Málþing um framtíðarskipulag sorpmála í Ísafjarðarbæ

Kynning á Envikraft a/s
Danmark

Erindi flutt af
Finni Sturlusyni
Mifo ehf

We Think Environment

Energy from Waste

ENVIKRAFT A/S

Turnkey plants for thermal treatment of general & hazardous waste

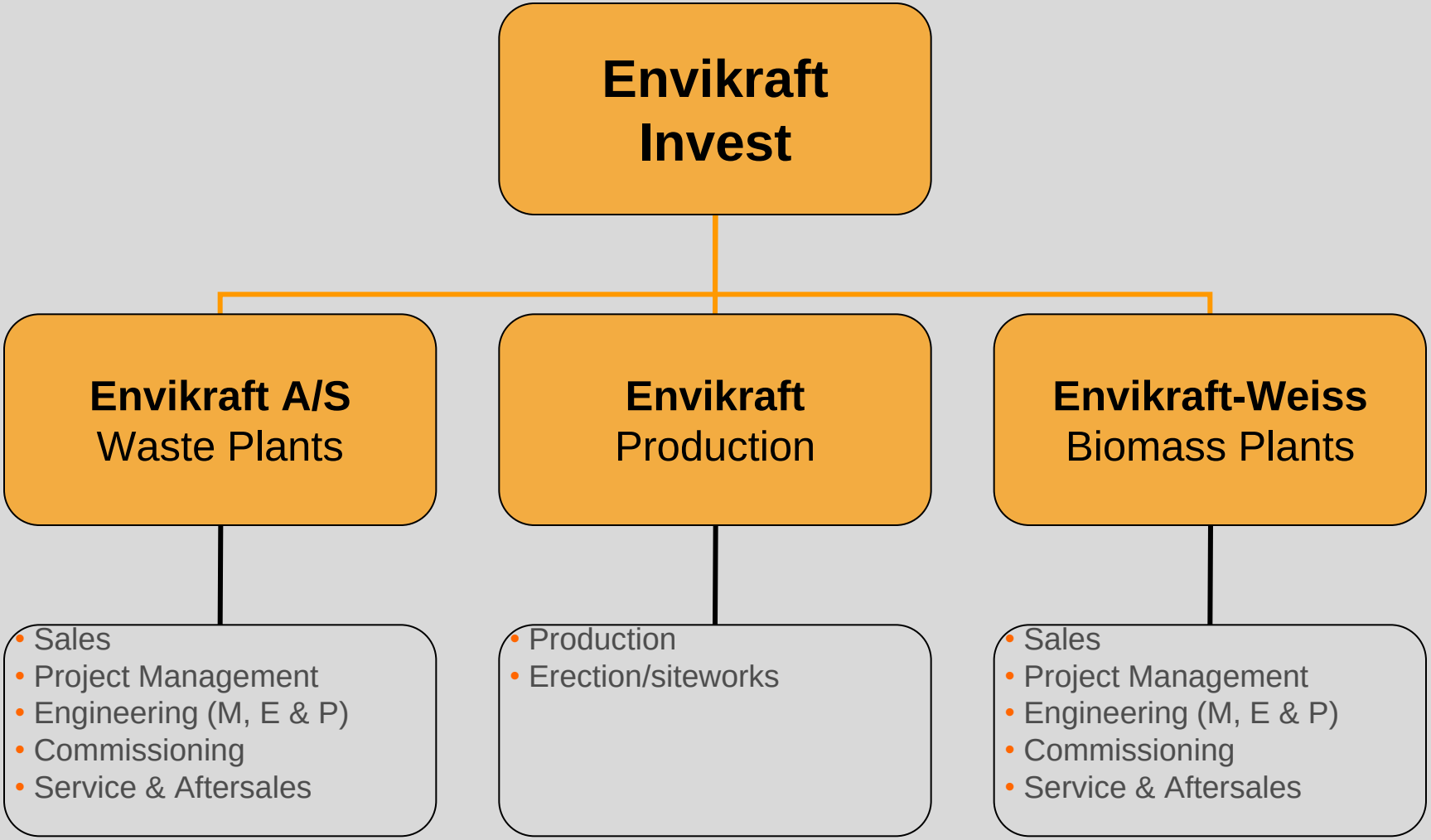
Founded 1967

More than 300 plants supplied world-wide

ISO 9001 certified

Technical advisor to ISWA, American Society of Low Level Radioactive Waste Handling and University of Sheffield

Company structure



Waste to energy systems

- **Capacity**
- 1 – 20 MW thermal input

- **District heating applications**
- Steam condensate/backpressure heat recovery
- Hot water applications
- Evaporative cooling and condensation heat recovery

- **Power production**
- Saturated or superheated steam systems up to 400 °C
- Organic Rankine Cycle (ORC) solutions
- Steam Engine

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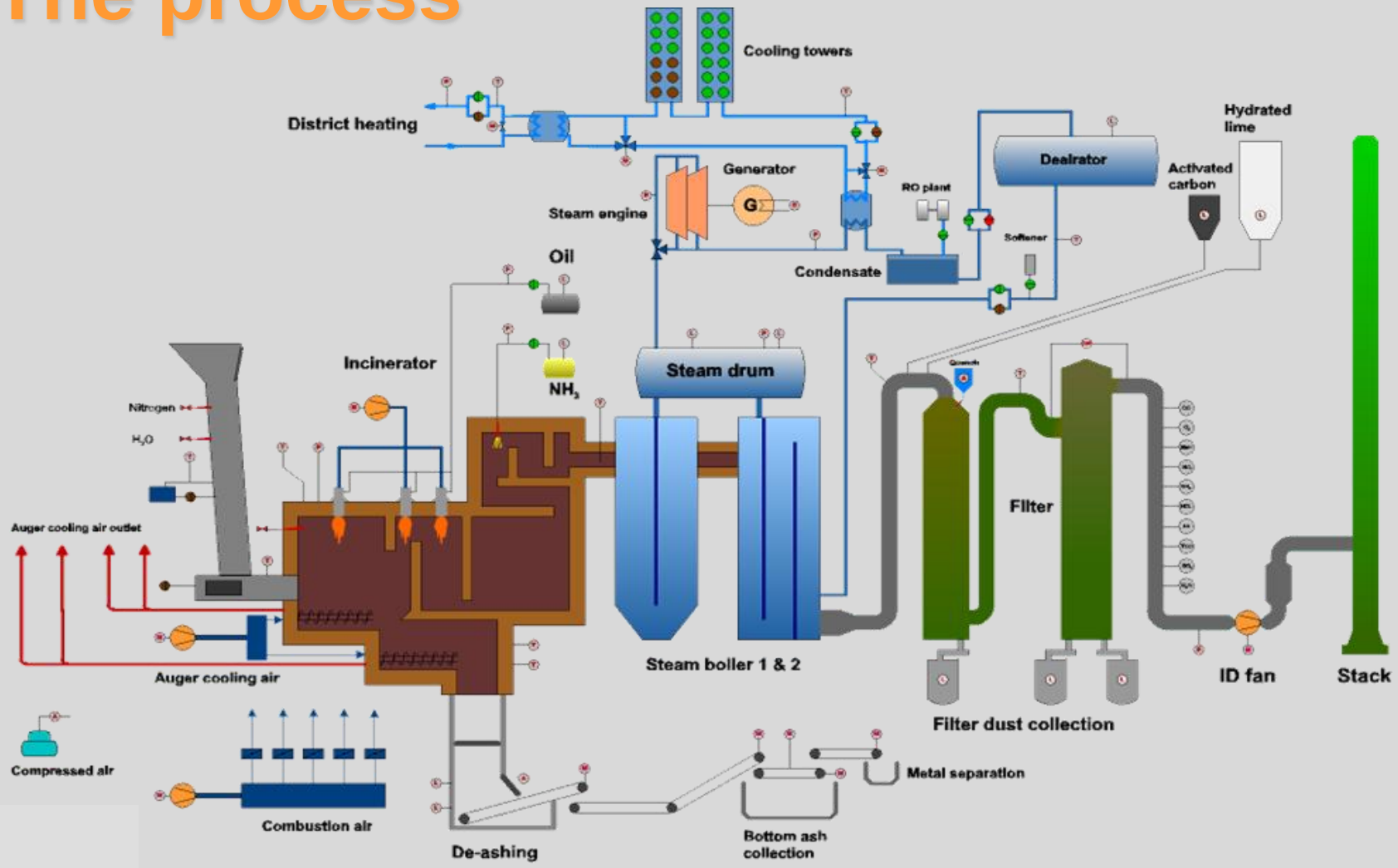
The process



Key features compared to Rotary Kiln

- Low operating and maintenance costs
- Waste/fuel type flexible – accepts wide range calorific input material, solid as well as liquid
- 60-110 % load variation with no supporting fuel consumption
- Low fly ash carry over = less secondary waste and high availibility

Advantages

- Low fly ash carry-over – *reduced operational costs*
- Little downtime – *reduced operational costs*
- Waste type flexibility – *less limitations*
- Efficient control – *reduced operational costs*
- High quality – *low plant lifetime cost*
- One-man operated – *low operational cost*

Briefing note

Regulation applicable for waste treatment in Europe

- *European Directive on Waste Incineration, Directive 2000/76/EC*
- Defines the technical and operational arrangement of waste incineration plants, including the use of BAT – Best Available Technology.
- Defines limits on emissions to air, water and ground

- *European Directive on Land filling, Directive 1999/31/EC*
- Defines reduction targets on land filling

- **Distribution of waste incineration in Europe today**

- Waste incineration is widely applied in Europe; however, the installed capacity per capita is insufficient in most countries. *Only Denmark, Sweden,*
- *The Netherlands, Switzerland and Luxemburg* have sufficient installed capacity to treat its waste.

- As a result of lack of capacity, most European countries are now in the process of planning new plants in order to comply with the Land filling Directive.
- Germany, as an example, has 71 plants in operation, and has 80 new plants in planning.

- Denmark, which is the most advanced country world-wide in terms of incineration or waste-to-energy plants, is the benchmark at which other countries are looking.

- *The highlights from the Danish waste treatment scheme are*
- Incineration has been the preferred method for waste treatment for more than 100 years. *The first plant was commissioned in* ***1903 in Copenhagen***
- Denmark has the worlds highest incineration capacity per capita – 600 kg/annum
- All burnable waste is being incinerated, no land filling is allowed and does not exist
- Bottom ashes are utilized instead of land filled
- Energy is recovered from all plants as electricity and heat

- **CO_2 reduction with waste incineration**

- Energy production from WTE-plants reduces the CO_2 emission by more than 60 % compared to natural gas and close to 80 % compared to coal-fired energy production. 4 tonnes of waste equals 1 tonne of oil or 1.6 tonne of coal.

- CO_2 emission factor for waste: 20 kg/GJ
- CO_2 emission factor for natural gas: 57 kg/GJ
- CO_2 emission factor for coal : 95 kg/GJ

Main requirements

European Waste Incineration Directive 2000/76/EC

- Secondary combustion chamber $\geq$ 850 °C
- Fluegas retention time $\geq$ 2 seconds
- Continuous measuring and reporting
- NO_x, CO, Total dust, TOC, HCL, HF, SO_2
- $\leq$ 3% TOC in the bottom ashes
- Emission limits

EMISSION LIMITS - European Waste Directive 2000/76/EC

Measured as Subject	Daily avarage	Half-hourly	30 min. - 8 hrs.	6 hrs. – 8 hrs
Total dust	10 mg/m^3	30 mg/m^3		
TOC	10 mg/m^3	20 mg/m^3		
HCl	10 mg/m^3	60 mg/m^3		
HF	1 mg/m^3	4 mg/m^3		
SO_2	50 mg/m^3	200 mg/m^3		
NO/NO_2	200 mg/m^3	400 mg/m^3		
Cd & Tl, total			0.05 mg/m^3	
Hg			0.05 mg/m^3	
Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, total			0.5 mg/m^3	
Dioxins and furans				0.1 ng/m^3
CO	50 mg/m^3	100 mg/m^3		

All values standardized at 273 °K, 101.3 kPa, 11 % oxygen, dry gas.

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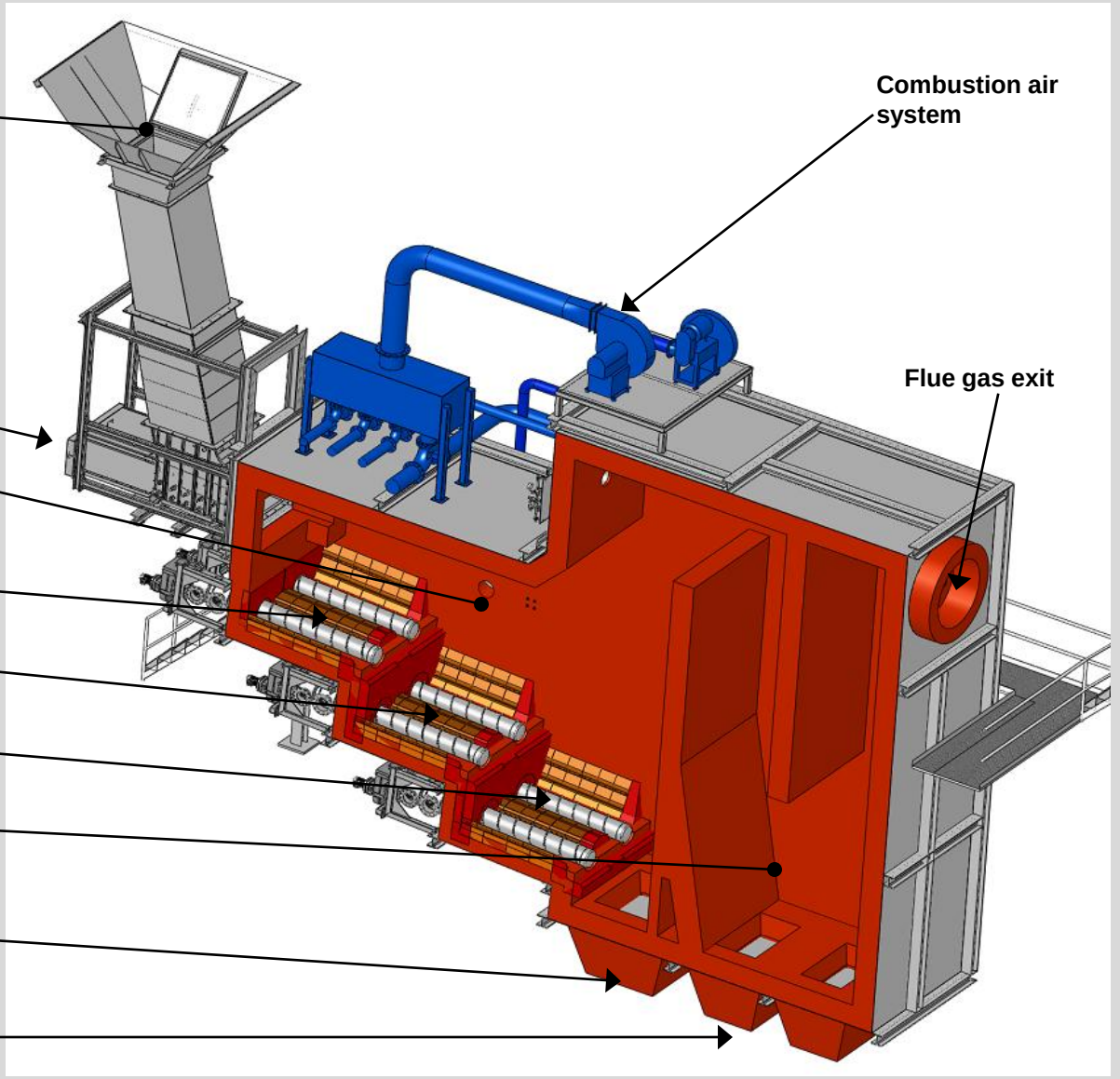
What's inside?



Energy from Waste We Think Environment

Senja Avfall, Norway

Main plant characteristics:

Plant capacity	16,000 t/Y
Waste calorific value$_{Av}$	11.5 MJ/kg
Plant efficiency	>80%
Steam production	7,150 kg/h
Heat production	4.7 MW
Power	350 kW
Thermal output	5.1 MW
Bottom ash production	20%
Fly ash production	0.7%
Flue gas flow, nominal	11,500 Nm^3/h

Energy from Waste We Think Environment

Senja Avfall, Norway

Molab as
Din Labpartner

Ordre nr.: 28796 Side 3 av 3

3. Resultater

Resultatet av målingene er gitt i tabell 2. Beregningene er gitt i vedlegg 1. Analyserapporten på dioksiner og bromerte flammehemmere er gitt i vedlegg 2.
Den 10/10 ble prøven tatt i tidsrommet 12:55 til 19:10. Det ble fyrt med ordinært husholdningsavfall, samt litt innblanding av spesialavfall.
Den 11/10 ble prøven tatt i tidsrommet 09:19 til 15:25. Under målingen ble det bl.a. fyrt med avfall som inneholdt bromerte flammehemmere og CCA.

Tabell 2. Oversikt over målte konsentrasjonen målt i røykgassen konvertert til 11 % O_2 (tørr gass).

Parameter	10/10, mg/Nm³	11/10, mg/Nm³	Konsesjon, mg/Nm³
Støv	< 0,1	2,61	10
CO	0,2	0,2	50
NO_x som NO_2	138	157	200
HCl	7,42	5,30	10
HF	< 0,008	< 0,008	1
SO_2	2,0	0,7	50
As, µg/Nm³	0,29	0,17	
Cr, µg/Nm³	1,33	1,25	
Co, µg/Nm³	0,32	0,55	
Cu, µg/Nm³	8,31	2,07	Sum:
Mn, µg/Nm³	18,2	8,65	500
Ni, µg/Nm³	1,18	0,60	
Pb, µg/Nm³	2,62	3,12	
Sb, µg/Nm³	0,23	0,07	
Sn, µg/Nm³	0,17	0,32	
V, µg/Nm³	0,12	0,11	
Cd, µg/Nm³	0,154	0,183	Sum:
Tl, µg/Nm³	0,007	0,006	50
Hg, µg/Nm³	1,9	0,9	30
TOC	2,4	0,63	10
Dioksiner, pg/Nm³	7,13	10,4	100

Proveresultatene gjelder utelukkende de prøvede objekter. Rapporten må ikke gjengis i utdrag, uten skriftlig godkjenning fra Molab as.

Molab as
Din Labpartner

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Telefon: 75 13 63 50
Besøksadr. Mo i Rana: Mo Industripark
Besøksadr. Oslo: Kjelsåsveien. 174
Besøksadr. Glomfjord: Omeveg. 3
Organisasjonsnr.: NO 953 018 144 MVA

Kunde:
SENJA AVFALLSSELSKAP BA
Att: Svein Jensen

BOTNHÅGEN
9300 FINNSNES

RAPPORT

Analyse av slaggprøve

Ordre nr.: 29994
Antall sider + bilag: 1
Rapport referanse: KR-05540
Dato: 13.02.2008
Rev. nr.: 0
Kundens bestillingsnr./ref.:
Utført:
Ansvarlig signatur: Terje V. Pedersen

Prøver mottatt dato: 11.02.2008

RESULTATER

Prøve merket:			Slaggprøve ref: brev dat. 5/2-08
Parameter	Enhet	Ana.dato	
TOC	%	13.02.08	0,59

ANALYSEINFORMASJON

Parameter	Metode/Analyseteknikk	Deteksjons-grense	Enhet
TOC	NS-EN 13137	-	%

A = Akkreditert prøving. Dersom ikke annet er oppgitt angis usikkerheten med 95 % konfidensnivå.

ANMERKNINGER

Totalt organisk karbon(TOC) er bestemt etter utsortering av ikke brennbare komponenter som metallrester og lignende.
Den rapporterte TOC-verdi er korrigert for utsortert andel og den representerer andel av hele prøven.

Proveresultatene gjelder utelukkende de prøvede objekter. Rapporten må ikke gjengis i utdrag, uten skriftlig godkjenning fra Molab as.
Selve rapporten representerer eller inneholder ingen produktgodkjennelse.

Feeding system

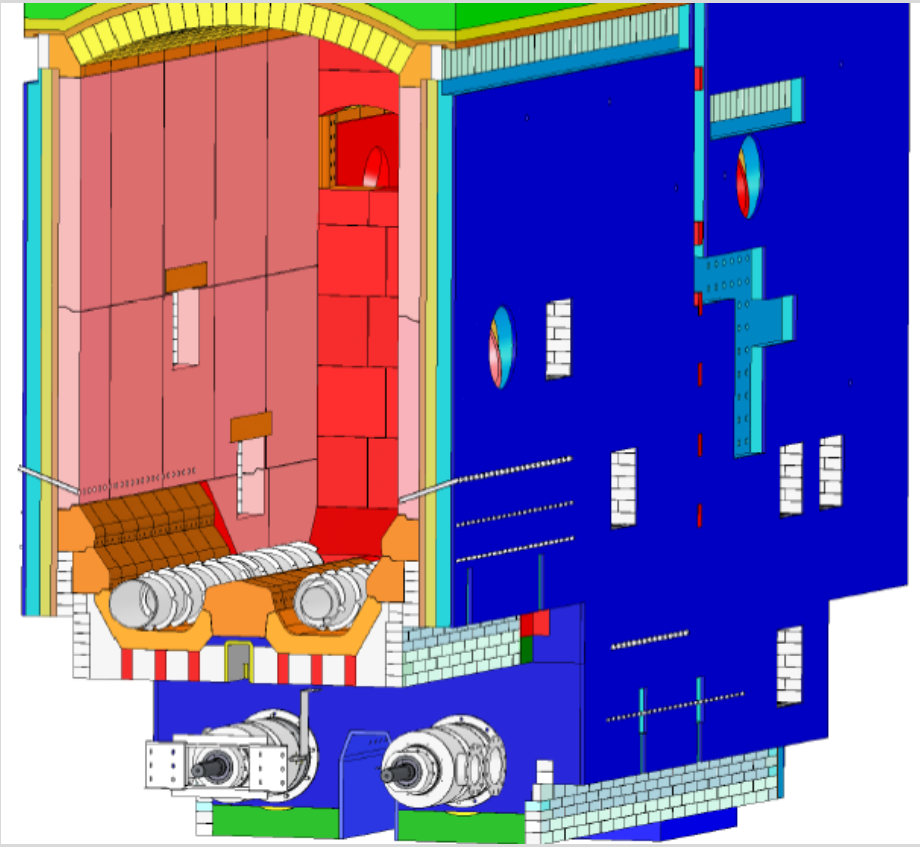
WASTE FEEDING

The feeding system is designed to accommodate loading of waste from the waste feeding overhead crane into the waste chute and subsequent pusher system. The chute is equipped with a safety door in the case of back fire in the system. Waste is automatically fed into the primary chamber by a ram-pusher. The pusher chamber is water cooled and is hydraulically driven via the hydraulic power pack and controlled proportionally with the thermal output to the boiler.

The supply includes:

- Waste hopper with pneumatically driven top door
- Horizontal ram pusher
- Hydraulic power pack
- Connections for cooling water circuit (from boiler)
- Instrumentation

Auger system



NEW AUGER SYSTEM

- Type EK
- Material SS AISI 304
- Auger dimension Ø 420 mm
- No. of augers 4
- Electrical drivemotor 0.75 kW

The system is designed with air cooled high temperature resistant augers above the incinerator bed, facilitating forward motion and stirring of the waste to ensure complete burnout of the ashes. The speed and retention time of the waste can be adjusted as set points from the supervisory system as well as the touch panel.

The supply includes:

- Two sets of augers – one upper and one lower
- Electrical drive motors and hollow shaft type gears to allow slow rotation
- Sealing arrangements with cooling air inlet and outlet
- Instrumentation – flow, pressure temperature, rotation
- Frequency controlled cooling air fan

Air cooled
Individually controlled ⇒ complete burn-out

Scope of modification

COMBUSTION AIR SYSTEM MODIFICATION

- Modification of the existing combustion air system with
- Frequency controlled fan
- 4 damper motors with position feedback 4-20 mA

MODIFICATION OF EXISTING BOILER

- The existing boiler can be modified with a separated radiation and convection part in order to reduce slagging and prolong operational up-time.

REPAIR/MODIFICATION OF INCINERATOR STEEL BODY

- The incinerator steel casing need to be modified to accommodate the new equipment.

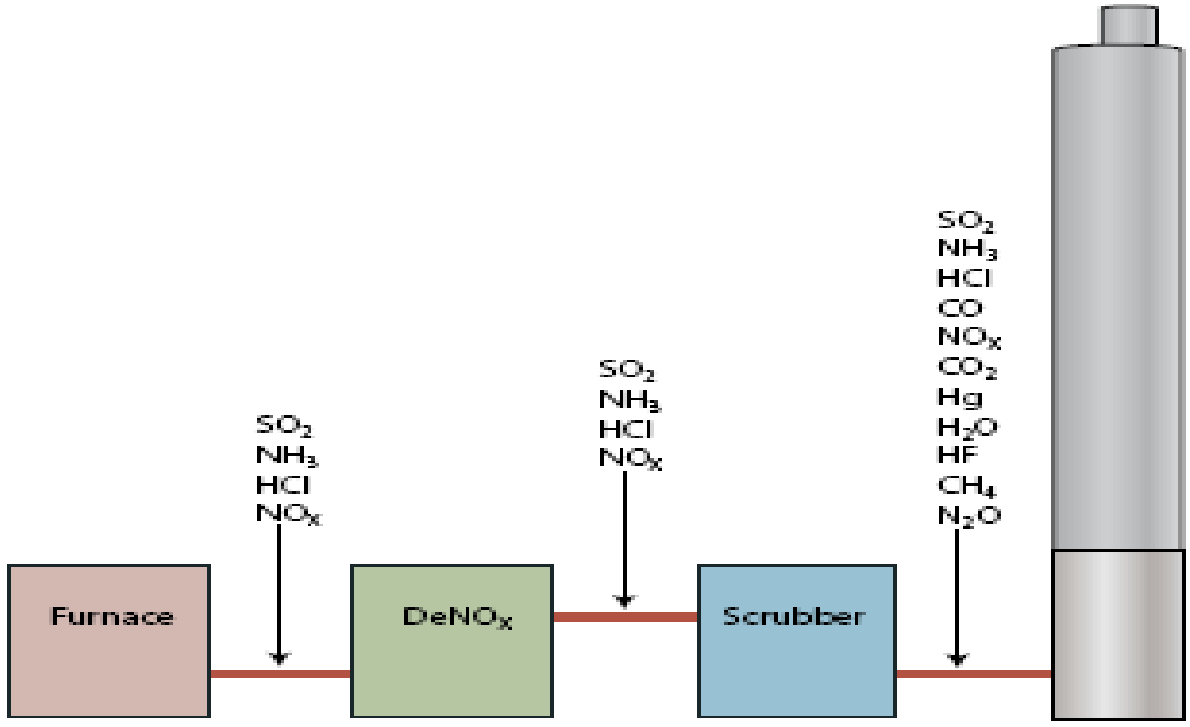
PLATFORM HARDWARE

- Access staircases and platforms on incinerators, boilers and filters for service and maintenance.
  Access to all major equipment.

FUE GAS CLEANING SYSTEM

FUE GAS CLEANING SYSTEM

Continuous measuring and reporting



Opsis monitoring system is an effective tool for controlling the different emissions and process control spots in a waste incinerator.

Municipal Solid Waste SOx and HCl reduction by Sodium bicarbonate (NaHCO3)

Chemistry of conversion of SO_2 , HCl and HF with Sodium Bicarbonate

Through adding heat to the sodium bicarbonate it is converted into sodium carbonate see formula below. By conversion the specific surface area is enlarged. The surface structure becomes porous and a totally virgin surface is reached. This makes the sodium bicarbonate substantially more reactive than traditional sodium bicarbonate. The conversion creates very good conditions for neutralisation of acid gases as well as absorption of heavy metals and furans.

Good effects regarding heavy metals have been recorded, but these cannot fully replace activated carbon with it's greater specific surface area.

Heat **Conversion:** $2\ NaHCO_3 \Longrightarrow Na_2CO_3 + H_2O + CO_2$

Sulphur SO_2: $Na_2CO_3 + SO_2 + 1/2\ O_2 \Longrightarrow Na_2SO_4 + CO_2$

Hydrochloric acid HCl: $Na_2CO_3 + 2HCl \Longrightarrow 2NaCl + CO_2 + H_2O$

Furans HF: $Na_2CO_3 + HF \Longrightarrow NaF + H_2O + CO_2$

Sodium bicarbonate prior to thermal activation : very smooth grain surface
Sodium carbonate with a high specific surface after thermal activation of the sodium bicarbonate : highly porous grain surface.

From Solvay's website www.neutrec.com

Possibilities of improving the emmission

Specialkemi Väst AB

How to decrease NOx?

Specialkemi Väst is representing CRI, a daughter company of Shell, in the Nordic countries

The system is quite advanced by having a low temperature reduction of NOx.

This enables the customer to have the modules after the textile filter and not interfering with the incineration itself.

When the improvement of the textile filter is completed this would be an option, which can give over 90% reduction of NOx.

The function is explained briefly in the following picture. To achieve NOx-reduction an addition of ammonia is needed. Also this addition is made after the textile filter.

What to do with the ashes?

Textile filter, dust management,

- Connect and upgrade the existing bag house filter – this will bring down the dust immediately.
- Choose a proper textile for the temperature and gas
- Invest in drying the compressed air, for both conditions of filter and for transporting the additives. Wet air gives lumps and corrosion.

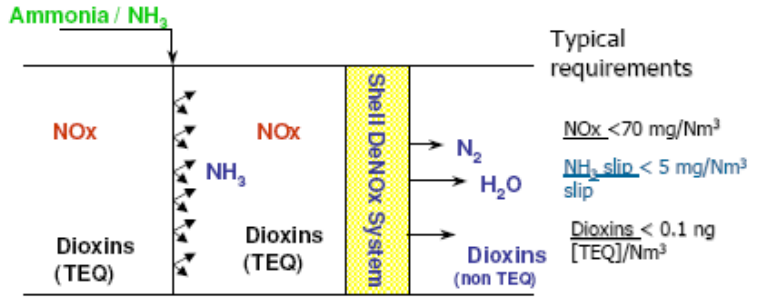
SOx ,HCl and NOx management,

- as a "**step one**" make measurements to know exact conditions
- if possible, invest in continuous measuring

- "**step two**" add bicarbonate and activated carbon, bicarbonate for SOx, HCl and activated also for dioxin, if going for a SCR, this amount can be
- Specialkemi Väst can supply both mixed and separate additives.

- "**step three**" when conditions are defines as low dust and SOx-levels a SelectiveCatalyticReduction can be installed after the textile filter. Using the CRI/Shell system enables to reduce NOx by more than 90%.
- Please note that step three should only be applied if there is a further need for NOx-reduction. Since Funi probably is allowed max.400mg/Nm^3 NOx, it might not be required.

Typical Lay-out Shell DeNOx/De-Dioxin System



What to do with the ashes

Specialkemi Väst AB

What to do with the ashes?

Ashes are at the present being deposited at the beautiful site next to Flateyri, together with the non combustable waste.
As long as this is accepted by the local Authorities, this will be the procedure. If there would be a need of disposing the ashes differently in the future Noah A/S, www.noah.no is to be recommended. Noah A/S is a company specialising on stabilising of ashes.
One possibility is to do a joint project together with the other MSW plants on Iceland using additives. Combined shipments out of Reykjavik would be beneficial for all parties involved.

Behandling af Bikarbonat affald.

- Hei Finnur.

  Takk for din forespørsel.

  1. Ja, Vi mottar og behandler røkgassrensningsprodukter fra hele Nord Europa også den type som du nevner.
  2. Dersom dette leveres i big bag à 1 tonn så er prisen NOK 800,- pr tonn fritt levert vår kai på Langøya - Norge.
  3. Vi mottar også fra Grønland og Færøyene. Herfra samler man til en last på ca. 1.000 tonn og seiler dette med skip til oss.

  Vennlig hilsen
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