GAS STORAGE DENMARK

GAS QUALITY IMPACT ON BLACK MATTER FORMATION IN GAS STORAGES

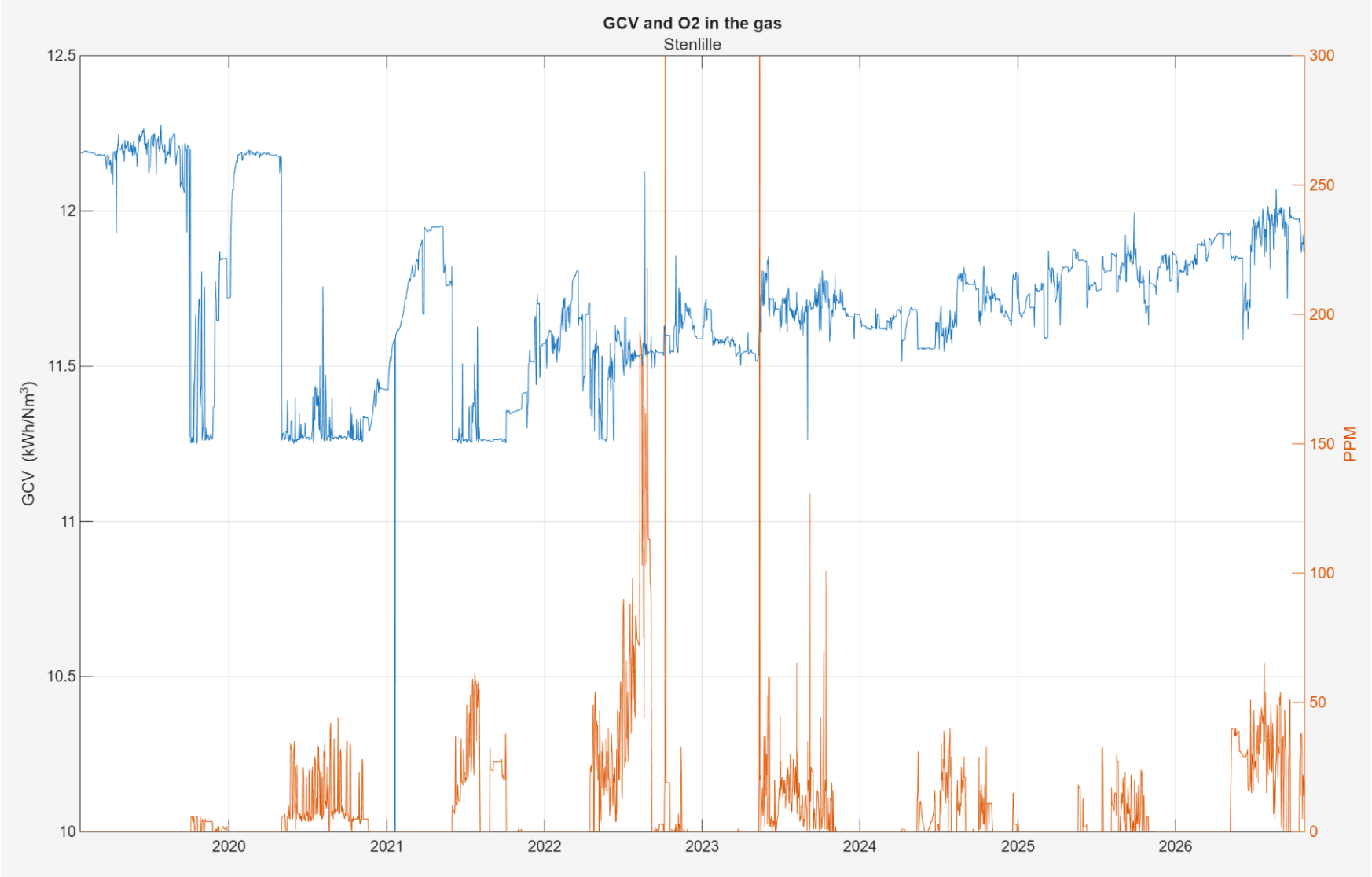
EXPERIENCES FROM STENLILLE

Sune Krogh

SJK@gasstorage.dk

Til arbejdsbrug/Restricted

CHANGES IN THE GAS



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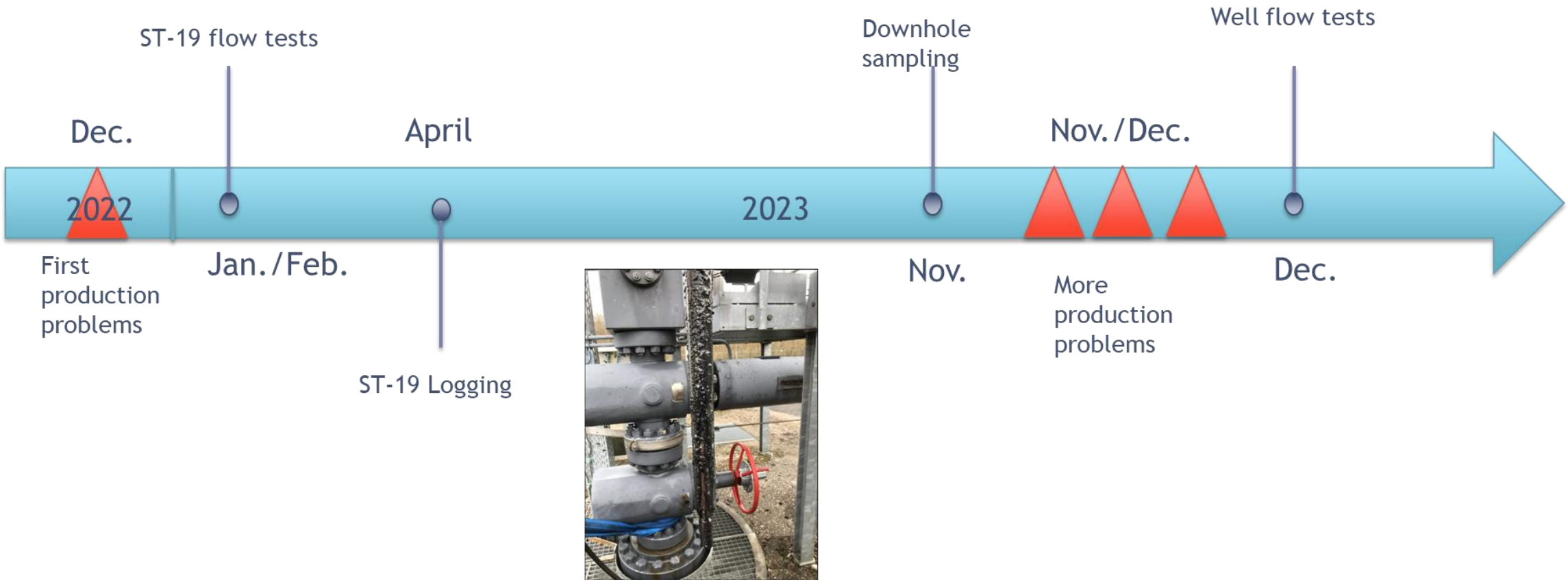
TIMELINE



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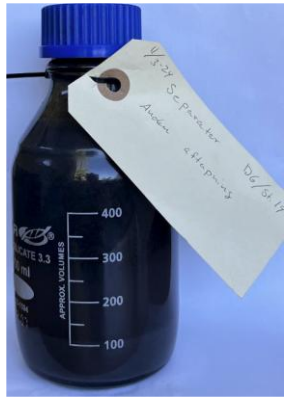



Separator Sample



CT brine campaign



Separator solid sample

2024

First problem well back in production

CT sand cleanout



Black substance problems in the central facility



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BLACK SUBSTANTS – EVERYWHERE

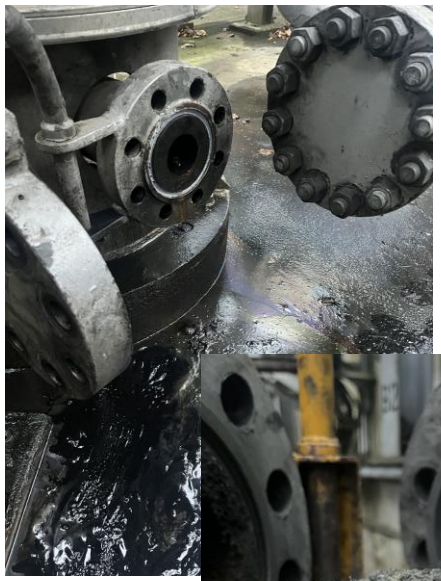
In the wells:



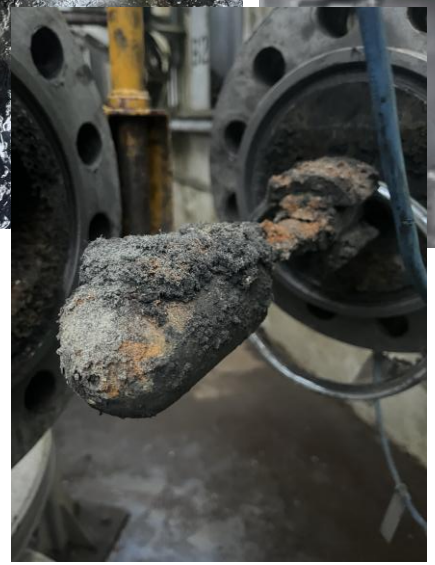




In the separators:







In the production facility:



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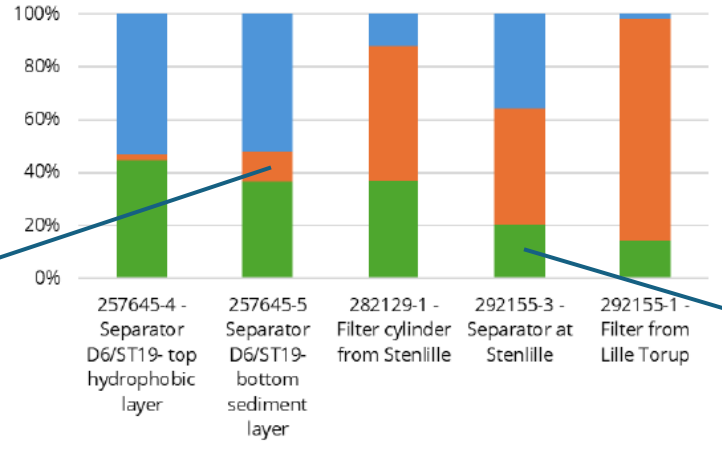
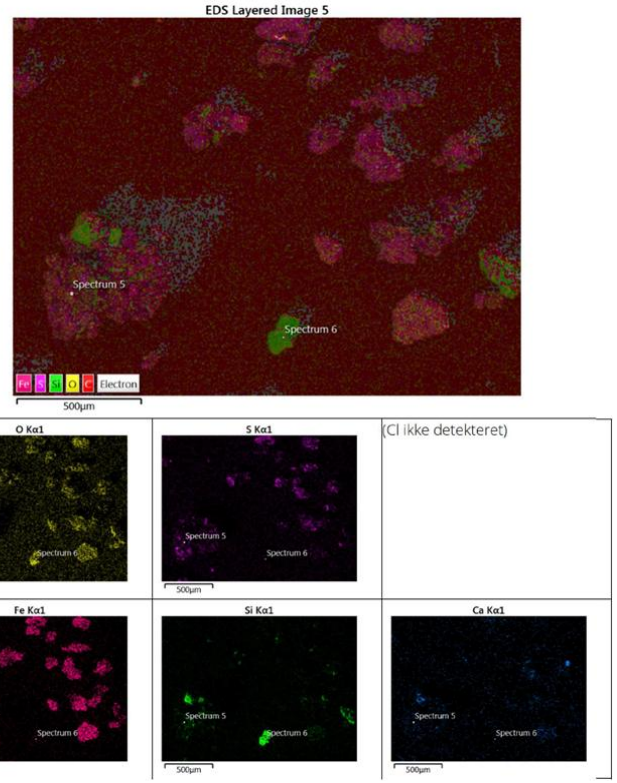
OUR KNOWLEDGE ABOUT BLACK SUBSTANCE



Inorganic part consists primarily of iron, sulfur and silicium(sand).

D6/St. 19





Organic part consists primarily of heavy hydrocarbons and grease/olie/fluids from topside.

Hydrocarbons

Grease/olie/fluids from topside

Hydrocarbons

282184-1

Component	RT	CAS	Concentration [mg/kg]
Benzene	4.82	71-43-2	57
Hexane, 2-methyl-	5.13	591-76-4	33
Pentane, 2,3-dimethyl-	5.18	565-59-3	25
Hexane, 3-methyl-	5.30	589-34-4	34
Heptane	5.77	142-82-5	43
Toluene	6.91	108-88-3	78
Ethylbenzene	8.81	100-41-4	16
p/o-Xylene	8.97	106-42-3	39
1,4-Dioxan-2-ol	9.08	22347-47-3	10
Triethylene glycol	14.66	112-27-6	430
1H-Indene, 2,3-dihydro-1,1,3-trimethyl-3-phenyl-	21.66	3910-35-8	17
9-Octadecenamide, (Z)-	27.53	301-02-0	49
Squalane	30.65	111-01-03	190
p-Terphenyl, 4,4''-diamine	32.72	3365-85-3	870
Cyclopentanes *	**RT**	**CAS**	**Concentration [mg/kg] ****
-methyl	4.39	96-37-7	170
-dimethyl	5.25 – 5.56	[1638-26-2] [2532-58-3] [1192-18-3]	180
-trimethyl	6.62 – 6.76	[2815-58-9] [15890-40-1]	33
-ethyl	6.45	1640-89-7	29
Cyclohexanes *	**RT**	**CAS**	**Concentration [mg/kg] ****
Cyclohexane	5.01	110-82-7	260
-methyl	6.23	108-87-2	290
-dimethyl	7.37 – 7.91	[638-04-0] [6876-23-9] [589-90-2] [590-66-9] [624-29-3]	160
-trimethyl	8.59	3073-66-3	12
-ethyl	8.48	1678-91-7	30

* Grouped according to degree of alkylation.
** Sum of components.

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SCHMOO/BLACK STICKY STUFF

Society of Petroleum Engineers

SPE-173719-MS

Investigation, Classification and Remediation of Amorphous Deposits in Oilfield Systems

Violette Eroini, Hilde Anfindsen, and Anthony F. Mitchell, Statoil ASA

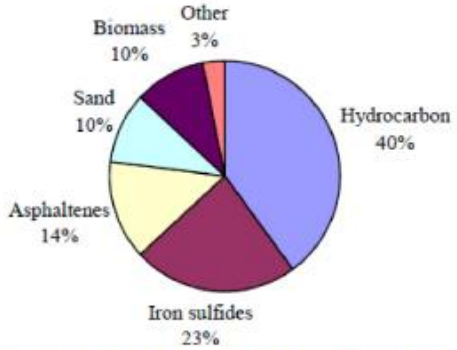

Figure 1—Analysis of "Schmoo" sample (Horsup et al., 2007)

Table 1—Classification matrix of major components contained in amorphous deposits composed of a mixture of organic and inorganic constituents to allow description of dominant type.

Organic / Inorganic	Micro-organisms (>>50%) Type 1					Oil base(>>50%) Type 2		Micro-organisms + Oil base (50:50) Type 3
	SRA a	SRB b	NUB c	MA d	Others e	Hydrocarbons from reservoir a'	Products used (grease, lubricant…) b'	
General corrosion product ($FeCO_3$ & or Fe_xO_y) **Type A**	1Aa	1Ab	1Ac	1Ad	1Ae	2Aa'	2Ab'	3A
Iron sulphide (Fe_xS_y) **Type B**	1Ba	1Bb	1Bc	1Bd	1Be	2Ba'	2Bb'	3B
Scale ($BaSO_4$ or $CaCO_3$) **Type C**	1Ca	1Cb	1Cc	1Cd	1Ce	2Ca'	2Cb'	3C
Formation fine (i.e. Quartz SiO_2, clays) **Type D**	1Da	1Db	1Dc	1Dd	1De	2Da'	2Db'	3D

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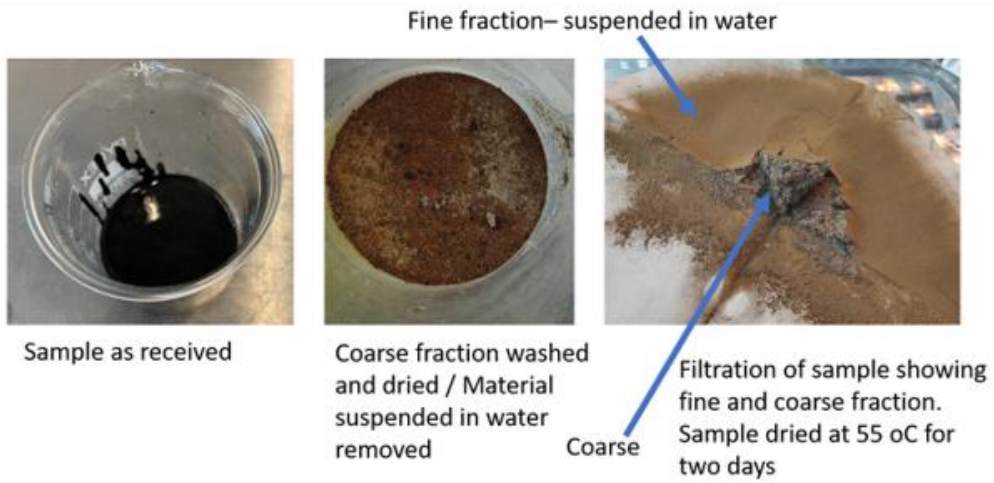

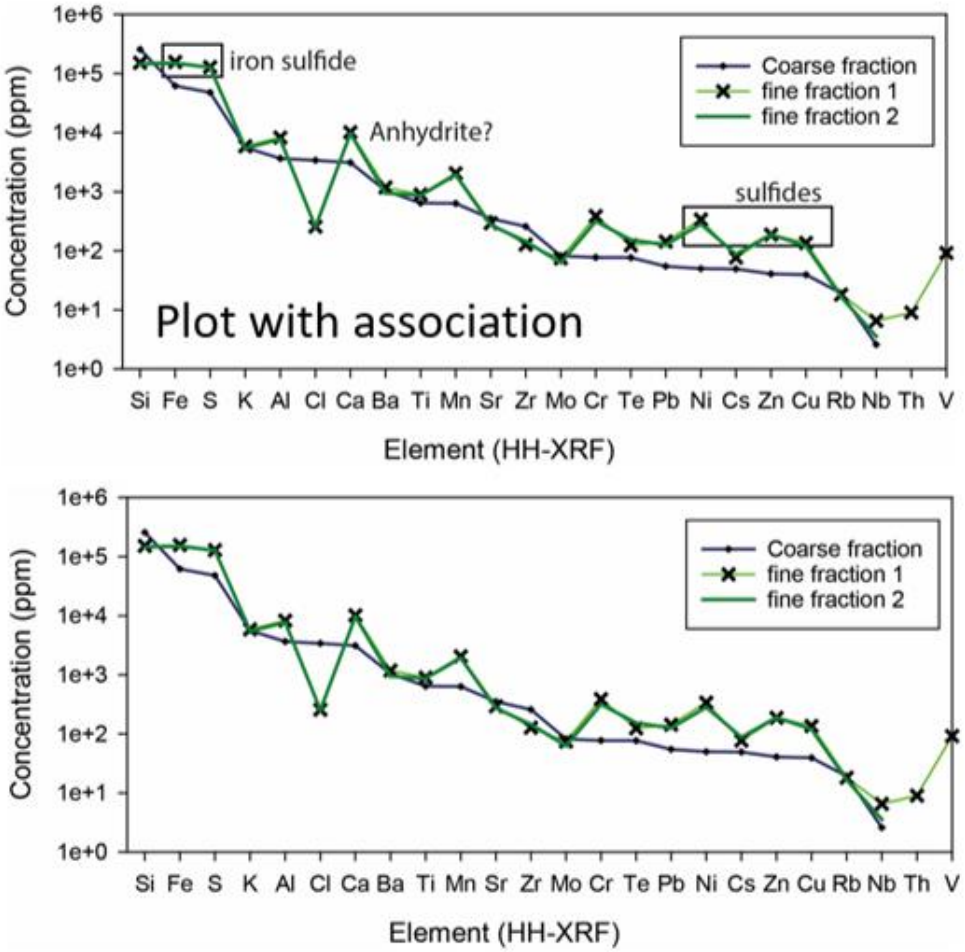

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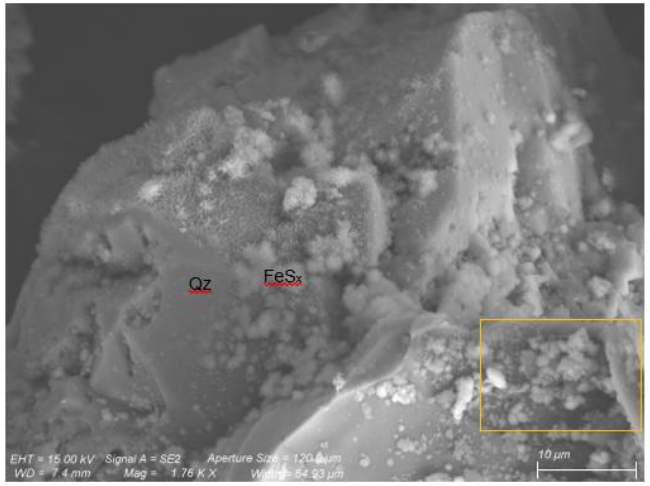

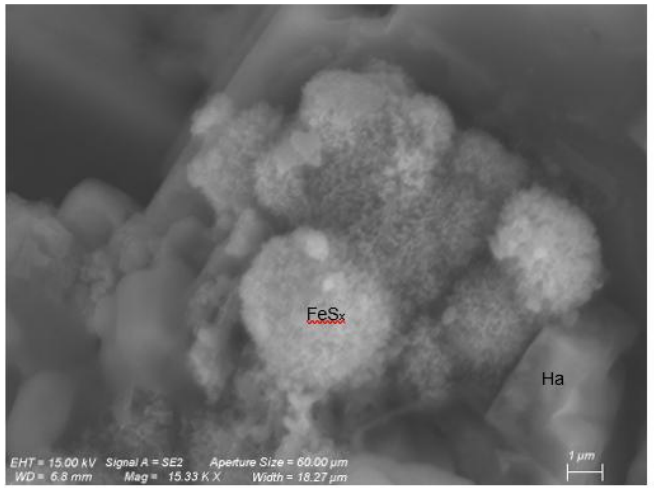

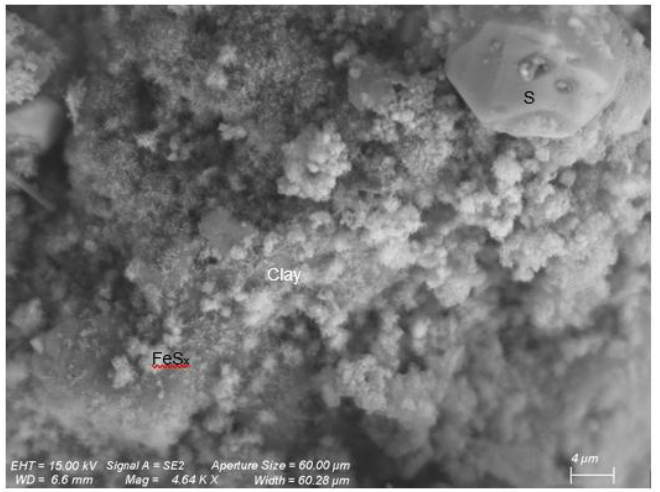

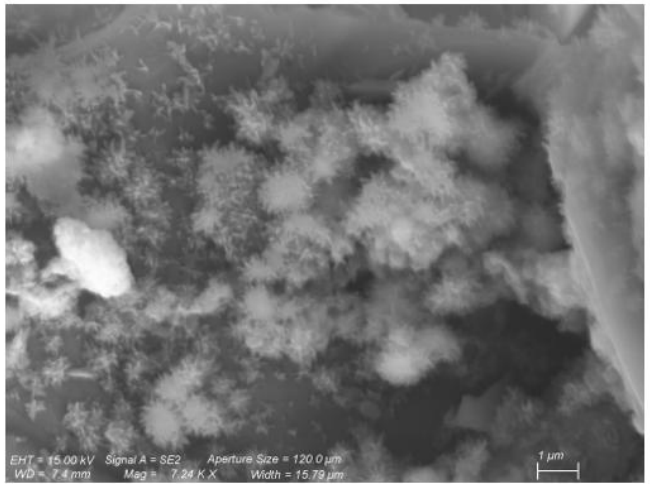

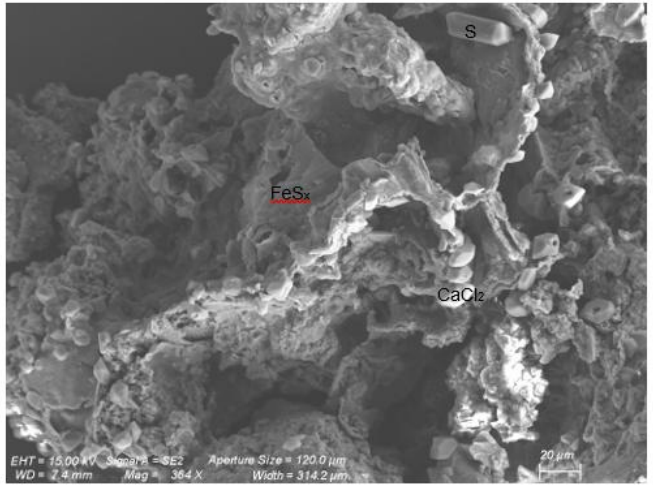

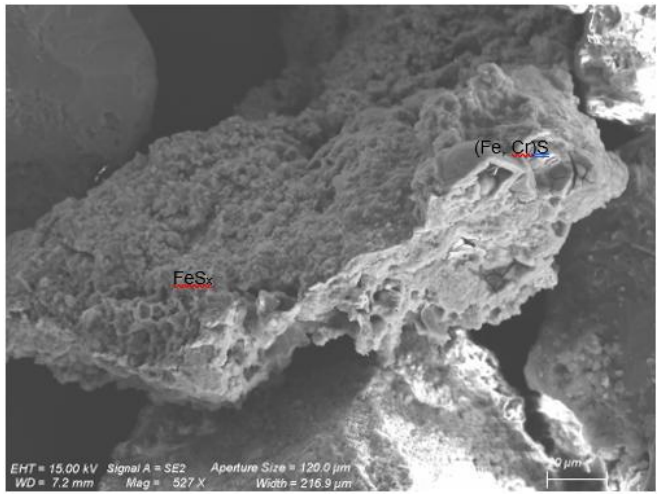

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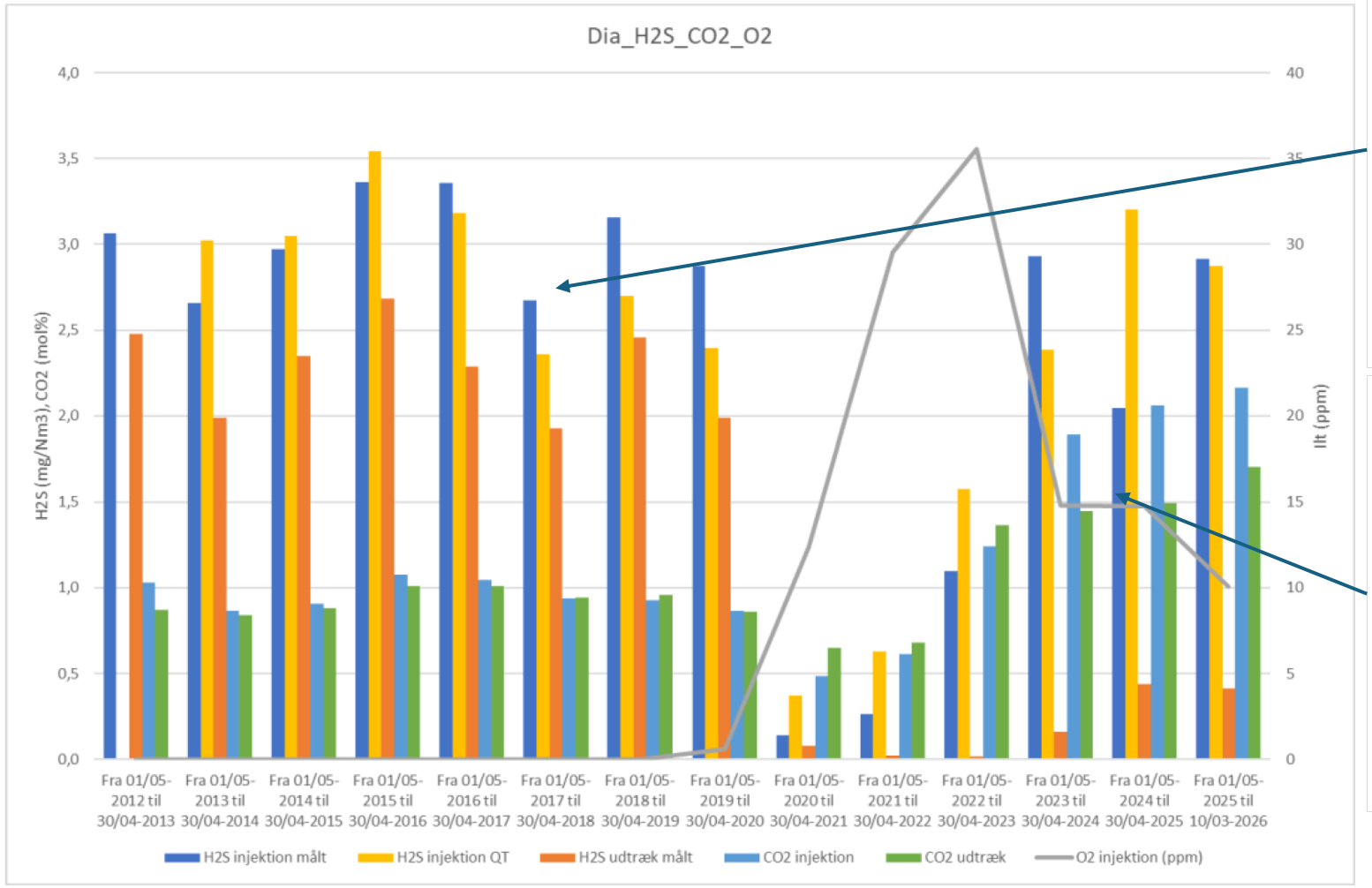
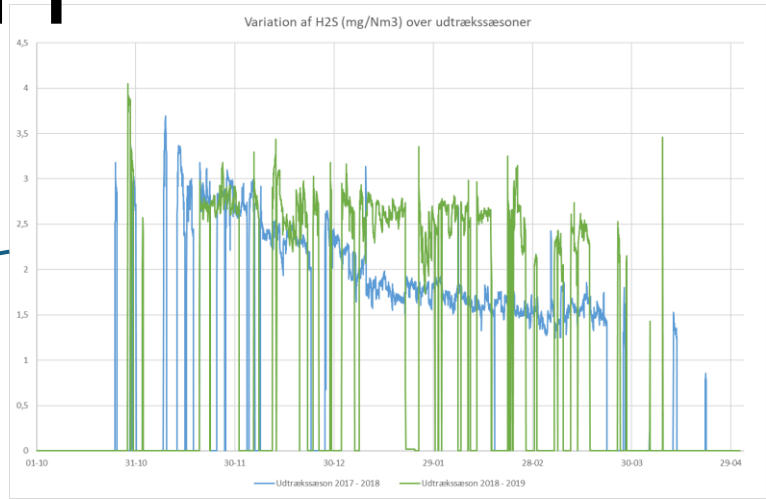
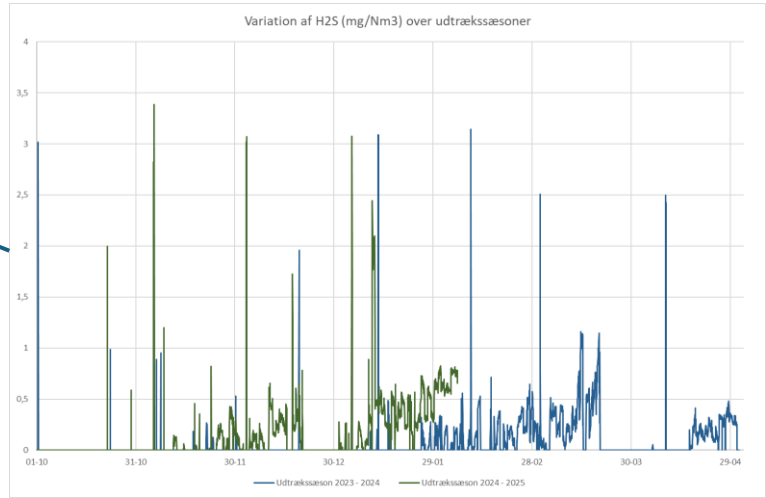
CHANGES TO THE GASQUALITY







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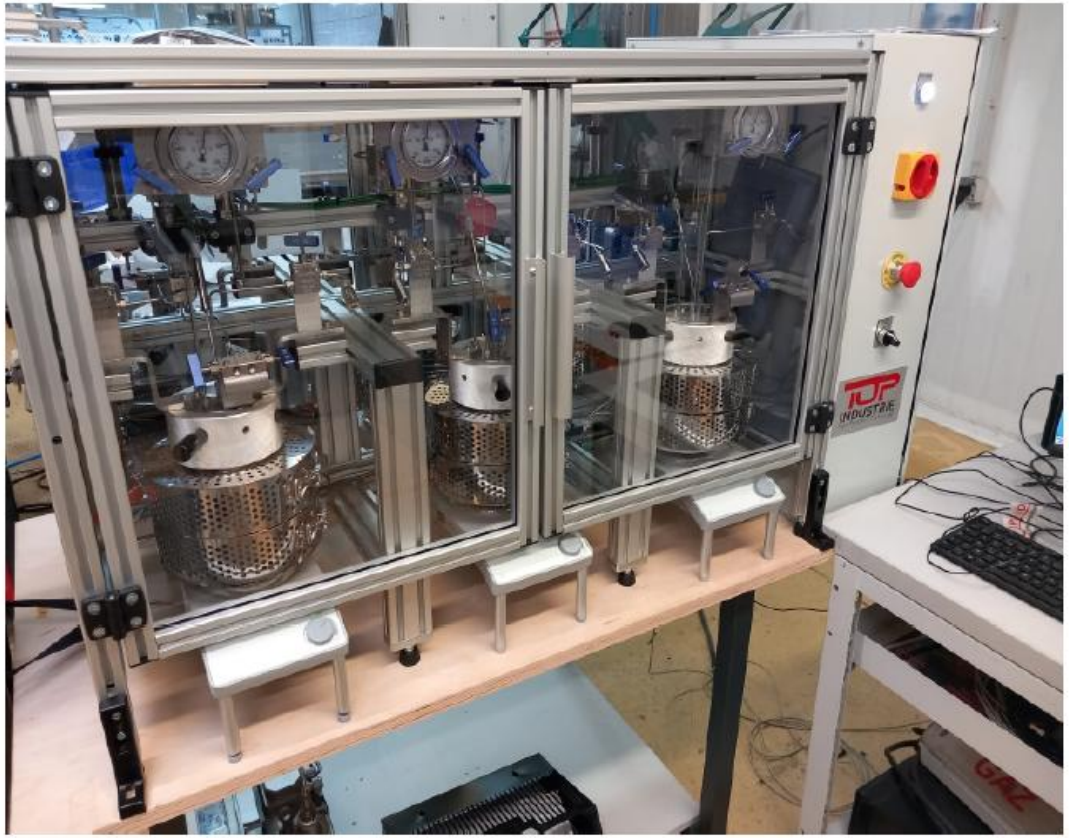
REACTOR EXPERIMENT



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Une société de ENGIE

UNIVERSITÉ DE PAU ET DES PAYS DE L'ADOUR

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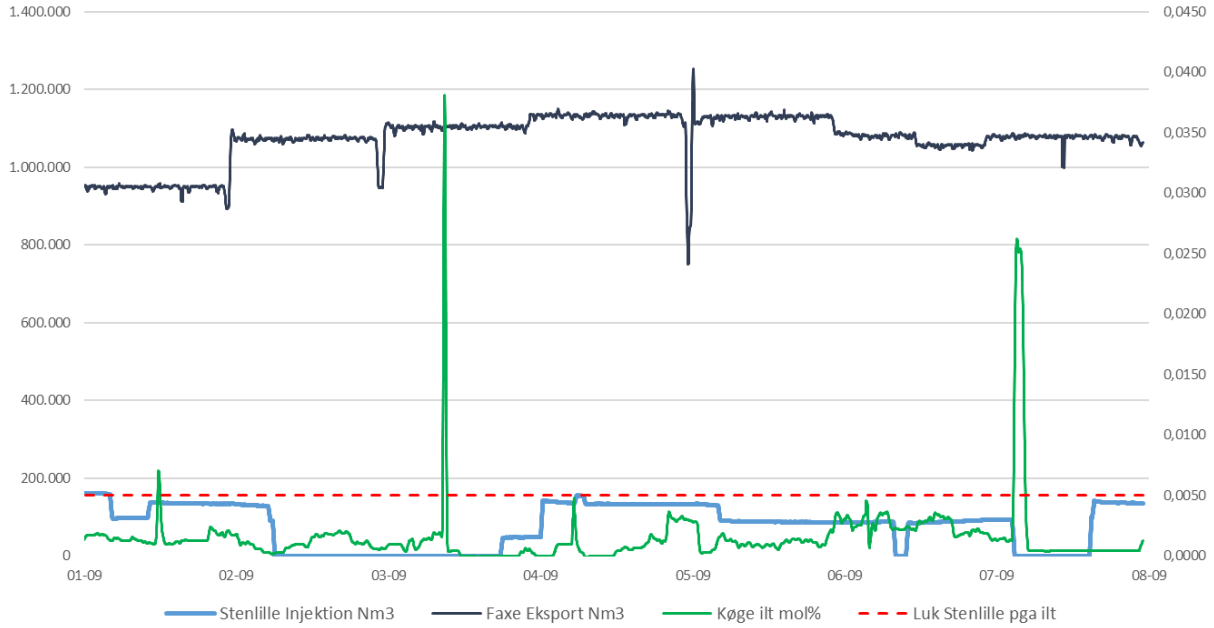
COUNTERMEASURES IMPLEMENTED

Development of wells cleaning methods





O_2 operational instruction



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THE WORK CONTINUES…



Acknowledgements to our partners:

Til arbejdsbrug/Restricted