

Minamata Convention: Initial Assessment of Turkey

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for toxic compounds
in the environment



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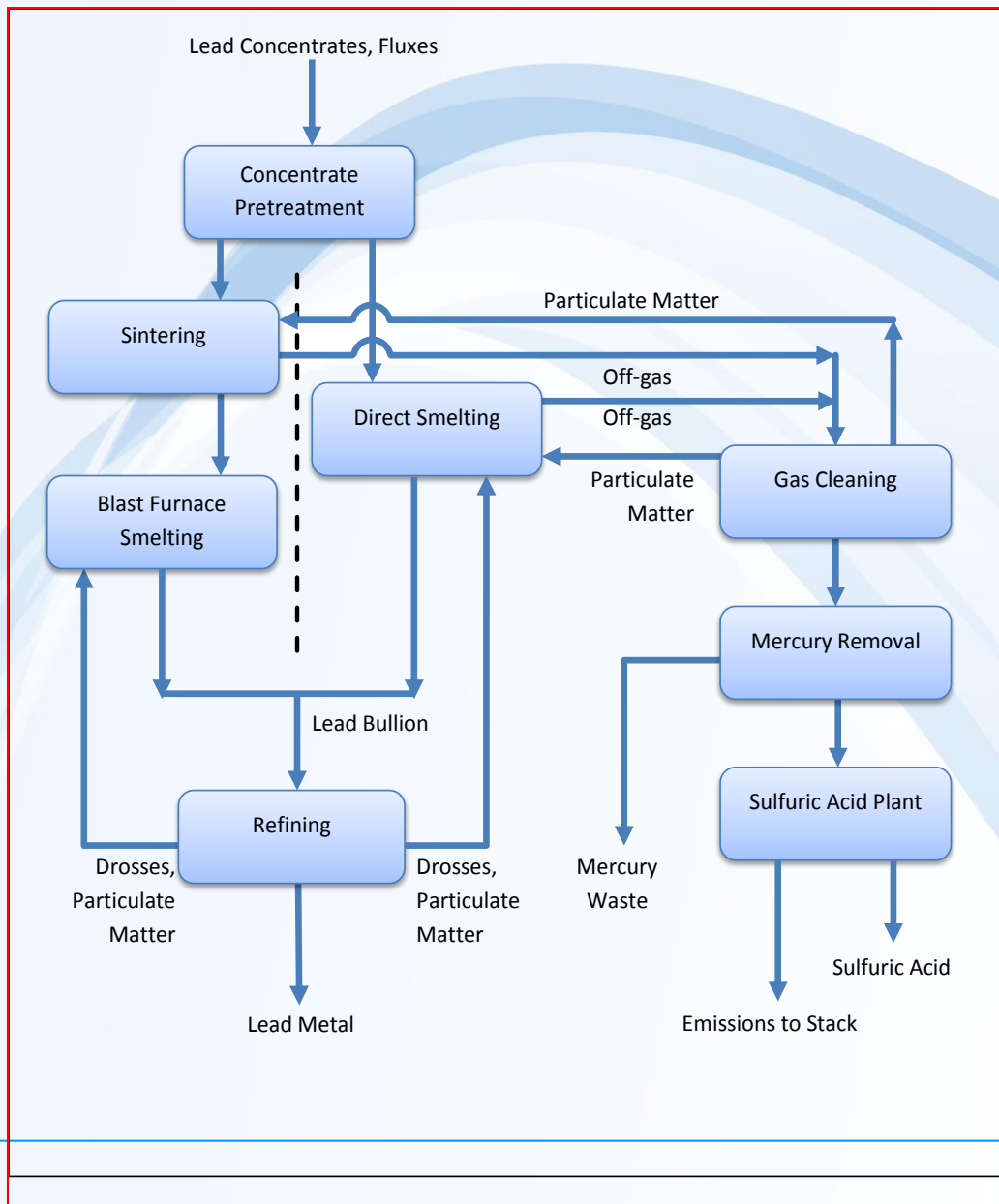
Lecture 7

Primary (virgin) metal production and production of other minerals and materials with mercury imputities

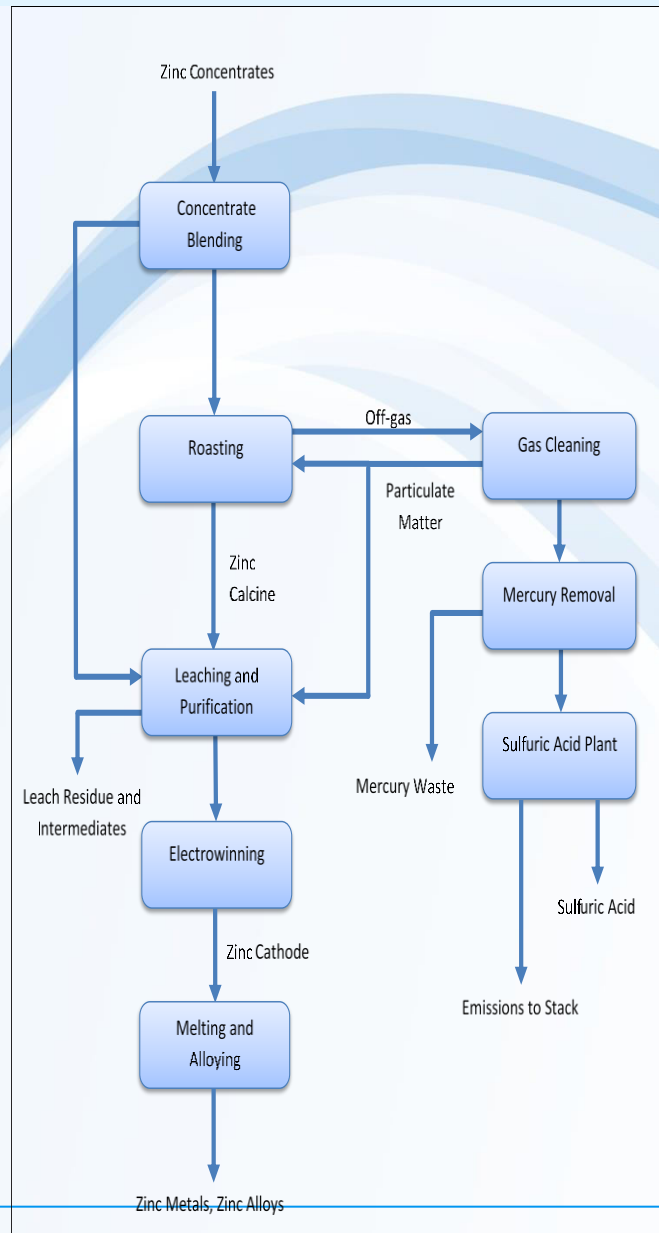
Lecture 7

Chapter	Main Source Category	Air	Water	Land	Products	Waste/ residue
5.1	Extraction and use of fuels/energy sources	X	X	x	x	X
5.2	Primary (virgin) metal production	X	X	X	X	X
5.3	Production of other minerals and materials with mercury impurities	X	x	x	x	x
5.4	Intentional use of mercury in industrial processes	X	X	X	X	X
5.5	Consumer products with intentional use of mercury	X	X	X	X	X
5.6	Other intentional products/process uses	X	X	X	X	X
5.7	Production of recycled metals ("secondary" metal production)	X	X	X	X	X
5.8	Waste incineration	X	X	X	x	X
5.9	Waste deposition/landfilling and waste water treatment	X	X	X		X
5.10	Crematoria and cemeteries	X		X		x
5.11	Identification of potential hot-spots	Probably registration only, to be followed by site-specific evaluation				

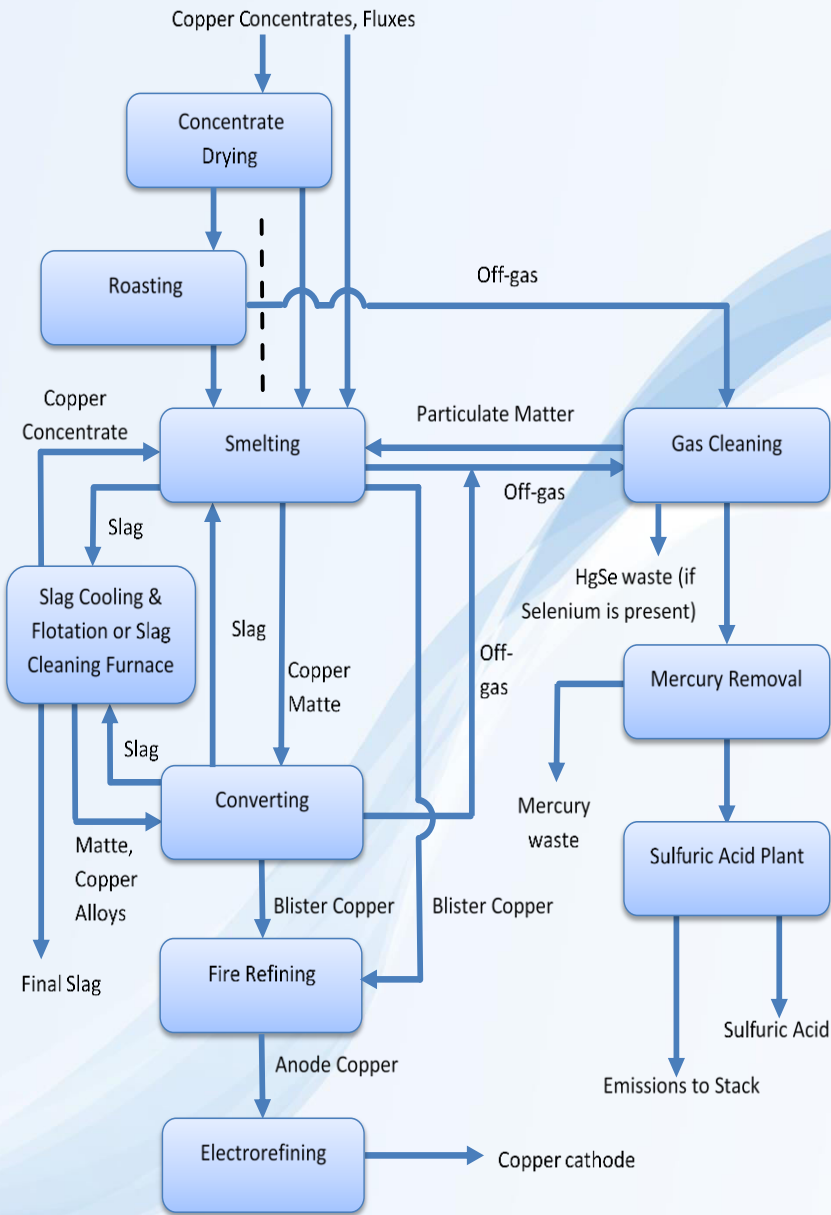
Processes in primary lead production



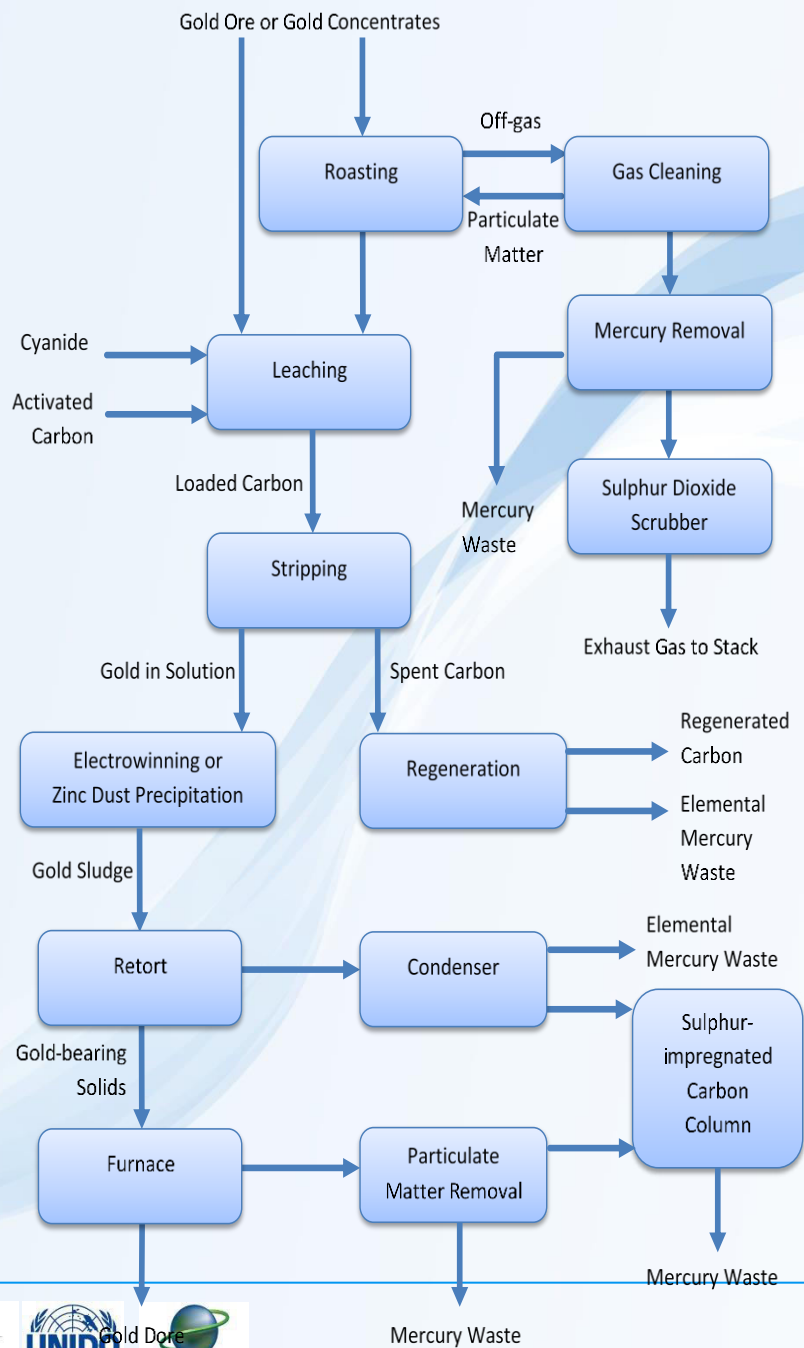
Processes in primary zinc production



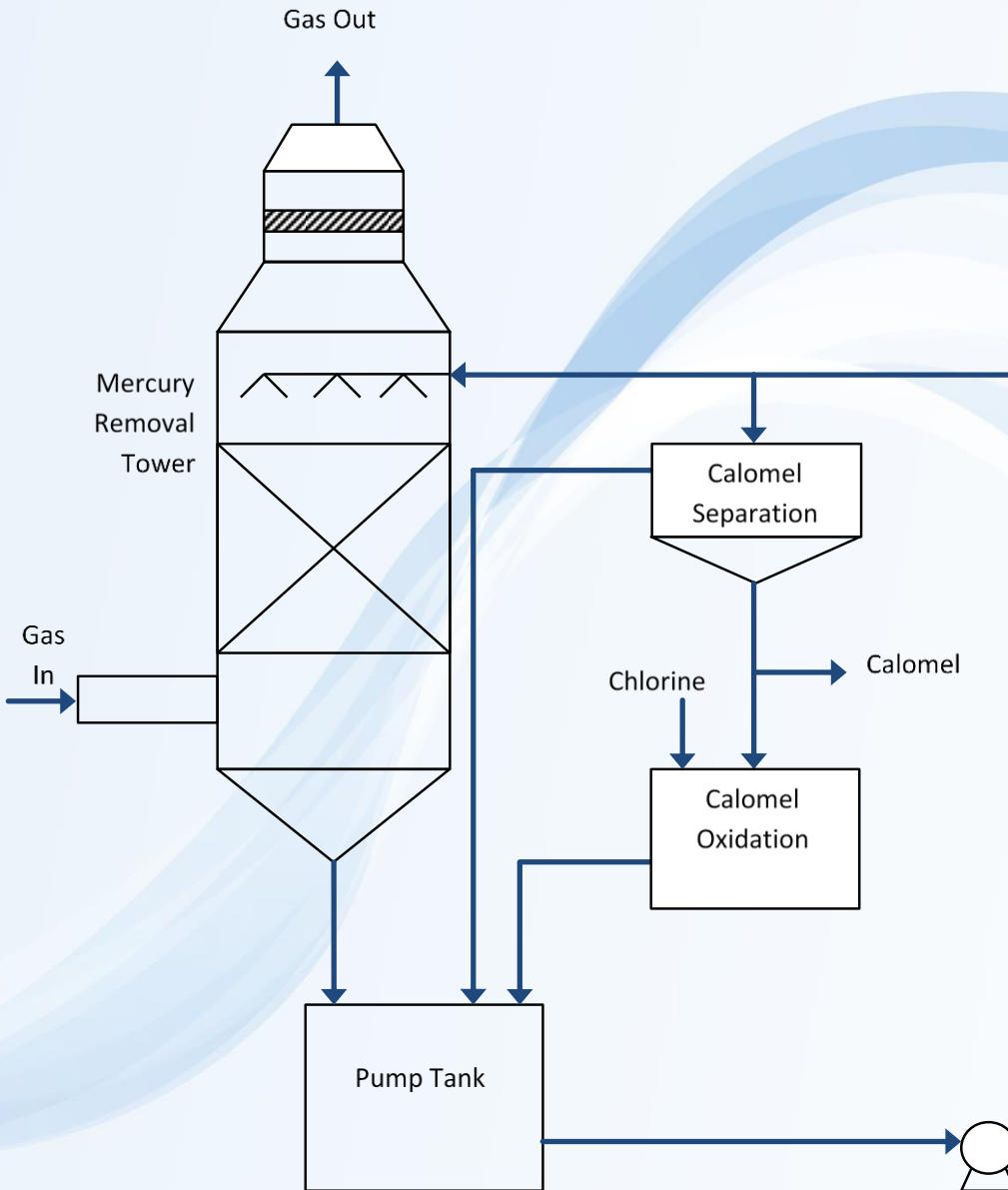
Processes in primary copper production



Processes in primary gold production



Flow chart of the Boliden Norzink process with Hg_2Cl_2 recovery (Hultbom 2003)



Primary (virgin) metal production

This category covers the following main sub-categories:

- ↙ **Primary extraction and processing of mercury, i.e. dedicated primary mercury mining;**
- ↙ **Gold and silver extraction with the mercury-amalgamation process, i.e. mercury is used intentionally to extract gold and silver, as opposed to other gold and silver extraction processes;**
- ↙ **Zinc extraction and initial processing, i.e. primary zinc extraction and processing where mercury impurities are present in the ores;**
- ↙ **Copper extraction and initial processing, i.e. primary copper extraction and processing where mercury impurities are present in the ores;**
- ↙ **Lead extraction and initial processing, i.e. primary lead extraction and processing where mercury impurities are present in the ores;**
- ↙ **Gold extraction and initial processing by other processes than mercury amalgamation, where mercury is present as a natural impurity in gold ore;**
- ↙ **Aluminium extraction and initial processing, i.e. primary aluminium extraction and processing where mercury impurities are present in the ores or other feedstock materials;**
- ↙ **Extraction and processing of other non-ferrous metals, i.e. primary extraction and processing of other non-ferrous metals, such as nickel and others;**
- ↙ **Primary ferrous metal production, such as production of iron, steel, ferromanganese, etc.**

Primary (virgin) metal production: sub-categories with main pathways of releases of mercury and recommended inventory approach

Chapter	Sub-category	Air	Water	Land	Product	Waste /residue	Main inventory approach
5.2.1	Primary extraction and processing of mercury	X	X	X	X	X	PS
5.2.2	Gold and silver extraction with the mercury-amalgamation process	X	X	X			OW
5.2.3	Zinc extraction and initial processing	X	X	X	X	X	PS
5.2.4	Copper extraction and initial processing	X	X	X	X	X	PS
5.2.5	Lead extraction and initial processing	X	X	X	X	X	PS
5.2.6	Gold extraction and initial processing by other processes than mercury amalgamation	X	X	X	X	X	PS
5.2.7	Aluminium extraction and initial processing	X		x		x	PS
5.2.8	Extraction and processing of other non-ferrous metals	X	X	X		X	PS
5.2.9	Primary ferrous metal production	X				x	PS

Production of other minerals and materials with mercury impurities

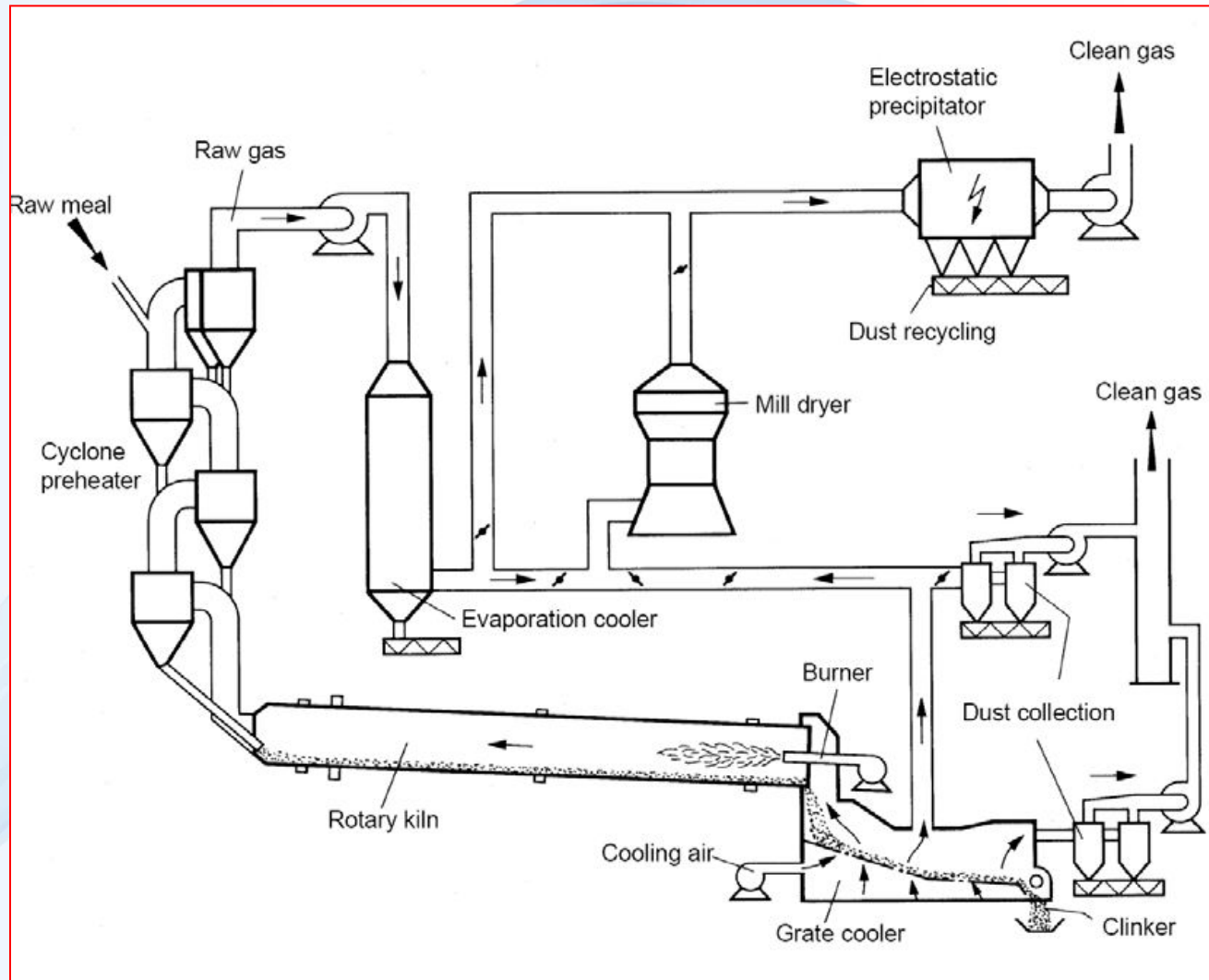
This category covers the following **main sub-categories**:

- ↪ **Cement production**, including mercury in lime, waste as fuel and other feedstock materials;
- ↪ **Pulp and paper production**, including mercury impurities in wood, other fuels and caustic soda, and in some cases mercury-based slimicides;
- ↪ **Production and processing of other raw materials**, including production and use of lime, light weight aggregates, mineral fertilisers, and others.

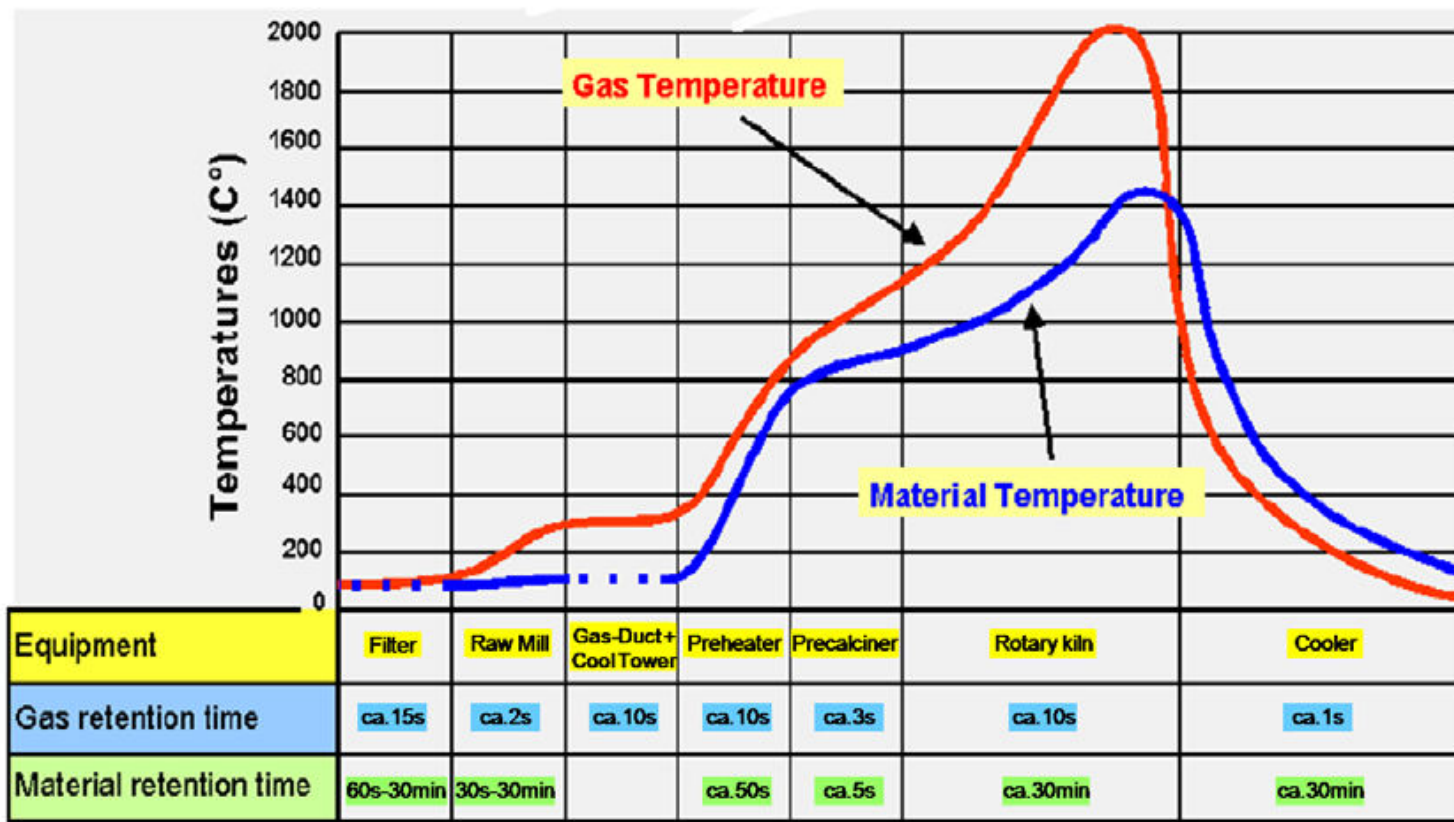
Production of other minerals and materials with mercury impurities

Chapter	Sub-category	Air	Water	Land	Product	Waste/ residue	Main inventory approach
5.3.1	Cement production	X		x	x	x	PS
5.3.2	Pulp and paper production	X	x	x		x	PS
5.3.3	Lime production and light weight aggregate kilns	X			x		PS
5.3.4	Others minerals and materials						PS

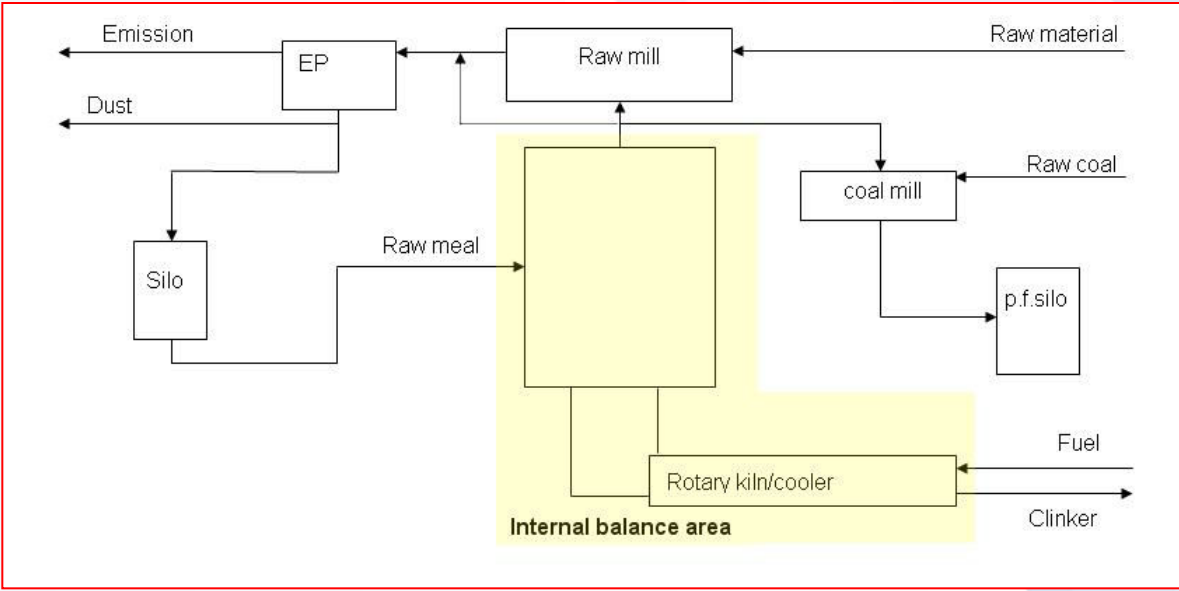
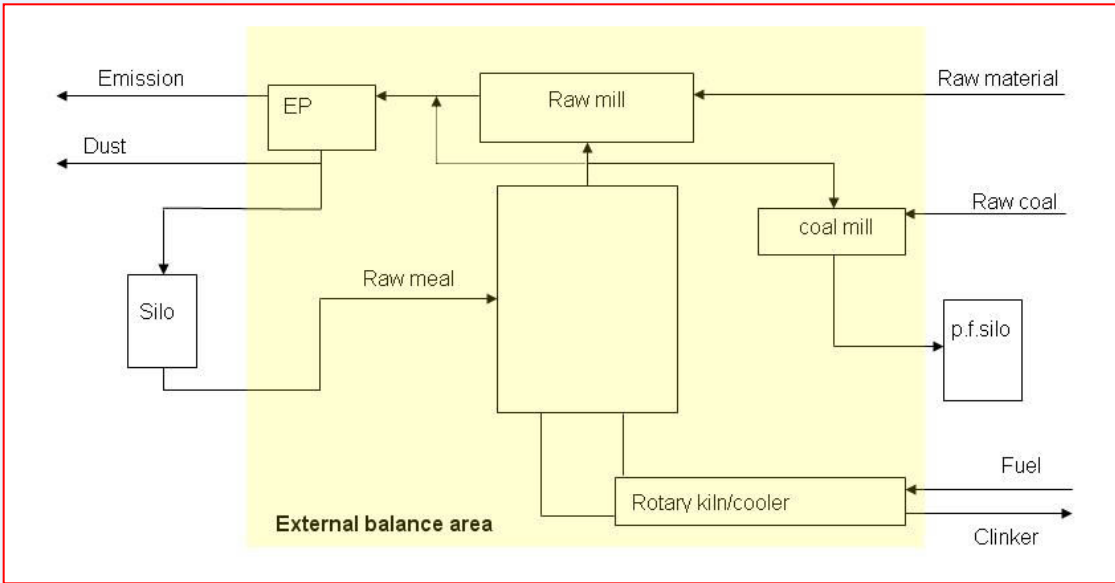
Rotary kiln with cyclone preheater and gas dust collection (IPPC, 2009)



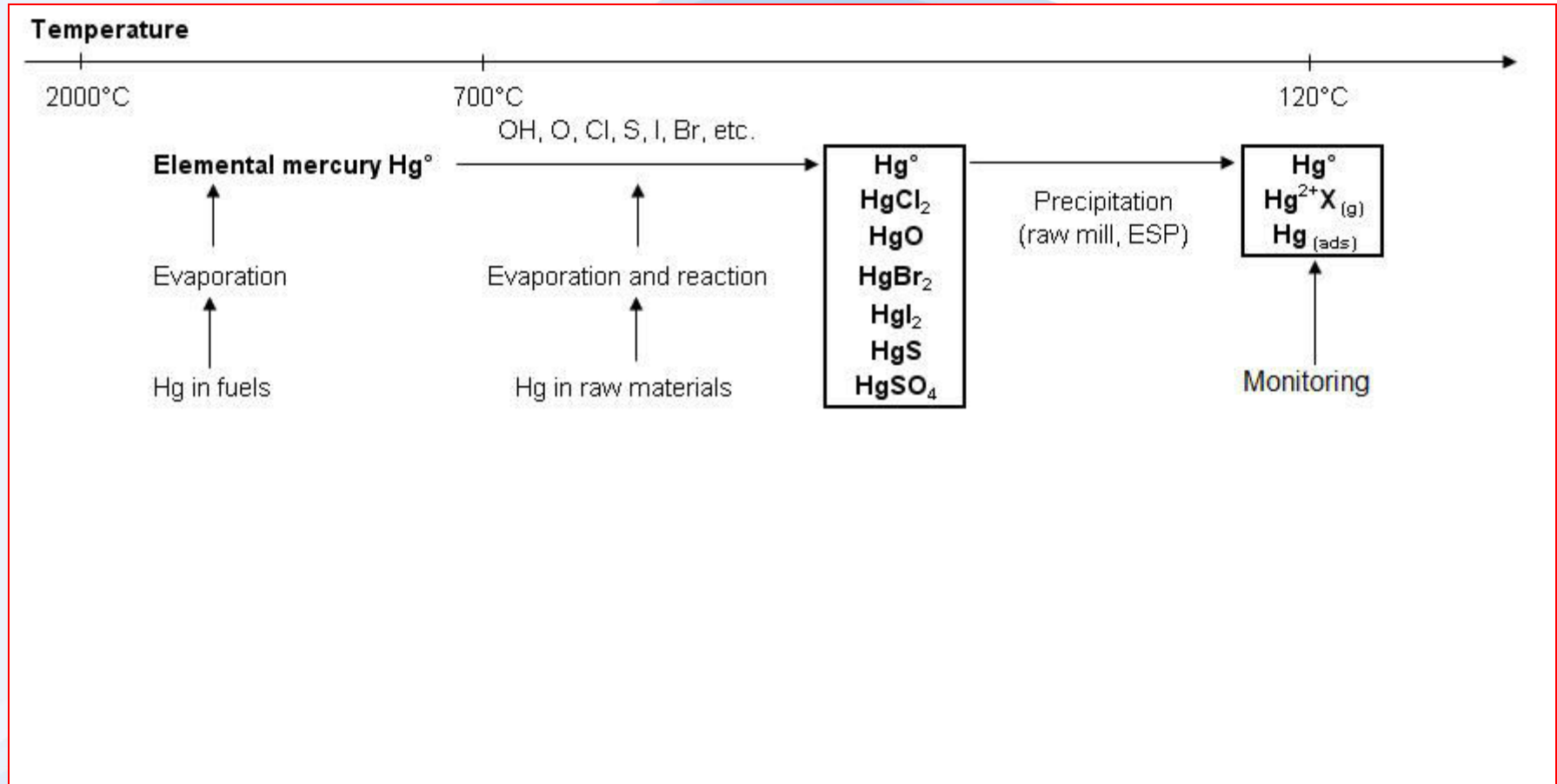
Gas and Materials Profile in a cyclone Preheater/precalciner System (Lafarge)



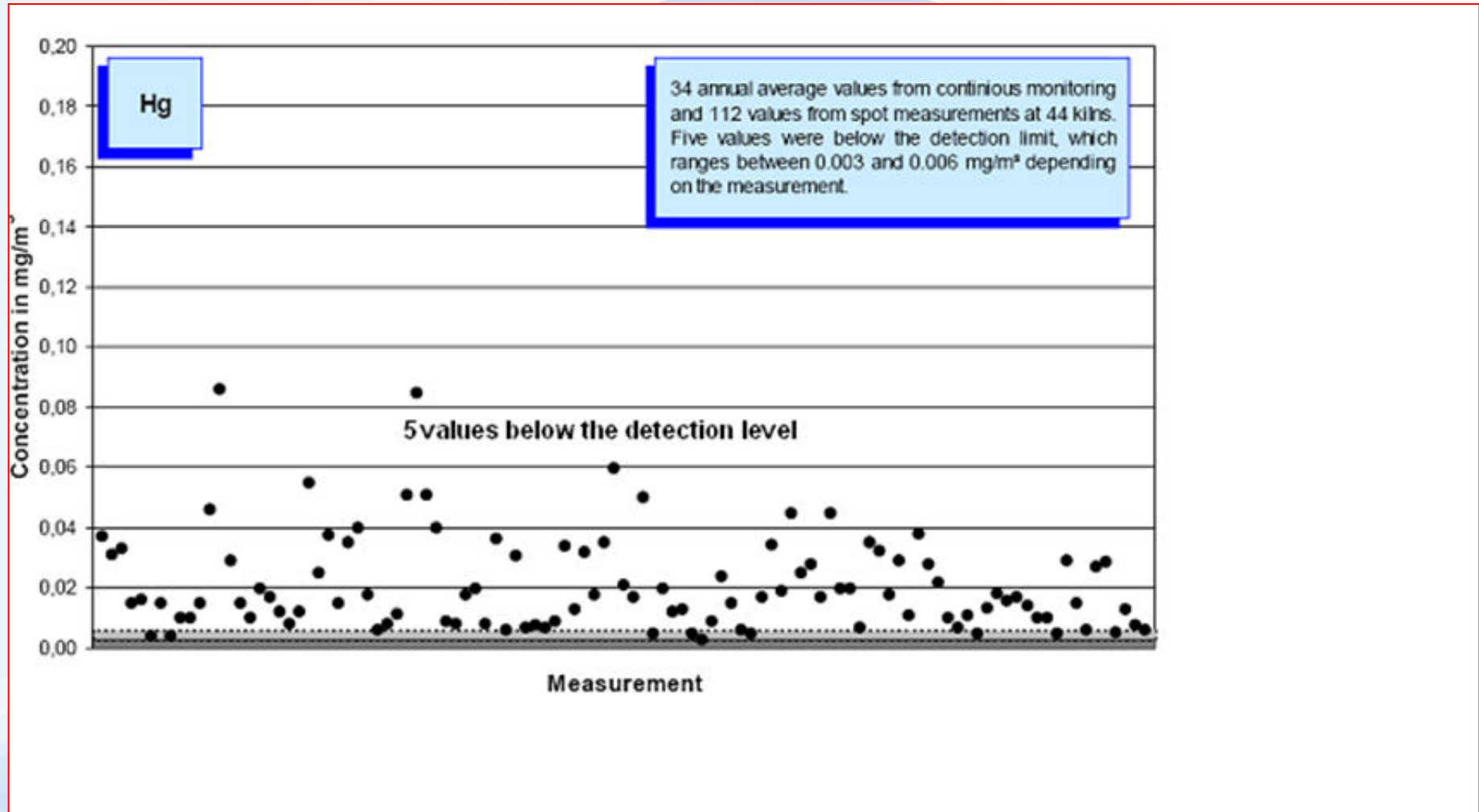
Internal and external balance in cement kiln system



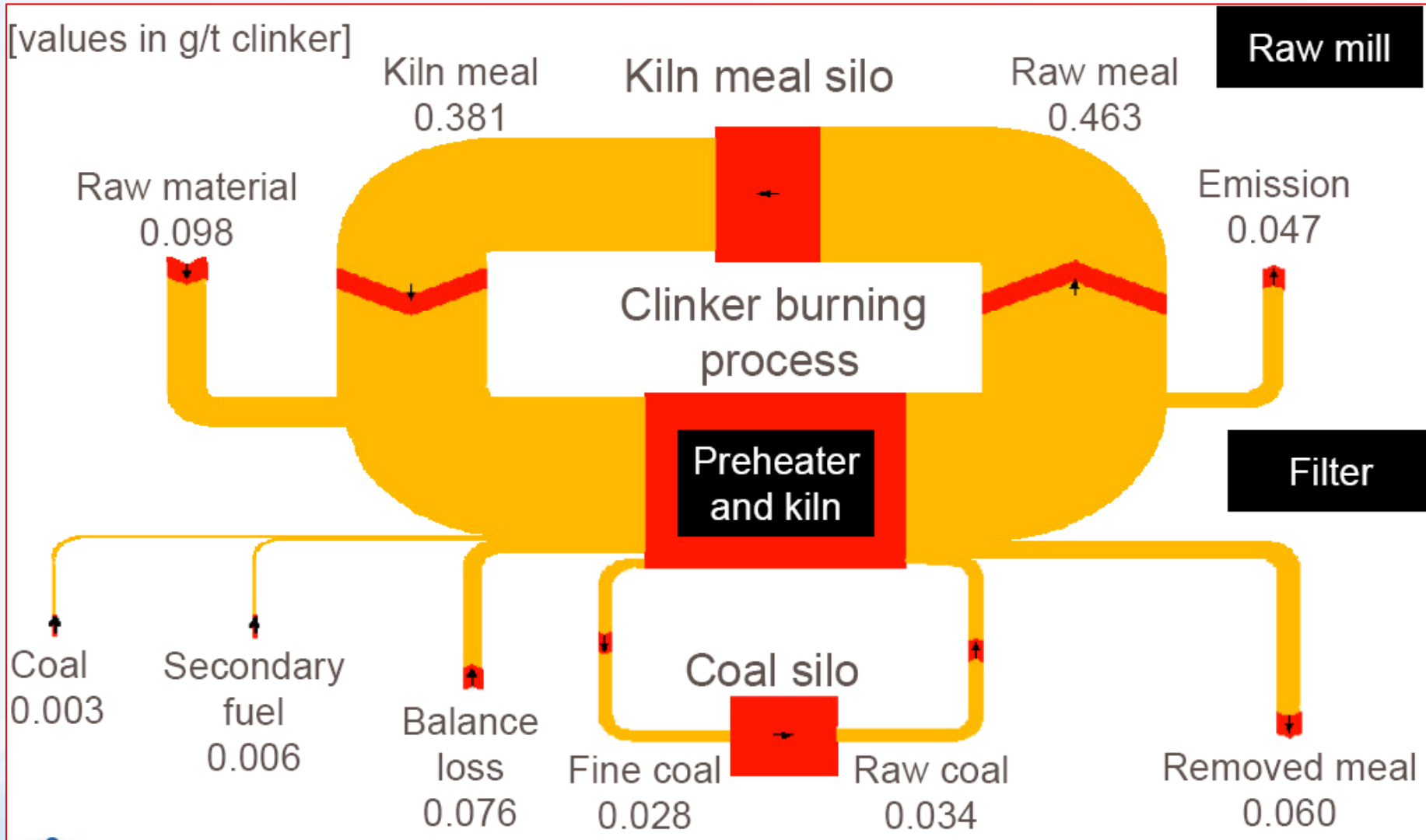
Potential mercury reactions within cement kiln systems



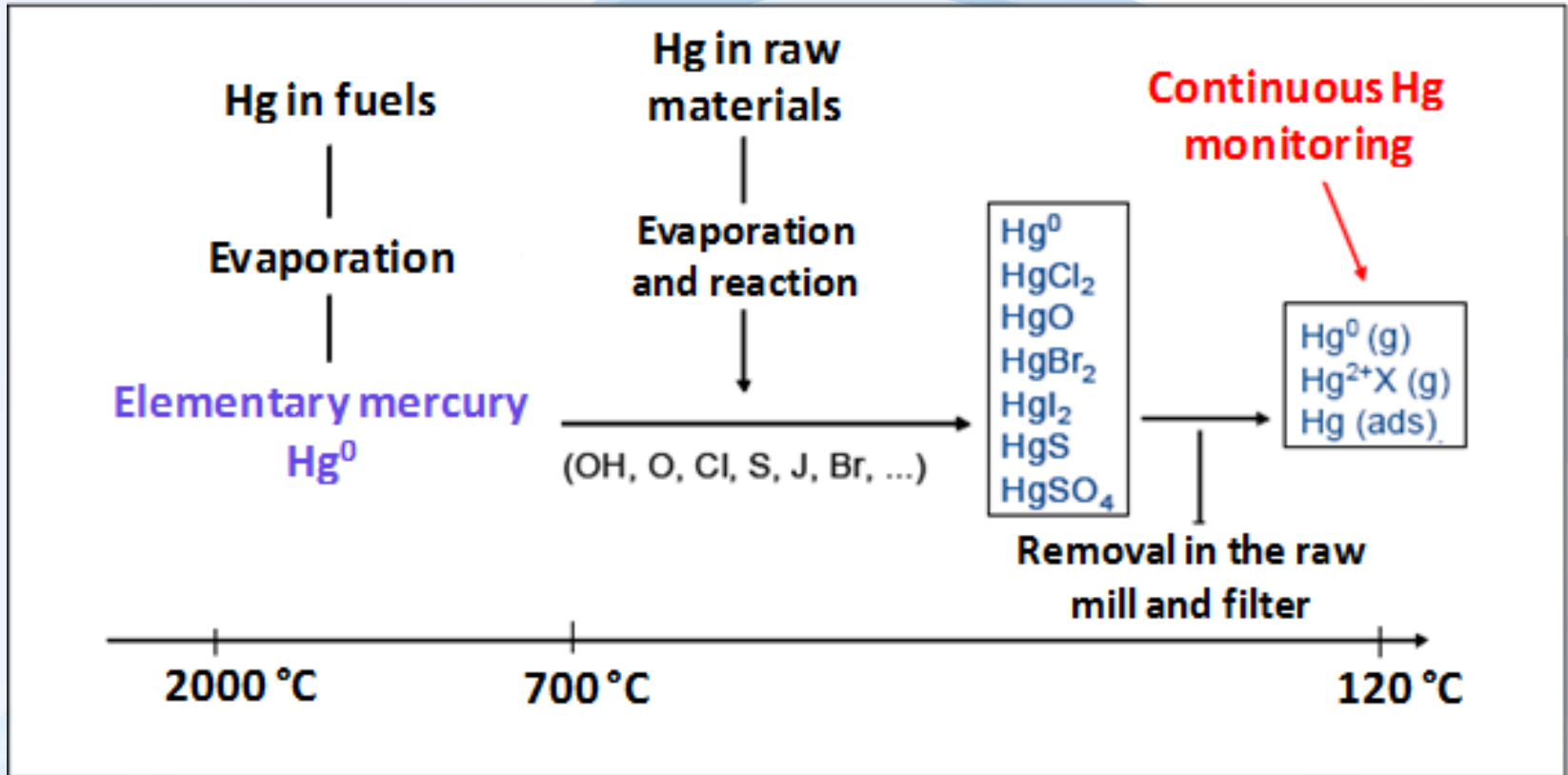
Mercury concentration values (year 2007) measured in the clean gas of 44 rotary kilns (VDZ, 2008a).



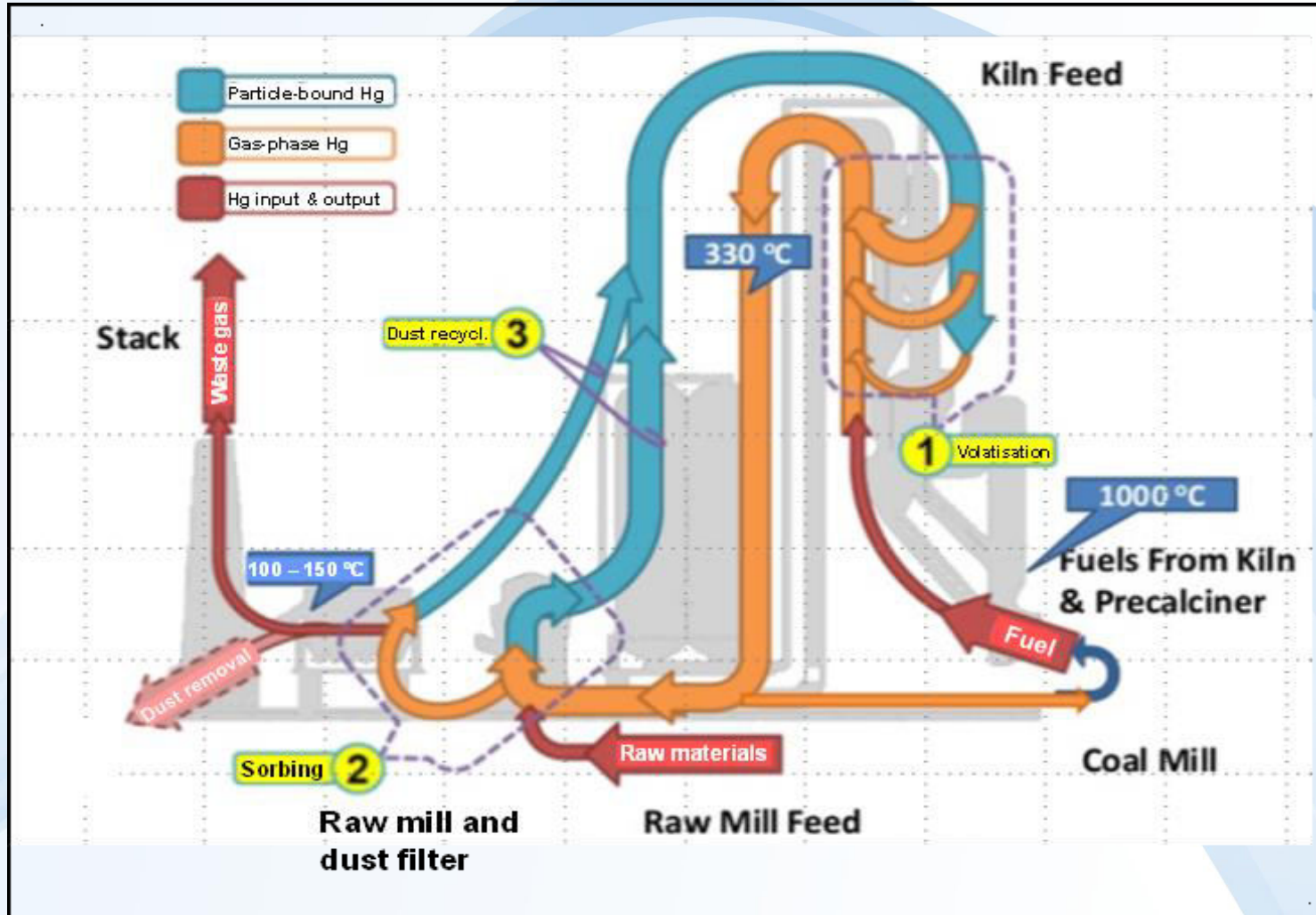
Mercury cycle under meal removal (ECRA, 2008).



Possible conversion reactions of mercury in the clinker production process



The external mercury cycle in a clinker production plant considering filter dust recycling and removal



Data collection

Source sub-category	Input data types and units	Possible data sources
Primary metal production (industrial)		
Mercury (primary) extraction and initial processing	Mercury produced, t/y	Primary mercury mines are only operating in a few countries today. For data, contact the mining company or the ministry responsible for mining activities (ministry of mining, industry, natural resources, or other), or resource persons in universities, institutes

Data collection

Source sub-category	Input data types and units	Possible data sources
Primary metal production (industrial)		
Production of zinc from concentrates	Concentrate used, t/y	<p>For data, contact the mining company or the ministry responsible for mining activities (ministry of mining, industry, natural resources, or other), or resource persons in universities, institutes. As a beginning, or if you have no other data, U.S Geological Survey publishes annual mineral yearbooks with information on minerals production for many countries at http://minerals.usgs.gov/minerals/pubs/country/index.html</p> <p>In most cases, these reports also mention individual facilities by name and can thus be used to identify such facilities in a point source approach.</p> <p>In cases of co-production of zinc, copper and/or lead from the same concentrate, enter the amount of concentrate used annually in the spreadsheet under the metal produced in largest quantities and make a note on this in the inventory report. If different concentrates are used for different metals, enter annual data for each concentrate input.</p> <p>In case you cannot get data for amounts of concentrates used, but you have access to data for total production of raw zinc in the country, you can use the unit conversion sheet now featured in the Inventory Level 1 spreadsheet.</p>

Data collection

Source sub-category	Input data types and units	Possible data sources
Production of copper from concentrates	Concentrate used, t/y	See advice above
Production of lead from concentrates	Concentrate used, t/y	See advice above; also on data conversion.
Gold extraction by methods other than mercury amalgamation	Gold ore used, t/y	See advice above; also on data conversion.
Alumina production from bauxit (aluminium production)	Bauxit processed, t/y	For data, contact the mining company or the ministry responsible for mining activities (ministry of mining, industry, natural resources, or other), or resource persons in universities, institutes. The data conversion mentioned above is also available for raw aluminium production. See also advice on data sources for zinc above.

Data collection

Source sub-category	Input data types and units	Possible data sources
Primary ferrous metal production (pig iron production)	Pig iron produced, t/y	Production of pig iron (raw iron) may be found in national production statistics held at the ministry of industry or in the national statistics bureau; otherwise contact companies. Only pig iron production is deemed relevant for the mercury inventory in this Inventory Level 1. See also advice on data sources for zinc above.

Data collection

Source sub-category	Input data types and units	Possible data sources
Gold mining with mercury amalgamation		
Gold extraction with mercury amalgamation - without use of retort	Gold produced, kg/y	<p>Production of gold may be found in national production statistics held at the ministry responsible for mining or in the national statistics bureau. If you have both large scale industrial and small scale gold mining in your country, you need to contact resource persons in ministries, universities or gold trading companies to make a (rough) estimate of the share of the national gold production from artisanal and small scale miners using the amalgamation method. Ask larger gold mining companies, if they also use mercury amalgamation. Studying statistics on import of mercury metal may give you a hint if large mercury amounts used in gold mining with amalgamation are imported (for example, if they are much larger than dental mercury use calculated in this Toolkit).</p> <p>Ask gold mining resource persons if small scale miners generally use retorts (vapour hoods with mercury condensation), or not. Note that in 2012, these are not used widely, so a general use will be rare or a new development. If both of these techniques (retorts/no retorts) are used in parallel in the country, form a rough estimate of the share of gold used with each technique, or simply assume that all gold is produced with no retort. Report your data and assumptions clearly in your inventory report.</p>
Gold extraction with mercury amalgamation - with use of retorts	Gold produced, kg/y	

Data collection

Source sub-category	Input data types and units	Possible data sources
Other high volume materials production with mercury releases		
Cement production	Cement produced, t/y	Production data may be available in national production statistics, consult the national statistics department or the ministry of industry. Otherwise, contact the company or resource persons in universities, institutes. See also advice for zinc above.
Pulp and paper production (with own pulp production)	Biomass used for production, t/y	Contact the companies for information on their biomass consumption (principally wood).

Relevant mercury controls that can be included in the Inventory Level 1 step

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Production of zinc from concentrates / Production of copper from concentrates / Production of lead from concentrates	No filters used or coarse, dry PM retention	No filters or coarse, dry PM retention such as electrostatic precipitators (ESP) and cyclones (CYC)
	Wet gas cleaning	Wet gas cleaning of the off-gas from roasting of concentrate
	Wet gas cleaning and acid plant	Wet gas cleaning of the off-gas from roasting of concentrate + removal of acid gasses (normally sold as by-product)
	Wet gas cleaning, acid plant and Hg specific filter	Wet gas cleaning of the off-gas from roasting of concentrate + removal of acid gasses + dedicated mercury removal (acid is normally sold as by-products, mercury or produced mercury compounds like calomel may be sold or deposited on-site or elsewhere)

Relevant mercury controls that can be included in the Inventory Level 1 step

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Gold extraction with mercury amalgamation - from concentrate	No retorts used	
	Use of retorts	Use of retorts or similar devices that prevent the mercury from evaporating when burning the amalgam, and collects it for possible re-use (sometimes after a simple cleaning procedure called "re-activation")

Relevant mercury controls that can be included in the Inventory Level 1 step

Source sub- category	Mercury control name in IL1 spreadsheet	Explanation
Cement production WITH WASTE USED as fuel (>3% of energy) /	No filter	
	Simple particle control (ESP / PS / FF)	Simple particle control with electrostatic presipitators (ESP), particle scrubbers (PS) or fabric filters (FF = bag filters)
Cement production WITH NO/LOW WASTE use as fuel	Optimized particle control (FF+SNCR / FF+WS / ESP+FGD / optimized FF)	"Optimized" particle control with fabric filters (FF) + selective non-catalytic reduction (SNCR) OR Fabric filters (FF)+ wet scrubbers (WS) OR Electrostatic precipitator (ESP) + flue gas desulphurisation (FGD) OR Optimized fabric filters (FF)

Relevant mercury controls that can be included in the Inventory Level 1 step

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Cement production	Efficient air pollution control (FF+DS / ESP+DS / ESP+WS / ESP+SNCR)	Efficient air pollution control with fabric filters (FF) + dry scrubber (DS) OR Electrostatic precipitator (ESP) + dry scrubber (DS) OR Electrostatic precipitator (ESP) + wet scrubber (WS) OR Electrostatic precipitator (ESP) + selective non-catalytic reduction (SNCR)
	Very efficient Hg pollution control (wet- FGD+ACI / FF+scrubber+SNCR)	Very efficient Hg pollution control with wet flue gas desulphurisation (wetFGD) + activated carbon injection (ACI) OR Fabric filter (FF) + scrubber + selective non-catalytic reduction (SNCR)

Relevant mercury controls that can be included in the Inventory Level 1 step

Source sub-category	Mercury control name in IL1 spreadsheet	Explanation
Pulp and paper production	No filters used	
	PM control with general ESP, or PS	Dust filters such as electrostatic precipitators (ESP), particle scrubbers (PS), or similar



Teşekkür Ederim

