

ASKDAGAN 2018 – HÅLLBAR OCH RESOURCEFFEKTIV ANVÄNDNING AF ENERGIASKOR

# HALOSEP FLY ASH TREATMENT AT WASTE TO ENERGY PLANTS

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ERIK RASMUSSEN, STENA RECYCLING A/S

# AGENDA

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1. Halosep fly ash treatment

2. Halosep products (fly ash from WtE plants)

- OS material (X-FGW > 1mm)
- Treated fly ash (X-FGW)
- Salt product
- Metal product

3. Halosep full scale plant (at WtE plant Vestforbrænding DK)

# AGENDA

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## 1. Halosep fly ash treatment

## 2. Halosep products (fly ash from WtE plants)

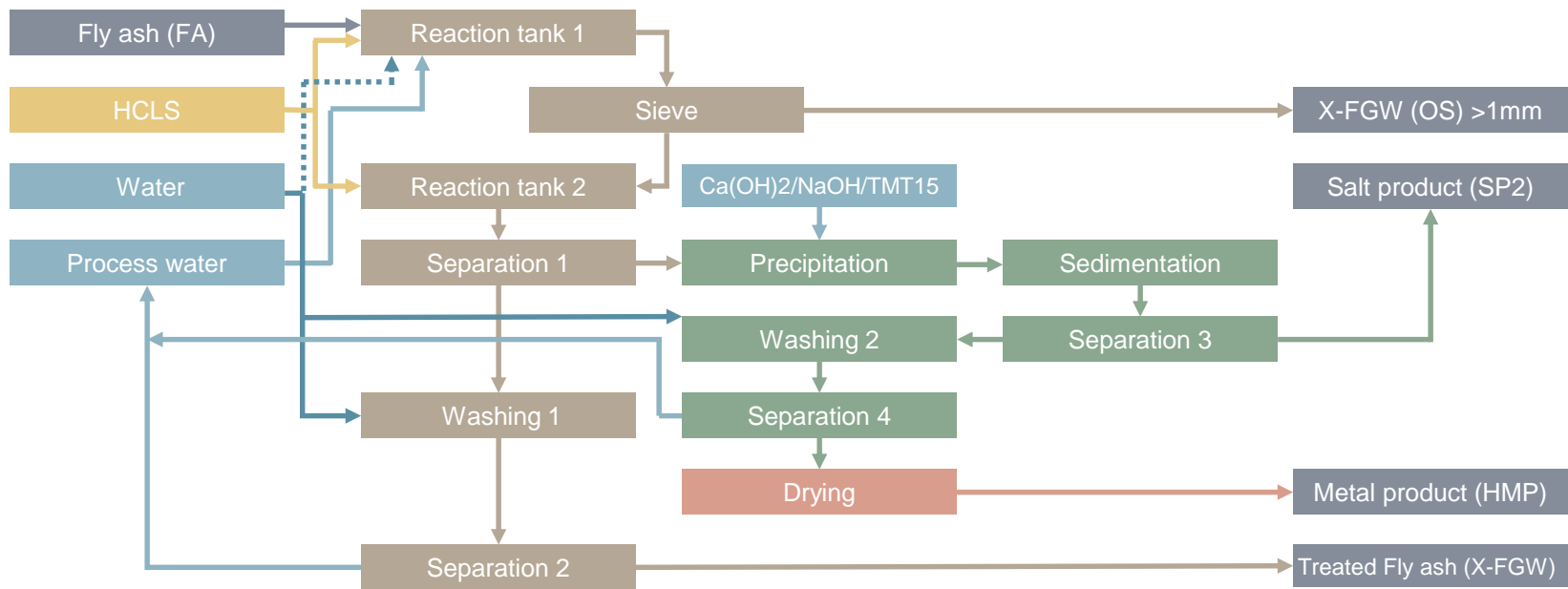
- OS material (X-FGW > 1mm)
- Treated fly ash (X-FGW)
- Salt product
- Metal product

## 3. Halosep full scale plant (at WtE plant Vestforbrænding DK)

# FLOW SHEET (VESTFORBRÆNDING)

IN: FLY ASH AND SCRUBBER LIQUID

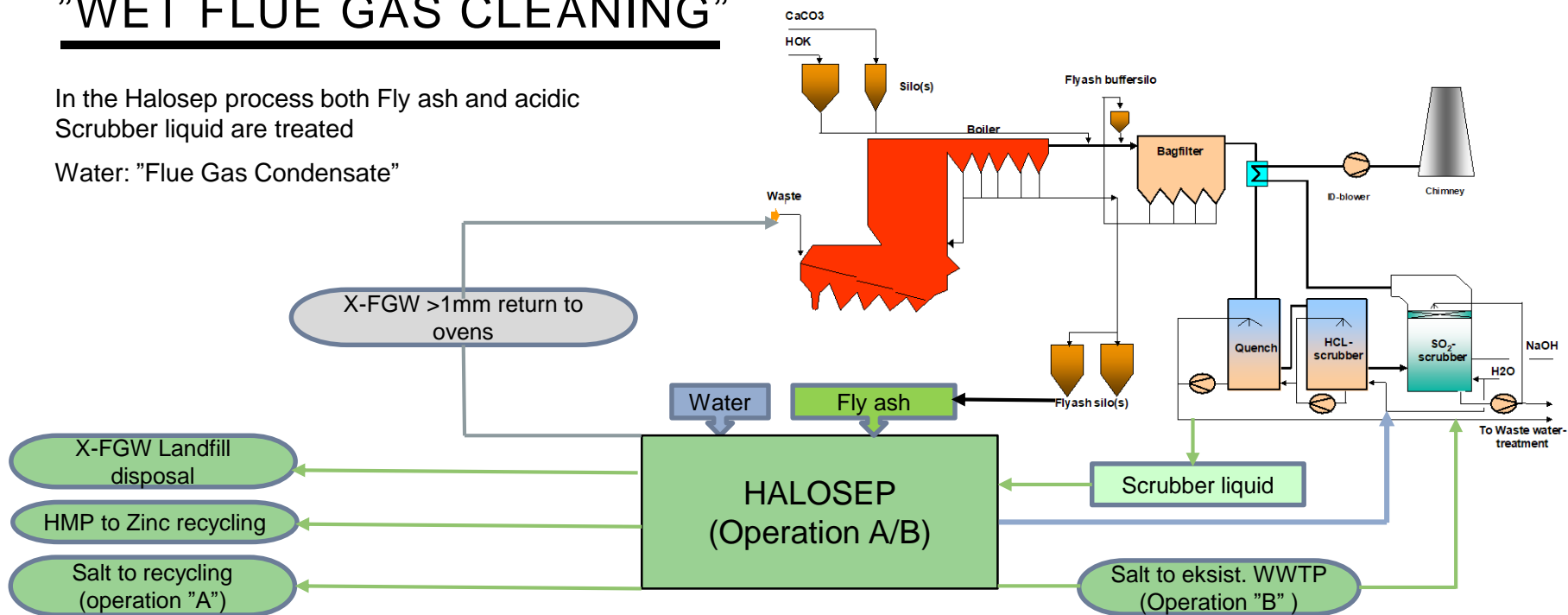
OUT: HALOSEP PRODUCT STREAMS



# HALOSEP FLY ASH TREATMENT AT WTE PLANTS WITH "WET FLUE GAS CLEANING"

In the Halosep process both Fly ash and acidic  
Scrubber liquid are treated

Water: "Flue Gas Condensate"



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3. Halosep full scale Plant (VF LIFE Project)

# FROM WTE PLANTS HAVING WET / SEMI-DRY FLUEGAS CLEANING

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	OUTPUT (FLY ASH) (VESTFORBRÆNDING)	OUTPUT (SEMI-DRY FGW) (GL. AMAGERFORBRÆNDING)
Treated fly ash (X-FGW)	60-61%	40-48%
Salt product	25-30%	42-50%
Metal product	~3%	~2%
X-FGW >1 mm (OS fraction)	~1%	~1%
H <sub>2</sub> O and CO <sub>2</sub> (g)	5-8%	8-12%

# REDUKTION OF SELECTED ELEMENTS FROM FLY ASH TO X-FGW

ELEMENT	EXTRACTED FROM FLY ASH IN %
Antimony (Sb)	69
Arsenic (As)	35
Barium (Ba)	60
Lead (Pb)	25
Cadmium (Cd)	86
Calcium (Ca)	49

ELEMENT	EXTRACTED FROM FLY ASH IN %
Chloride (Cl)	98
Sodium (Na)	90
Nickel (Ni)	39
Zinc (Zn)	66
Tin (Sn)*	77

Calculated substance reductions in % (average values from operation A and operation B tests) at HALOSEP treatment of Fly ash from Vestforbrænding, selected elements.



HALOSEP PRODUCTS

## X-FGW > 1 MM (OS MATERIAL)

- Amount < 1 %(w/w) of Fly ash (in)
- TOC-content 4-10% (w/w)
- "OS material" to be returned to ovens



HALOSEP PRODUCTS

## TREATED FLY ASH (X-FGW)

- Amount 60-61 %(w/w) of Fly ash (in)
- Pb content (tests VF, feb.2017): 0,27% (w/w) Pb  
Hazardous Waste limit value: 0,30% (w/w)
- No single substance content causes inherent Hazardous Waste properties of X-FGW (VF)
- PCB's: below detection limits
- Aromatic HC's (BTEX): < 0,2 mg/kg
- Carbon fractions "Sum Benzene-C40":20-200 mg/kg
- PAH's (15): typical values < 0,01 – 0,03 mg/kg



HALOSEP PRODUCTS

# TREATED FLY ASH (X-FGW)

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## Classification (X-FGW):

- Not relevant Hazardous Properties: HP1, HP2, HP3, HP9, HP12
- NHW (non hazardous waste): HP4, HP5, HP6, HP7, HP8, HP10, HP11, HP13
- Ecotoxic HP14/N/H410 (?): In DK it is the municipality that decides, whether HP14 should be taken into consideration in connection with classification. We expect NHW classification of X-FGW when biotests (HP14) will be used.
- X-FGW to a disposal site class MA1 or class FA1 ?
- X-FGW use for other purposes: Applications will be evaluated and tested in the Halosep full scale demonstration plant




HALOSEP PRODUCTS


# TREATED FLY ASH (X-FGW) "BATCH LEACHING L:S=10"

## Landfill Classes :

 Inert waste (IA1)

 Mineral waste (MA1)

 Hazardous waste (FA1)

 Fly ash cannot go to any local Landfill.




Raw Fly ash (left coloumn) : leaching values obtained from raw Fly Ash  
X-FGW (right coloumn) : leaching values are compliant with current  
limit values (EU directive 2003/33) for disposal at local landfill class MA1

X-FGW (FLY ASH) From VESTFORBRÆNDING	Raw FLY ASH MG/KG	X-FGW (average) MG/KG
pH	12,4	9,4
NVOC, non vol.org.carbon	40,5	43
Antimony (Sb), dissolv	0,01	1,4
Arsenic (As), dissolv	0,12	0,2
Barium (Ba), dissolv	2,3	1,5
Lead (Pb), dissolv	170	0,01
Cadmium (Cd), dissolv	0,05	0
Chloride, filtered	75.000	2.400
Chromium (Cr), dissolv	2	0,18
Fluoride, filtered	75	21
Coppar (Cu), dissolv	0,29	0,01
Mercury (Hg), dissolv	0	0,13
Molybdenum (Mo), dissolv	4,7	3
Nickel (Ni), dissolv	0,01	0,01
Selenium (Se), dissolv	0,15	0,21
Sulfate, filtered	35.000	15.000
Zinc (Zn), dissolv	15,5	0,1

## HALOSEP PRODUCTS

# TREATED FLY ASH (X-FGW) COLOUMN LEACHING DATA

### Landfill Classes:

	Inert waste (IA1)
	Mineral waste (MA1)
	Hazardous waste (FA1)

X-FGW (right coloumn): The Antimony (Sb) leaching value at L:S=10 may exceed the current MA1 limit value

All other leaching values are compliant with current limit values for disposal at local landfill class MA1

A process technical solution to "Sb-leaching" has been developed in order to fulfill the MA1 leaching limit value for Antimony.

Conclusion: X-FGW (from VF) can be disposed on a landfill class MA1

VF 8A	Operation A	0.1 L/KG	2 L/KG	10 L/KG
As	mg/kg	IA1	IA1	IA1
Ba	mg/kg	IA1	IA1	IA1
Cd	mg/kg	IA1	IA1	IA1
Cr	mg/kg	MA1	IA1	IA1
Cu	mg/kg	IA1	IA1	IA1
Hg	mg/kg	IA1	IA1	MA1
Mo	mg/kg	MA1	MA1	MA1
Ni	mg/kg	IA1	IA1	IA1
Pb	mg/kg	IA1	IA1	IA1
Sb	mg/kg	MA1	MA1	FA1
Se	mg/kg	MA1	MA1	MA1
Zn	mg/kg	IA1	IA1	IA1
Cl	mg/kg	MA1	MA1	MA1
F	mg/kg	MA1	MA1	MA1
SO4	mg/kg	MA1	MA1	MA1
DOC	mg/kg	IA1	IA1	IA1

HALOSEP PRODUCTS

# SALTPRODUCT RECYCLING OR DISCHARGE (OPER. "A"/"B")

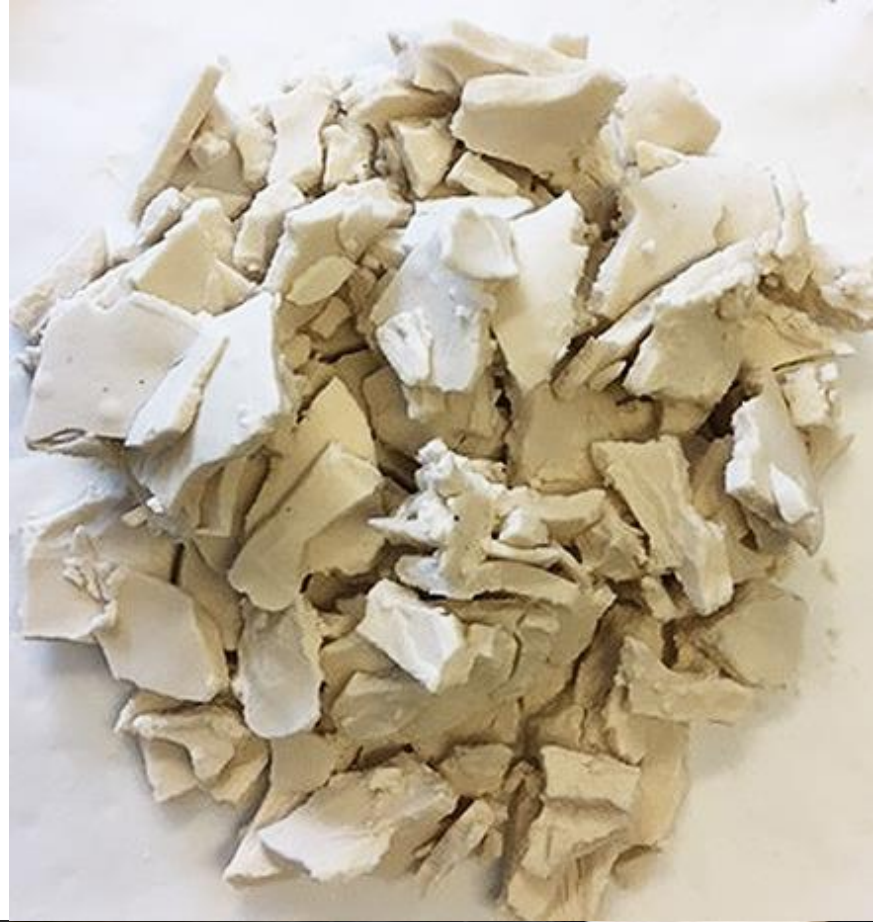
- Saltproduct amount is 25-50 %(w/w) of fly ash (in)
- Trace metals in Saltproduct SP2-VF are all below max. Limits for De-Icing agents shown in table 4.4
- Saltquality (DS) is OK according to EUSALT CEN TC337 "Standard for De-Icing agents"

EUSALT Standard of De-Icing agents: CEN TC337 FOR DE-ICING AGENTS (TABLE 4.4)		SALTPRODUCT SP2-VF
Soluble Heavy metals	Max Limit mg/kg DS	mg/kg DS
Al	50	0,03
As	2,5	0,01-0,05
Cd	2	0,03-0,9
Cr	5	0,02-0,03
Cu	5	< 0,01
Hg	0,5	< 0,01
Ni	5	< 0,01
Pb	5	0,01
Zn	20	0,1-0,3
Co	2	0,02
Hydrocarbons	100	< 20 (DOC)
Sulfate Type 1	Max. 1,5%	0,5-1% (w/w)*

HALOSEP PRODUCTS

## METAL PRODUCT (HMP)

- Amount approx. 3% (w/w) of fly ash (in)
- Zinc content 37-45 % (w/w)
  - Lead content 0,4-3,0% (w/w)
  - Cadmium content 0,3-1,0 % (w/w)
  - Other Mg, Ca, Si, Cl, S, Al
- To Zinc recycling



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3. Halosep full scale plant (LIFE Project at Vestforbrænding)



# LIFE HALOSEP

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- PROJECT PURPOSE

“To successfully demonstrate how two waste streams from incineration plants, fly ash and flue gas waste scrubber liquid, can be co-treated leading to a reduction of waste (DS) going to landfills by approximately 40–60%”

- PROJECT INFORMATION

Project start: 01/07/2016

Expected end date: 31/12/2020

- COORDINATING BENEFICIARY

Stena Recycling Int. AB, Sweden

- ASSOCIATED BENEFICIARIES

Stena Recycling A/S, Denmark

I/S Vestforbrænding, Denmark

- PROJECT BUDGET & FINANCING

Total project budget: 5.4 million EURO

Total eligible budget: 3.8 million EURO

EU (LIFE) support: 2.3 million EURO



VESTFORBRÆNDING

# LIFE HALOSEP - EXPECTED RESULTS

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- Built an approx. 13.000 ton/yr Halosep plant in an existing Fluegas cleaning building at VF
- Integrate the Halosep plant with the existing Flue Gas cleaning plant and the existing WWTP
- Total costs for treatment of fly ash (incl scrubber liquid) to be reduced by approx. 20%
- Chemicals consumption to be reduced by > 80%
- Treated Fly ash amount (DS) is 60-62% of Fly ash input, ie. the reduction in DS will be 38-40%
- Metal product (HMP) will be upgraded to about 45% zinc content. The zinc yield will be optimized during the Halosep test period.
- Show that the salt product can be recycled as a brine with about 10% salt content. It will be evaluated during the test period if up to 2.000 tons salt can be used as roadsalt during the winter period
- Treatment of Fly ash from other WtE plants will be tested during the test period.
- Use of the treated Fly ash (X-RGA) as an additive in concrete, cement or as construction material will be tested and evaluated during the test period.



# THANK YOU FOR YOUR ATTENTION

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## CONTACT INFORMATION:

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