Advanced Mercury Removal Technologies

Neil Eckersley
UOP LLC

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A Honeywell Company

Why Remove Mercury?

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1. Equipment Protection

2. Improving product quality

- Mercury found in refinery naphtha
- >50% of world's ethylene plants are naphtha fed

3. Catalyst protection

- Many precious metal catalysts are susceptible to mercury poisoning
- 1:1 Hg amalgams with Pt, Pd are stable at temperatures <150°C

4. HS&E

- TLV Limit = 0.025 mg/m^3 air
- >> 1.0 mg/m^3 has been measured

Natural Occurrence of Mercury Compounds in Hydrocarbon Streams

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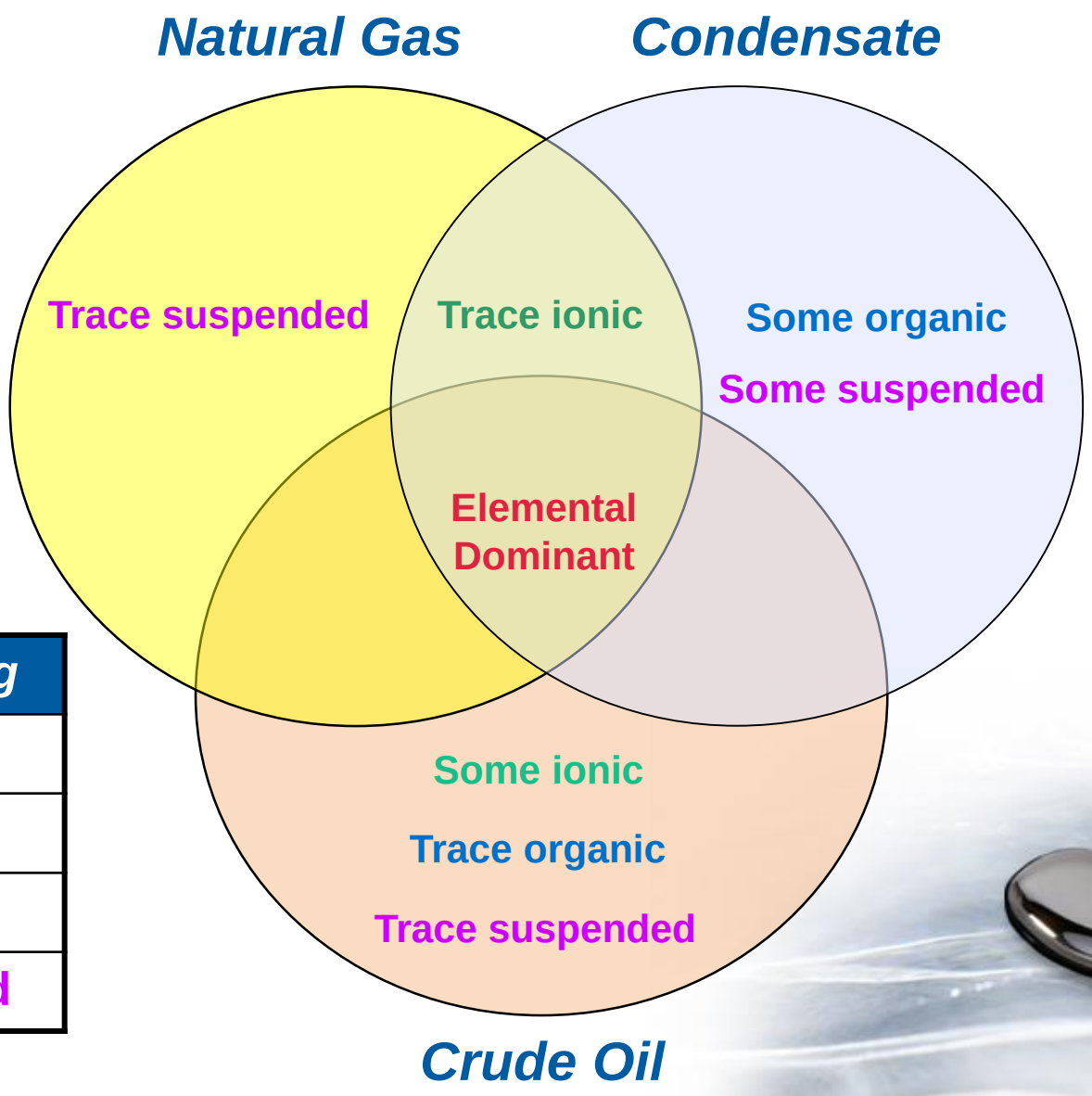
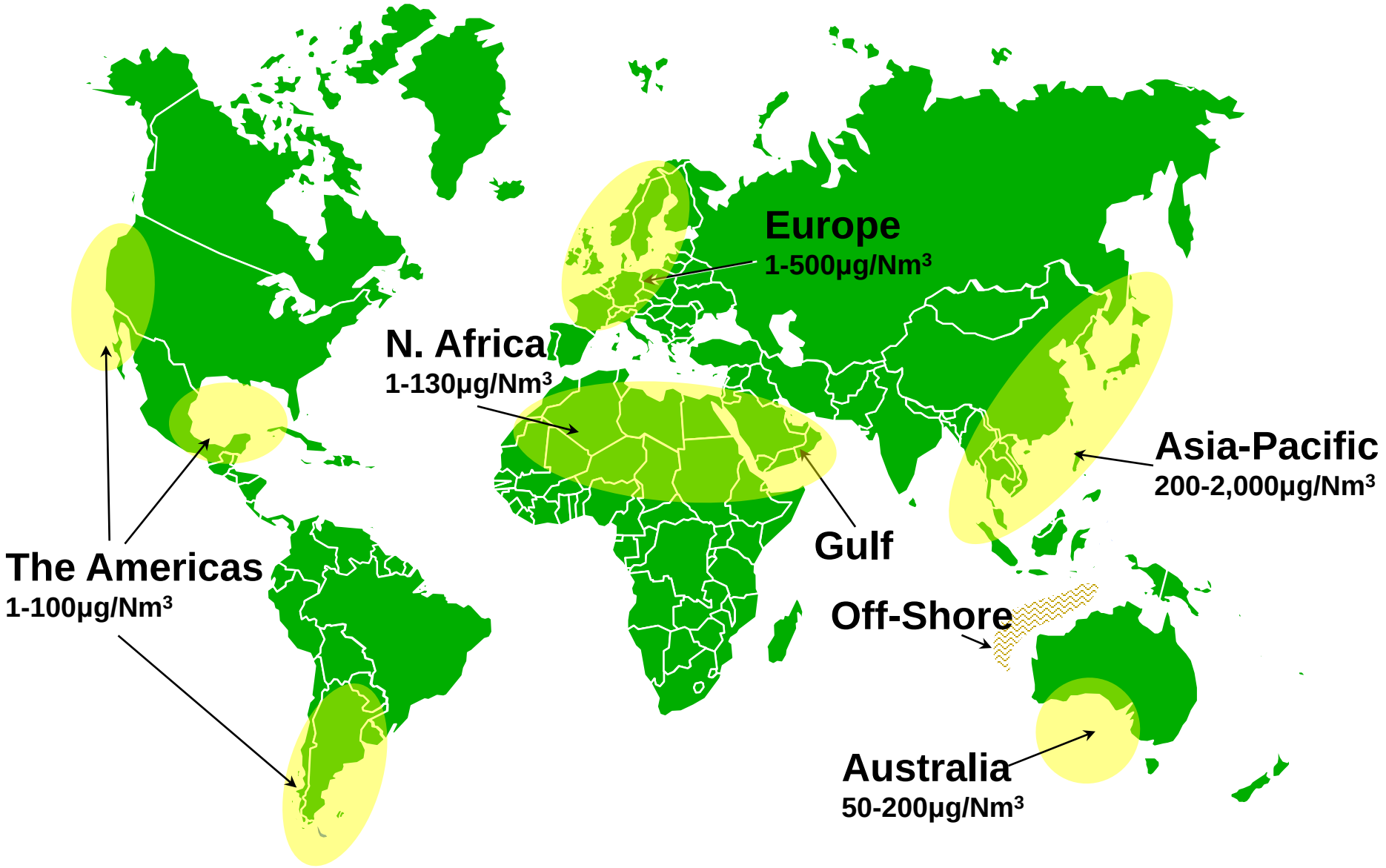


Types of Hg
Elemental
Organic
Ionic
Suspended

Natural Gas Mercury Levels



Existing Mercury Removal Technologies

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	Sulphur Impregnated Activated Carbon	*Silver Impregnated Molecular Sieve*	*Metal (Copper) Oxides and Sulphides*
Technology	Non-regenerable fixed bed	Regenerable fixed bed	Non-regenerable fixed bed
Reactor fill volume	Larger	Smaller	Medium
Contributory ΔP	High	Lowest	Low
Capex	High	Lowest	Low
Flow-sheet location	Dry gas	In mol sieve dryer vessels	Flexible
Disposal	No use	Hg-free	Fully recyclable
Stability	Sulphur dissolution	Very stable	Very stable

“Must Have” MRU Product Features

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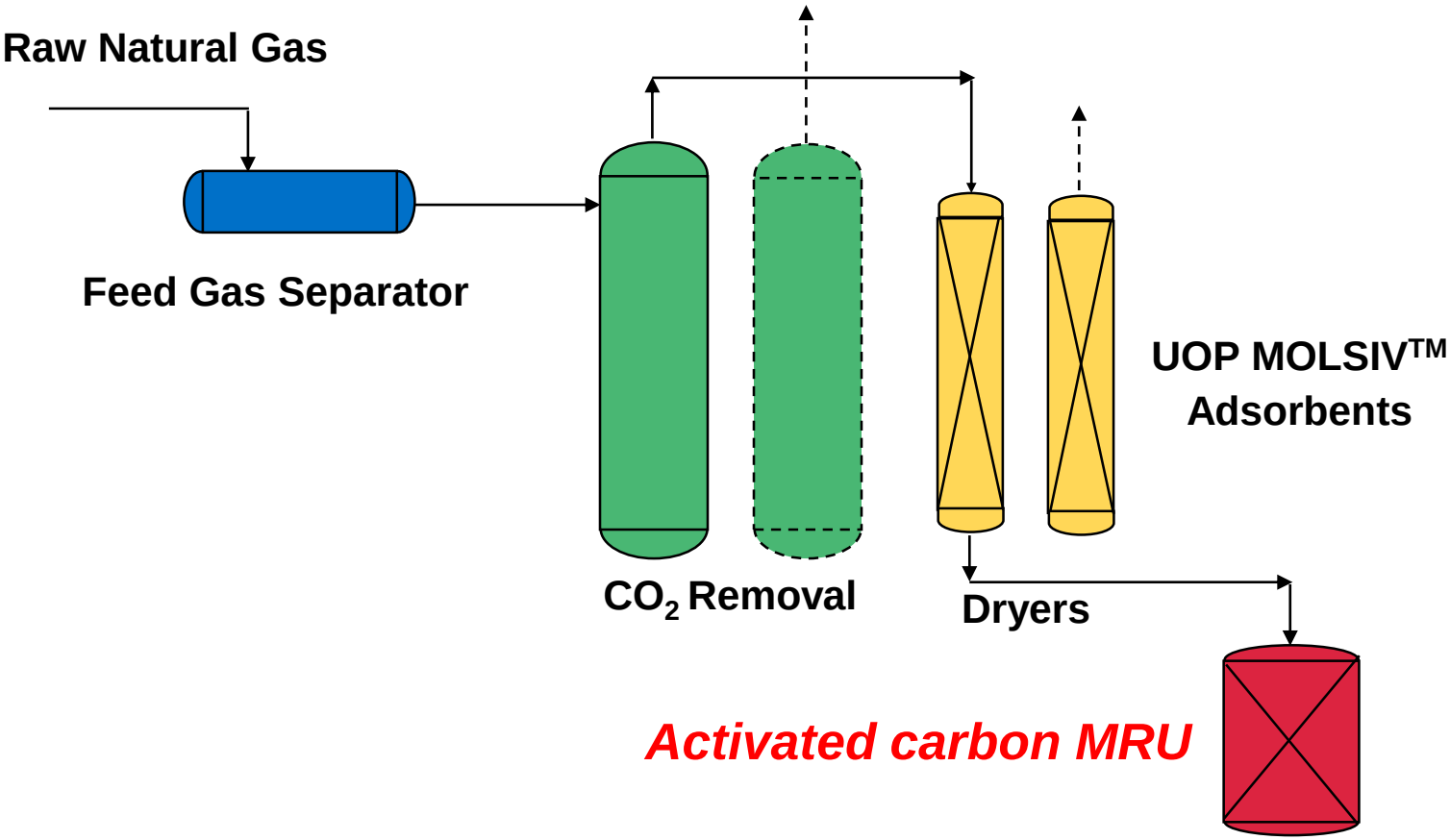
Feature	*Benefits*
Large pore volume	Superior Hg capacity. Better resistance to liquid carry-over
Specifically engineered pore size distribution	Superior Hg capacity
High surface area substrate	Superior Hg capacity
Highly dispersed active phase	Superior pick-up capacity
High crushing strength	Low & stable pressure drop with plug flow & no channelling
High attrition resistance	No powder formation, no downstream powder issues

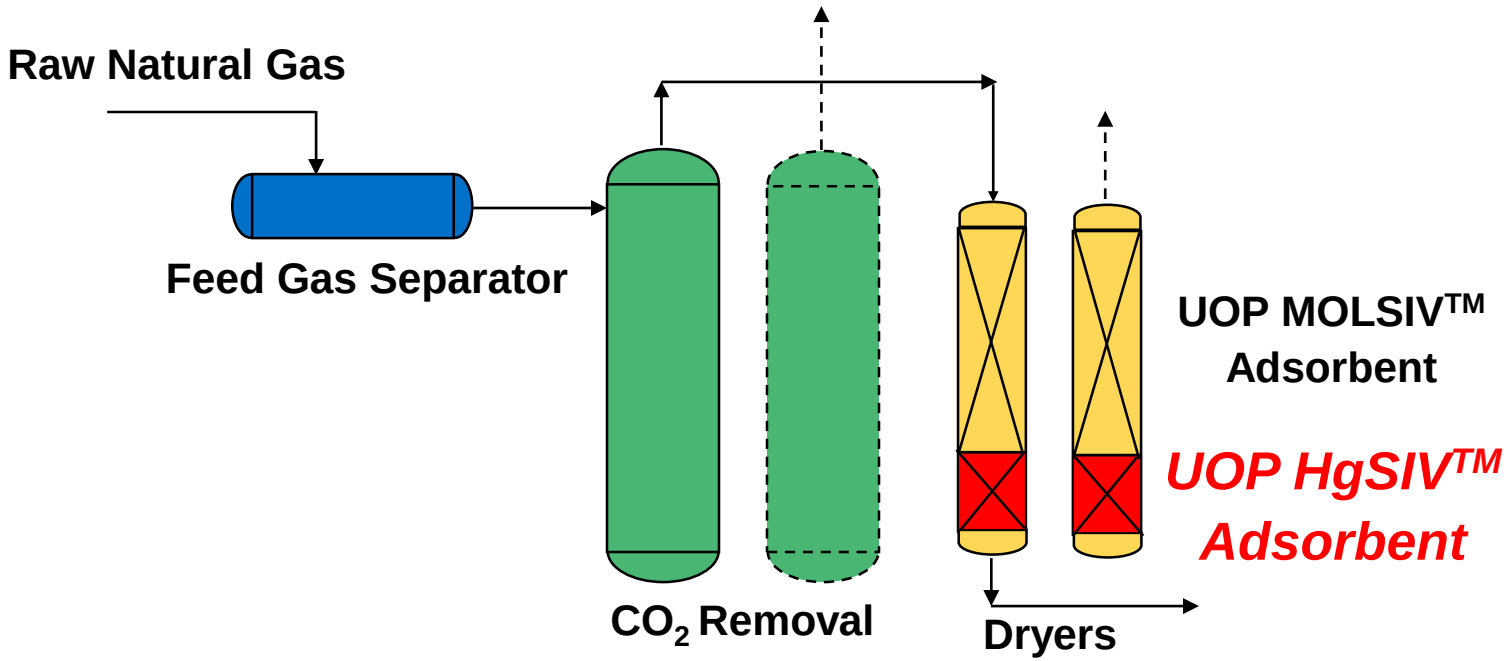
Treatment Locations Within the Gas Plant

- Downstream of the dryers
- Inside the dryers
- On the regeneration gas from the dryers
- Upstream of the amine and dryer units

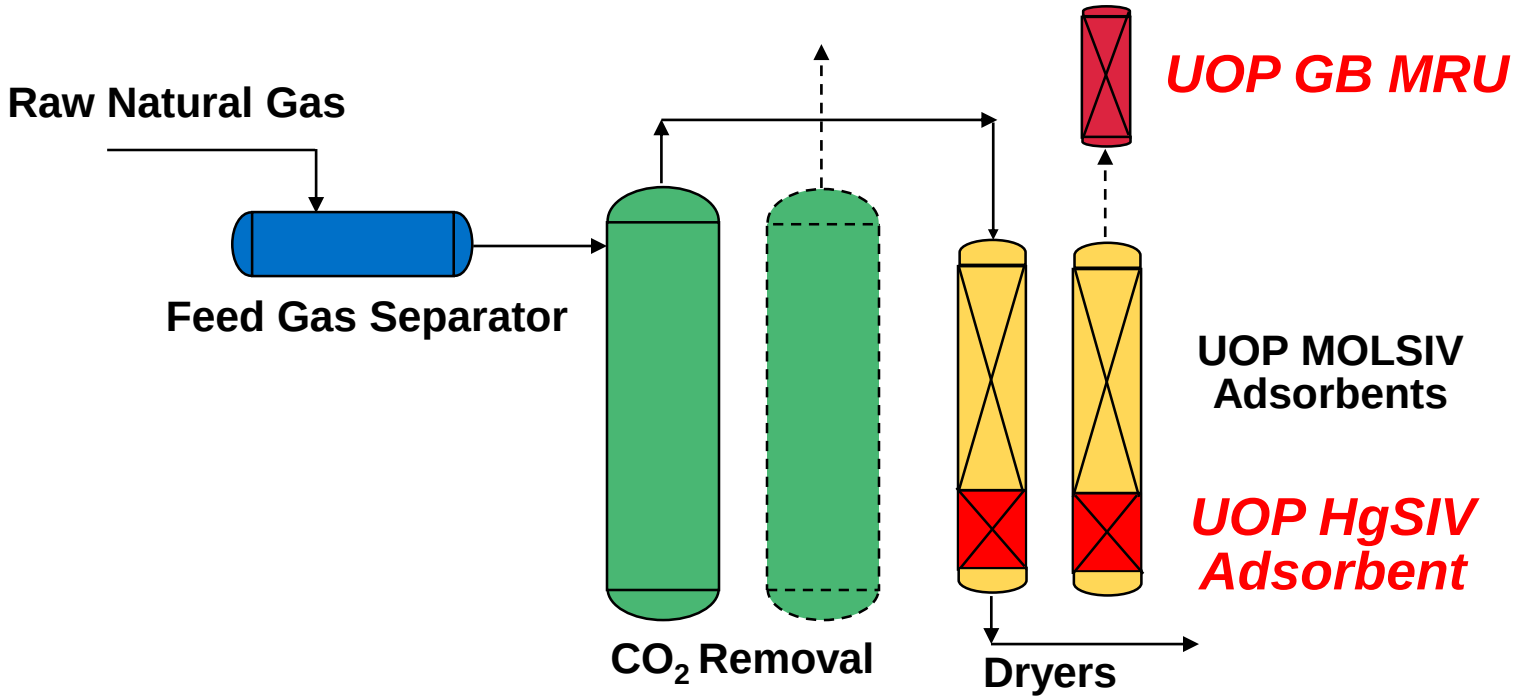
Downstream of the Dryers



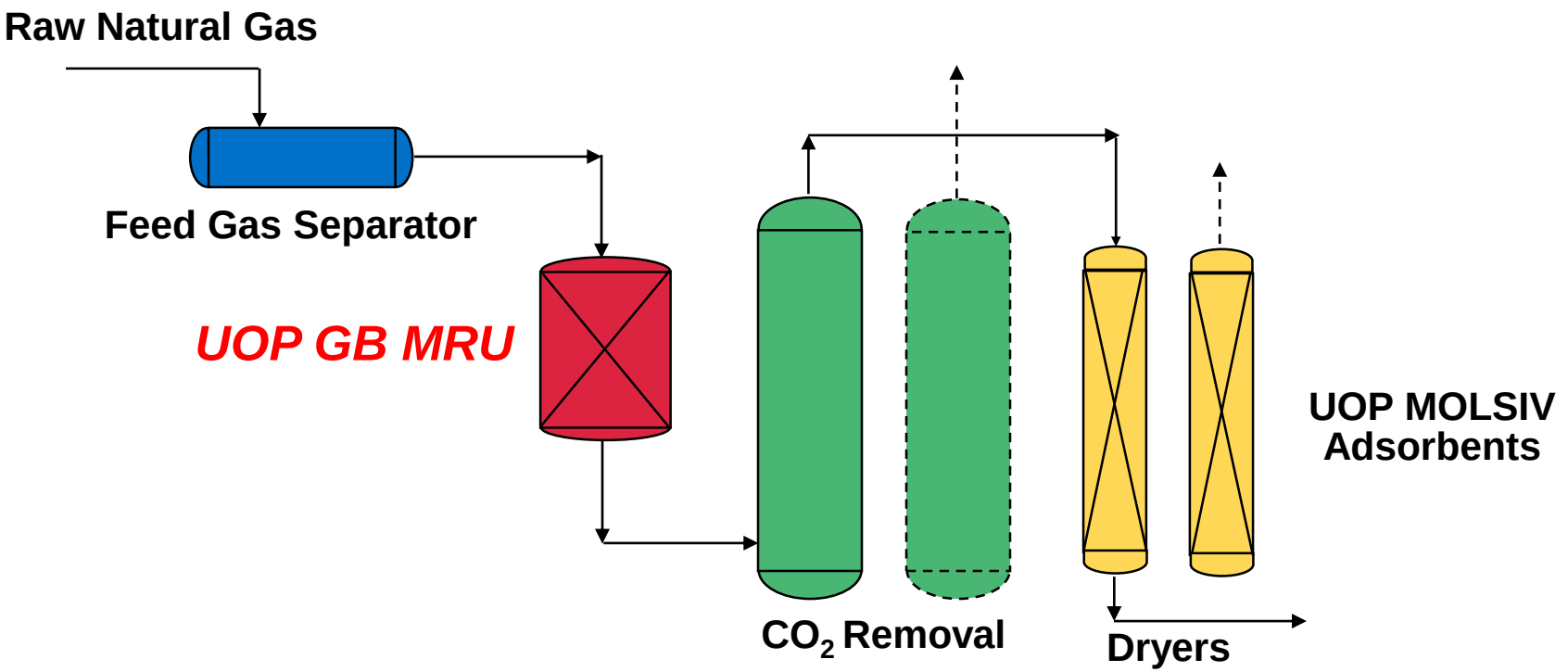
In the Dryers



In the Dryers & on the Regeneration Gas

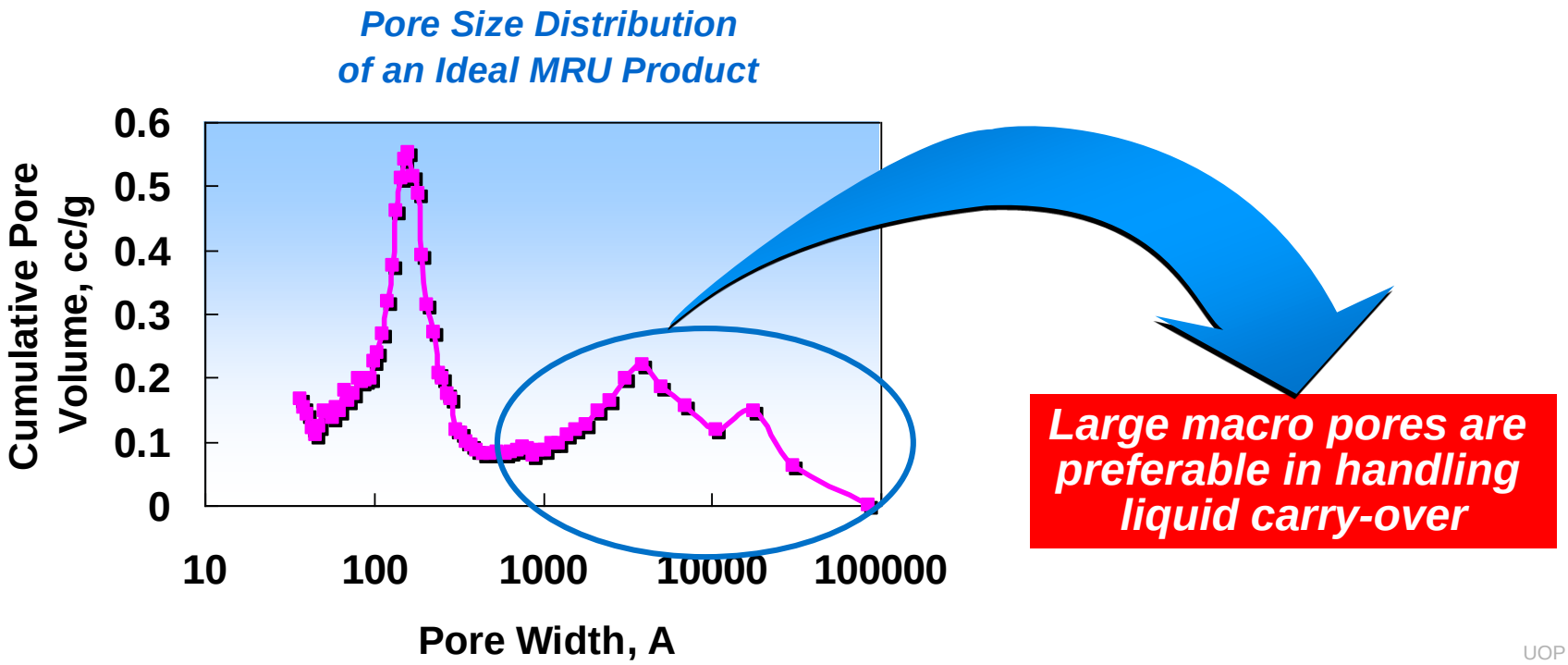


Upstream of the Amine and Dryer Units



MRU Resistance to Liquid Carry-over

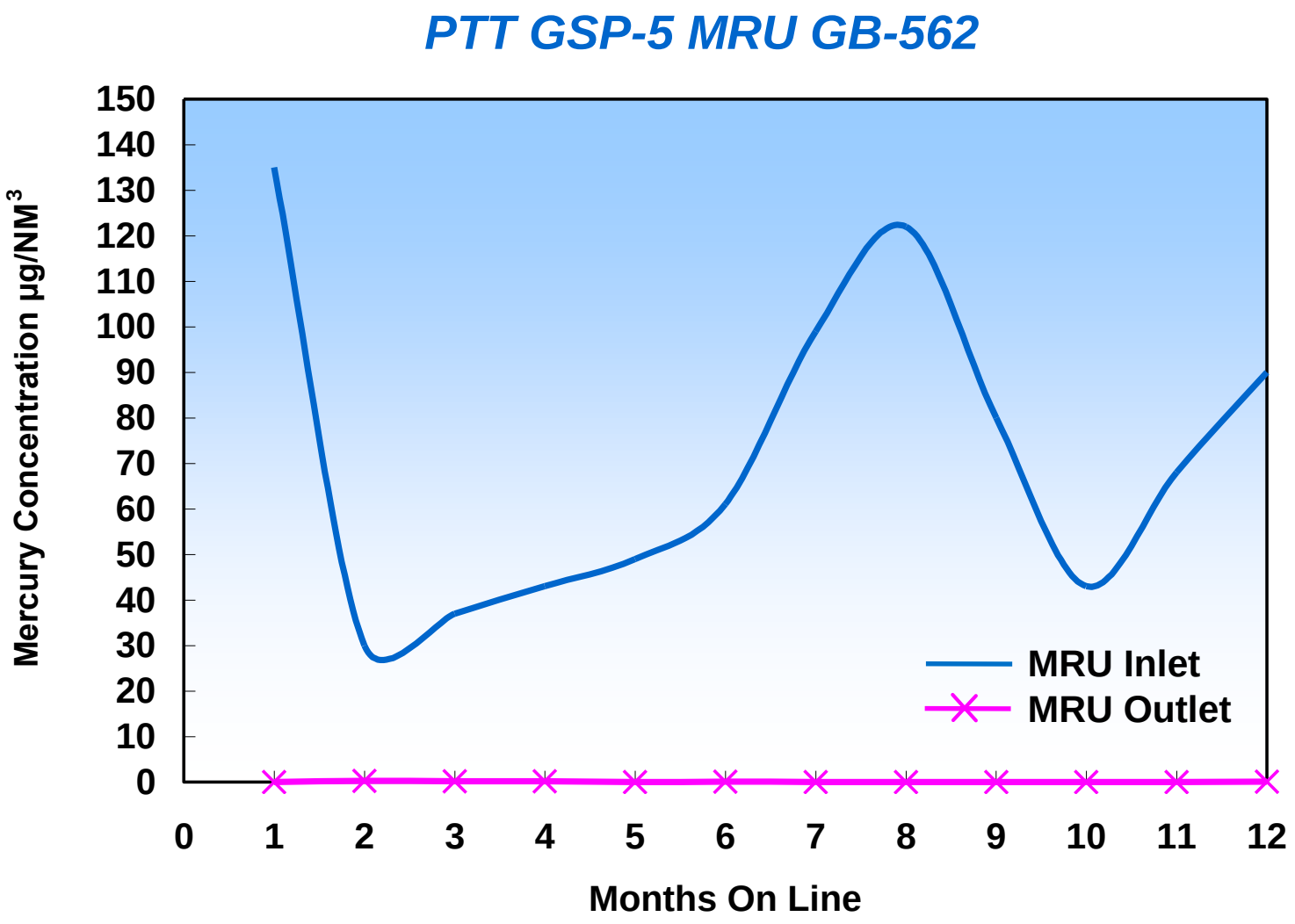
- More gas processors require the treatment of on and off-shore raw gas streams close to their dew point
- Both liquid hydrocarbons and water can be an issue with some MRU products
- Successful MRU products are developed to withstand transient carry-over



Case Study 1: Gas Phase GB-562

- PTT GSP-5
- S-Up March 2008
- Flow-rate 265MMSCFD/vessel
- Operating pressure 48 Kg/cm^2
- Operating temp 18°C
- 4 year design life
- Replaced carbon

Case Study 1: *Continued*



CASE STUDY 2: Mercury Removal From Condensate

- PTT GSP- 4
- S-Up December 2009
- Flow-rate 6,962 Kg/Hour
- Operating pressure 31 BarG
- Operating temp 12°C
- 4 year design life

Case Study 3: Liquid Phase GB-346

- Oil refiner
- Successful operation since 2006
- 70% propylene / 30% propane
- Flow-rate 14,000 Kg/H
- Operating temperature 35 °C
- Operating pressure 2045 KPaG

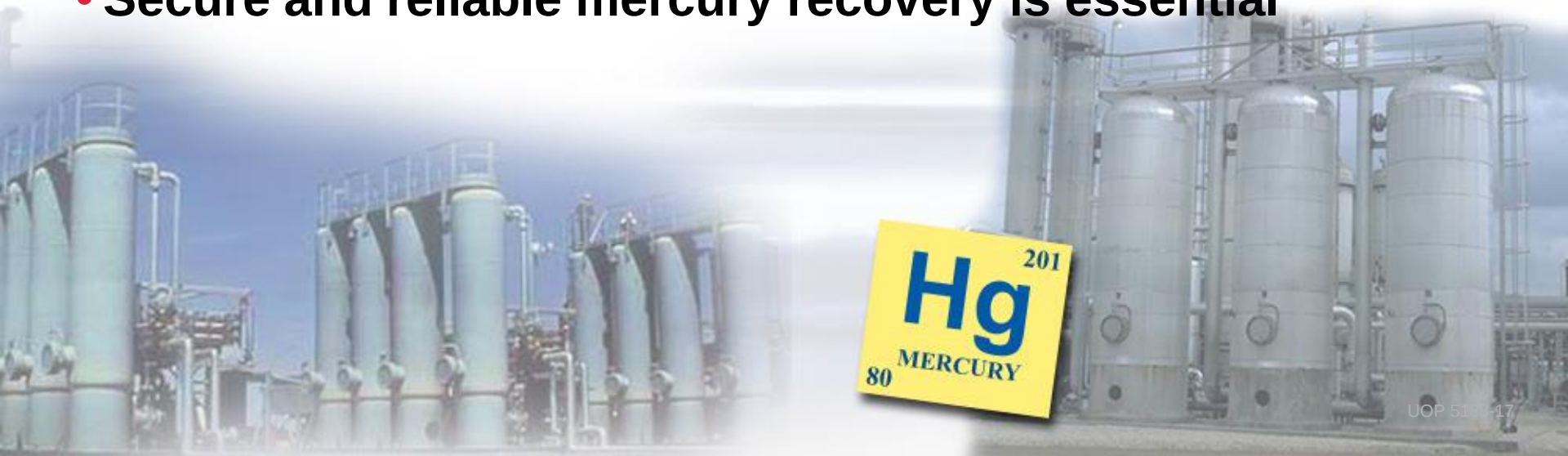
Mercury Management: From On Site Analysis to Hg Recovery

- Important to measure Hg to 0.01 µg/Nm^3 at the plant site
- Each sample gathered and analysed within hours
- Level of Hg quantified before the analytical team departs
- Liquid analysis is available

- GB products are compatible with Hg recovery processes
- Clients are placed in touch with certified mercury recovery outlets
- Hg is separated via retort oven & vacuum distillation at 600°C
- Reclaimed Hg is used in existing industries
- Copper waste goes to smelters and is sold onto the open market

UOP Mercury Removal Philosophy

- Gas processors need the choice of non-regenerable and regenerable mercury removal options, as applicable
- Flexible flow-sheet location choices are paramount in positioning an MRU
- Raw gas MRU technology should be able to resist transient, episodic liquid carry-over
- Mercury measurement techniques need to provide dependable, accurate and precise analytical data
- Secure and reliable mercury recovery is essential




Q&A