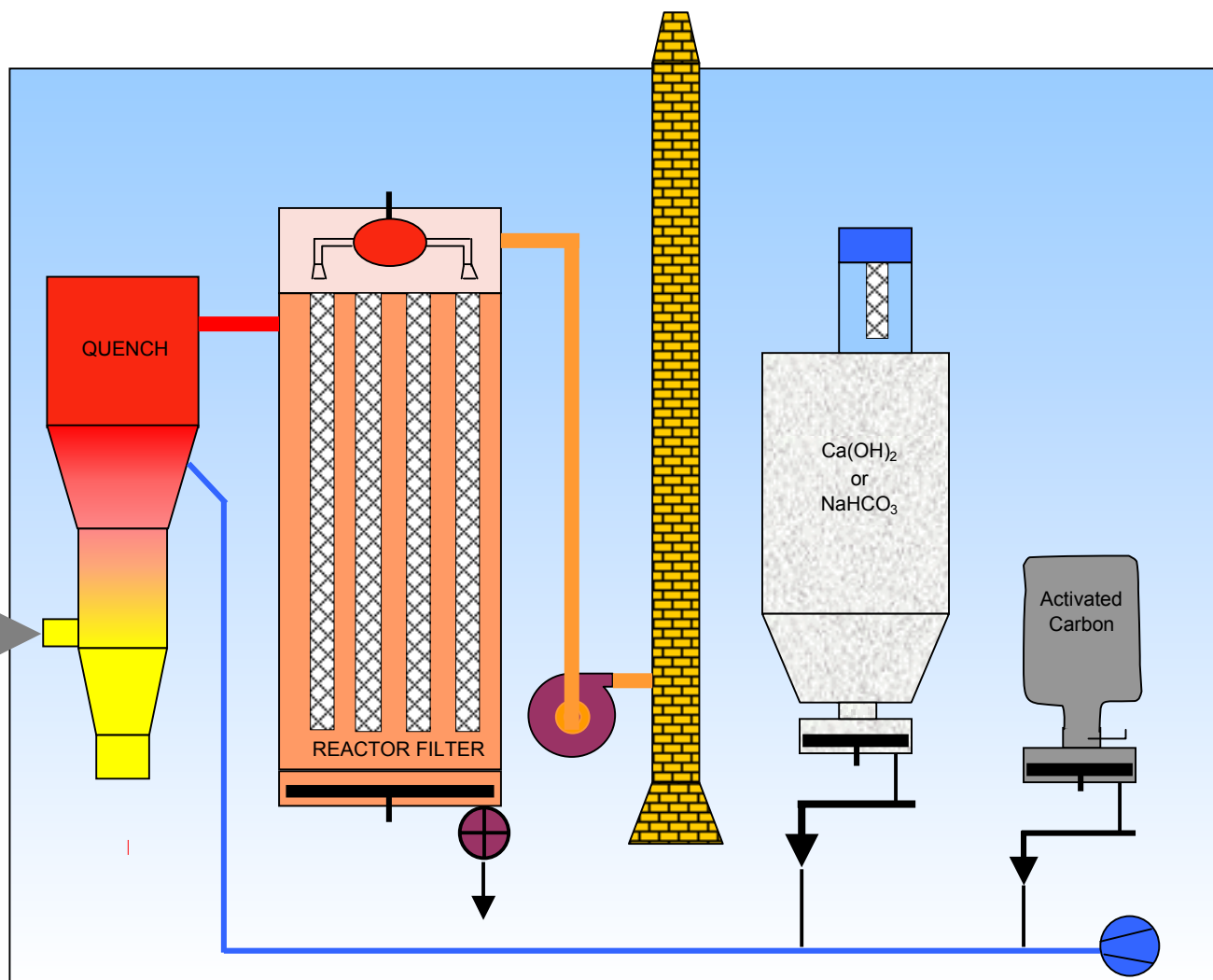


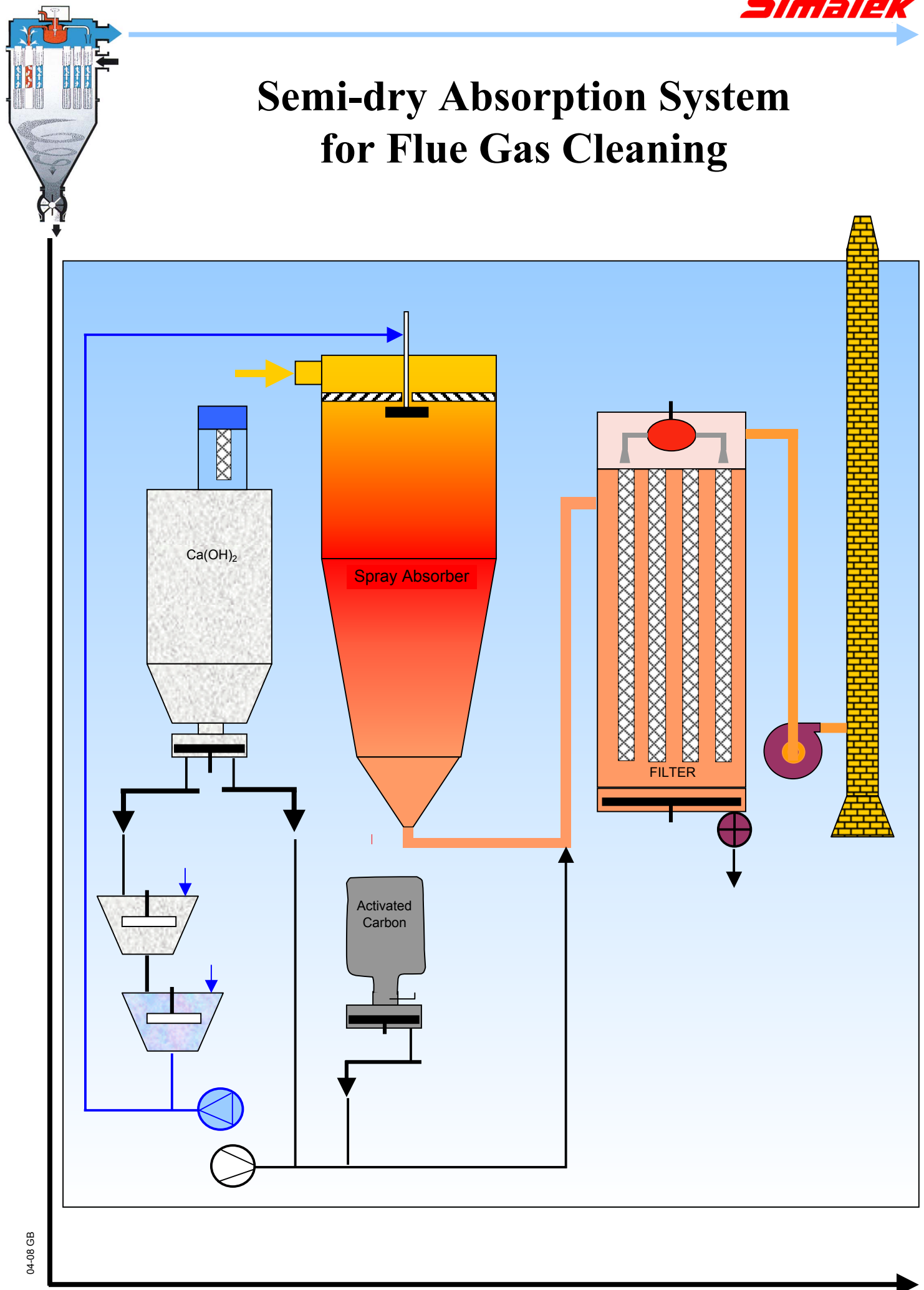


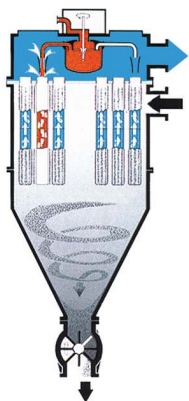
Dry Absorption System for Flue Gas Cleaning



	Flue gas Inlet concentrations	EU-Directive or 17 BimSchV	Achieved Emissions
HCL	1500 mg/Nm ³	10 mg/Nm ³	< 5 mg/Nm ³
SO ₂	800 mg/Nm ³	50 mg/Nm ³	< 10 mg/Nm ³
HF	100 mg/Nm ³	1 mg/Nm ³	< 1 mg/Nm ³
PCDD/F TEQ	10 ng/Nm ³	0,1 ng/Nm ³	0,034 ng/Nm ³
Hg	5 mg/Nm ³	0,05 mg/Nm ³	0,005 mg/Nm ³
Other heavy metals, total	200 mg/Nm ³	0,5 mg/Nm ³	0,005 mg/Nm ³

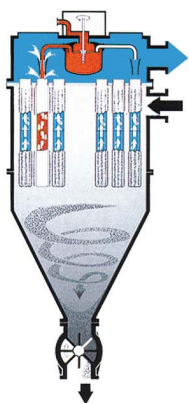
Semi-dry Absorption System for Flue Gas Cleaning





Simatek 3C Filter Experience in Flue Gas Cleaning

- ☒ **Bio Fuel**
 - Straw
 - Chemically Treated Wood
 - Wood Chips
- ☒ **Municipal Waste**
- ☒ **Hazardous Waste**
- ☒ **Clinical Waste**
- ☒ **Crematorium Incinerators**
- ☒ **Oil Waste**
- ☒ **Sludge**
- ☒ **Coal**
- ☒ **Metal Furnaces**



Operating Opportunities with the most Advanced Filter Simatek 3C

• Filter Resistance Control:

- The **dP set point** will fluctuate with the **Gas Flow**, **higher dP set point with higher gas flow** and a **decreased set point with a reduced gas flow**.
- The **pulse pressure** will be controlled by the **dP**, **lower dP** gives automatically **lower pulse pressure** and **higher dP** gives a **higher pulse pressure**, but still within **0.4-0.9 bar**.
- Only **one (1) bag being pulsed** and the **Gas Flow** between the bags is **down flow** to support the transport of particles, mainly the **sub micron particles**, down to the filter bottom and out.

• Constant Thickness of Ab-/Adsorbing Filter Cake:

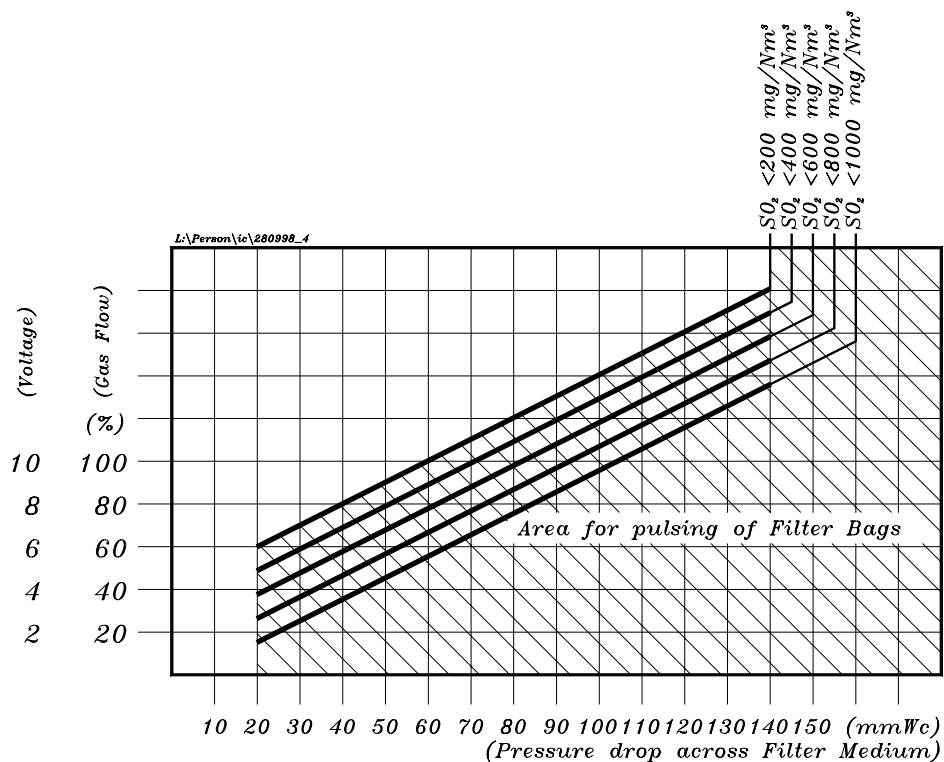
- With the above-mentioned control of the **Filter Resistance** the filter cake with **Chemicals** for **Ab-/Adsorption** is controlled to a **constant thickness** which gives a controlled **Emission** of **Acid Gases** and **Toxic Elements** and with an **optimized utilization** of the **injected chemicals**.

• Injection of Chemicals depends on the Flue Gas:

- The amount of **injected Chemicals** is regulated from the **Emission** of **HCl** and **SO_x** if the concentration is fairly stable. If the **inlet concentration** of **SO_x** is suddenly **heavily increased** both the **set point for dP** and the **amount of Chemicals injected** is also **increased** to form a **thicker and more reactive filter cake** as well as the **Recycling of unreacted Chemicals** is also initiated.
- This way of **operating the filter** is **only used** with **very high SO_x inlet concentrations** while still **receiving low SO_x emission** and it is due to its **slower reaction** compared with **HCl** and **HF**.
- The **Injection of Activated Carbon** is kept **constant** because the **PCDD/F Emission** is **not constantly measured**.

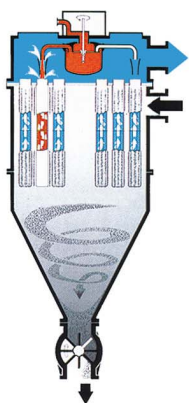


Intelligent Filter Control for constant thickness of Ab-/ Adsorption Filter Cake



Flue Gas Cleaning System

Application: Aluminium Melting Furnace
 Capacity: 80.000 m³/h
 Temperature: < 200 °C
 Dust: Aluminium Oxide
 Acid Gas: Hydrogen Fluoride (HF)

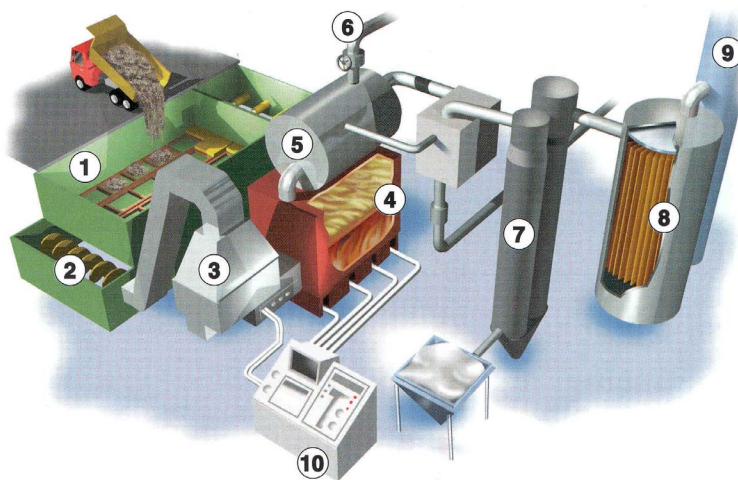


AITOS Norway

Industrial Waste incinerator

Simatek scope of supply:
Item 7,8 and 9

Complete Flue Gas
Cleaning System
for removal of: HCl, SO_x,
Dioxins,
heavy metals and fly ash

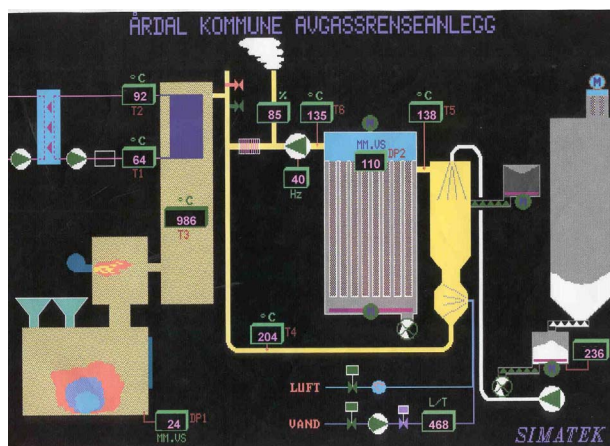


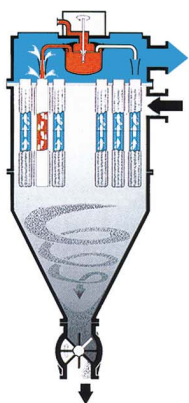
Årdal Norway

Municipal Waste
Incinerator

Simatek scope of supply:

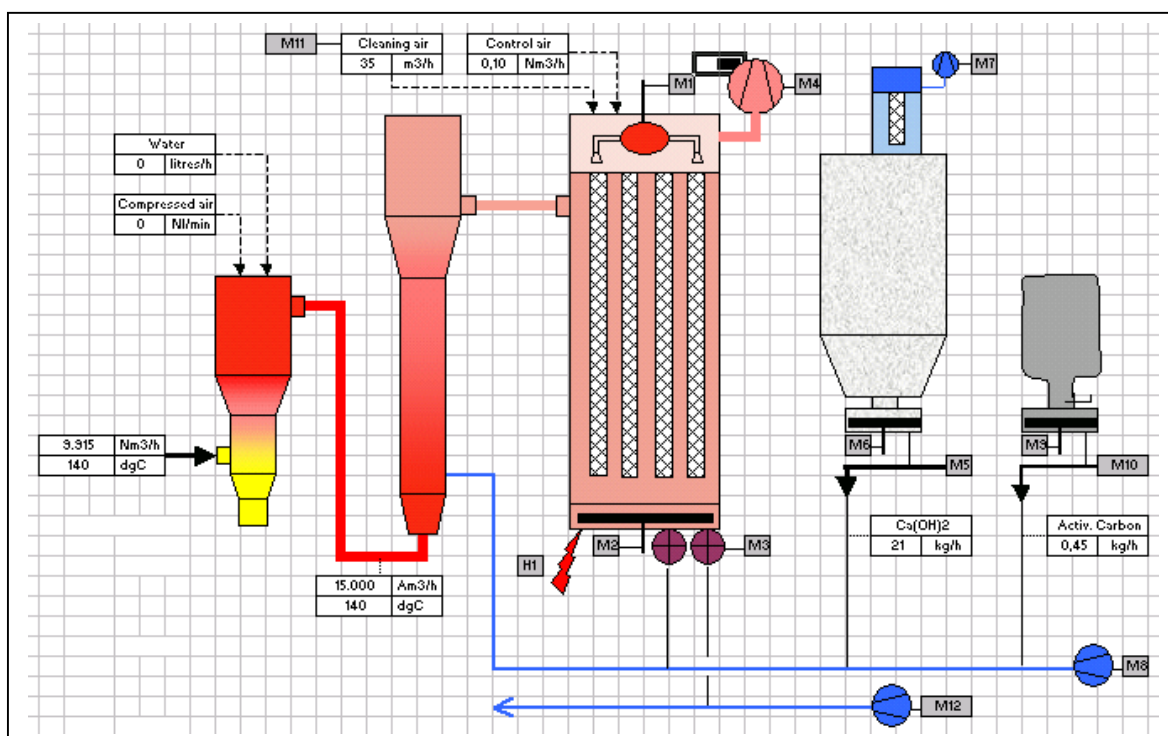
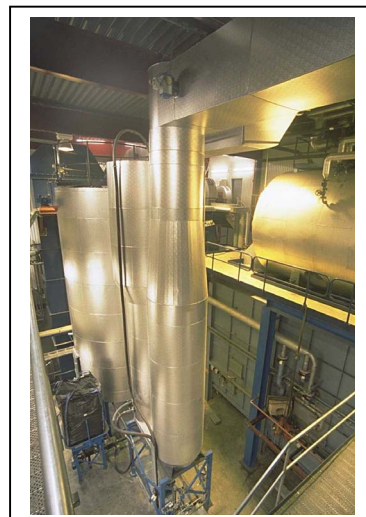
Complete Flue Gas Cleaning System
Including boiler, reactor, filter,
stack, silos, quench and dosing-
systems.





AITOS NORWAY

Removal of: SO_x, HCL, Dioxins and Heavy Metals



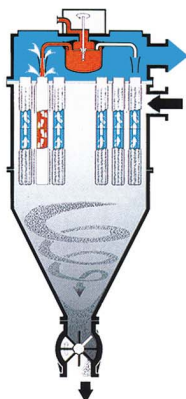
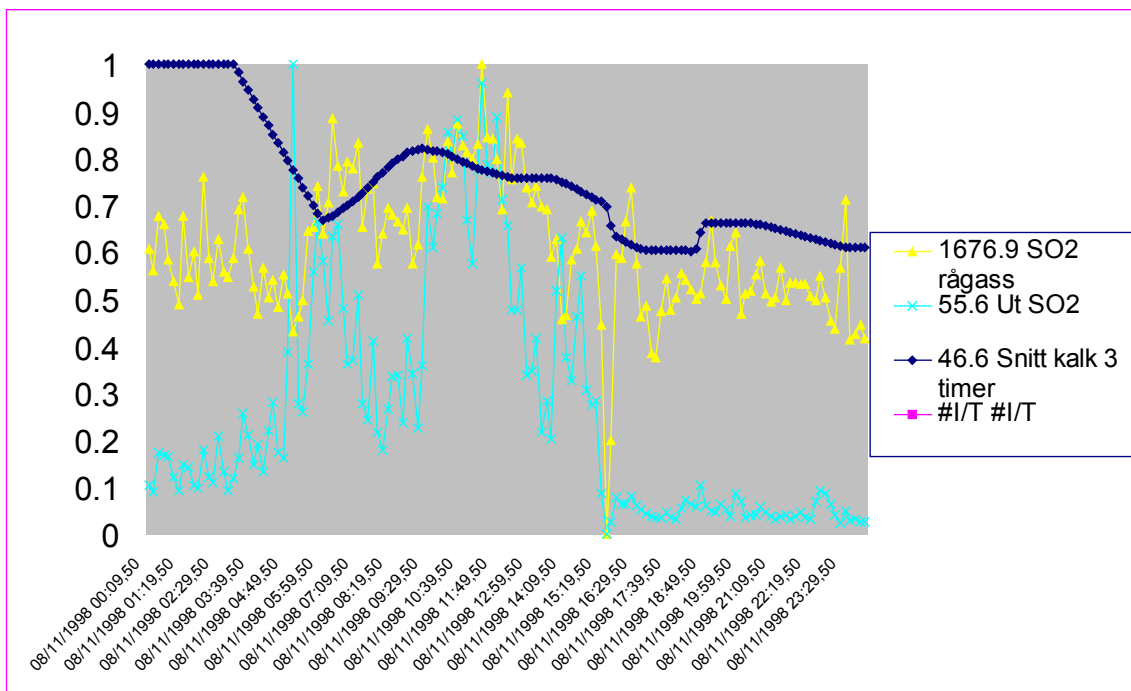


Diagram for SO₂



Measuring period: 08-11-98 at 00,09,50
09-11-98 at 00,09,50

Values: SO₂ Raw gas (rågass): mg/Nm³
Out (Ut) SO₂ : mg/Nm³
Lime average (Snitt kalk) 3 hours: kg/h

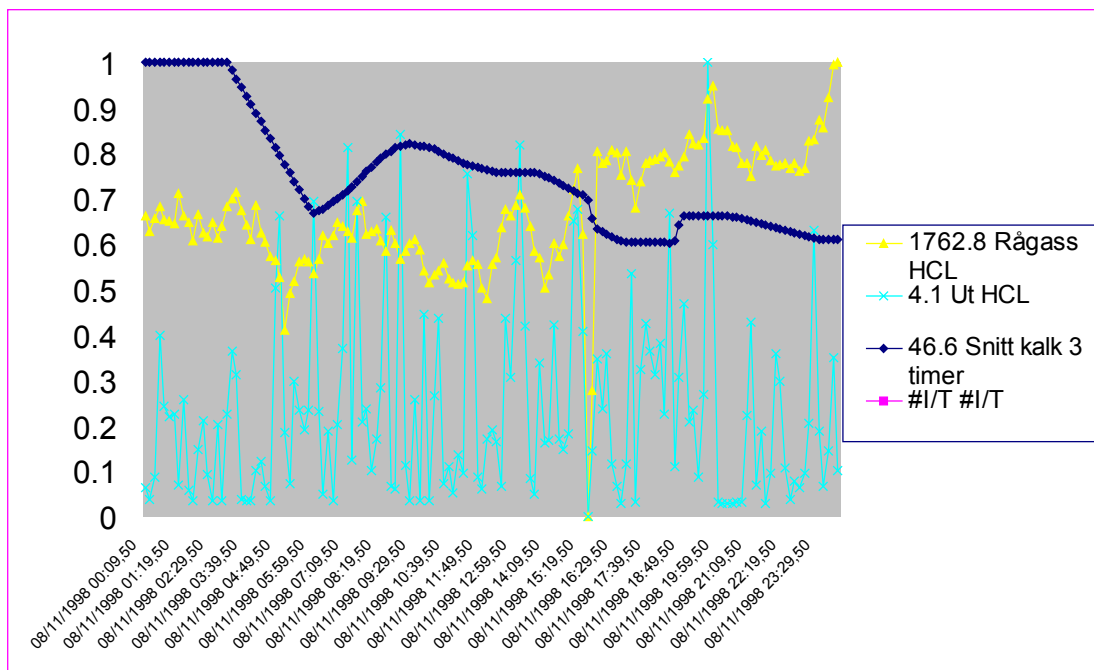
The values placed in the box to the right of the data area represent the maximum values of the data in question. The ordinate to the left in the data area shows the multiplication factor for calculation of the actual value.

Example: Raw gas SO₂ on 08-11-98 at 00,09,50 shows the ordinate of app. 0.6, and the maximum value for raw gas SO₂ is 1676.9. Multiply the factors and you have 0.6 x 1676.9 = 1006 mg/Nm³.

The diagram situation shows that the plant is operating with a SO₂ inlet concentration of app. 1200 mg/Nm³ during the first half of the period. Then the concentration falls to 1000 mg/Nm³ in the latter part of the diagram. The emission requirement is <50mg/Nm³ and the average for the whole period is app. 20 mg/Nm³, with an average lime consumption of 35 kg/h. In this situation 98% of SO₂ is removed.



Test Results of Aitos A/S Ranheim energi



Measuring period: 08-11-98 at 00,09,50
09-11-98 at 00,09,50

Values: Raw gas (Rågass) HCl: mg/Nm³
Out (Ut) HCl: mg/Nm³
Lime average (Snit kalk) 3 hours: kg/h

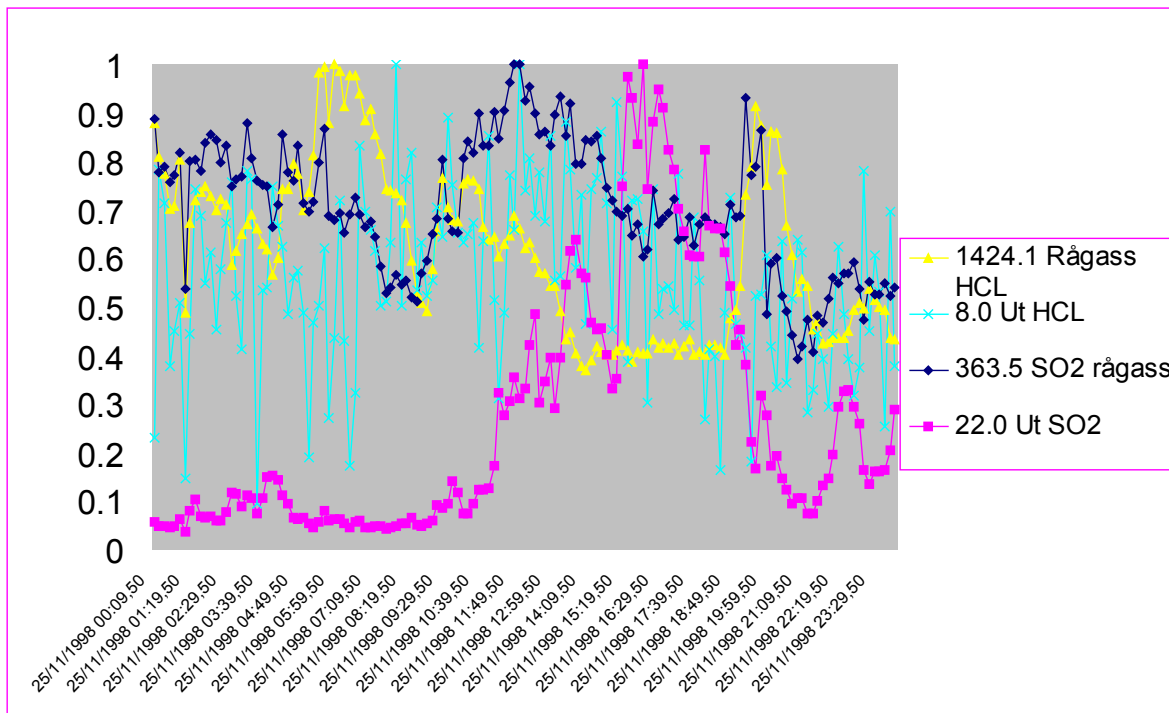
The values placed in the box to the right of the data area represent the maximum values of the data in question. The ordinate to the left in the data area shows the multiplication factor for calculation of the actual value.

Example: Raw gas HCl on 08-11-98 at 00,09,50 shows the ordinate of app. 0.65, and the maximum value for raw gas HCl is 1762.8. Multiply the factors and you have $0.65 \times 1762.8 = 1145 \text{ mg/Nm}^3$

The diagram situation shows that the plant is operating with a stable inlet concentration of HCl of app. 1100 mg/Nm^3 during the first half of the period. Then the concentration rises to 1762.8 mg/Nm^3 in the latter part of the diagram. The figures show clearly that there is no difficulty in complying with the emission requirement of $<10 \text{ mg/Nm}^3$, as the average for the whole period is 1.8 mg/Nm^3 , with an average lime consumption of 35 kg/h . In this situation 99.8 % HCl is removed.



THIS DIAGRAM SHOWS A NORMAL OPERATING SITUATION AT THE INCINERATION PLANT OF AITOS A/S RANHEIM ENERGI

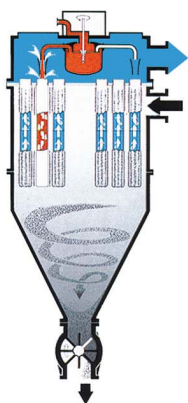


Measuring period: 25-11-98 at 00,09,50
26-11-98 at 00,09,50

Values: Raw gas (Rågass) HCl: mg/Nm^3
Out (Ut) HCl: mg/Nm^3
Raw gas (Rågass) SO₂: mg/Nm^3
Out (Ut) SO₂: mg/Nm^3

Emissions of Acid gases and Toxic elements:

Parameter	Req. mg/Nm^3	Measured Wet chemistry
HCL	10,0	0,3 mg/Nm^3
HF	1,0	< 1 mg/Nm^3
SOx	50,0	9,0 mg/Nm^3
PCDD/F	0,1	0,034 ng/Nm^3
Hg	0,03	< 0,01 mg/Nm^3



Filter No.: 4241

Flue Gas Ref. No.: 72

Dry Absorption (Sodium Bicarbonate)



Application: Fluid-bed Incinerator for Municipal Sludge

Flue gas flow: 8,300 Am³/h

Temperature: 230°C

Country: Denmark (Krüger / Lundtofte Renholdningsværk, Lyngby)

Measured by: MILJØ-KEMI, Dansk Miljø Center A/S

Filter type: JM 80/50-05, Series 3C

Filter area: 176 m²

Bag length: 5.0 m

Absorbent: Bicarbonate - NaHCO₃

Adsorbent: Activated carbon

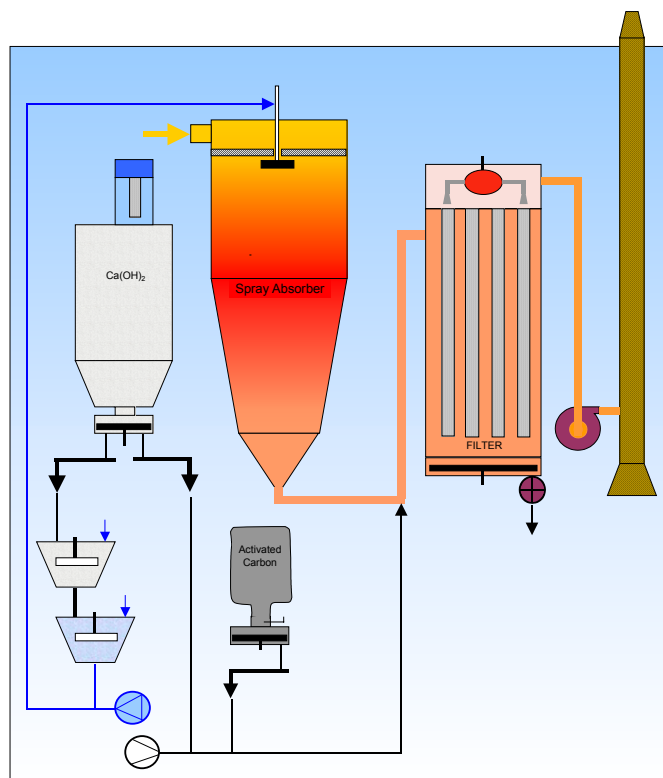
Parameters	Flue Gas (dk-Teknik) Inlet Concentration	Flue Gas Emission (Measured)	Official Requirement Emission (Permissible)
Dust	21840 mg/Nm ³	<4 mg/Nm ³	10 mg/Nm ³
HCl	44 mg/Nm ³	1.5 mg/Nm ³	10 mg/Nm ³
SO ₂	1470 mg/Nm ³	<1 mg/Nm ³	50 mg/Nm ³
HF	24 mg/Nm ³	<0.1 mg/Nm ³	1 mg/Nm ³
PCDD/F TEQ	-	0.0054 ng/Nm ³	0.1 ng/Nm ³
Hg	< 0,01 mg/Nm ³	0.009 mg/Nm ³	0.05 mg/Nm ³
Other heavy metals - Σ	3.8 mg/Nm ³	0.087mg/Nm ³	0.5 mg/Nm ³



Filters No.: 4258+4259

Flue Gas Ref. No.: 79

Semi-Dry Absorption (Hydrated Lime)



Application: Waste Incineration (Foster Wheeler Circulating Fluid-Bed Boiler)

Flue gas flow: 95,000 Am³/h

Temperature: 140-170°C

Country: Norway

Measured by: METLAB Kontrol

Filter type: 2 modules JM 280/80-05, Series 3C

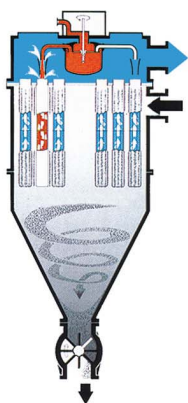
Filter area: 1970 m²

Bag length: 8.0 m

Absorbent: Hydrated lime – Ca(OH)₂

Adsorbent: Activated carbon

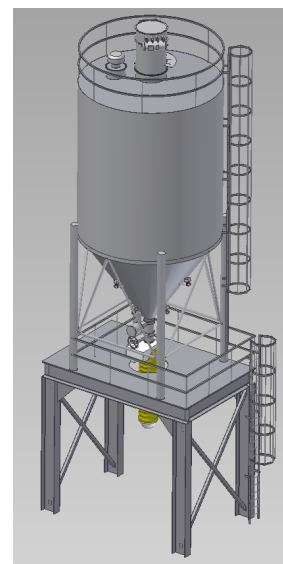
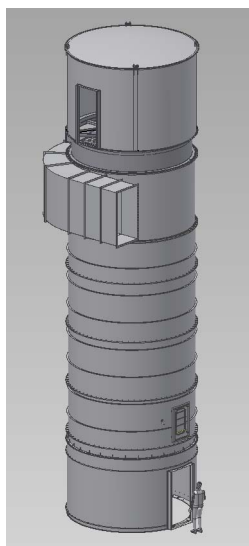
Parameters	Flue Gas Inlet Concentration	Flue Gas Emission (Measured)	Official Requirement Emission (Permissible)
Dust	20 g/Nm ³	1-2 mg/Nm ³	10 mg/Nm ³
HCl	1000-2500 mg/Nm ³	0-3mg/Nm ³	10 mg/Nm ³
SO ₂	300-1500	10-50 mg/Nm ³	50 mg/Nm ³
HF	5-20	<1 mg/Nm ³	1 mg/Nm ³
PCDD/F TEQ	?	<<0.1 ng/Nm ³	0.1 ng/Nm ³
Hg	?	<<0.03 mg/Nm ³	0.03 mg/Nm ³
Other heavy metals - Σ	?	<<0.5 mg/Nm ³	0.5 mg/Nm ³



Filter No.: 4402

Flue Gas Ref. No. 80

Dry Absorption (Hydrated Lime)



Application: Waste Incineration

Flue Gas Flow: 72,000 Am³/h (Energos incineration plant)

Temperature: 140-170°C

Country: Norway

Measured by: Jebens Miljøteknikk

Filter type: JM 280/100-05, Series 3C

Filter area: 1232 m²

Bag length: 10.0 m

Absorbent: Hydrated lime – Ca(OH)₂

Adsorbent: Activated carbon

Parameters	Flue Gas (Expected) Inlet Concentration	Flue Gas Emission (Measured)	Official Requirement Emission (Permissible)
Dust		3.2 mg/Nm ³	10 mg/Nm ³
HCl	300-1200 mg/Nm ³	1.9 mg/Nm ³	10 mg/Nm ³
SO ₂	200-800 mg/Nm ³	0.9 mg/Nm ³	50 mg/Nm ³
HF		<0.02 mg/Nm ³	1 mg/Nm ³
PCDD/F TEQ		0.008 ng/Nm ³	0.1 ng/Nm ³
Hg		0.00004 mg/Nm ³	0.03 mg/Nm ³
Other heavy metals - Σ		0.004 mg/Nm ³	0.5 mg/Nm ³