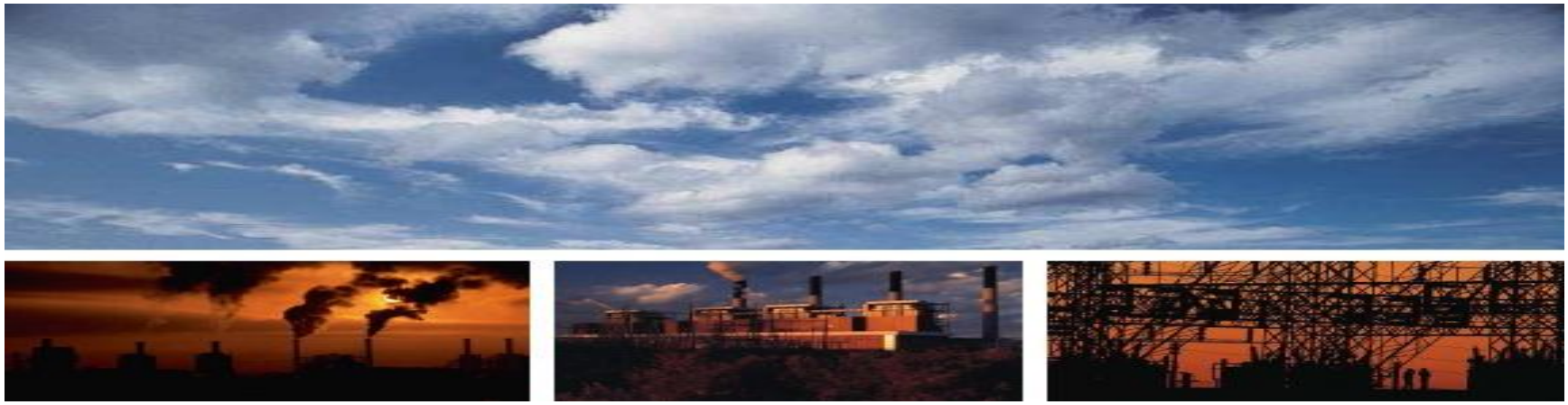
Mercury removal from flue gas streams

去除废气中的汞排放



MercuRemoval
GAS TREATMENT TECHNOLOGY

Hutchison Kinrot
WATER & CLEANTECH VENTURES

Hagay Keller, CEO
Dr. Zach Barnea, CTO

www.mercuremoval.com

December 2015

A new approach . . .一种新方法

80RT-IL Technology

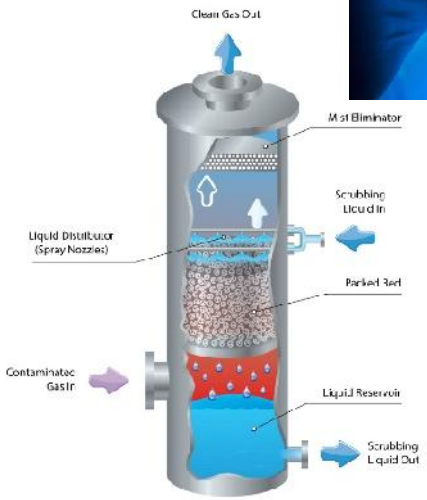
Innovative proprietary absorption process based on:

- Ionic liquid and an oxidant agent

  独特的离子液体和氧化剂混合物

- A wet scrubber

  通过使用湿式洗涤器来实施



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Starting with the “Bottom Line”:
从“最关键的问题”开始：

Current common solutions:
当前普遍的解决方案:

1 Kg of Hg

In > 20 tons of contaminated Solids
超过20吨固体污染物

When Implementing
实施80RT-IL方案：

1 Kg of Hg

-

Separated, measurable
可分离、可测量
年成本较低

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Known challenges – Driving our company

- Lethal air pollution with main toxic effect on maritime environment
- Increasingly stringent governmental norms and regulations
- Existing, but still limited and costly solutions

Regulation Overview 管制一览

Air pollutant emission standards for coal-fired power plants in (mg/m^3)

		China	EU / Germany	USA
SO_2	New	100	200	160
	Existing	200 / 400	400	160 / 640
NO_x	New	100	500 / 200	117
	Existing	100 / 200	500 / 200	117/160/640
PM	New & existing	30	50	22.5
Hg Mercury	New	0.03	0.03	0.001
	Existing	0.03	0.03	0.002

http://www.airclim.org/acidnews/china-new-emission-standards-power-plants

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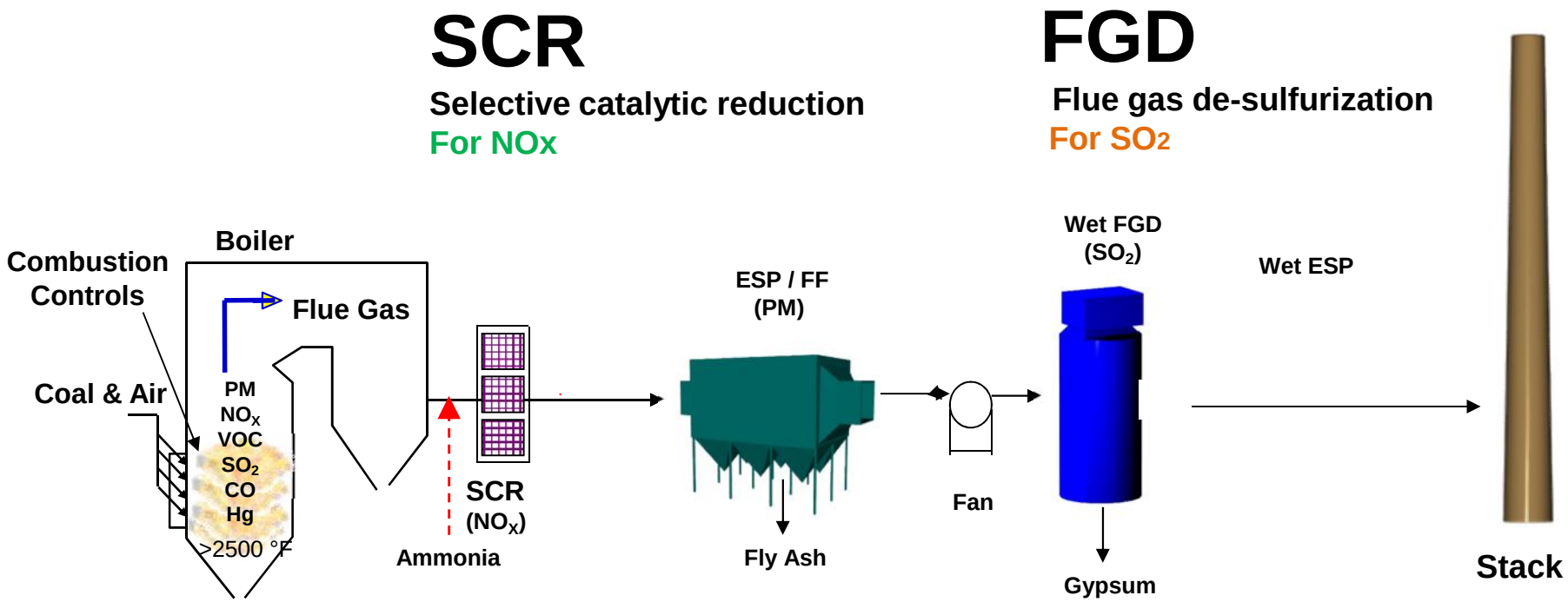
Available Solutions

APCD's in a Typical Power Station



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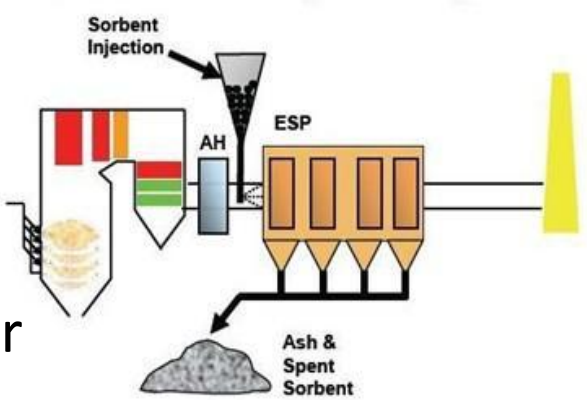
Common Mercury Removal Technologies 1

- Activated Carbon Injection (ACI) 活性炭喷射
  - Effectiveness varies from coal to coal
  - Hg adsorption efficiency is limited

    (unless using Brominated ACI)
  - Intensive usage of consumable absorber
  - Annual cost per boiler - 1-3M $US
  - Hg contamination: Gas → Solid (AC)



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Common Mercury Removal Technologies 2

- Addition of Calcium Bromide 溴化钙使用
  - Effective
  - Results comply with current regulation standards
  - Relatively low operating costs

But:

  - Requires SCR + WFGD
  - Hg is spreads throughout the system
  - Hg contamination: Gas → Solid / Liquid (Gypsum/Wastewater)

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So what about Re-distribution?

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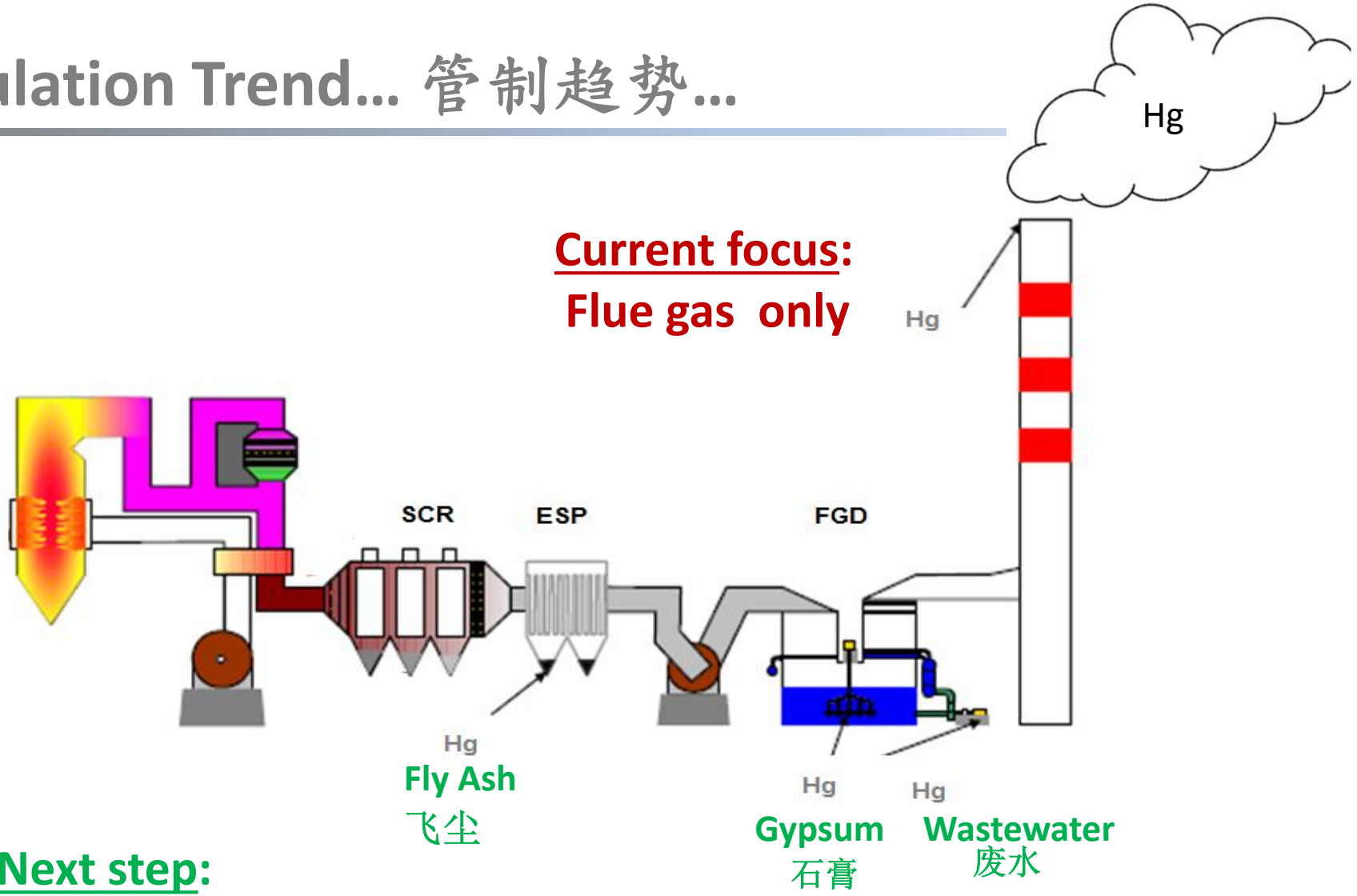
Regulation Trend… 管制趋势…



Current focus:
Flue gas only

Next step:
Hg Re-distribution

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80RT-IL
New Approach
我们的全新方案

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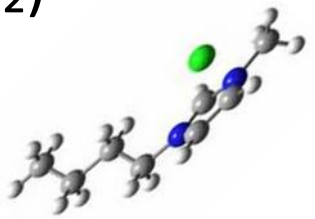
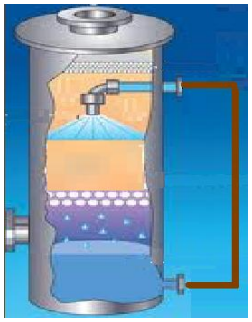
Our offered Solution…

- Unique complex of ionic liquid and an oxidant (Br_2)



- Implemented in a wet scrubber
  - Hg is oxidized into a steady complex
  - Rapid Kinetics
  - Short contact time between flue gas and liquid
  - High capacity absorption of Hg into the liquid



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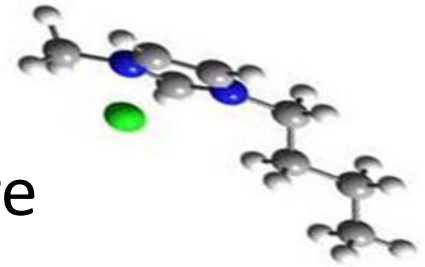
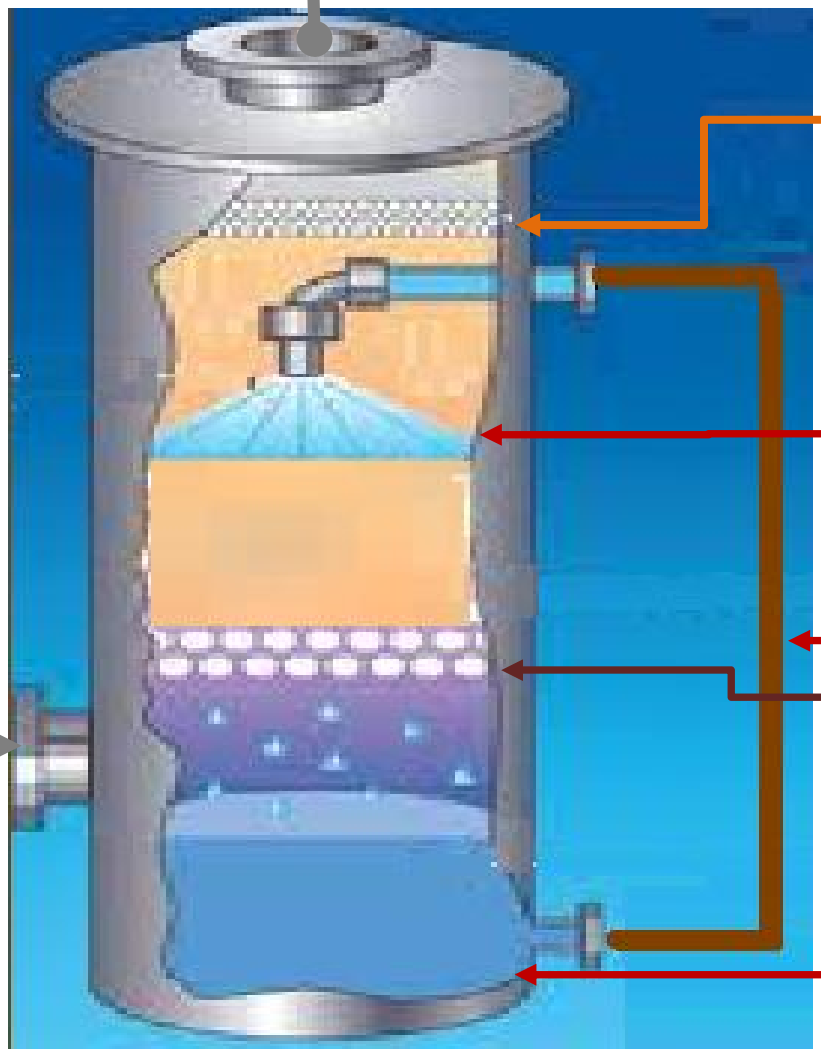
Ionic Liquid



- Salts in a liquid state
- Has no measurable vapor pressure
- Highly stable at wide temp ranges
- Excellent solvent for organic, inorganic and Metal ions
- Used today in many industrial processes & chemical /gas absorption processes

80RT-IL Scrubber: a close system process



Flue Gas outlet
0.5-1.0 µg/m³ Hg

Mist eliminator

Ionic Liquid sprays

Circulation system

Packed bed

Ionic Liquid tank

Flue Gas inlet
20-40 µg/m³ Hg

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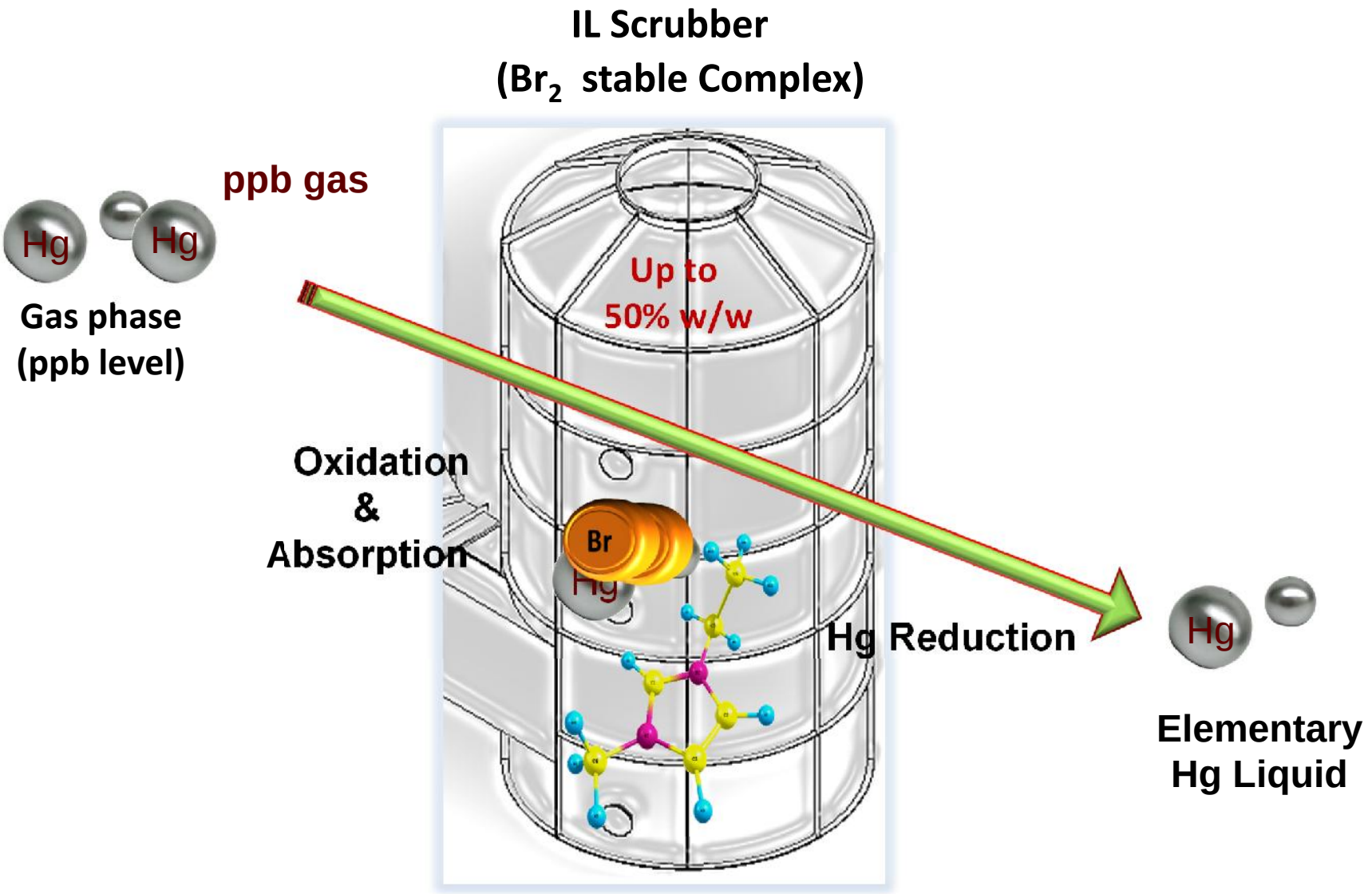
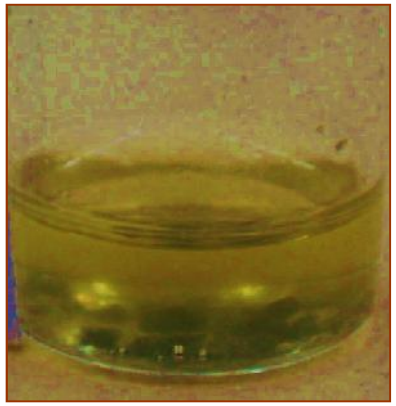
80RT-IL concept

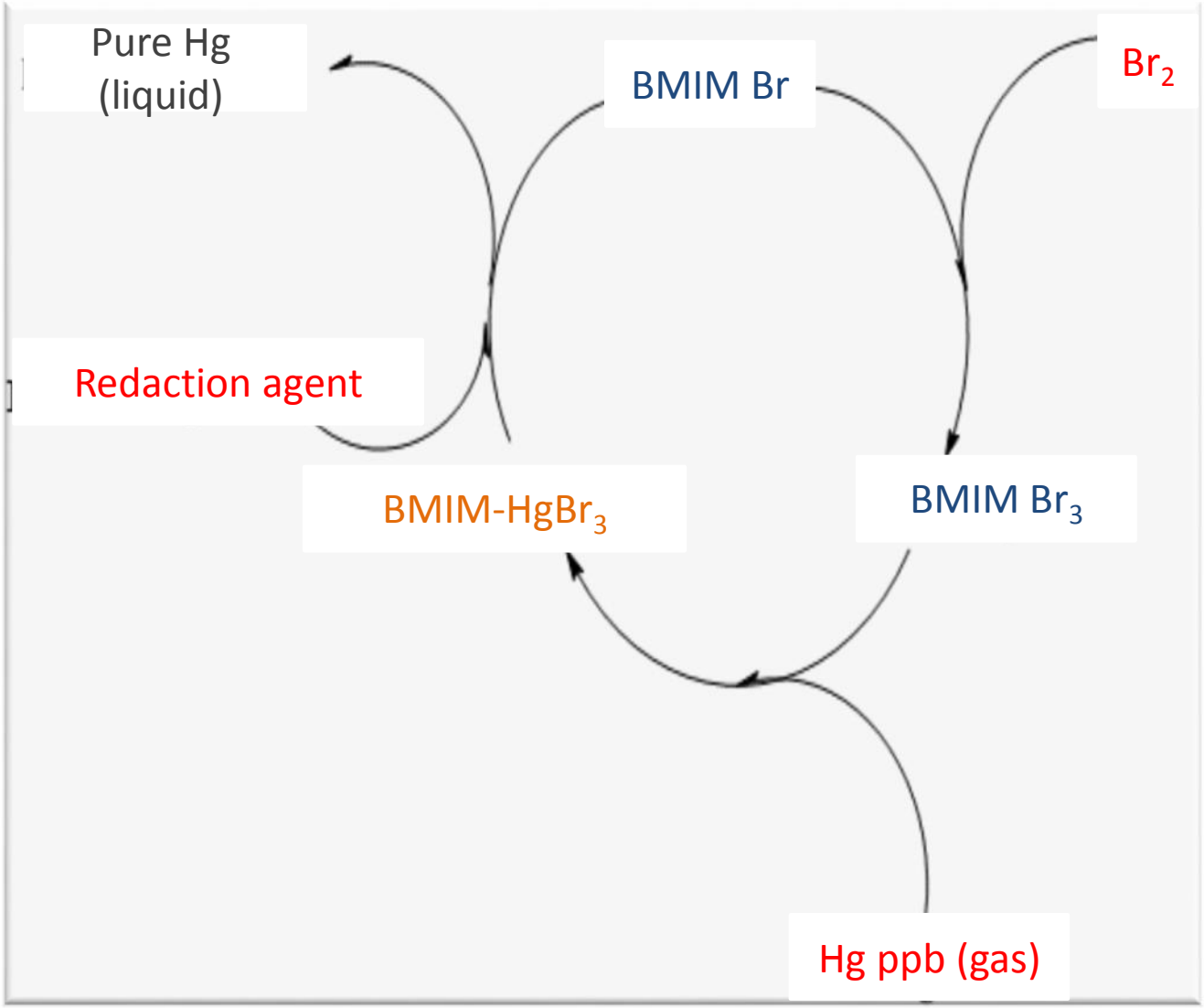


80RT-IL- Regeneration process

Regeneration



Pure Hg in a liquid phase



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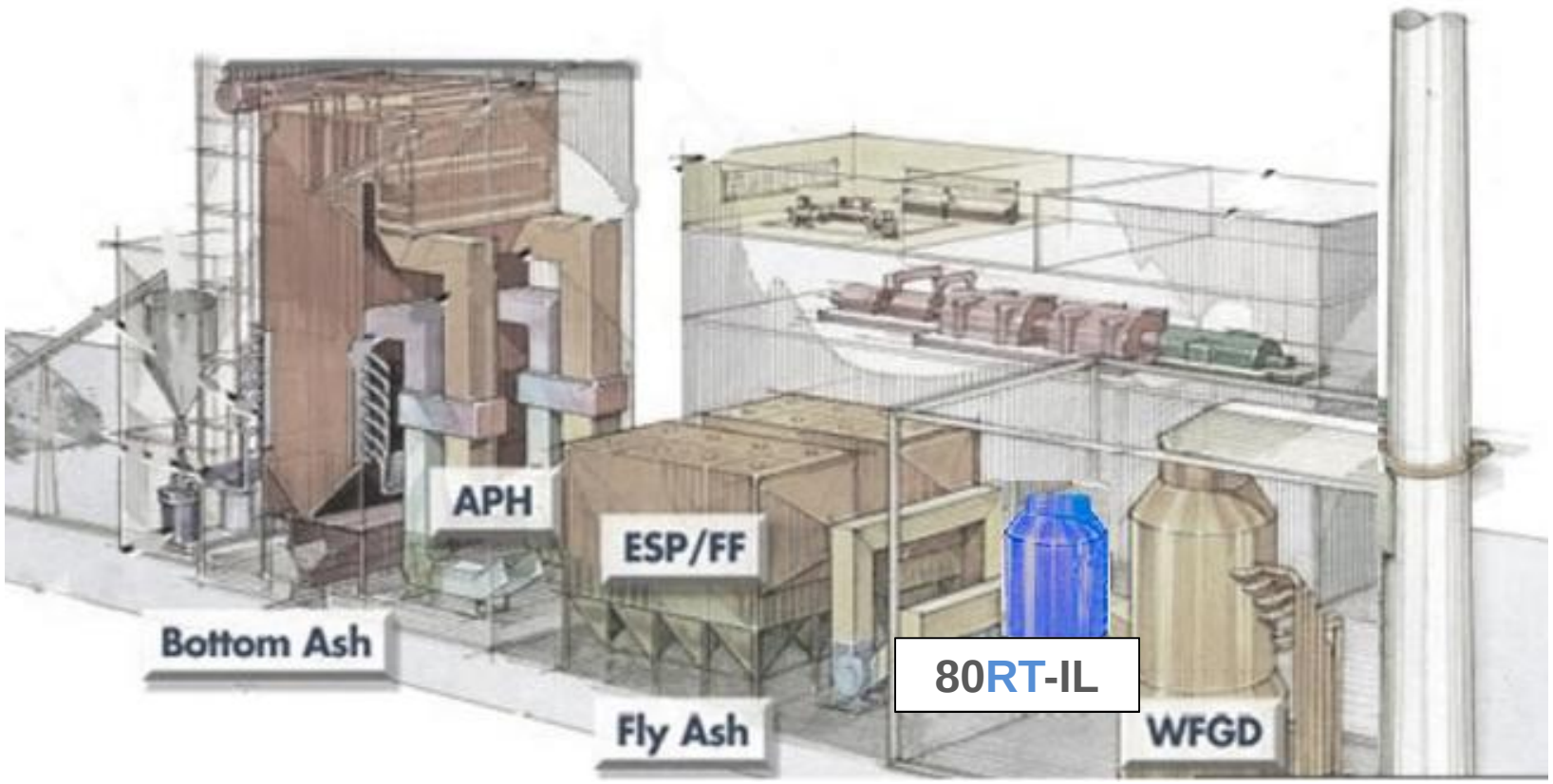
80RT-IL Implementation in a Power Plant



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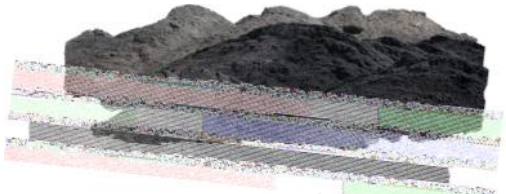
Our Technology Benefits

- Applicable in various industries emitting Hg
  - Coal Power Plants
  - Industrial Boilers
  - Cement Kilns
  - Landfill Incineration

- Complementary treatment for contaminated Active Carbon

80RT-IL process :



Byproduct after the adsorption process:

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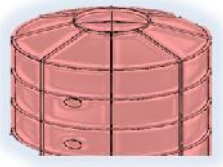

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GAS TREATMENT TECHNOLOGY

Our Technology Benefits

- Removes >97% of all Hg emissions
- Based on non-toxic, stable chemical absorber
- Long product life cycle (regenerated)
- Closed and controlled system
- Environmental friendly
- Reduced OPEX

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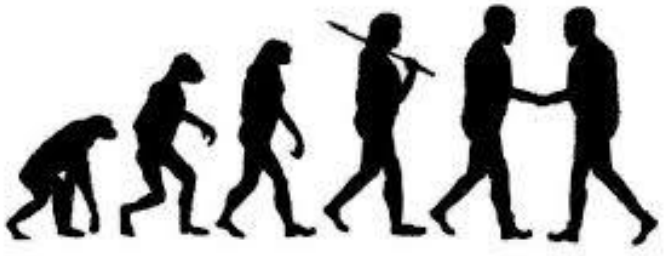
MercuRemoval - At a Glance…

- Founded in 2015 within Hutchison Kinrot - owned by Hutchison Water of CK Hutchison Holdings Ltd.
- Unique patented technology for Hg removal from gas streams
- Backed by worldwide experts (The faculty of applied chemistry - Hebrew University)

Our Current Status

- 4 Patens, 2 already granted
- Ongoing running small scale industrial pilot
- Additional field pilot, medium scale - Q2/Q3 2016
- Looking for international strategic partners



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Returning to the “Bottom Line”:

Current common solutions:

1 Kg of Hg

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When Implementing 80RT-IL :

1 Kg of Hg

In > 20 tons of contaminated Solids

Concentrated Hg - from ppb levels in gas phase to elementary Hg

浓缩汞- 从十亿级别的气相到基本汞

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Mercury Emission Removal from Gas Streams
去除废气中的汞排放

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