

Soil decontamination of POPs by thermal desorption, applying of thermal desorption for soil decontamination process.

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Thermal desorption is NOT incineration process

Thermal desorption is a way to treat soils contaminated with organic wastes. By heating these soils to temperature 350-800 degrees C°, contaminants will vaporise and separate from the soil. The vaporised gases are collected and treated in cyclone, oxidiser and bag-house and finally washed by gas scrubber. Vaporised contaminants are destroyed in oxidiser in high temperature 850-1100 degrees C° (with a gas retention >2 sec).

SAVATERRA Oy — Site SNCF, Moulin Neuf 110, 60230 Chambly, Paris, France
2012



SAVATERRA Oy – Samples of References desorption,

Year	Ref.	Description	Compound	Concentration	Amount (t)
2002	1	Receptory site operated by ST	VOC+C ₁₀ -C ₄₀	0.7-3%	20000
2002	2	Receptory site operated by ST	VOC+C ₁₀ -C ₄₀	3 %	5000
2002	3	Maarlenhavn oilharbour	VAC+C ₁₀ -C ₄₀	5 %	20000
2003-2004	4	Puistolanniemi oilharbour	VOC+C ₁₀ -C ₄₀	0.3%+ 1%	100000
2003-2004	5	Puistolanniemi oilharbour	VOC+C ₁₀ -C ₄₀	0.3%+ 1%	30000
2004-2005	6	Refinery waste site	VOC+C ₁₀ -C ₄₀ + PAH	7-20%	175000
2005	7	Impregnation site	VOC+C ₁₀ -C ₄₀ + PAH	0.8-3% + 0.2-0.5%	18000
2003-2008	8	Receptory site operated by ST	VOC+C ₁₀ -C ₄₀ + PAH+PCB	>2% + >0.5% +0.1-0.2%	100000
2003->	9	Receptory site operated by ST	C ₁₀ -C ₄₀ + PAH	>3% + >0.5%	150000
2003->	10	Receptory site operated by ST	C ₁₀ -C ₄₀ + PAH - PCDD/F –metals, pesticides, TNT	0.1-5%+0.1-0.5%	250000
2009	11	Oil drilling mud	C ₁₀ -C ₄₀ + PAH	22 %	3000
2010	12	Pulpmill site	C ₁₀ -C ₄₀ + PAH+turpentine+ black liquor	0.05-4%	55000
2012	14	Impregnation site	VOC+C ₁₀ -C ₄₀ + PAH	0.8-3% + 5%	60000
2012	15	Impregnation site	CP+PCDD/F	1.5-2000µg/kg	15000
2014	16	Impregnation site	CP+PCDD/F	1.5-150µg/kg	12000
2014	17	Mustard gas	military compounds	not public	200
				Total	1013200

In all Savaterra's environmental permits authorities have given following regulations :

- all treated samples must be analysed by outside independent accredited laboratory
- emission (air) must be made similar way

Savaterra's owns 6 environmental permits :

- 3x Finland, Norwegian, Sweden, France

*REGULATION (EC) No 166/2006 OF THE
EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 18 January 2006 concerning the establishment of a
European Pollutant Release and Transfer Register and
amending Council Directives 91/689/EEC and
96/61/EC*



Contaminated soils = specific waste



It is mixture of soil and contaminant



Mixture is already hazardous waste



50 mg of contaminant in 1 kg

is relation

0,005% of contaminant = Hazardous Element

and

99,995% of soil = inert material

Is very noneffective to utilize 99,99..% of inert soil like hazardous waste



Effective and safe way is to utilize only contaminant and clean soil use for earth works

SAVATERRA Oy - temperature of desorption, oxidation, content of contaminant in after and before treatment :

Contaminant	Temperature of desorption/boiling point	Temperature of oxidation	Content of contaminant in soil in input - before	Content of contaminant in soil in output -after
SemiVOC	200-300°C	850°C	<80.000mg/kg	0,02-10mg/kg
PAH	>400°C	850°C	<20-30g/kg	<5mg/kg
PCB	>500°C	>1000°C	<10.000mg/kg	<0,5mg/kg
Pesticides and herbicides	200-300°C	850°C	<10.000mg/kg	Less than detection limit
VOC	200-300°C	850°C	<80.000mg/kg	0,02-10mg/kg
Total hydrocarbons TOC	200-400°C	850°C	<80.000mg/kg	<50mg/kg
Chlorophenols (CP)	>400°C	850°C	<10.000mg/kg	<5mg/kg
PCDD/Fs	>600°C	>1000°C	<1.000mg/kg*	<0,00005mg/kg
Cyanid's (CN)	>400°C	850°C	<40.000mg/kg	<10mg/kg
Metals of 12.groups table of elements (f.e. Mercury Hg)(volatile metals)	>400°C	850°C	<10.000mg/kg	0,005mg/kg
Heavy metals	>400°C	850°C	<10.000mg/kg	Insoluble Salt

Reasons for application thermal desorption for contaminated soils?

- 1) High capacity (40-80t/h) allows reasonable time schedules in bigger projects
- 2) Post treatment monitoring is minimal
- 3) Versatility of the method allows high variation of the contamination level and compounds in the input material
- 4) The method is quite insensitive of the moisture and soil type of the input material
- 5) The space requirement is low (40m*60m)
- 6) Comparison of the total costs to other treatment methods, make thermal treatment very attractive alternative
- 7) Emission control and mass balance are easy to make
- 8) On-site treatment removes truck rally to landfills and also the use virgin materials as treated material can be used as backfill material.

A large pile of dark brown soil, likely the result of a decontamination process, is shown under a blue sky with light clouds. The soil is piled high and appears to be a uniform, dark brown color. The background shows a clear sky and some distant trees.

**In our decontamination process we destroy
contaminant and produce clean soil.**

**Cleaned mixture is SOIL - NOT ASH
is classified like waste without hazardous
properties**

Our process is NOT INCINERATION process

FINALLY WE PRODUCE CLEAN SOIL ONLY

SAVATERRA Oy - Extract from European Patent register :



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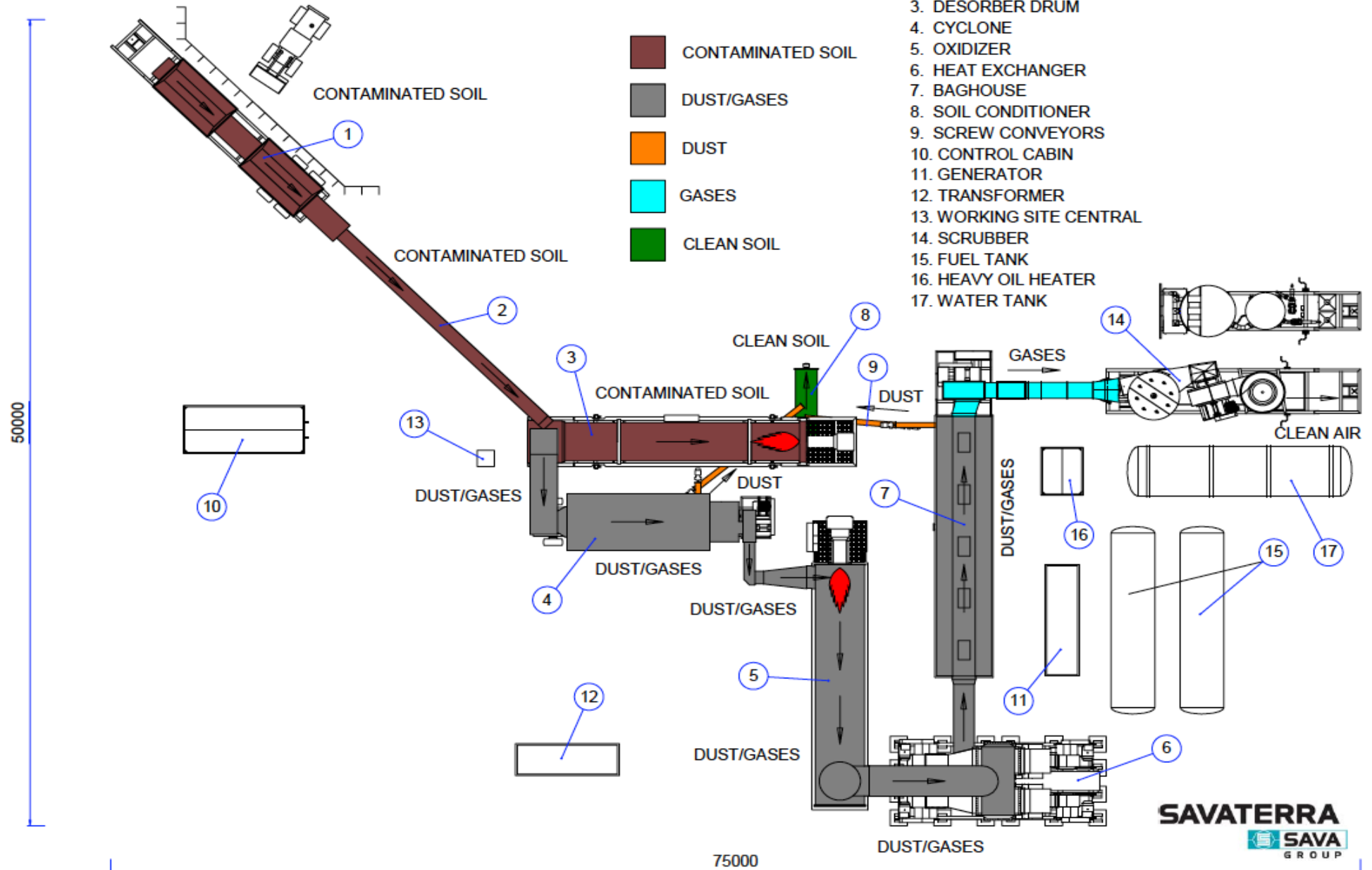
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(54) **Direct contact high temperature thermal desorbtion**

SAVATERRA Oy – thermal desorption layout

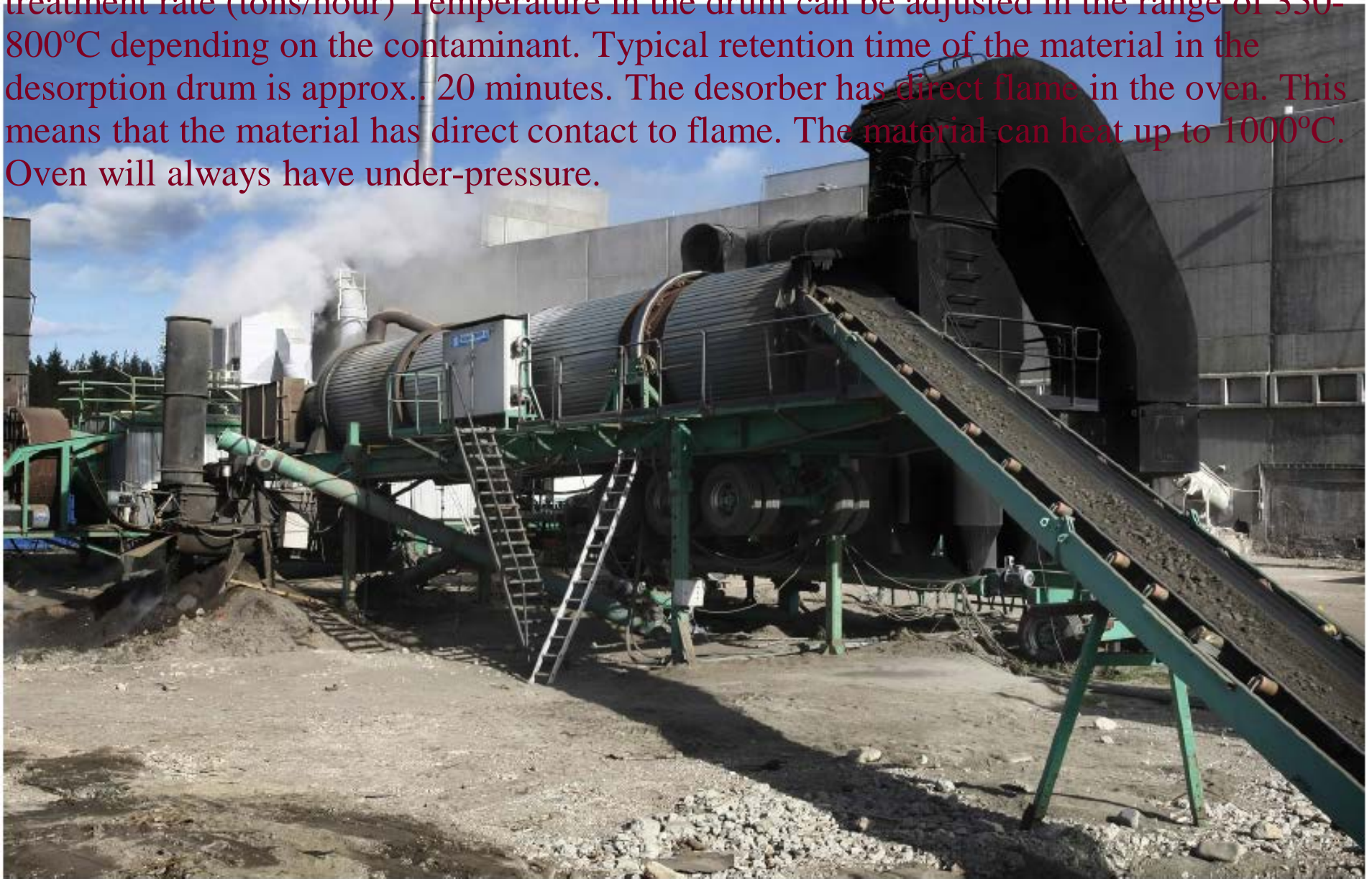
SOIL CLEANER LAYOUT



SAVATERRA Oy - 1.Feed hopper - The wheel loader unloads the contaminated soils to **feed hopper** where material larger than 150 mm in diameter are removed. Larger material will be crushed and recycled into the feed or delivered to landfill. The capacity is adjusted in feed hopper according the concentration and quality of contaminant. If contaminated soil is very wet or has a lot contamination, it may need to be mixed with less contaminated or workable soil for treatment in desorption unit. Metal material will be removed by **magnetic** after feed hopper.



SAVATERRA Oy - 3.Desorption unit - The desorption unit is used to heat contaminated soil to a high enough temperature and for a long enough time to dry it and vaporise the contaminants from soil. The unit is a rotary desorber which has a rotating, cylindrical metal drum. The rotation speed and the angle of the drum will adjust treatment rate (tons/hour) Temperature in the drum can be adjusted in the range of 350-800°C depending on the contaminant. Typical retention time of the material in the desorption drum is approx. 20 minutes. The desorber has direct flame in the oven. This means that the material has direct contact to flame. The material can heat up to 1000°C. Oven will always have under-pressure.



SAVATERRA Oy - 4.Cyclone - As the soil is heated, the contaminants will vaporize and become a part of gas stream of air which is caused by blowers. Gas flow from desorber is guided by under-pressure to cyclone where most of the particulate matter will be removed.



SAVATERRA Oy - 5. Afterburner - After cyclone, vaporized contaminants will be burned in an afterburner (oxidiser). Temperature 850-1100 degrees °C destroys the contaminants in to CO₂. **6. Heat exchanger** - The flue gas is cooled to 180°C before entering the bag house.



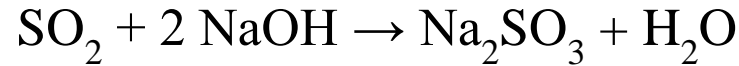
SAVATERRA Oy - 7. Bag house takes away most of particles. Activated carbon can be utilised in the bag house to remove Hg from the flue gases.



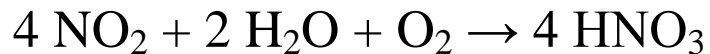
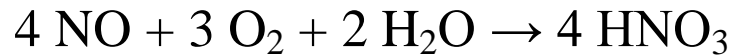
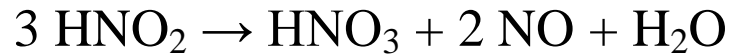
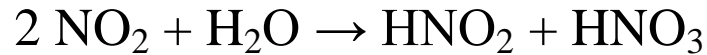
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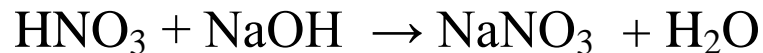
SAVATERRA Oy - 14. Gas scrubber is connected to process if sulphur (SO_x) concentration in soil or fuel is exceptional high level. SO_x will react with water and sodium hydroxide as follows:



Scrubber also helps to remove last particles. Water of the scrubber will be treated in water treatment process and re-used in dust binging of soil. Gas washing unit will also take some nitric oxides :



In the gas washer nitric acid will form:



SAVATERRA Oy — Emission measurements

Gasmet™ CEMS II

The Gasmet CEMS II FTIR measuring system is designed for continuous emissions monitoring measurements (CEM). Typical application is H₂O, CO₂, CO, N₂O, NO, NO₂, SO₂, HCl, HF, NH₃, CH₄, C₂H₆, C₂H₄, C₂H₂ monitoring from Waste Incinerator or Large Combustion Plants. Measured components and calibration ranges can be changed according to application.

The Gasmet CEMS II is an ideal tool to use for measuring trace concentrations of pollutants in wet, corrosive gas streams. All parts of the Gasmet CEMS II are heated up to 180 °C. It can be used for undiluted gases and the sample gases do not need drying beforehand.

The Gasmet CEMS II consists of Gasmet FTIR Gas Analyzer, Gasmet industrial computer, Gasmet sampling system. As an option the system can be equipped with Gasmet TDL or ZrO₂ oxygen analyzer and/or with total hydrocarbon analyzer (FID). All parts of the system are 19" rack mounted and are installed on the pull-out shelves. The Gasmet CEMS II includes all power connections and temperature controllers for heated lines and heated sample probe. The operation of the system is fully automatic and controlled by the Calcomet software. Additionally all functions of CEMS II can be controlled manually.

Comprehensive I/O functions make possible to connect CEMS II into all kind of automation or reporting systems. Measuring data and alarms can be transferred from Gasmet CEMS II to other systems with analog or digital format. Gasmet CEMS II is also equipped with analog / digital inputs for external data (other analyzers or process).

Gasmet CEMS II provides different alarm functions such as System alarm, Service request, Maintenance on progress (can be set also manually), Concentration alarm, and Result valid. Combination for each alarm can be set on Calcomet. If any of the critical alarm is activated, instrument air starts to flow automatically into the system to prevent condensation.

Standard CEMS II is equipped with a two span gas valve to allow automated span/zero checks as required by the new legislation.

Gasmet CEMS II is air conditioned with a compressor-cooling unit on top of the cabinet. Cabinet includes ready made through-leading rubbers on each side and top of the cabinet for all cables and lines. Gasmet CEMS II is also supported by full remote control.

The Gasmet CEMS II FTIR has a very low cost of ownership; the equipment is extremely well designed, and requires very little maintenance. The system also has a number of in-built failsafe devices to protect the instrument from potential damage.



General parameters

Measuring principle:	FTIR (Fourier Transform Infrared)
Performance:	Simultaneous analysis of up to 50 gas components
Operating temperature:	20 ± 20 °C, non-condensing
Storage temperature:	-20 - +60 °C
Response time, T ₉₀ :	< 180 s, 20m heated line
Gas cell temperature:	180 °C
Sample gas:	Non-condensing, particle free
Flow rate:	~ 4 liters per minute
Sample gas pressure:	Ambient
Installation place:	Dust free and clean ambient air, without external vibrations

DUSTHUNTER SP100 Scattered Light Particulate Monitor



Continuous Measurement of Dust
with Low to Medium Concentrations

Intended Purpose

The DUSTHUNTER SP100 monitor provides continuous measurement of particulates in industrial plants for process control and PS-11 compliance.

Models

The DUSTHUNTER SP100 (probe version) is available with the following probe lengths:

- 17.13 in (435 mm)
- 28.94 (735 mm)
- 40.75 in (1,035 mm)
- 52.56 in (1,335 mm)

This makes the DUSTHUNTER SP100 ideal for a wide range of applications.



The DUSTHUNTER SP100 consists of the following components:

- DH-SP sender/receiver unit
- Flange with tube
- MCU control unit (with/without purge air supply)
- External purge air unit (option)
- Connection cable
- Purge air hose for MCU-P control unit with integrated purge air supply

SAVATERRA Oy — Emission measurements

Compound	Measured concentration	Allowed concentration by 2003/76/EY
Total parties (TP)	10 mg/m ³	10 mg/m ³
Total organic Carbon(TOC)	<1 mg/m ³	10 mg/m ³
Hydrochloric Acid (HCl)	<1 mg/m ³	10 mg/m ³
Hydrofluoric Acid (HF)	<1 mg/m ³	1 mg/m ³
Sulphur Dioxide (SO ₂)	43 mg/m ³	50 mg/m ³
Nitrogen Oxides (NO _x)	143 mg/m ³	200 mg/m ³
Carbon Monoxide (CO)	2 mg/m ³	50 mg/m ³
Carbon Dioxide (CO ₂)	7,5%	Not Defined
Metals: Cd+Tl	0,00001 mg/m ³	0,05 mg/m ³
Metals: Hg	0,001 mg/m ³	0,05 mg/m ³
Metals: Sb+A +Pb+Cr+Co+ Cu+Mn+Ni+V	0,022 mg/m ³	0,5 mg/m ³
Dioxins/ furans (I-TEQ)	0,00007 ng/m ³	0,1 ng/m ³

SAVATERRA Oy company
from Arctic Circle
Thank you for your attention

