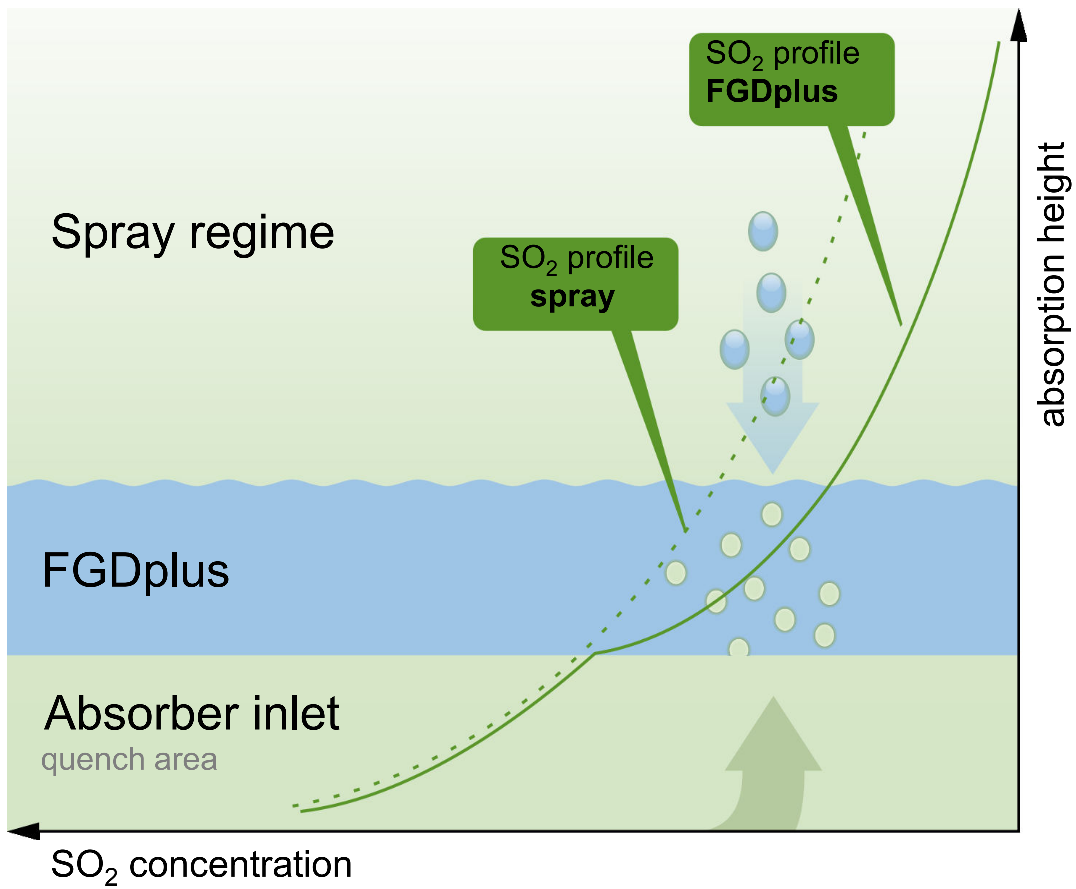
Optimizing Absorber STEP 2 - FGDplus

Working principle for DeSOx

- High GAS mass transport resistence at gas outlet
  - **max. SURFACE**
  - **spraying system**
- High LIQUID mass transfer resistence at gas inlet
  - **max. VOLUME**
  - **FGDplus system**

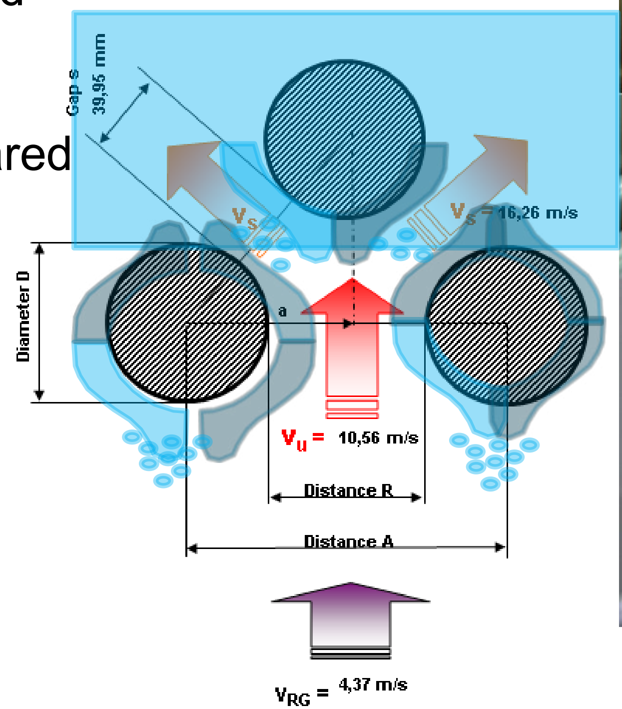


Optimizing Absorber STEP 2 - FGDplus

Concepts for DeDusting using FGDplus

USING of „venturi scrubber principle“

- Flue Gas with dust particles is accelerated and forced to flow through a liquid layer → **efficient particulates separation**
- Hit Rate of cross flow through liquid layer depending on the liquid layer height
- No deposit risk compared to a sieve tray



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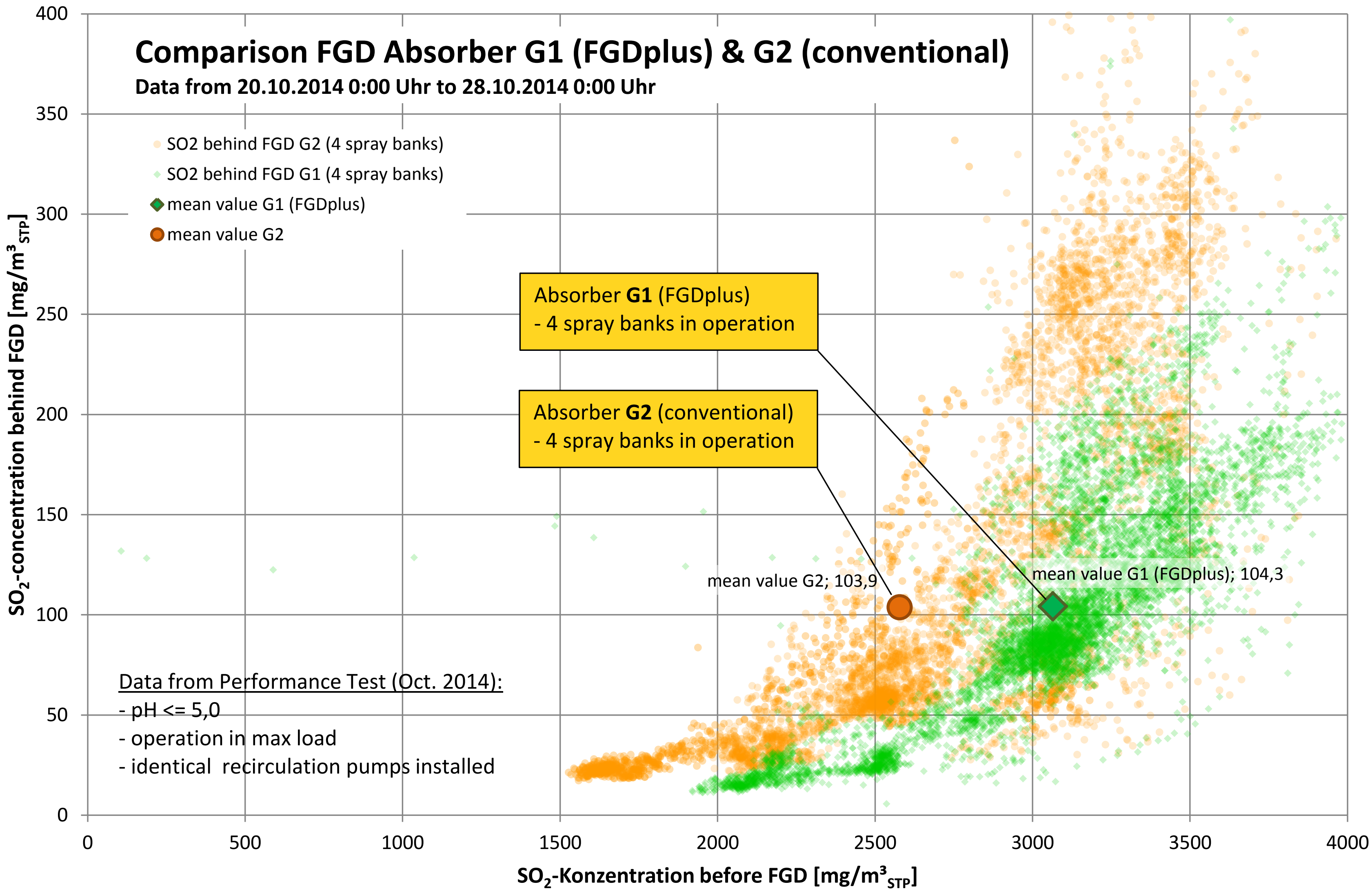
Optimizing Absorber STEP 2 - FGDplus

FGDplus layer - Niederaußem

- 2 Absorber for Block G (660 MW_e)
  appr. **18 m diameter**, ca. 40 m height
- Design (‘80ies)
  SO_2 = 400 $mg/m^3_{N, dry, 6\% O_2}$
- New Regulation (2016)
  SO_2 = 200 $mg/m^3_{N, dry, 6\% O_2}$
- Expanded coal band > higher SO_2 inlet concentrations
- Compared Retrofit-Options:
  - 4 spray banks (à 6.000 m^3/h)
    & FGDplus Module
  - 5 spray banks (à 6.000 m^3/h)

FGDplus – Reference RWE- PP Niederaußem (GER)

Results



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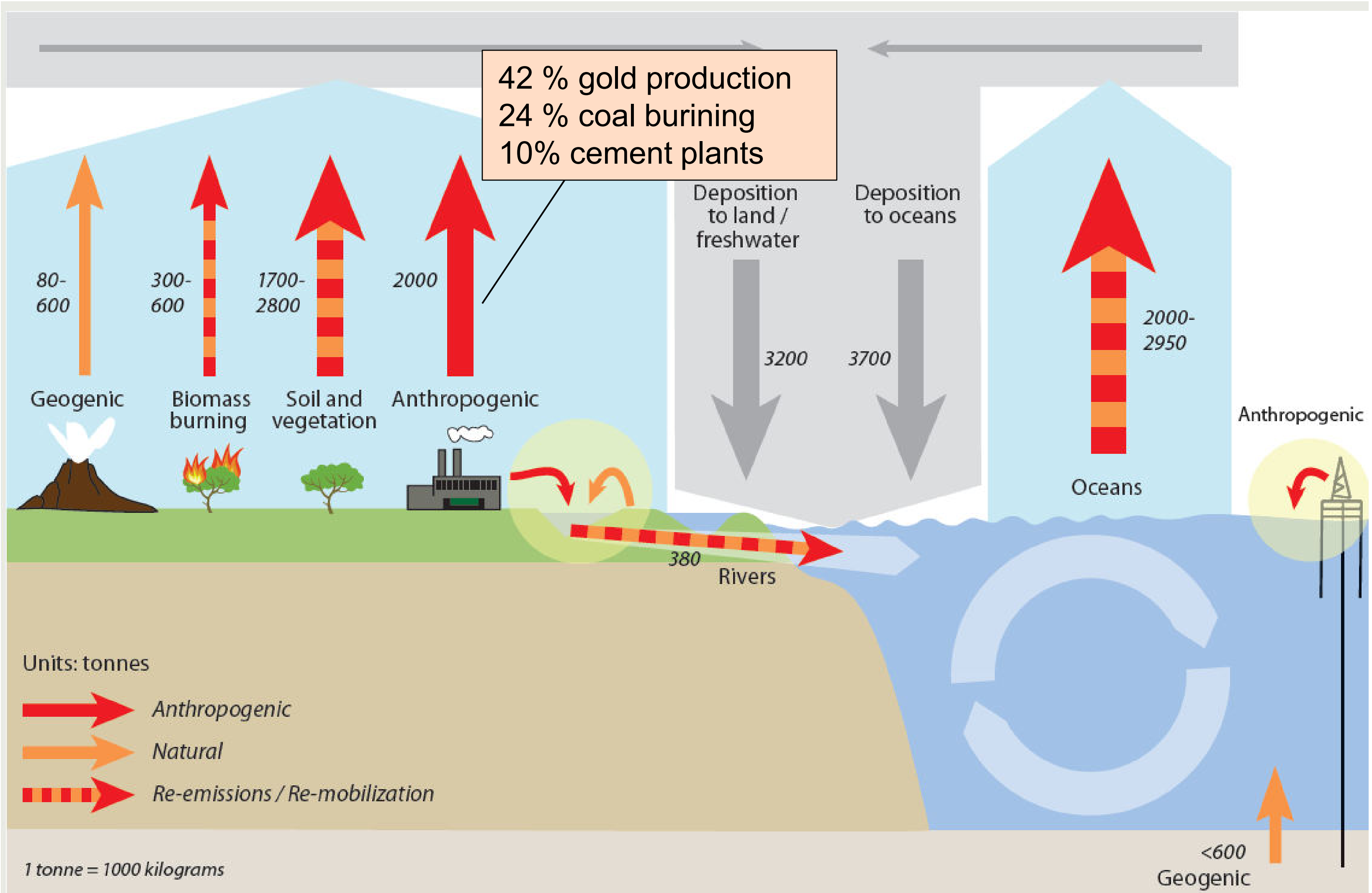
Mercury Control by ANDRITZ

Mercury Control by ANDRITZ

Global Mercury Emissions

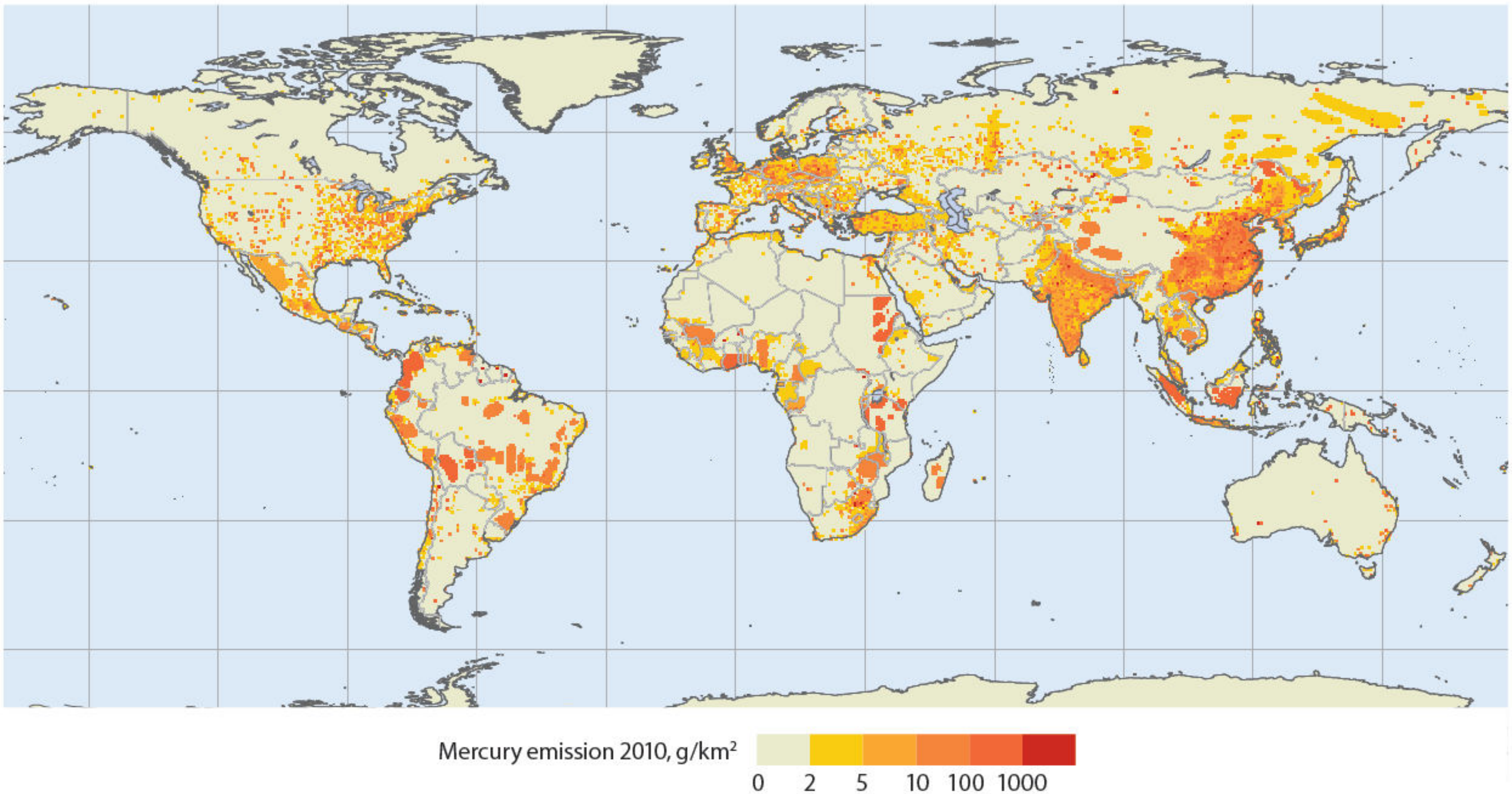


Source: Global mercury assessment 2013, UNEP

Mercury Control by ANDRITZ

Anthropogenic mercury emissions according to regions

Main players are: East / Southeast Asia, Europe, USA



Global distribution of anthropogenic mercury emissions to air in 2010.

Source:
Global mercury assessment 2013, UNEP

Mercury Removal - Legislation

- In USA: MATS (Mercury Air Toxics Standard) limits:
  - Bituminous Coal, existing plants: 1,2 lb/TBtu (~ 1,5 µg/Nm³, dry, 5% O_2, 30 days rolling average value, to be established until 2016).
  - Bituminous Coal, new plants: 22 ng/Nm³, dry, 5% O_2
  - Lignite coal: 4,1 µg/Nm³ @ 6% O_2 both for existing and new plants;

- India:
  - 30 µg/Nm³ for caol fired power plants > 500 MWel

- E.U. - BAT/BREF restrictions (to be implemented in national legislation of each EU-member until 2020)
  - 1 – 4 µg/Nm³ for biuminous coal
  - 1 – 7 µg/Nm³ for lignite grades

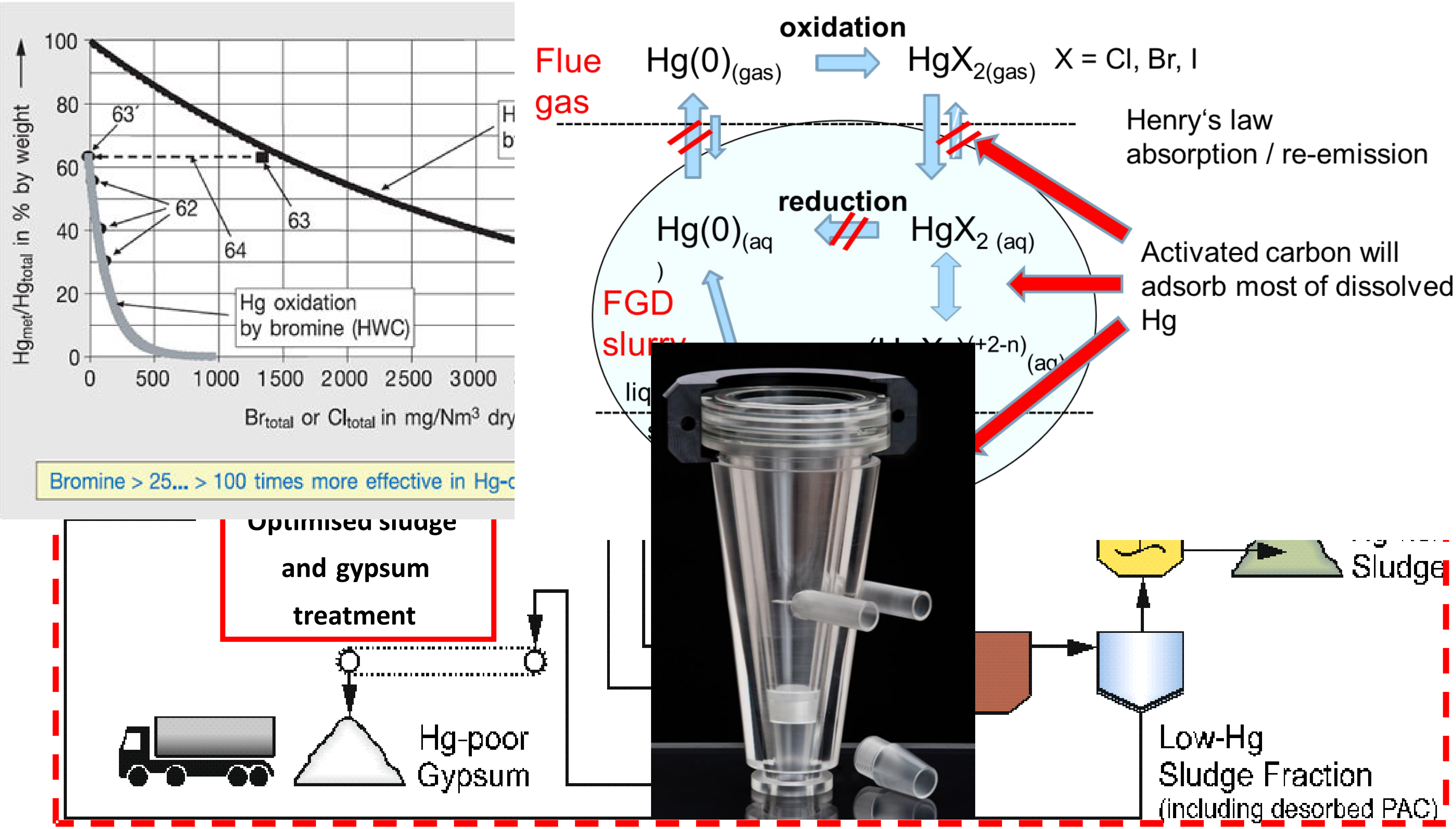
Mercury Control by ANDRITZ

Some Facts

- Natural mercury occurrence mainly represents Cinnobar (HgS), very rarely also genuine mercury. Other compounds occur rather seldom (HgO, $AgHg$, $CuHg$)
- During the combustion process mercury usually decomposes to elemental mercury (T>1000°C)
- Depending on flue gas path and composition, mercury oxidation may take place ($Hg + X_2 \rightarrow HgX_2$ with X = Cl, Br, I) depending on X- concentration and if/or not SCR
- Elemental mercury ($Hg_{el,}$ Hg_0) is nearly insoluble in water, hardly adsorbs on sorbent surfaces (except special doped activated carbon grades) and is very volatile
- Oxidised mercury (Hg_{ox}, HgX_2) is water soluble and easy to adsorb on carbon containing surfaces; it is very volatile as well.

Mercury Control by ANDRITZ

Integrated mercury control



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Mercury Control - Absorber

ANDRITZ approach - integrated mercury control

- STEP 1: Oxidation Additives
  - ⇨ Provide oxidized Hg- species
- STEP 2: Absorption into Slurry of Wet Scrubber
  - ⇨ Separation from the flue gas **-> flue gases partially cleaned (>70%)**
- STEP 2a: Addition of PAC or Anti-reemission Additive into Slurry of Wet Scrubber
  - ⇨ Avoid Reemission of Hg **-> flue gases fully cleaned (>90%)**
- STEP 3: Andritz Washwater Hydrocyclone Technology
  - ⇨ Remove Hg + PAC from Gypsum **-> white gypsum with low Hg content**
- STEP 4: 2 Stage Waste Water Technology
  - ⇨ Remove Hg from waste water

-> Hg cleaned waste water and controlled Hg-sludge disposal