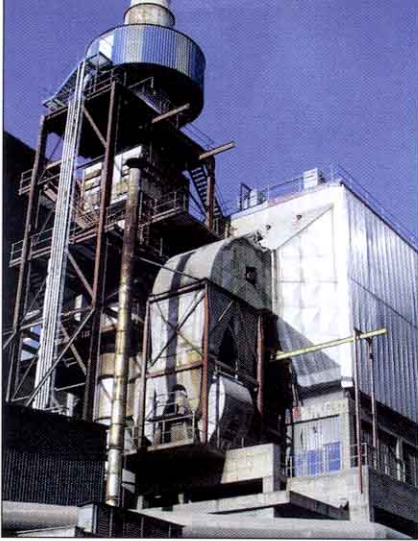


Dusting down kilns



Old filter (ESP)

When the Wietersdorf plant, in Austria, had been operating with electrostatic filters it had no difficulty in meeting the official limits for dust emissions applicable to the late-1980s. In these circumstances the plant used coal and oil cake with plastics as fuels. However, emissions needed to be reduced in the long run, and the authorities instructed the company to adopt measures that would ensure compliance with future applicable legal limits. The company could not afford to replace plastics as an alternative fuel, so it had no option but to implement several major changes.

Improvements were undertaken in the hope of achieving an acceptable degree of compliance with the regulations. The flow rate of the air for cooling the clinker was reduced for example. This was to minimise the volume of waste air from the cooler and so the total volume of raw gas (with the flue gas from the kiln) in front of the electrostatic filter. Its moisture content was increased to come as close as possible to the ideal flue-gas condition. Help was also requested from the company that supplied the electrostatic filters. These measures, however, did not add up to a long-term solution of pegging dust emissions within the new required limits.

Johann Grabmeyer, Wietersdorfer & Peggauer & Kurt Hofer, Scheuch

The Wietersdorfer & Peggauer cement company manufacture cement at the Wietersdorf plant in a 1000tpd rotary kiln with a LEPOL preheating system. Until early 1998, the flue gases from the kiln and the air from the cooler were dedusted by electrostatic filters. Problems with higher dust emissions (30-50mg/Nm³ dry, sometimes peaking as high as 80mg/Nm³ dry) were encountered when increased use was made of processed plastics from waste packaging as an alternative fuel. In this paper, the process to reduce emissions at the plant with filter bags is described.

Bag filter option

After inspecting other kilns equipped with bag filters, Wietersdorfer & Peggauer decided that this investment would enable the plant to get to grips with the emission problem. The company made the decision to go ahead with installing bag filters despite the fact that few cement plants in Europe were using bag filters for this purpose at the time. In terms of durability and air permeability, the performance of filter bags in LEPOL plants in particular left something to be desired.

Suppliers & materials

Nine companies were invited to tender for the project. After several rounds of meetings, the standard had been defined

to the extent that all the bidders could comply with approximately the same technical preconditions. This applied primarily to the choice of material for the filter bag, a major factor in terms of cost.

By the same token, Wietersdorfer & Peggauer stipulated the following specification for all project bidders:

- filter bag material: gore on glass, six metres long
- hoppers: standard steel, heated (0.7kW/m²)
- filter head with blast pipes, injectors: stainless steel
- bag cages: stainless steel, two-part
- temperature resistance entire system: 250°C continuous
- maximum vacuum in casing: 80mbar
- air to cloth ratio; 66m³/m²/h=1.1m/min
- cleaning, chamber shutdown during operation: online, clean-gas disc valves pneumatic and raw gas shut-off flaps manually operated.

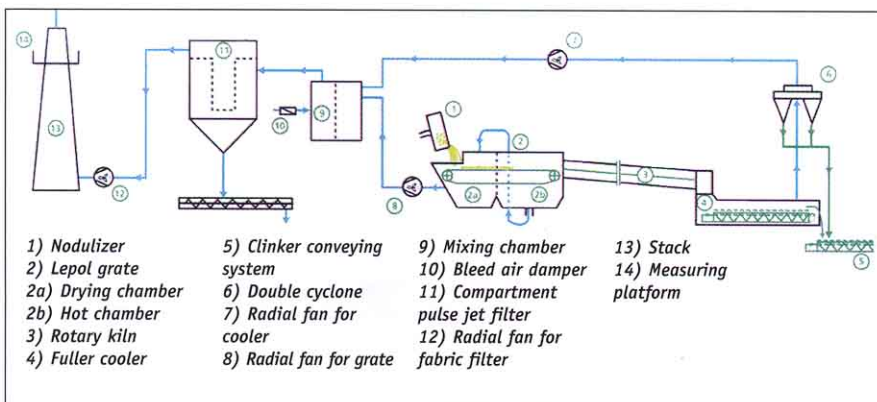
For technical and commercial reasons and after many rounds of talks with the potential suppliers, Wietersdorfer & Peggauer opted for Scheuch GmbH.

Filter technology

The factors that convinced Wietersdorfer & Peggauer to install a bag filter system at the plant are the following:

- guaranteed compliance with emission

Figure 1: Process flow sheet of the LEPOL kiln dedusting system



limits under all operating conditions

- compliance with noise-abatement requirements
- adequate dependability with alternative fuels in use at the plant
- low investment costs and low operating overheads
- compact dimensions, because it must fit into the space originally intended for the electrostatic precipitator.

For the sake of operational reliability, the filter is of chamber design, which means that a chamber can be shut down sporadically for inspection or maintenance purposes during a kiln campaign. The operating mode here is on-line, in other words the entire filter surface is normally available for cleaning the exhaust air.

In the off-line mode, the chambers are taken out of the gas stream one after the other at regular intervals, cleaned and then reconnected. This operating mode is eminently suitable for removing very light and fine types of dust, which have more opportunity to settle during the cleaning phase in the absence of a gas flow with the chamber closed.

The shut-off flaps and valves can be operated manually or pneumatically; in this configuration the filtered-gas valves are pneumatically operated and the raw-gas flaps are manually operated.

Technical specifications of the filter

- design: Scheuch pulse-jet filter with six chambers
- number of bags/length: 1.170, each six metres long
- cleaning pressure: 4.5bar
- flow rate: 240.000m³/h gross
- operating temperature: 130-150°C/max 180°C
- filter surface area: 3.600m²
- A/C ratio: 1.1m/min
- raw-gas dust content, approx: 5g/Nm³
- clean-gas dust content: <10mg/Nm³

Conversion procedure

The new system was delivered partially pre-assembled (Figure 8). These units were assembled on site at the Wietersdorf plant in order to have as many prefabricated modules as possible ready for installation.

When the kiln was shut down for its winter inspection in 1998, the electrostatic precipitator was dismantled to the reinforced-concrete cradle. This took approximately four weeks in total, with two weeks needed for removing the thermal insulation while the kiln was still in full operation.

A steel supporting framework for the bag filter was then erected on the concrete base. This steel framework was necessary because the dimensions of the bag filter

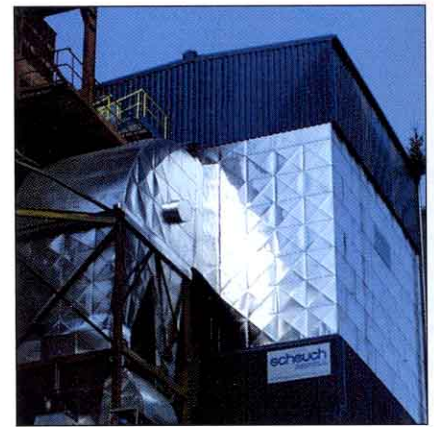


Figure 2: erection completed

did not match those of the original base. The preparations for installation of the bag filter itself were then complete. Installation progressed rapidly without any major complications. All in all, the kiln outage for installing the bag filter and disassembly of the old electrostatic precipitator, not including removal of the insulation, lasted six weeks.

A year-and-a-half on

Everything seemed to be working well at first. The continuous measuring station showed dust-content readings well below 10mg/Nm³ dry in the clean gas. After about one month, the sensors showed that the dust cones were filling up for the first

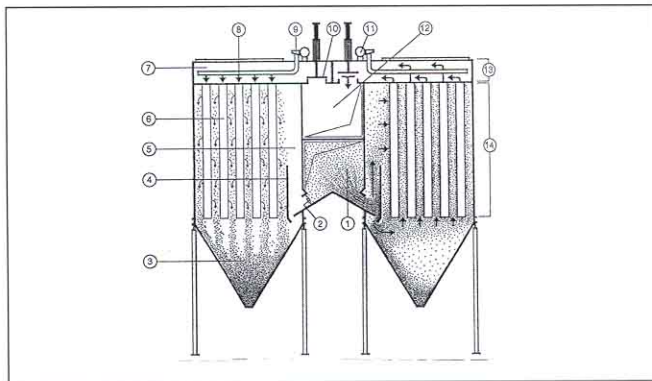


Figure 3: off-line bag cleaning

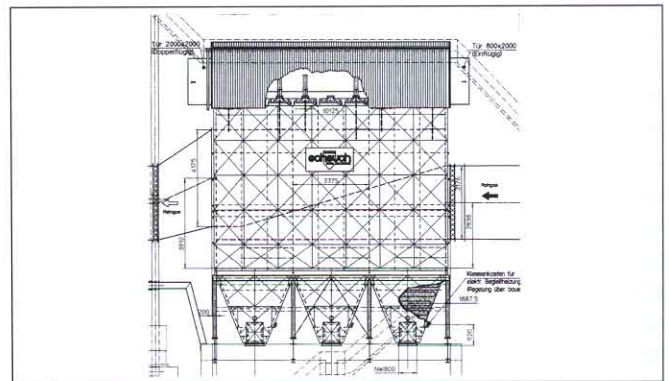


Figure 4: filter installation

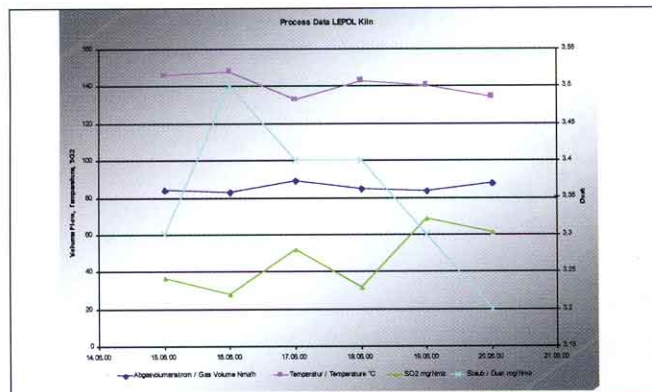


Figure 5: process data LEPOL kiln



Figure 6: hopper preassembly on site



Figure 7: penthouse construction

time. A check of the cones revealed that all of them were full of dust and needed cleaning by hand. This was achieved with the plant in operation by shutting down each chamber in turn, but the work was exhausting and dangerous.

The cones filled up on account of a slow but steady build-up of adhesive dust in the corners and on all faces and internals where it could settle, even on sloping surfaces. These changed dust properties mainly result from better fine dust separation and increased adsorption of acid gases at the bag filter stage. These accretions had risen as far as the bags and prevented the incoming dust from dropping down. After several attempts, this problem was successfully eliminated by installing several acoustic horns. Since March 2000,

Bag selection

A great deal of care and attention went into the choice of the filter medium for a LEPOL kiln, in order to ensure correct operation and optimum durability. The most important parameters for specifying the quality of the bags were as follows:

- thermal and chemical resistance to the exhaust gas from the rotary cement kiln and the clinker cooler
 - primary and secondary fuel types
 - accretion of a filter cake to protect the bag fabric
 - adequate margin between acid dewpoint and flue gas temperature
 - economy, the best balance of procurement costs and durability.
- The most common filter fabrics for continuous operation at temperatures in excess of 150°C are listed in the following table.

Base material	Temperature °C		Resistant to							Price factor
	Contin-uous	Max peak	Hydrol	Mineral acids	Organic acids	Alkalis	Salts	Oxyd subst		
PPS (Ryton)	170	190	++	++	++	+	+	--	1.5	
Aramide (Nordex)	180	200	-	-	-	+	-	-	1.0	
Polyimide	210	230	+	+	+	+	-	-	1.75	
Fibre glass/ Teflon B with membrane	230	280	++	+	++	-	-	++	2.5	
PTFE	260	280	++	++	++	++	++	++	5	

each of the six chambers has an acoustic horn to prevent further accretions forming in the cones.

Until then, sporadic manual cleaning had been the only way of keeping the bags filter operational. This was not as complicated as the first time, however, because the accretions were not allowed to build up to the same extent. The problem of dust accretions in the cones has not reoccurred since the acoustic horns were installed in all six chambers.

dust-content readings averaging between four and seven mg/Nm³ dry.

The limit now stipulated by law is 20mg/Nm³ dry. Observations of the principal parameters show readings as follows:

- differential pressure specifies/as-is: 20mbar
- number of pulses/h:60-80
- filter cleaning-air pressure: four bar
- compressed air for filter cleaning: 50-100Nm³/h.

Tests with variations in operating parameters

- filter cleaning pressure increased to five bar: significant reduction in pulses/hour
- differential pressure increased to 25mbar: increase in fans power draw reduction in SO₂ emissions.

Outlook

At this time, the filter bags' durability, air permeability and other important parameters are normal. Examination of the bags after one year in operation revealed no signs of deterioration. It is not known for how long this situation will remain satisfactory. Experience gained in similar plants is too recent, and as all experts are aware, the data is not comparable because even when configurations are the same, there are many factors that act differently on the performance of a filter system.

Operators, therefore, have no option but to see how their individual systems perform. They will be able to utilise only details from the experiences of others in projects of their own. □

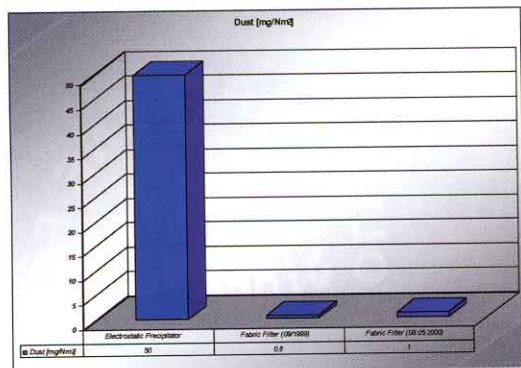


Figure 8: dust content in clean gas

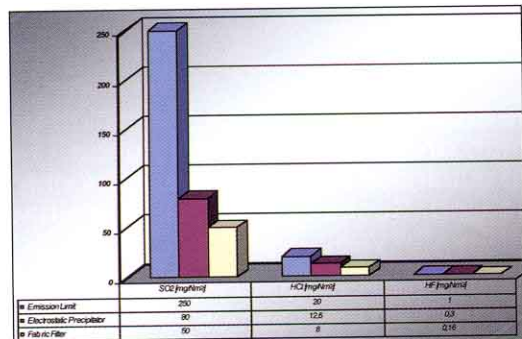


Figure 9: acid gases