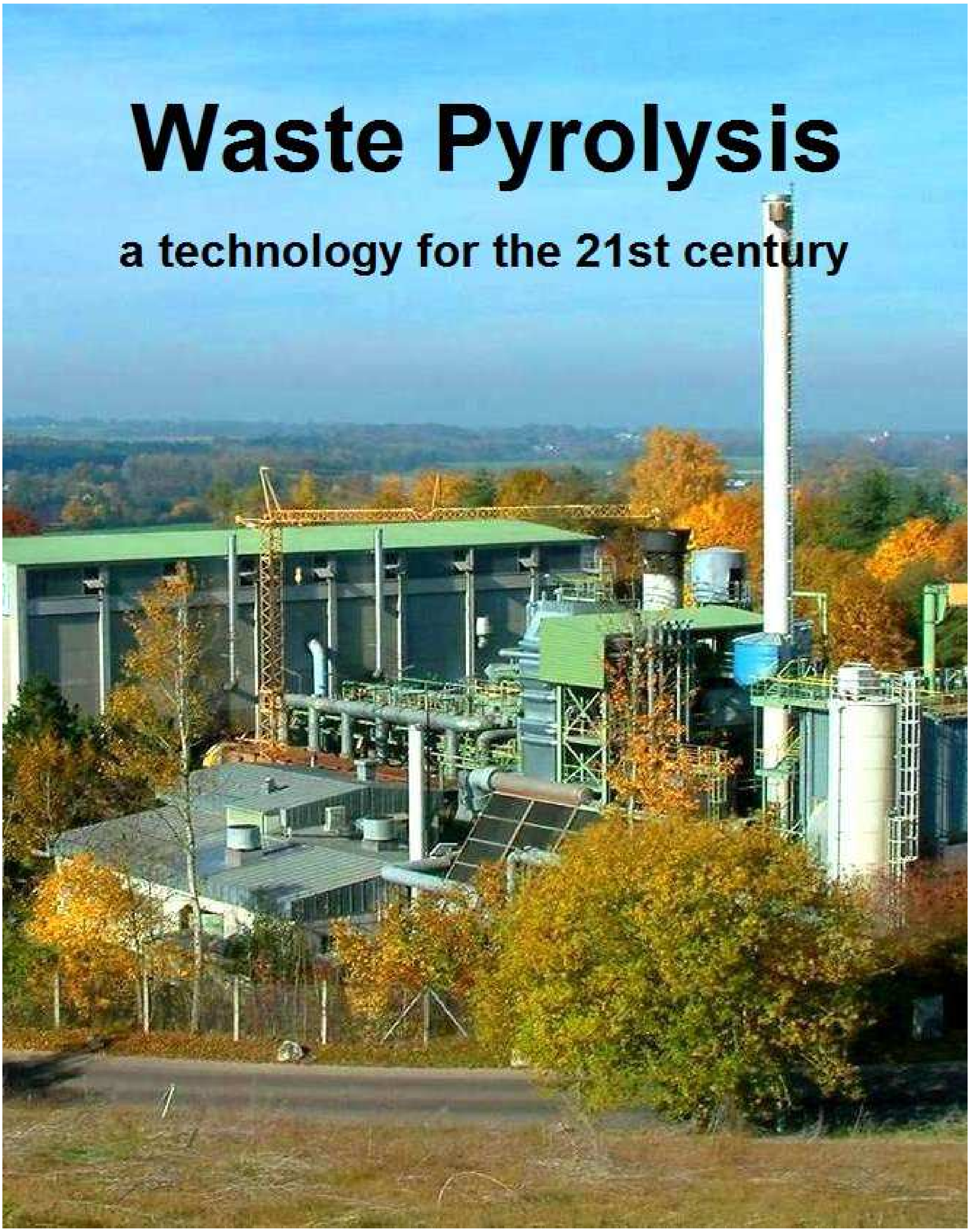
Waste Pyrolysis

a technology for the 21st century



PSE ENGINEERING GMBH

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PSE pyrolysis technology for Waste to Energy

The PSE and its affiliated partner companies, the **PSE Pyrolysis Group**, has leading technologies for pyrolysis waste treatment.

In the **PSE Pyrolysis Group** following activities are summarized:

¬ research and development in collaboration with universities and specialists
¬ project planning, basic engineering u. detailed engineering
¬ manufacture, supply and installation of turnkey plant
¬ plant operation
¬ training of operating personnel

The pyrolysis system PSE / Burgau is possible to treat waste with a simple method, to obtain a residue without any organic components. With high availability, low cost and compliance with the statutory emission regulations.

It contains:

¬ indirect heated rotary kiln
¬ pyrolysis gas burner
¬ boiler with turbine and generator
¬ flue gas cleaning

The pyrolysis system is particularly suitable for the treatment of types of waste, such as:

¬ household waste
¬ commercial waste
¬ industrial waste
¬ bulky waste
¬ sludge
¬ hazardous, toxic, infectious u. Hospital waste

Waste Pyrolysis Plant

“System Burgau”

Process description

Overall view

Burgau Pyrolysis Plant processes municipal and industrial waste, bulky waste and sewage sludge.

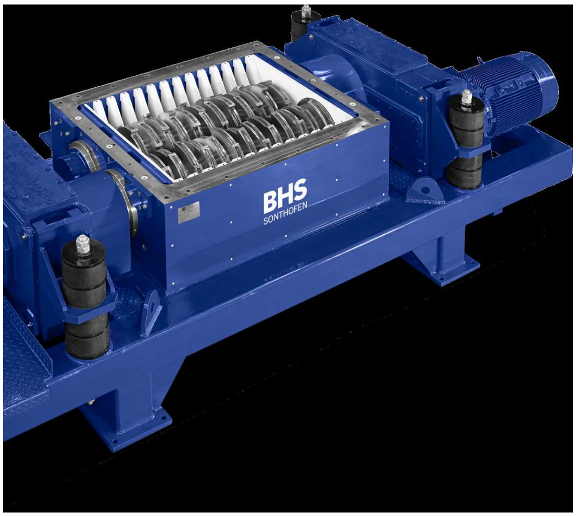
Waste are delivered by waste collecting vehicles and discharged into the coarse waste bunker.

Waste delivery

From the waste storage bunker, the waste mixture is picked up by a crane, discharged into two alternatively operated rotor cutters and cut to pieces with 30 cm.

From the rotor cutters, the material is delivered into the mixed waste storage bin. A crane thoroughly mixes waste and sewage sludge in order to obtain a highly homogeneous mixture.

Waste discharging



Rotor cutter

This mixture is charged by the crane of the mixed waste storage bin into the charging devices of the two rotary kiln the feeding chute.

A feeding screw arranged downstream the feeding chute conveys the waste mixture into the pyrolysis kiln.

As soon as the filling level reached a minimum, the feeding chute gate opens and feeding via belt and plate conveyers starts again.

Rotary kiln

The two rotary kilns are heated indirectly with flue gas from the pyrolysis gas incineration having a temperature of approx. 1.200 ℃. Both rotary kiln s are operated at slight underpressure of about 100 Pascal.

The outer surface of the rotary kilns is heated to a temperature of 550 ℃, resulting in a pyrolysis temperature of approx. 500 ℃ and a heating gas tem perature after kiln heating of 600 to 650 ℃.

Speed of the rotary kiln and thus residence time of the material within the kiln can be set to periods from 30 min. to two hours. A residence time of one hour is usually sufficient for complete decomposition of the waste, i.e. production of an inert free residue of organic compounds.

About 60 to 80 % of the acid gaseous pollutants formed during the pyrolysis process, such as hydrogen chloride, hydrofluoric acid and sulphur compounds react already within the rotary kiln with the lime added feeding. Thus, the flue gas resulting from pyrolysis gas incineration needs only a minimum of cleaning.

In the first part of the rotary kiln, the waste is simply dried, in the following; it is heated up to the actual process temperature. This is where degasification and decomposition of organic matter take place.

Discharge housing

Residues of the pyrolysis process are discharged via a wet slag remover with the pyrolysis gas being sealed from the atmosphere by the water level in the deslagger. The residues, having a residual humidity of 30 to 35 % and a temperature of 40 to 50 ℃, are transported to the residue container by means of a conveyor belt which may be connected alternatively to each of the two kilns.

Pyrolysis coke container

Metall scap

Directly in front of the low temperature coke silo, coarse ferrous components are picked up by an overhead magnetic separator and discharged into a container for recycling.

From the top end of the discharging housing, the pyrolysis gas is led to hot gas cyclones. The efficiency of the cyclones is about 70 %.

This cyclone dust, having a temperature of about 450 °C, is discharged through double pendulum flaps and added to the pyrolysis coke via cooling screw conveyors.

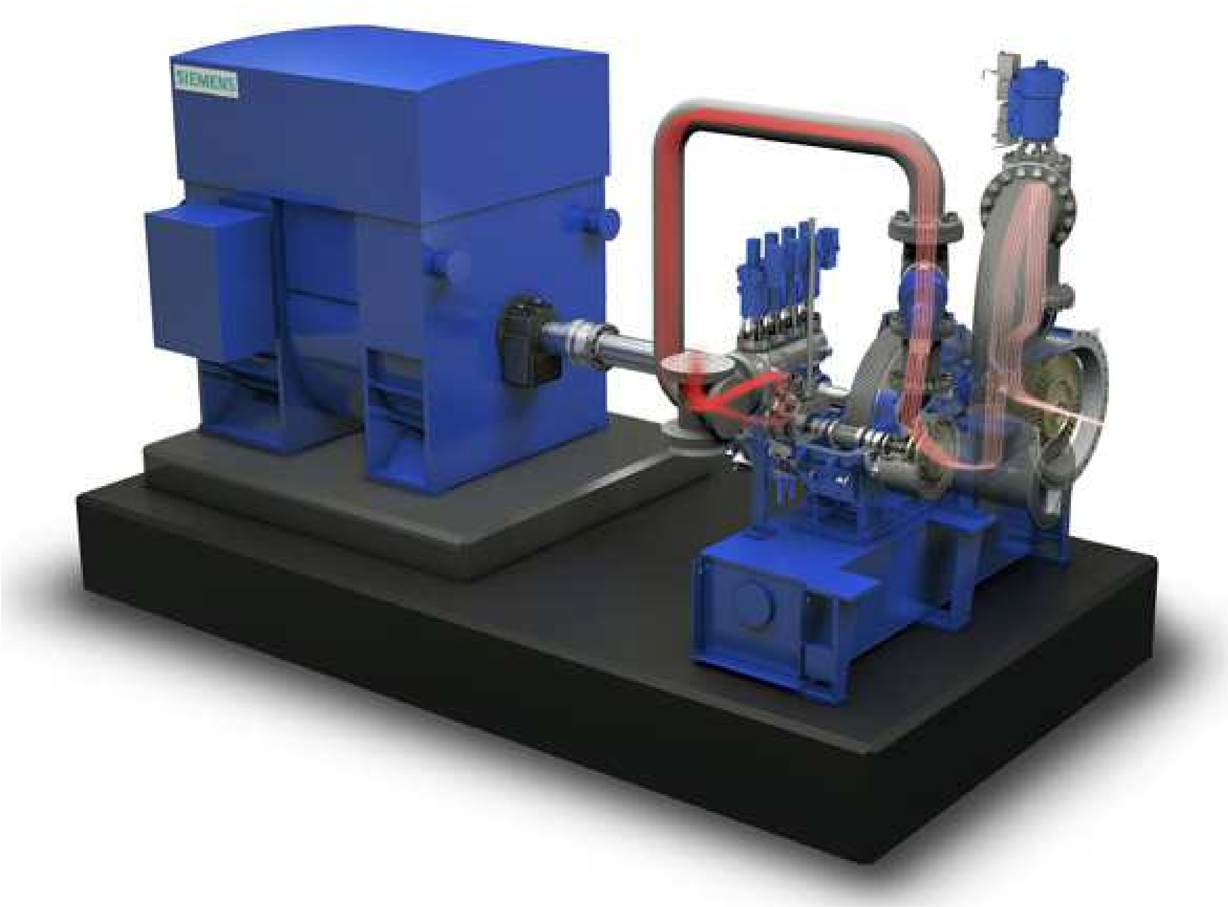
All gas containing components, including the cyclones, are heated to a temperature slightly exceeding that of the pyrolysis gas.

After the dust removal, pyrolysis gas of two rotary kilns is collected and fed to the combustion chamber where it is incinerated with an excess air of approx. 5 to 8 %, at a temperature of approx. 1.250 °C.

Combustion chamber with steam boiler

Optimum combustion conditions are created by the homogeneous fuel pyrolysis gas generated in the rotary kiln during pyrolysis of the waste mixture and combustion chamber temperatures considerably higher than in conventional grate incinerators (>1.200 °C). Therefore, the flue gas contains only small quantities of carbon monoxide, dioxins, furans and hydrocarbons, and no additional treatment for reduction of these pollutants is necessary.

One part of the flue gas generated in the combustion chamber is fed back for heating the rotary kiln, the remaining flue gas as well as the recirculated heating gas – cooled down to approx. 600 to 650 °C - are feed into a steam boiler. In this boiler, steam at 25 bar and 350°C is generated from the heat of the flue gas and subsequently fed to a turbine-generator for power generation.



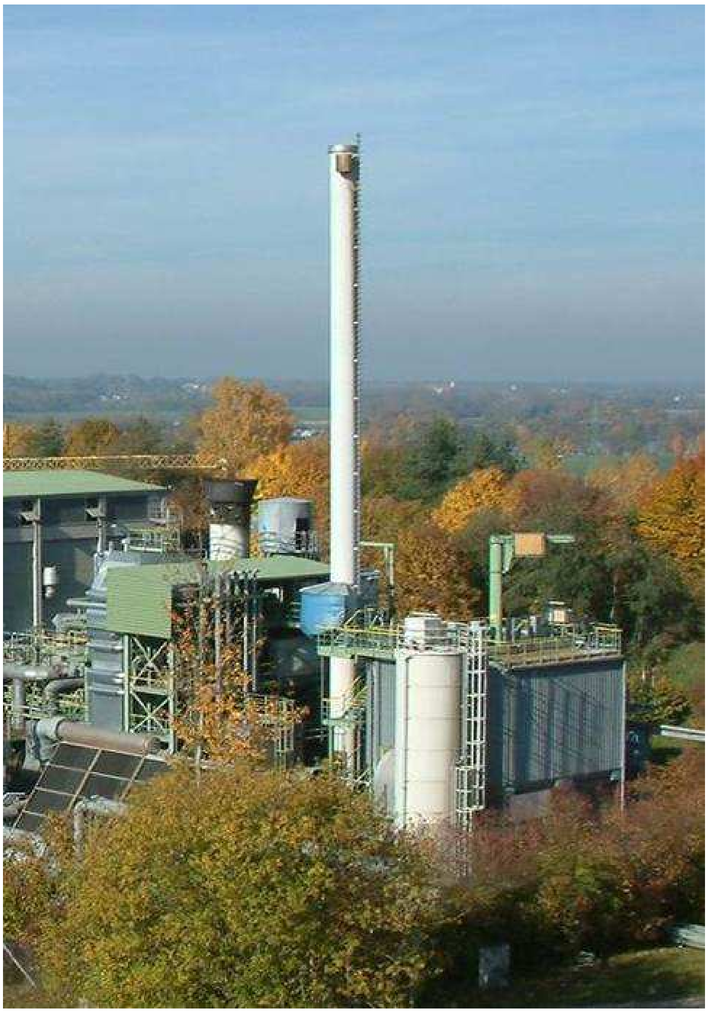
Turbine generator

After cooling of the flue gas to approx. 200 °C, th e remaining dust is removed in a baghouse filter. At the same time, the remaining gaseous pollutants and mercury are absorbed and adsorbed by adding a mixture of sodium bicarbonate and activated carbon upstream the baghouse filter. This simple technique guarantees that the limits set for these compounds are kept.

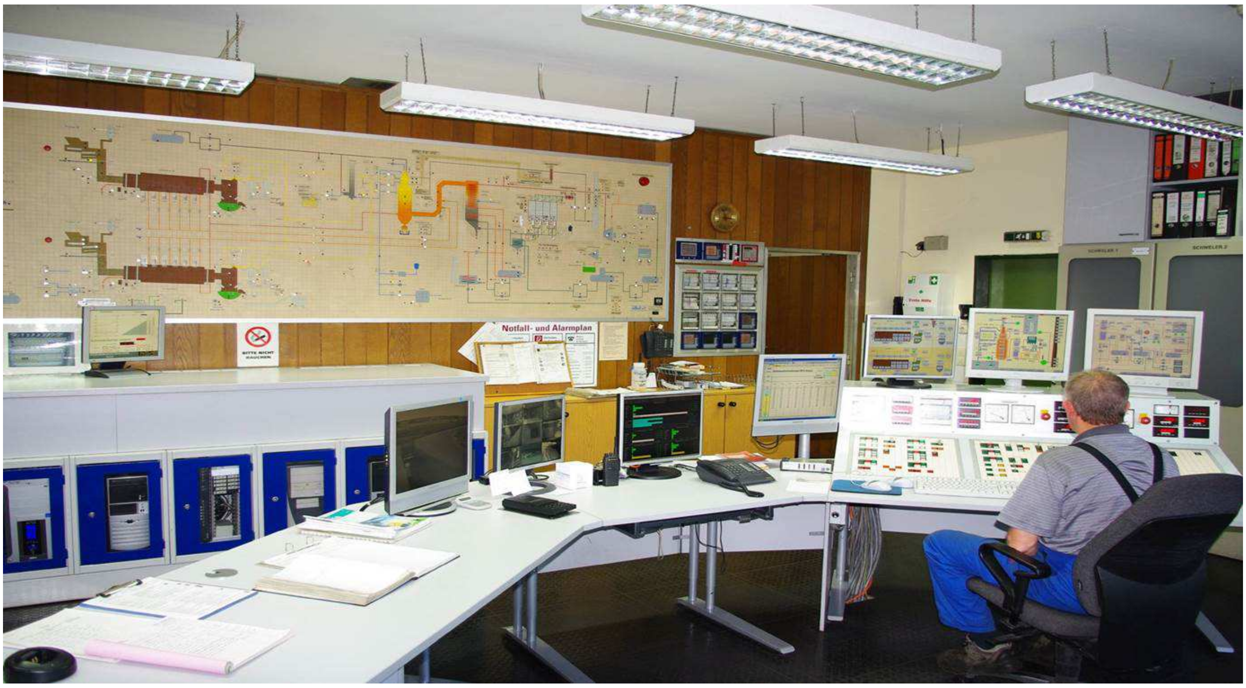
Flue gas cleaning

The bags of the baghouse filter are cleaned by pressure and the dust removed is collected in a silo.

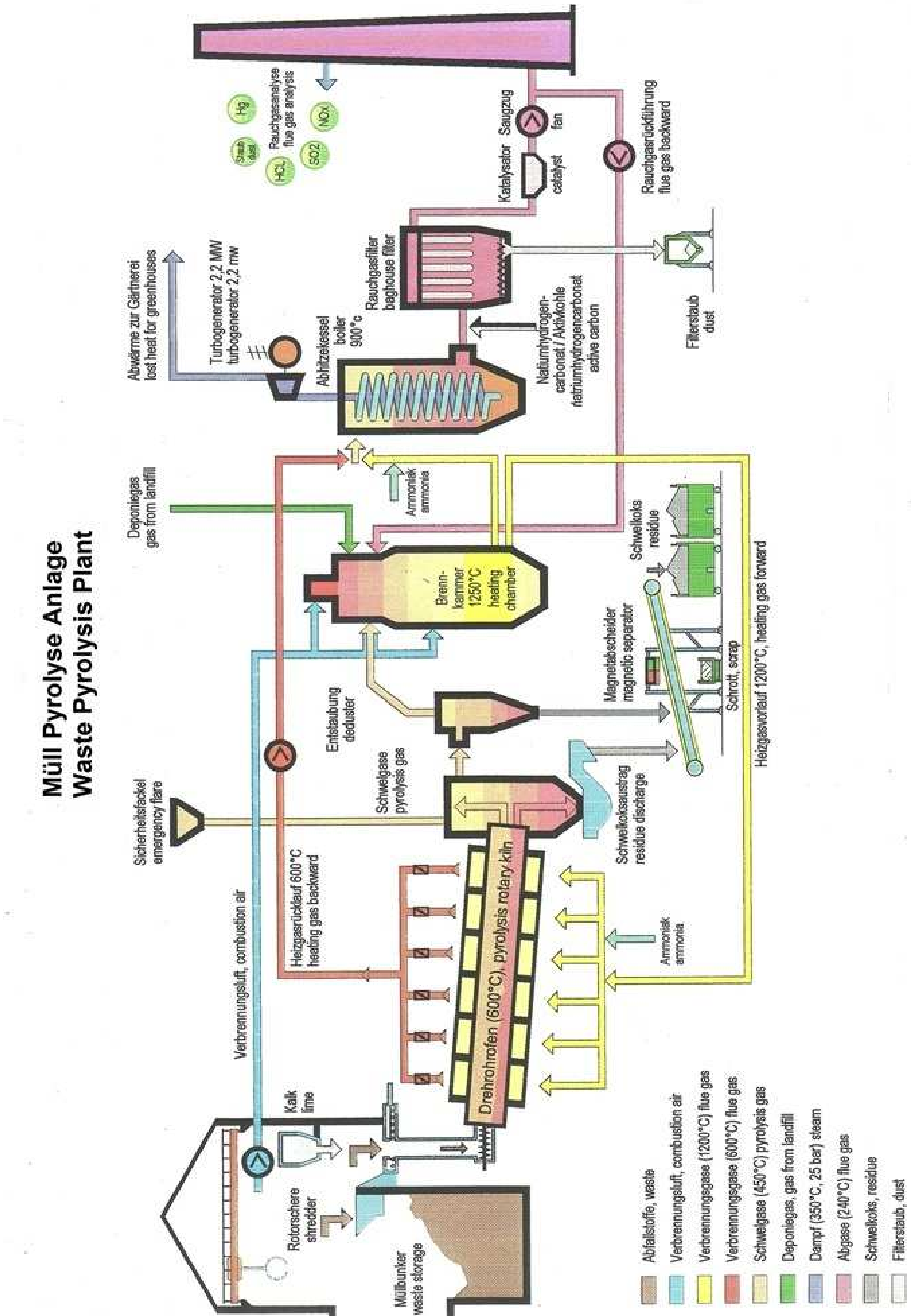
After treatment, the flue gas is compressed by a thyristor-controlled induced draught and taken to the stack. This induced draught controls the pressure profile of the plant, activated by pressure measurements within the kiln. Pressure zero reference point of the plant is set in the front part of the rotary kiln, at the feed section.



Stack



Process control room



Process flow sheet

Emissionswerte MPA Burgau

Kontinuierlich gemessene Emissionswerte für 2012:

Schadstoff	Abkürzung	Dimension	Grenzwert		Jahresmittel 2012
			Tag MW	1/2 h MW	
Schwefeldioxide	SO_2	mg/Nm^3	50	200	13,78
Chlorwasserstoff	HCl	mg/Nm^3	10	60	4,31
Stickoxide	NO_x	mg/Nm^3	200	400	158,76
Gesamtstaub		mg/Nm^3	10	30	1,94
Quecksilber	Hg	mg/Nm^3	0,03	0,05	0,00258

Diskontinuierlich gemessene Emissionswerte:

Schadstoff		Dimension	Grenzwert	Mittel-Wert	Max.-Wert
Stoffe gemäß § 5 Abs. 1 Ziffer 2 Buchstabe g) der 17. BImSchV					
Quecksilber	Hg	mg/m3	0,05	0,005	0,007
Stoffe gemäß § 5 Abs. 1 Ziffer 3 Buchstabe a) der 17. BImSchV					
Summe: Cd + Tl		mg/m^3	0,05	< 0,005	< 0,007
Cadmium	Cd			< 0,001	< 0,002
Thalium	Tl			< 0,003	< 0,004
Stoffe gemäß § 5 Abs. 1 Ziffer 3 Buchstabe b) der 17. BImSchV					
Summe: Sb bis Sn		mg/m^3	0,5	0,011	0,012
Antimon	Sb			< 0,001	0,001
Arsen	As			< 0,001	< 0,001
Blei	Pb			< 0,001	< 0,001
Chrom	Cr			< 0,001	< 0,001
Cobalt	Co			< 0,001	< 0,001
Kupfer	Cu			< 0,001	< 0,001
Mangan	Mn			< 0,001	< 0,001
Nickel	Ni			< 0,001	< 0,001
Vanadium	V			< 0,001	< 0,001
Zinn	Sn			< 0,001	< 0,001
Stoffe gemäß § 5 Abs. 1 Ziffer 3 Buchstabe c) der 17. BImSchV					
Summe: As bis Cr		mg/m^3	0,05	< 0,005	< 0,006
Arsen	As			< 0,001	< 0,001
Benzo(a)pren				< 0,00002	< 0,00002
Cadmium	Cd			< 0,001	< 0,002
Kobalt	Co			< 0,001	< 0,001
Chrom	Cr			< 0,001	< 0,001
Dioxine u. Furane (ITEq)	PCDD/PCDF	ng/m^3	0,1	0,0013	0,0017
Gesamtkohlenstoff	C ges.	mg/m^3	20	< 3	< 3
Distickstoffmonoxid	N_2O	mg/m^3	-	16,9	19
Ammoniak	NH_3	mg/m^3	20	4	6,0
Fluorwasserstoff	HF	mg/m3	4	< 0,1	< 0,1

Diskontinuierliche Messungen wurden durchgeführt: Institut für Umwelt- und Arbeitsplatzanalytik, Burkon GmbH, Nürnberg (Mess- und Kalibrierstelle nach §§ 26, 28 BImSchG)

Messbericht vom 18.01.2013

Important:

Emissions of dioxins and furans are 1000 times smaller than the legal limits.

Cooperate in Pyrolysis Technology

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