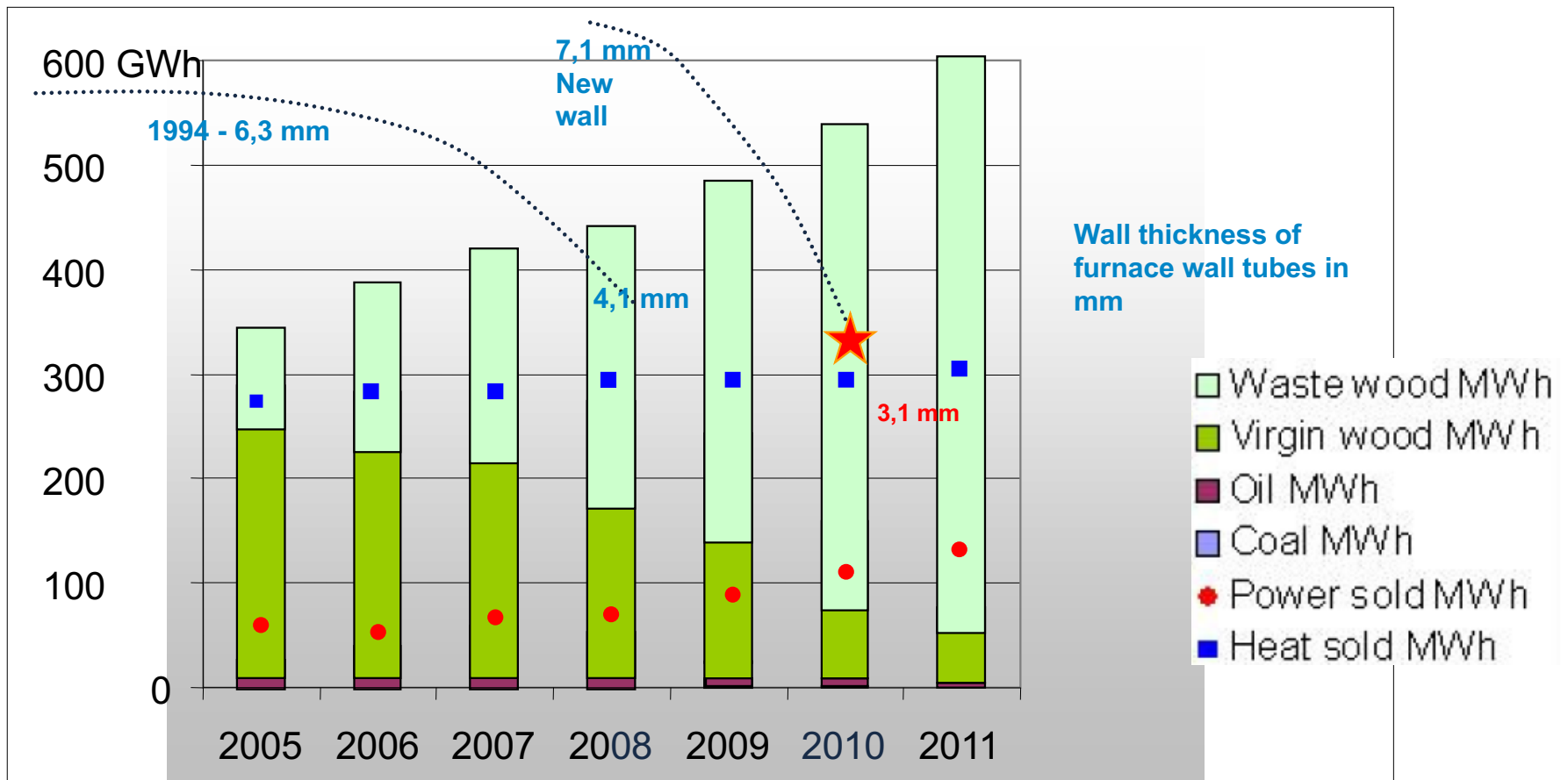
70 MW_{heat} 35 MW_{el}

Steam data: 140 bar/540°C

Fuel : used wood



FOREST FUEL TO WASTE WOOD INCREASES THE CORROSION ON THE FURNACE WALL



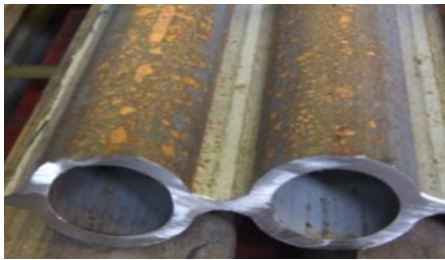
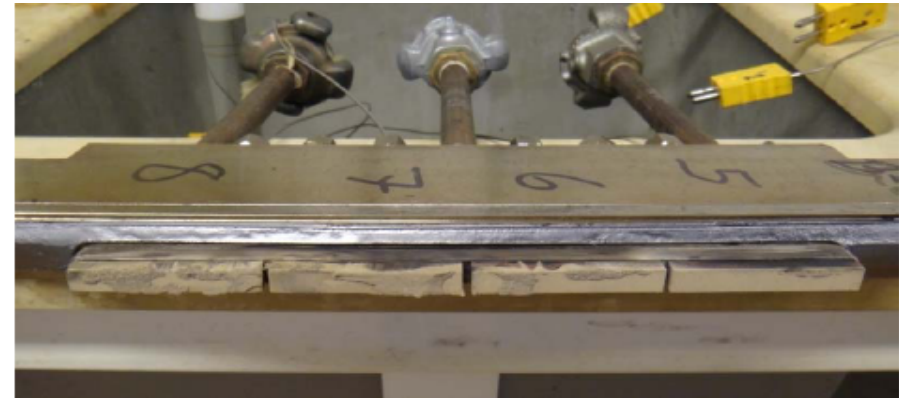
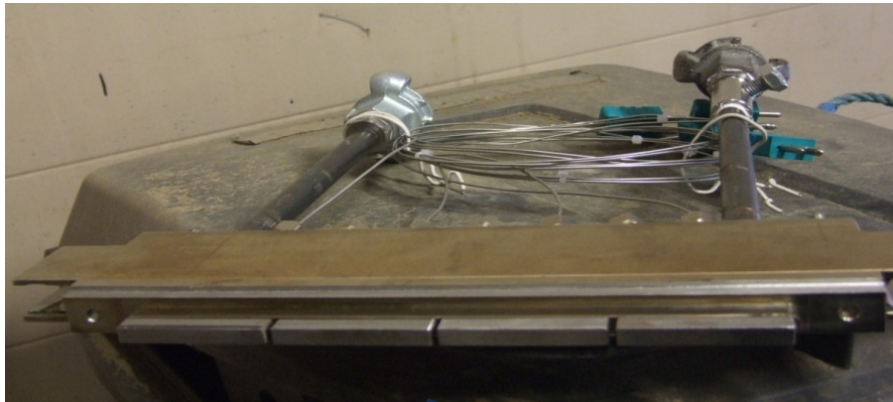
Fuel quality testing in Idbäcksverket CHP 100 MW

- Two fuel grades. 2 x 2 weeks tests. 2 wall probes each test, 350°C and 400°C. 2x16Mo3 and 2x Alloy 625 on each probe.
- Also 3 h deposit probe tests near superheaters

	Moisture %	Ash % d.s.	Cl % d.s.	S % d.s.	N % d.s.	K ppm d.s.	Na ppm d.s.	Pb ppm d.s.	Zn ppm d.s.
Used wood 1	34.9	6.2	0.13	0.07	1.1	1141	1783	36	390
Used wood 2	22.3	6.9	0.17	0.07	1.5	927	1019	119	111

UW 1 – low Cl, low Pb, higher Zn. UW 2 - high Cl, high Pb, lower Zn
These fuels were supplied to SP for laboratory testing

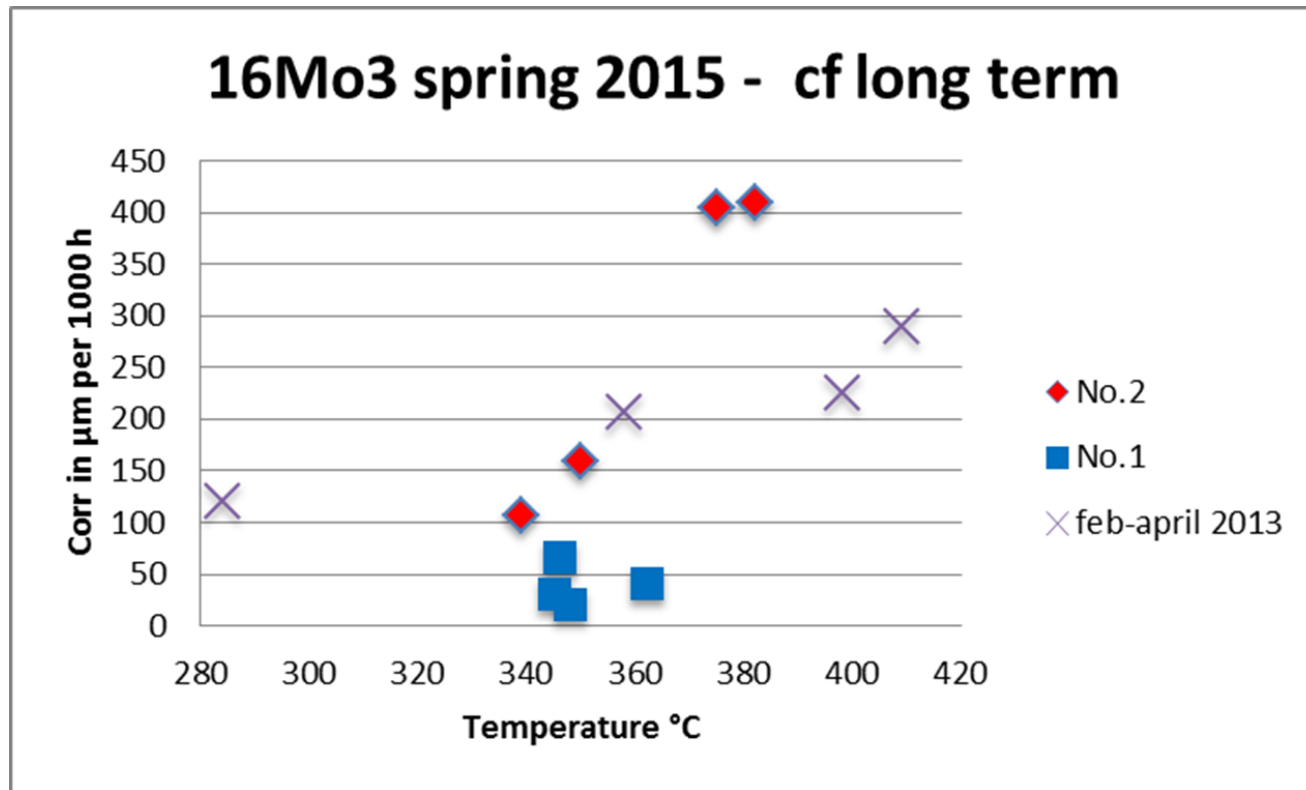
Vattenfall's corrosion probe testing – air-cooled furnace wall probe



Vattenfall's in-house probe. Sits between the tubes in the furnace wall. 4 specimens on each probe. Thermocouple in each specimen for individual temperature measurement. Control temp 350 and 400°C

2-week tests

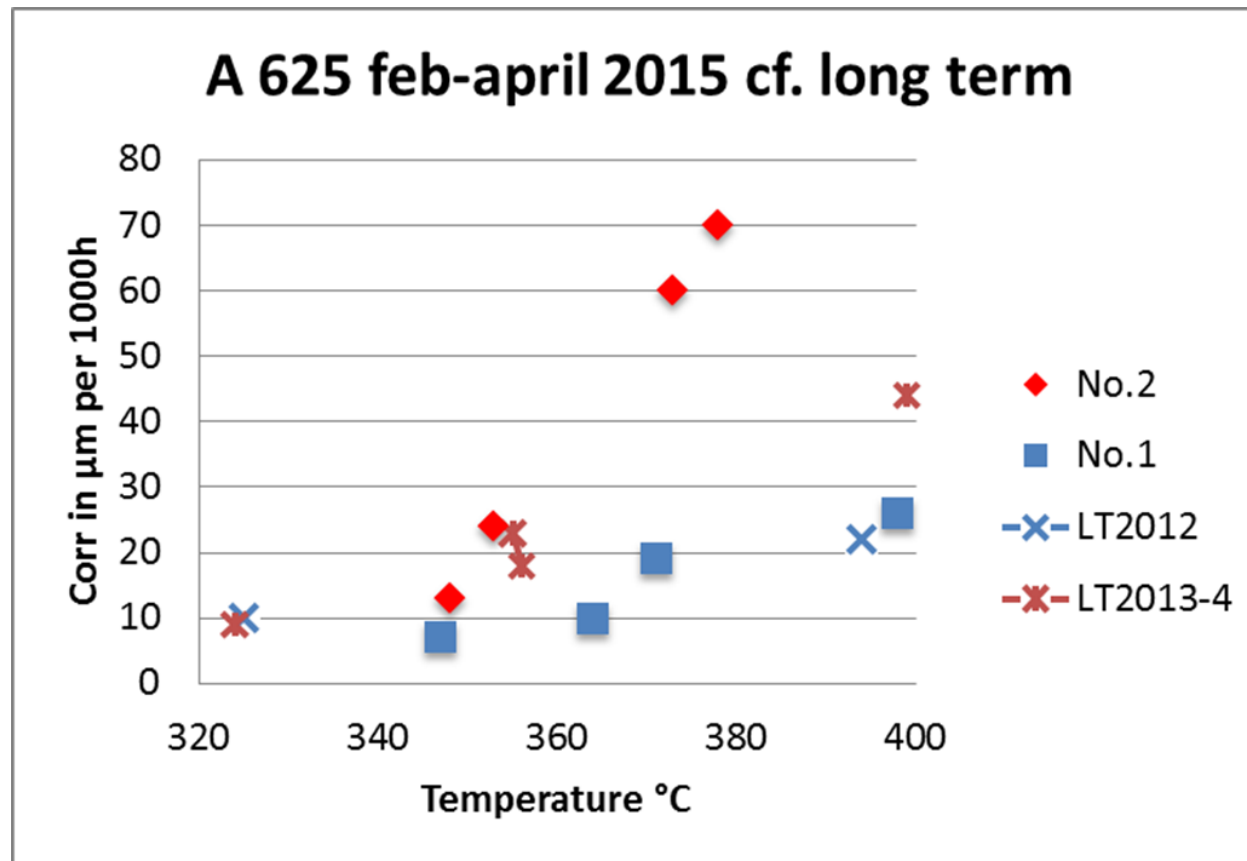
Used wood composition – 2 week corrosion testing at furnace wall



Fuel no. 2 (High Cl and Pb) causes more corrosion on 16Mo3 and is more temperature sensitive.

6 times more corrosion at the highest temperature

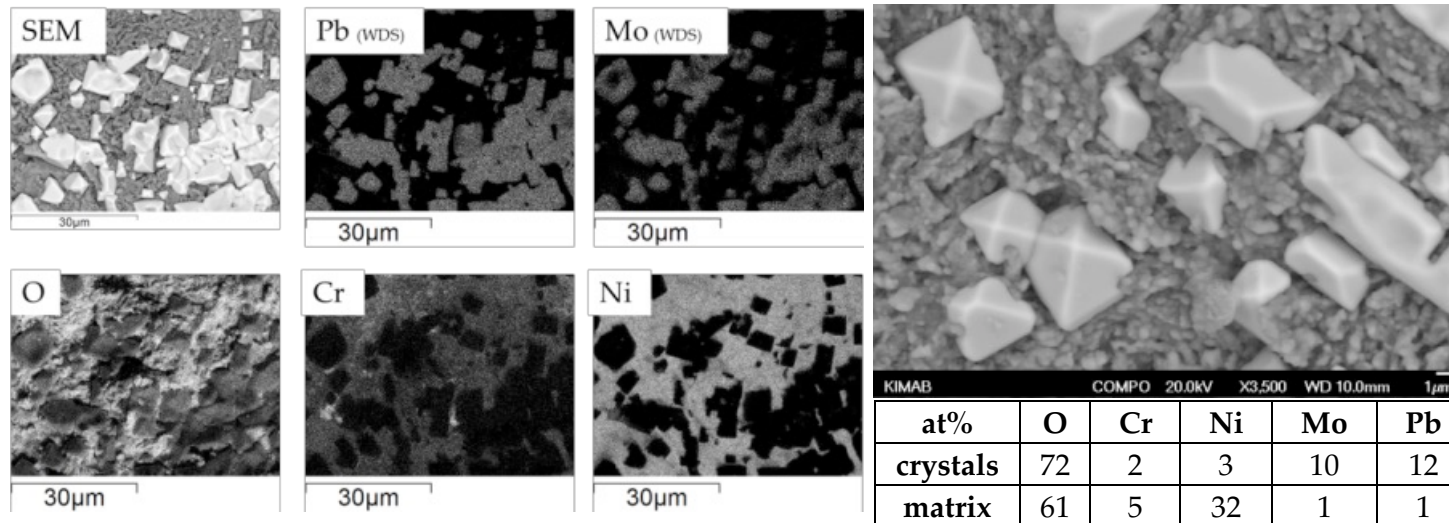
Fuel quality – 2 week corrosion testing at furnace wall



Fuel no. 2 (High Cl and Pb) causes more corrosion on Alloy 625 and is more temperature sensitive.

3 times more corrosion at the highest temperature.

Fuel quality – 2 week corrosion testing furnace wall A625 370°C



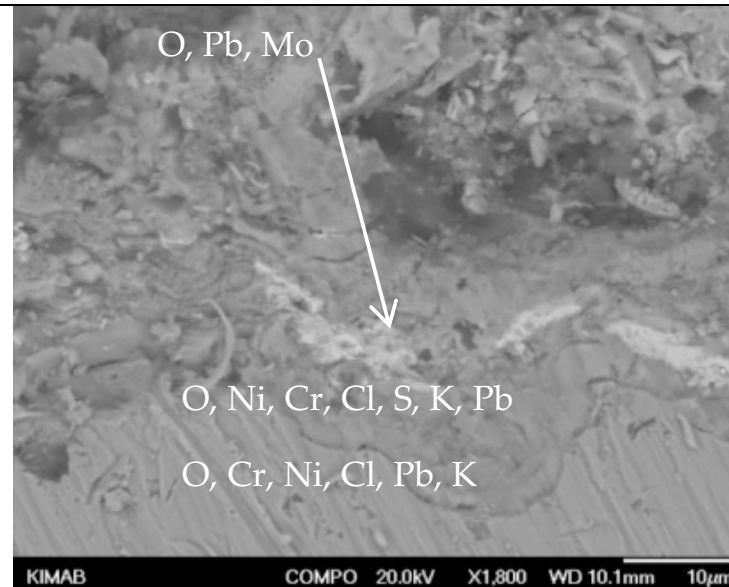
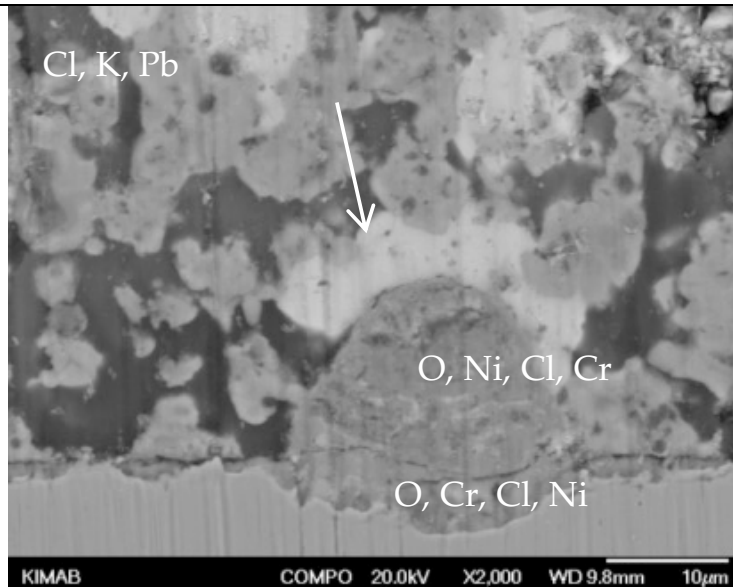
Lead molybdate, PbMoO₄, was found on the surface and in the cross sections of Alloy 625 samples exposed in Fuel 2 at temperatures of 370°C and higher. PbMoO₄ was identified by EDS analysis and X-ray diffraction.

Fuel quality – 2 week corrosion testing furnace wall A625 350 - 370°C – Fuel 2

350 °C

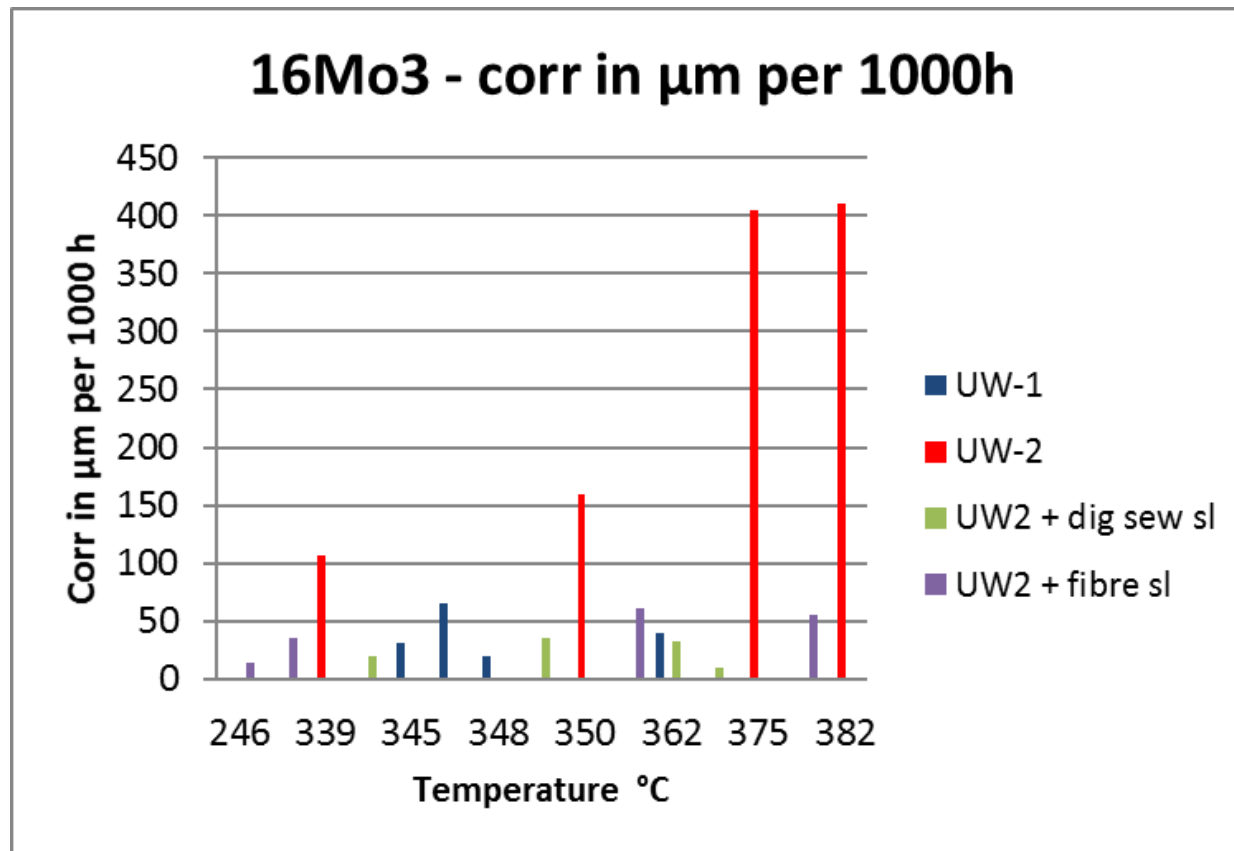
370 °C

Local corrosion attack

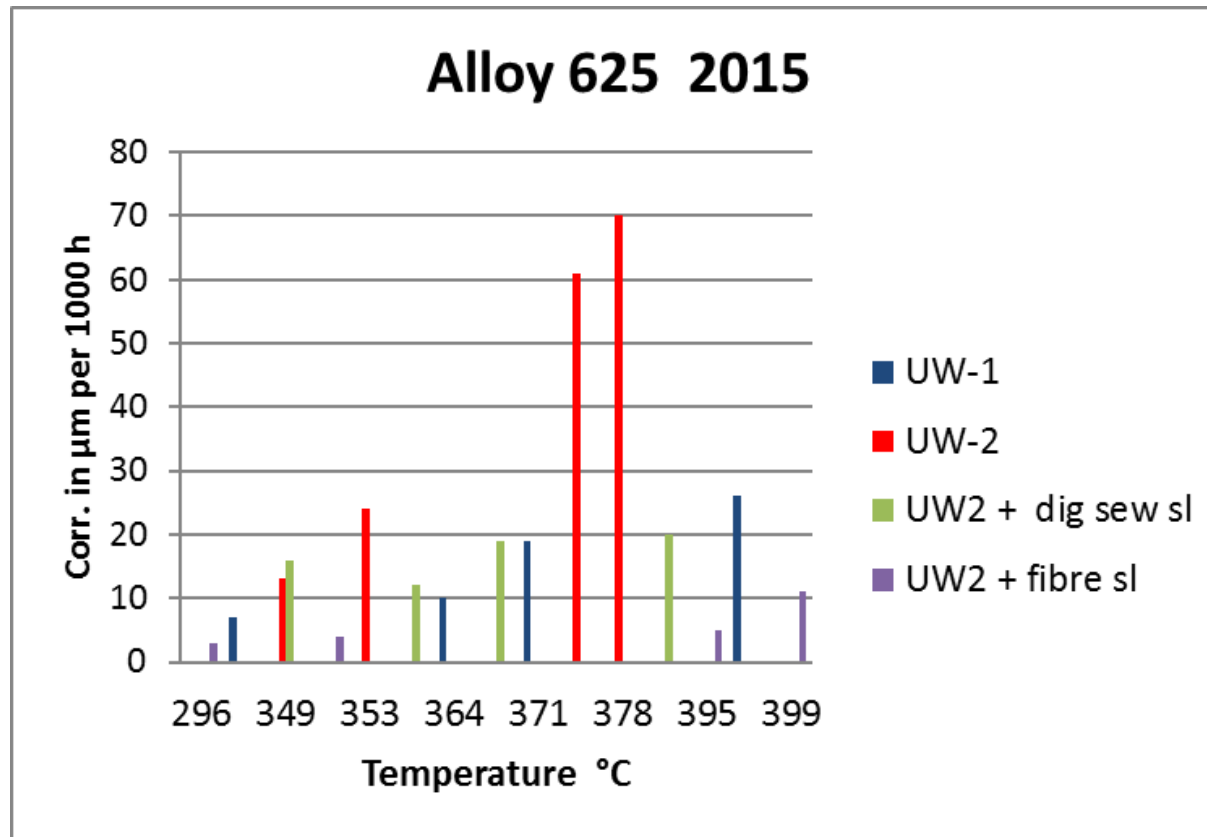


At lower temperatures (350 °C) no lead molybdate PbMoO_4 , was found in the corrosion products but compounds rich in Pb, K and Cl were often found in a deposit -alloy mixture

Co-firing Used wood no.2 with sludge – furnace wall corrosion

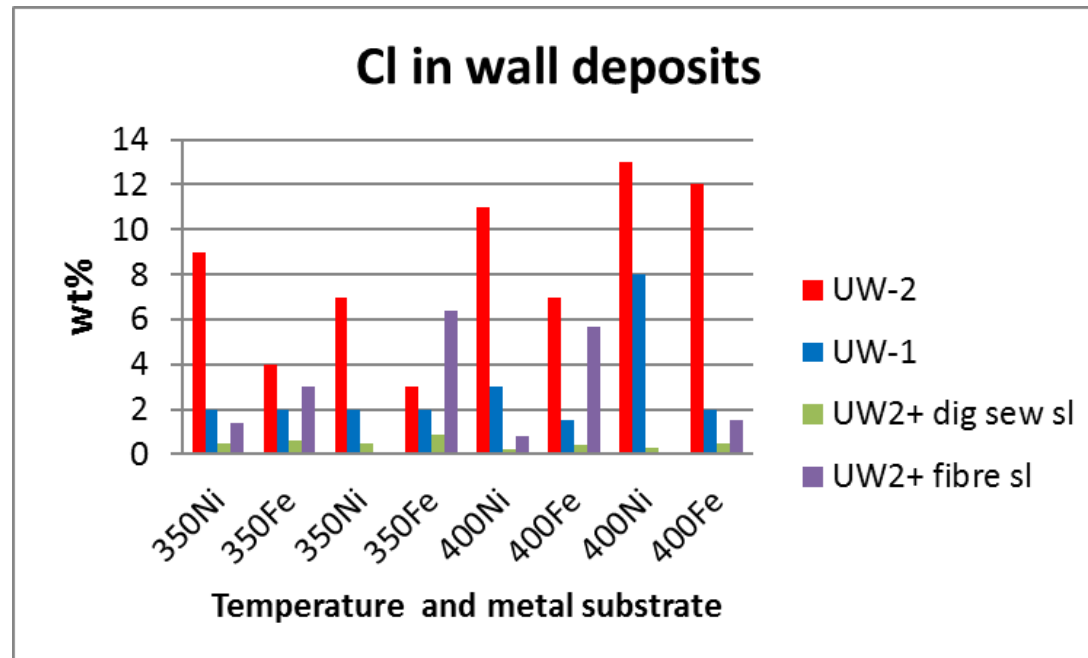


Co-firing Used wood no.2 with sludge – furnace wall corrosion



Furnace wall corrosion can be reduced by careful control of used wood composition and mixing high Cl/Pb used wood with sludge

CL- IN WALL DEPOSITS AFTER 330H EXPOSURE. 350°C AND 400°C PROBES



The deposits were uneven/ inhomogeneous and some caution is needed in interpretation.

Generally:

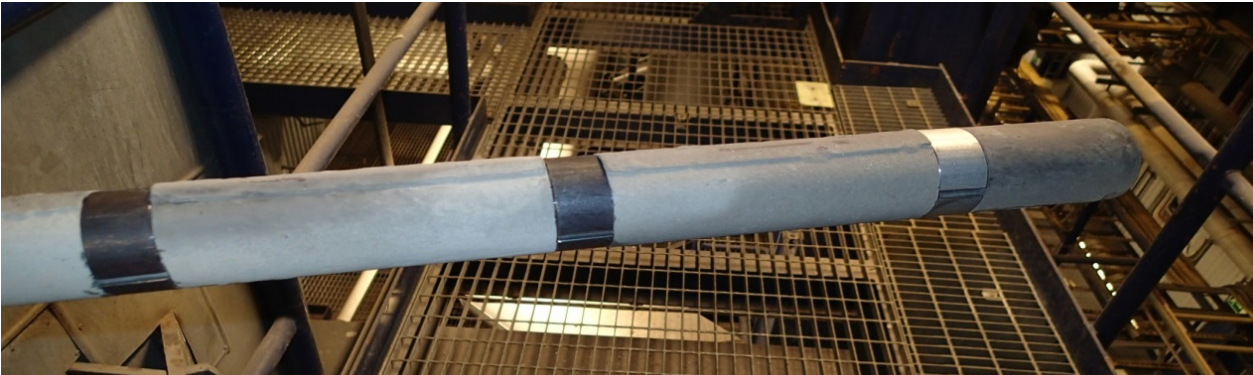
More Cl in UW2 deposits

Sludge reduces Cl-levels

Vattenfall's deposit probe testing in SH region. UW1 and 2

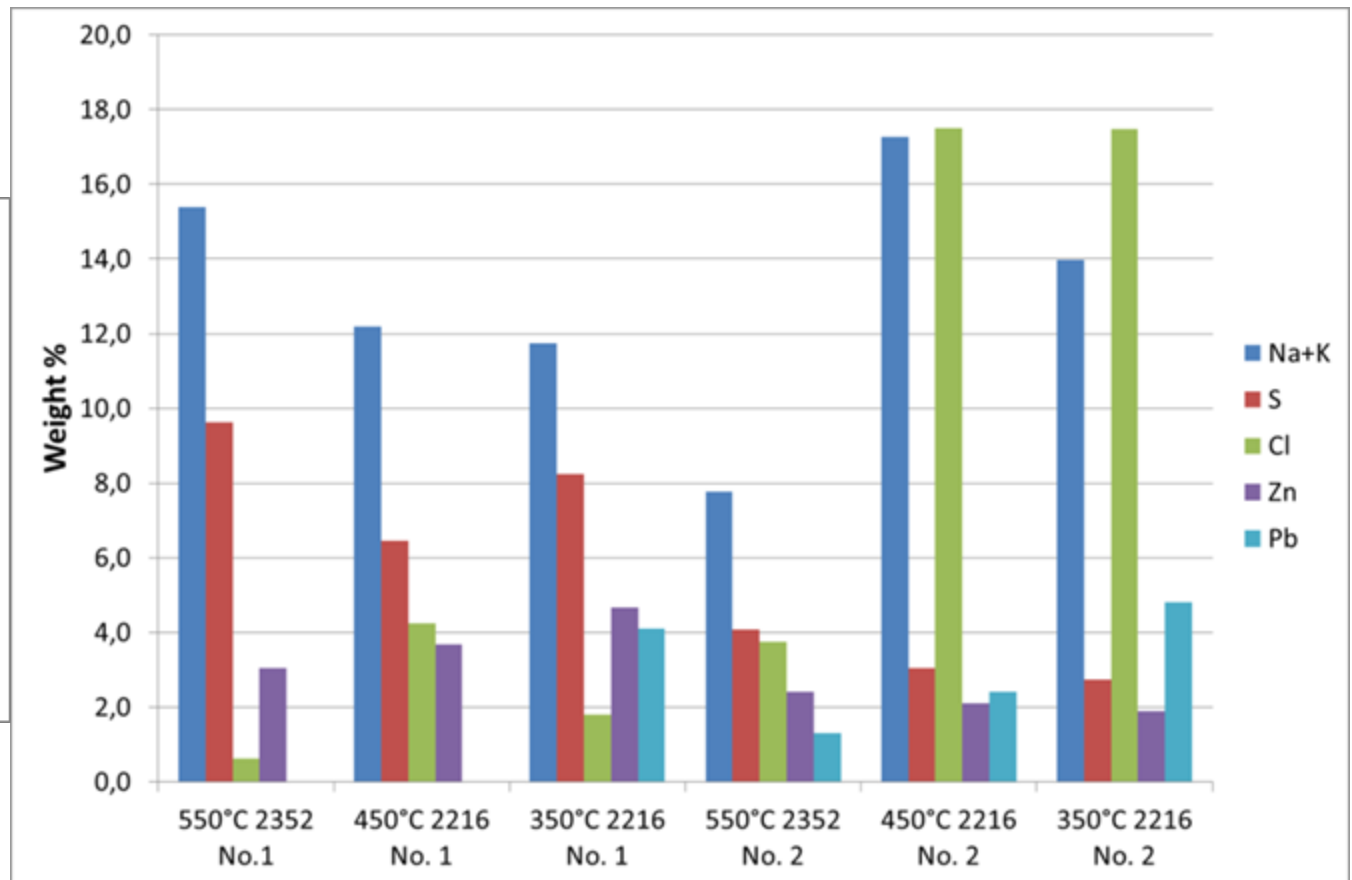
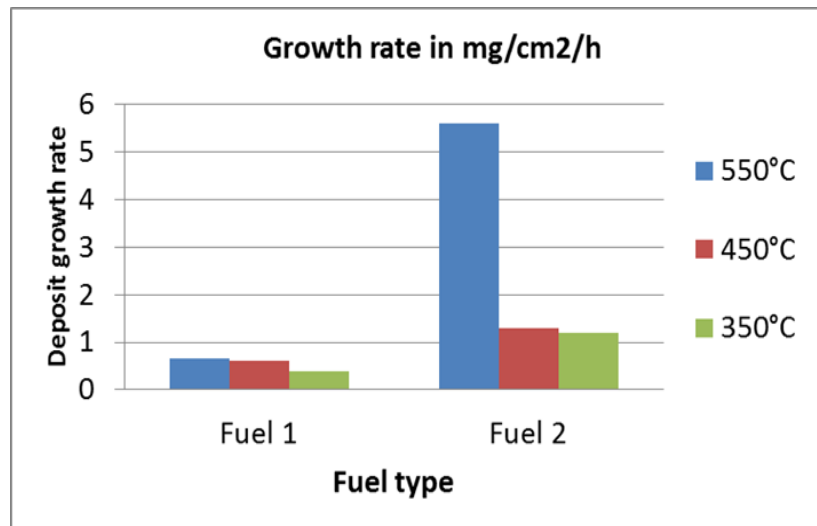
Air cooled probe – 3 hour tests. ChlorOut shut off

Three rings at temperatures 350, 450, 550°C
(equivalent to steam temp ~520°C)

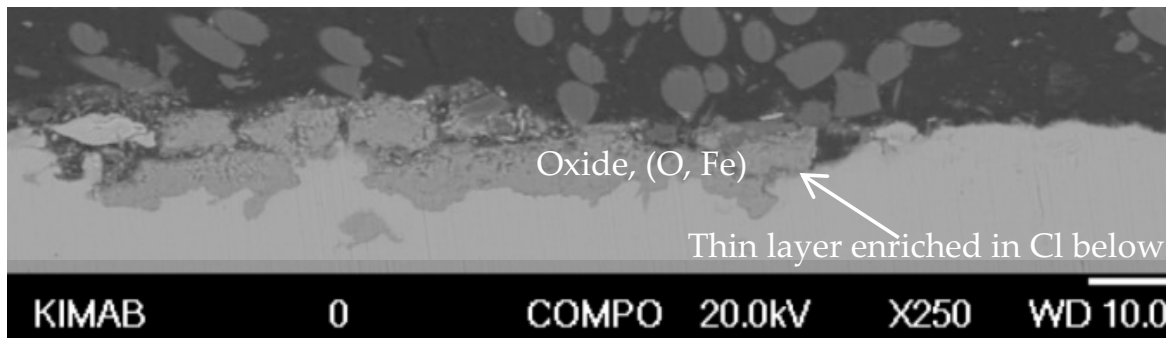


- Weigh ring before and after exposure for deposit growth rates.
- Analyse deposit with SEM for information on corrosion risk

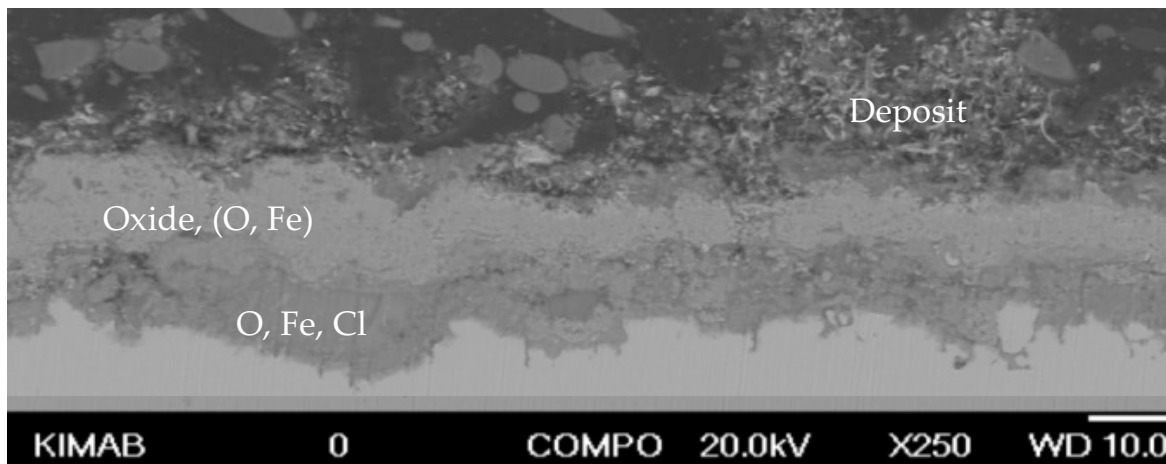
Fuel quality - 3 hour deposit testing near SH in 100MW CHP



Fuel quality - 3 hour deposit testing near SH – 13CrMo44 450°C

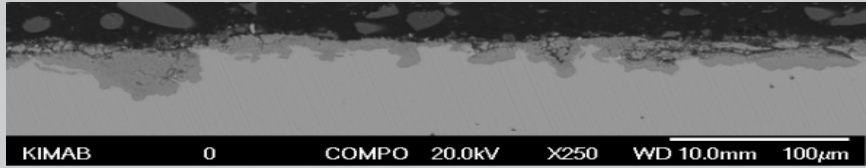
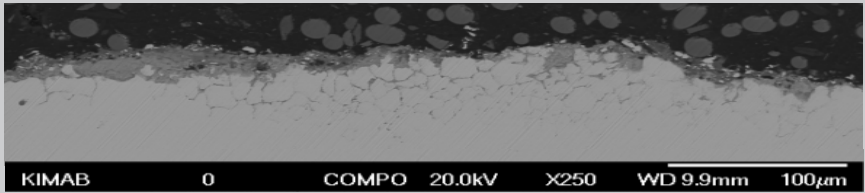
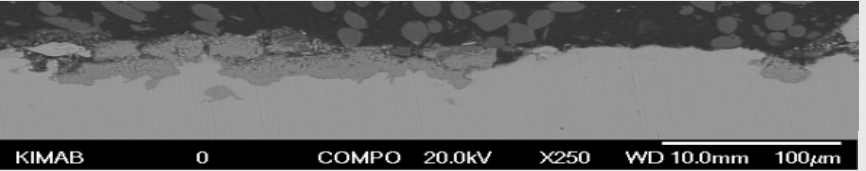
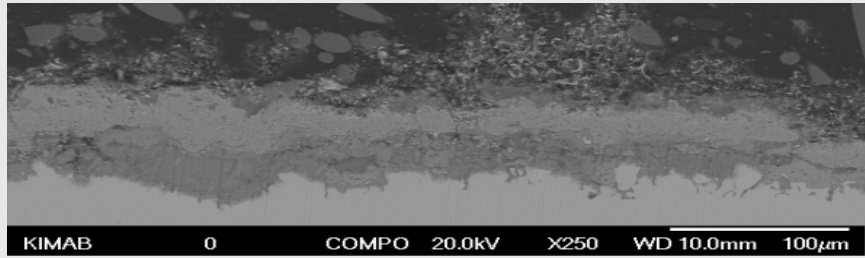
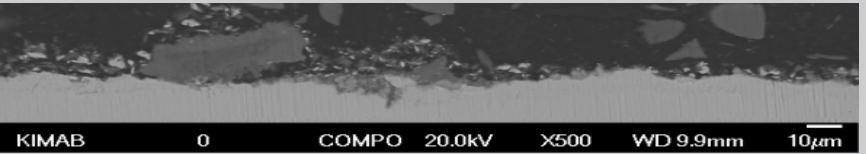
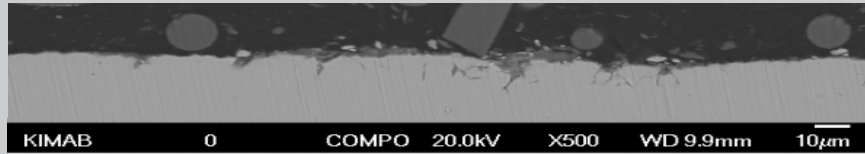


Fuel 1



Fuel 2

Superheater 3h cross-section appearance summary

		Low Pb/Cl	High Pb/Cl
2216	350		
	450		
2352	550		

For all temperatures the corrosion increases with higher Cl/Pb-content in the fuel.

Corrosion low in both cases for stainless steel at 550°C.

SS2216 = 13CrMo44, SS2352 = TP304L

Thank you

