
HaloSep
PURE SEPARATION

CONTENT

HALOSEP FRACTIONS

Treated Fly Ash

Salt Product

Metal Product

LIFE HALOSEP – FINALIZATION

- LIFE Project Finalized and all documentation approved
- Closing seminar Summer 2023

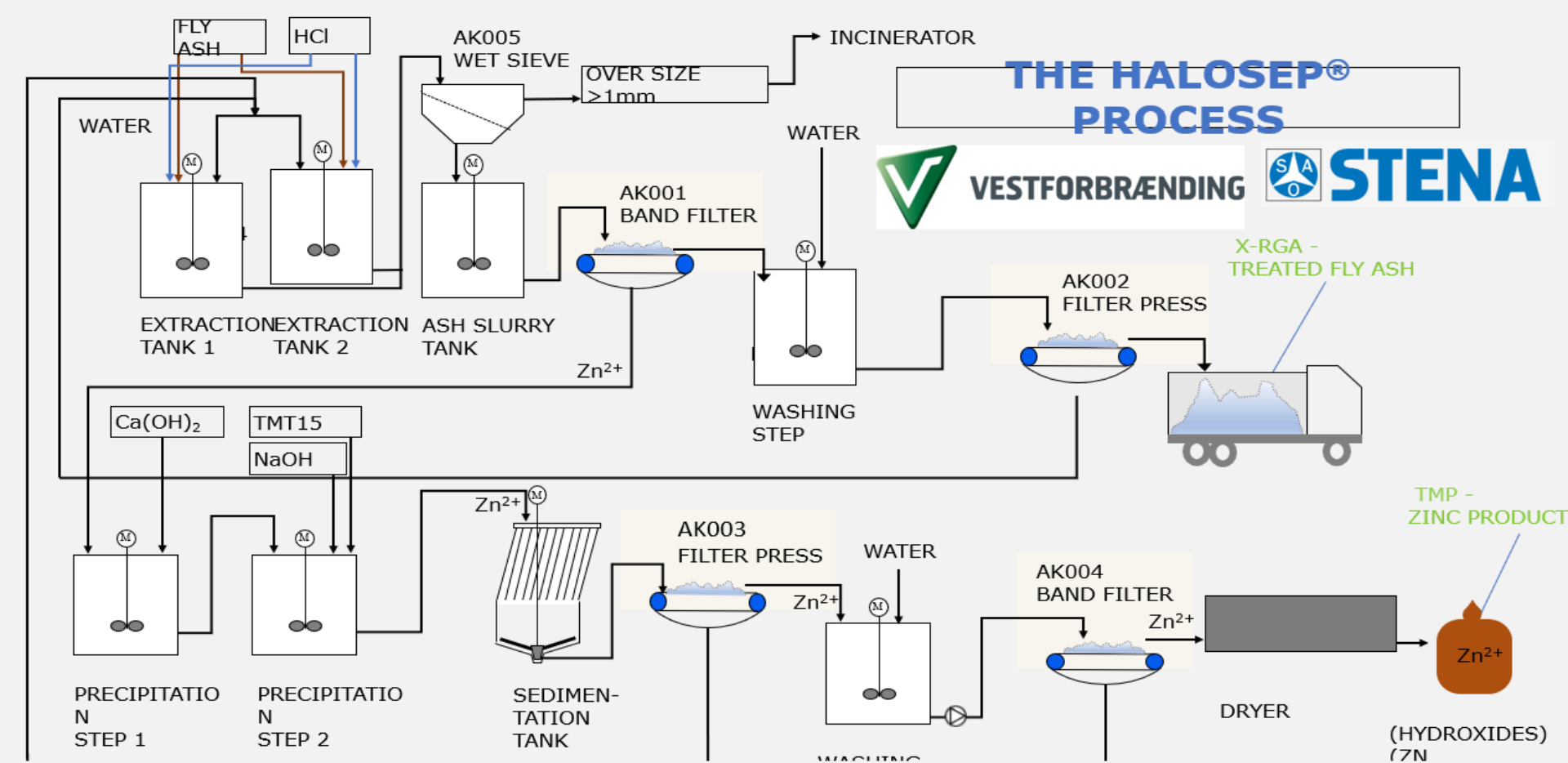
After LIFE Finalization

- All HaloSep activates are now diverted from Stena Metall to the fully owned subsidiary HaloSep AB
- Vestforbrænding and HaloSep AB actively work together to ramp up capacity and performance
- Turning the Demonstration Plant “LIFE HaloSep” into a fully Commercially Operating HaloSep Plant at Vestforbrænding

VESTFORBRÆNDING

HaloSep

THE HALOSEP® PROCESS



VESTFORBRÆNDING

STENA

HaloSep

PROGRESS AT LIFE HALOSEP PLANT

- Number of Shifts from 1 ➔ 2 ➔ 3
  - 5 days a week

- Improvements & Optimizations

  - Slurry pumps
  - pH-metering
  - Cycle time reduction
  - Agitation
  - Oven efficiency

- Results

  - Zinc content: 20% ➔ 30%. Max 39%
  - Capacity moving towards full fly ash production:
    - Up to 75% of total daily fly ash production
  - Moisture content reduced in both treated fly ash and metal fraction

CLASSIFICATION OF HALOPUR

To use HaloPur in society it needs to be a classified as non-hazardous waste

		Before HaloSep	After HaloSep
HP1	Explosive	N/A	N/A
HP2	Oxidizing	N/A	N/A
HP3	Flammable	No	No
HP4	Irritant	Yes	No
HP5	Specific Target Organ Toxicity (STOT)/Aspiration Toxicity	No	No
HP6	Acute Toxicity	No	No
HP7	Carcinogenic	Yes	No
HP8	Corrosive	Yes	No
HP9	Infectious	N/A	N/A
HP10	Toxic for reproduction	Yes	No
HP11	Mutagenic	No	No
HP12	Release of an acute toxic gas	N/A	N/A
HP13	Sensitising	No	No
HP14	Ecotoxic	Yes	No
HP15	Other*	N/A	N/A
POP	Persistent Organic Pollutants	No	No

Classification approved by Danish Authority with the European Waste Code 19 02 06 (Sludges from physico/ chemical treatment other than those mentioned in 19 02 05)

- Water soluble salts and reactive calcium is greatly reduced in the HaloSep process
  → No HP4 and HP8
- Advanced measurement methods show that toxic forms of heavy metals are removed in the HaloSep process
  → No HP7, HP10 and HP14
- HaloSep AB have our own Classification Tool to classify the treated fly ash as non-hazardous waste in accordance with European standards and thereby enable industrial use

Based on ***Commission notice on technical guidance on the classification of waste (2018/C 124/01)*** on the Waste Framework Directive 2008/98/EC.

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LARGE SCALE TEST AT MANUFACTURER

- Discussions with several European manufacturers
- Larger trial performed with one partner
    - 24m^2 of pavement blocks
    - HaloSep ash from Vestforbrænding
- Next step a follow up full-scale test planned with recipe adjustment
- Aim: Fully replace a commercial filler material
- NB! Product was not put on the market
- Environmental impact over the product lifecycle needs to be evaluated

REACHING CIRCULARITY

- Facilitate usage
  - Wet filter cake ➔ dry powder
    - Mixing
    - Dosage
  - Drying 70% ➔ 85% dry substance, low value heat preferred
  - Powder for ease of transportation and customer infrastructure
  - Drying: Dry X-RGA

- Restproduktbekendtgørelsen
  - Only 4 wastes specified in BEK nr 1672
  - The treated fly ash from HaloSep meet the same criteria as specified for approved Category 3 materials in BEK nr 1672
    - IBA one of the approved wastes
    - HaloSep treated fly ash comparable to IBA
    - Include treated fly ash that meet the requirements specified in BEK nr 1672

SALT RECYCLING & WATER RECOVERY

- Salt as challenge ➔ Salts as a value
- Water as abundant free resource ➔ Water as a scarce and valued resource (as a condensate)

HaloSep´s solution: Integrated Salt & Water Recovery Process as an add-on to the HaloSep ash treatment process

- Partnering with companies with extensive knowledge & experience in the field
- Established technology applied since the 1970´s
- Preferred outputs NaCl, KCl and $CaCO_3$
  - Ca^{2+} as $CaCO_{3(s)}$ not as $CaCl_{2(l/s)}$
  - $CaCO_3$ is a commodity in high demand
  - More robust process to take away polyvalent ions like Ca^{2+} before monovalent ions like Na^+, K^+ and Cl^-
  - $CaCO_3$ requires input chemicals but significantly less energy than $CaCl_2$ production

CONCLUSIONS

- HaloSep
  - A complete on-site solution to allow full circularity
  - Avoiding excessive transportation
  - Future proofing plant to avoid landfilling
  - Utilizing available resources and waste heat

Hazardous fly ash

Salts

- Replacing virgin materials

Treated fly ash

- Meets EU Landfill criteria
- Approved Waste Code in Denmark
- Meets technical & composition requirements of alternative virgin or recycled materials
- For future approval, application and use

Metals

- Recovery through established smelters

THANK YOU FOR YOUR ATTENTION

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