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Sources of mercury, behavior in cement process and abatement options

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Cement Industry Sector Partnership on Mercury
Partnership Launch Meeting

Geneva, 18/19 June 2013



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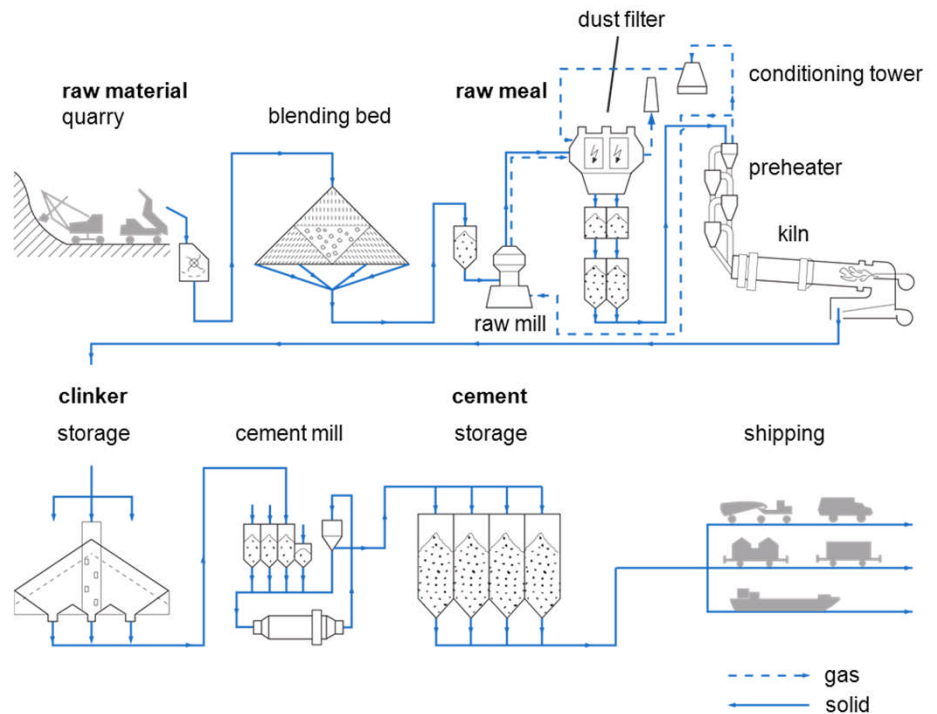
Agenda

1	Cement production process
2	Behaviour of mercury in Cement Production Process
3	Mercury abatement techniques
4	Monitoring of mercury emissions
5	Mercury emission inventories
6	Best Available Technique and Best Environmental Practice

1 Cement production process

General principle:

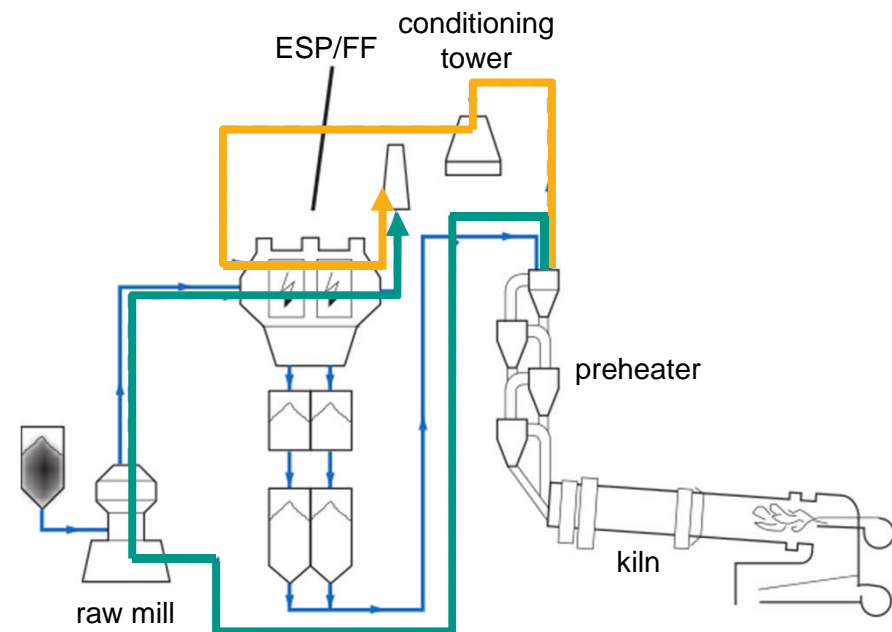
- Raw materials: limestone, clay, lime marl
- Thermal treatment to produce cement clinker (1450°C)
 - Commonly in rotary cement kilns
 - Regular fuels: black coal, lignite, petroleum coke, natural gas, heavy fuel
 - Alternative fuels: plastics, mixed industrial wastes (RDF), tyres, ...



1 Cement production process

Exhaust gas utilization

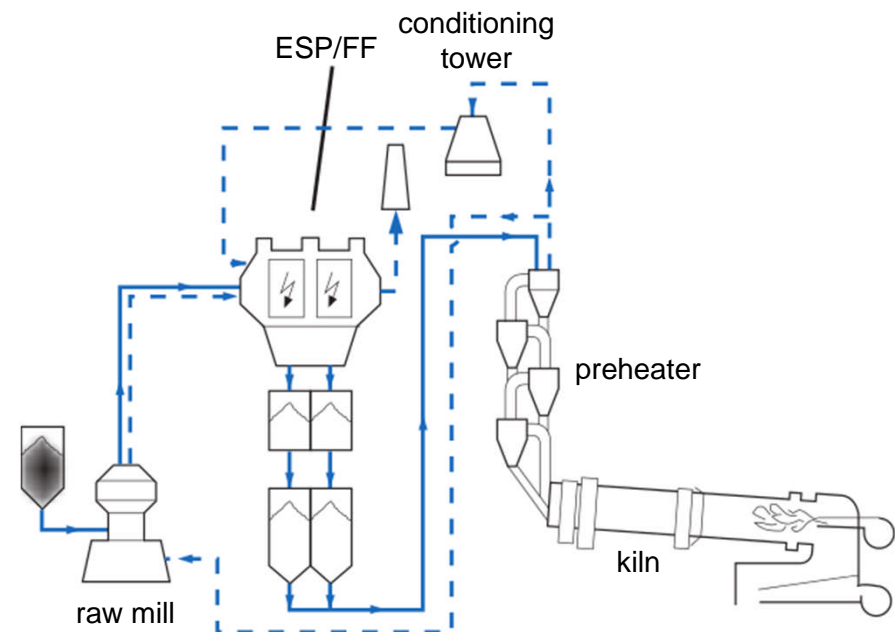
- Kiln exhaust gases are mainly used for drying of raw materials
- Two modes of operation:
raw mill on / **raw mill off**
- Raw mill gas stream determined by required heat -> raw material moisture
- Residual kiln exhaust stream bypasses raw mill and is conditioned in evaporating cooler
- Example: dry raw materials
 - Less exhaust gas needed for drying
 - More exhaust gas bypasses raw mill
- Ratio raw mill on/off operation mainly determined by ratio raw mill/kiln capacity



1 Cement production process

Dust utilization

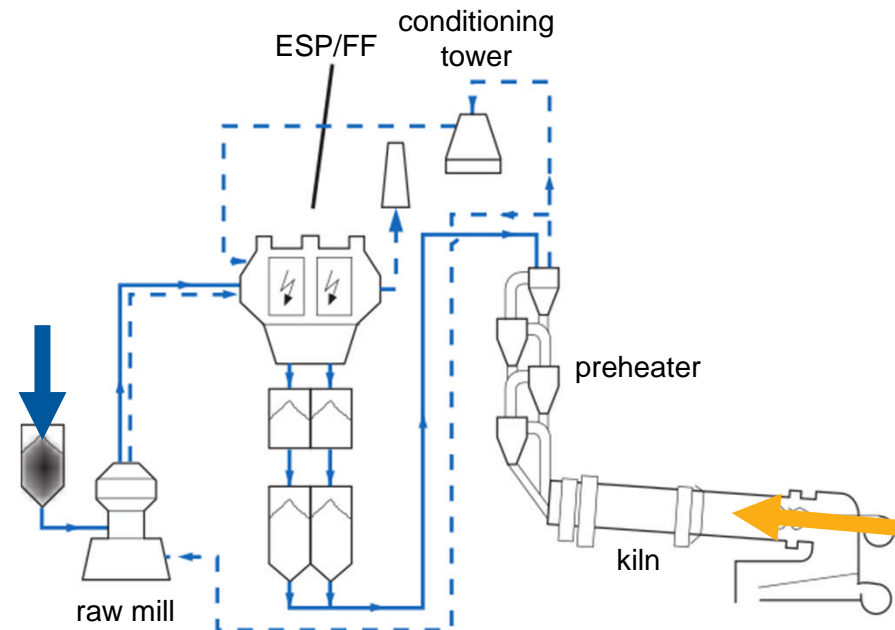
- Precipitated dust consists mainly of raw material
- **Raw mill on:** „dust“ is ground raw material
- **Raw mill off:** recirculation of filter dust to kiln feed or raw meal silo
- Dust can be used in cement mill to adjust cement quality
 - Depending on national cement standards and market conditions



2 Behaviour of mercury in cement production process

Origin of mercury:

- Mercury is introduced to the process via **raw materials** and **fuels**
- Concentrations may vary significantly between
 - fuels
 - raw materials
 - within deposits or quarries
- Alternative fuels and raw materials can have higher or lower mercury contents than regular/conventional ones



2 Behaviour of mercury in cement production process

Mercury content in fuels

Fuel	Mercury content in mg/kg
Coal	0.1 – 13
Lignite	0.03 – 0.11
Petcoke	0.01 – 0.71
Heavy oil	0.006
Liquid-waste derived fuel	< 0.06 – 0.22
Solid-waste derived fuel	< 0.07 – 2.77
Sewage sludge	0.31 – 1.45
Secondary fuel	0.04 – 10
Tire-derived fuel	0.01 – 0.4

- Due to fuel-raw material ratio, Hg intake through raw materials can be up to 10-fold higher
- Substitution of fuels commonly does not lead to rising mercury emissions

Mercury content in raw materials

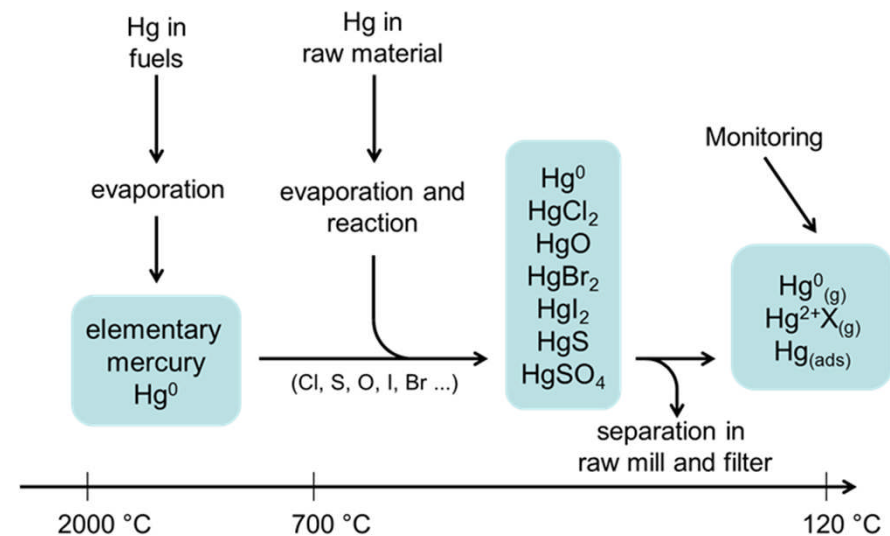
Raw material	Mercury content in mg/kg
Limestone, lime marl, chalk	< 0.005 – 0.40
Clay	0.002 – 0.45
Sand	< 0.005 – 0.55
Fly ash	< 0.002 – 0.8
Iron ore	0.001 – 0.68
Blast furnace slag	< 0.005 – 0.2
Pouzzolana	< 0.01 – 0.1
Burned oil shale	0.05 – 0.3
Shale	0.002 – 3.25
CaSO ₄	< 0.005 – 0.02
Gypsum (natural)	< 0.005 – 0.08
Gypsum (artificial)	0.03 – 1.3
Aggregates	< 0.01 – 0.1
Raw meal	0.01 – 1
Earth crust (avg.)	0.05, 0.08

Main source: Université de Liège, 2010

2 Behaviour of mercury in cement production process

Behaviour of mercury

- Determined by thermal conditions between preheater, raw mill and dust precipitator:
 - Vaporization of Hg and its compounds in kiln or preheater
 - Depending on temperature and available reaction partners, HgCl_2 , HgO and HgSO_2 are formed



预览已结束，完整报告链接和二维码如下：

https://www.yunbaogao.cn/report/index/report?reportId=5_14057

