Challenges in Managing Mercury in Field Development and Production

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Identification of Mercury Species in Condensate and Subsequent Evaluation of the Removal Efficacy of Various Chemicals and Gas Purging Technology

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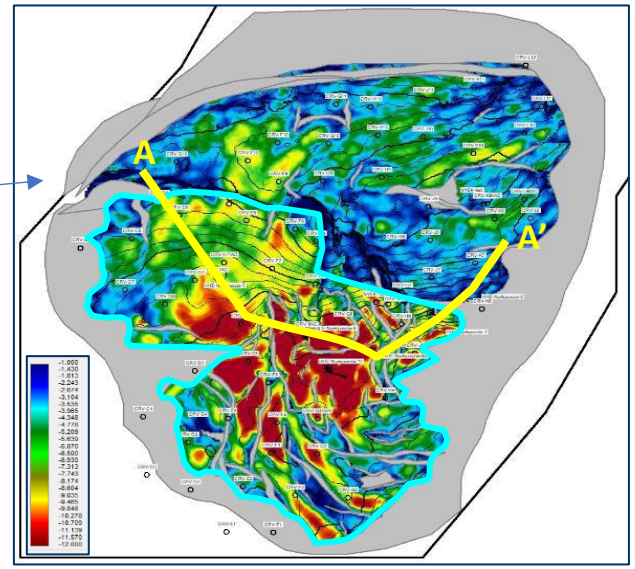
Contents

- Reservoir and Production Background
- Condensate Characteristics
- Background to Discovery of Mercury Presence
- Trials to Reduce Mercury by Chemical Treatment
- Trials to Reduce Mercury Using Gas Purge Technology
- Next Steps

Reservoir and Production Background

- Corvinus Project – JV with MVM CEEnery since 2021
- 6 HPHT Gas-Condensate Production Wells, the next one is under drilling, rather unconventional characteristics
- TD varies between 3702-4500 m TVD
- Opened intervals between 3635 – 4183 m TVD
- Hydraulic fracturing is a common treatment in these wells
- Multilayer commingled production from Mid-Miocene tuffaceous sandstones and micro-conglomerates
- Production was very often limited due to issues with Mercury, the wells are able to provide higher rates.

Seismic anomaly map of the Field



	Above 4200 m TVD	Below 4200 m TVD
Thickness	1-30 m	15-20 m
POR	6-25 %	5-10%
Perm	<0.1 mD	
Pres	>2.2 SG PP	
Tres	>200 deg C	

Cumulative Field Production*

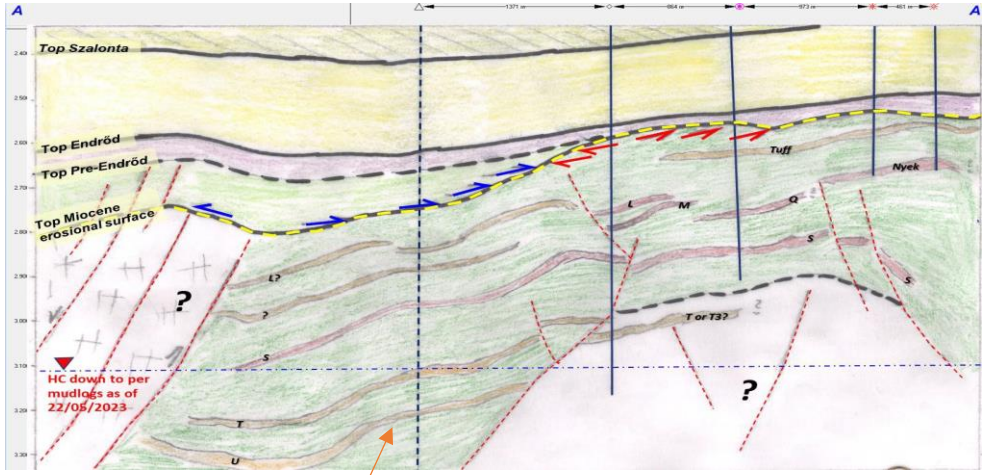
Gas 182.7 MMm³
Cond. 232.7 Mm³
Water 77.4 Mm³

*until 06.2025

Current Daily /well

Gas 69-133 Mm³
Cond. 77-137 m³
Water 9-72 m³

Simplified A-A' geological cross-section through the area



The red patches show the producing levels

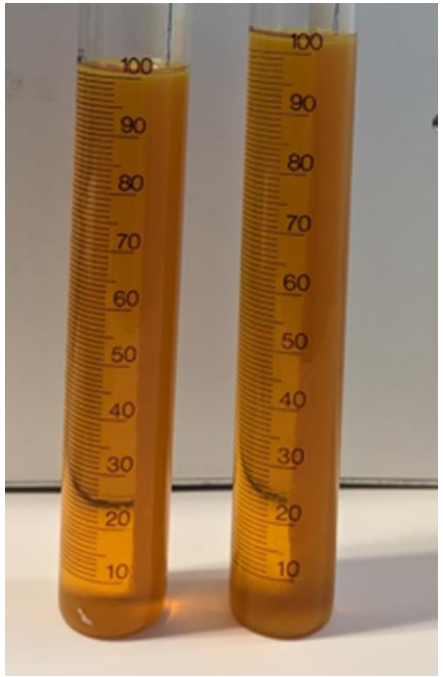
Condensate Characteristics

Produced condensate has orange waxy appearance with following characteristics

- Density – 0.82 kg/L , API – 40.5
- Visual wax Appearance Temperature - ~50˚C
- Wax Content - ~10%
- H_2S Concentration – 50 ppm
- Mercury Concentration - ~300 – 800 ppb (µg/kg)

Condensate at Ambient 20˚C

Condensate at 60˚C



Background to Discovery of Mercury Presence

- Sales specification limit of < 100 µg/kg (ppb m/m)
- The product was frequently above the specification limit, which risked continued production as there were no other export routes

Initial Solution:

- Settling in the storage tanks at temperatures below the wax appearance temperature

Issue:

- Losses in production (~10%)
- The wax into which the mercury settled was difficult to remove from tanks

Initial Mercury Concentration @ 60°C: 414 µg/kg

Depth from bottom (%)	Mercury (µg/kg)
90	17
50	15
5	1308

Heated to 32°C and allowed to settle for 8 hours

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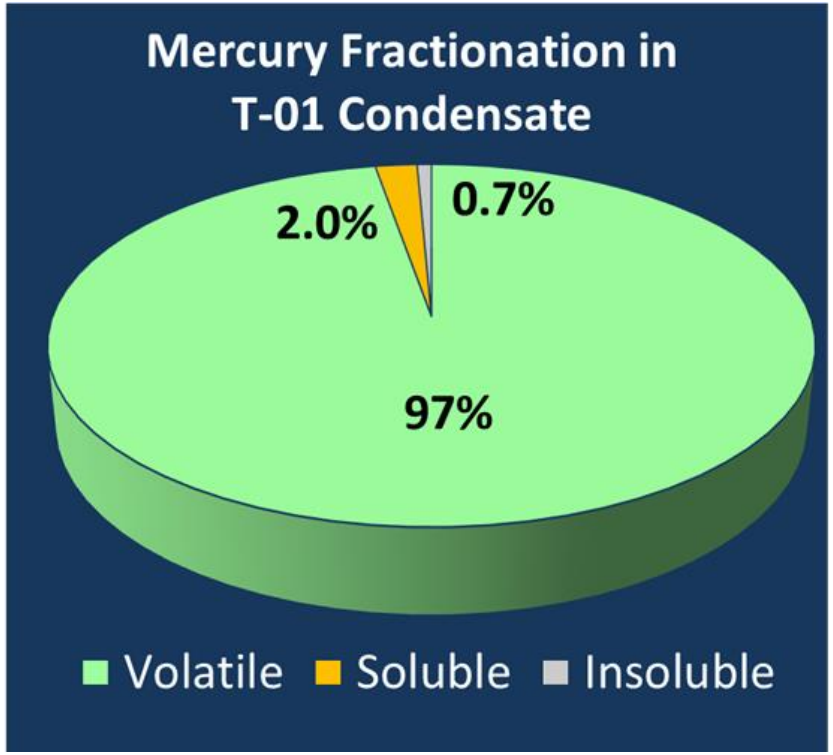

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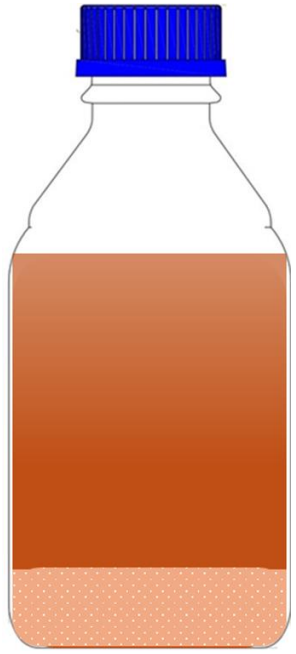

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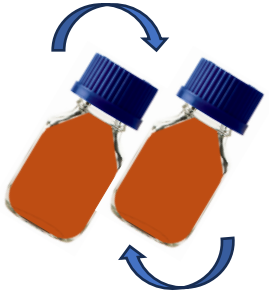
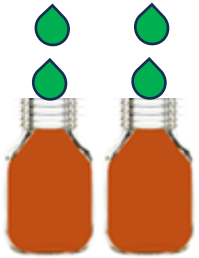
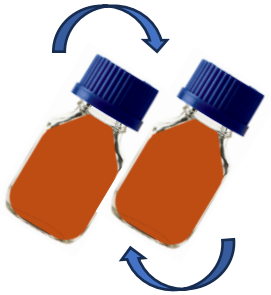
Trials to Reduce Mercury by Chemical Treatment

Laboratory based bottle tests all conducted at 70°C

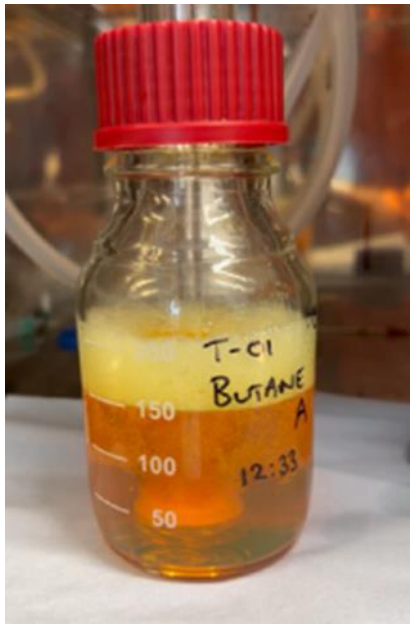
	Initial Heating	Chemical Addition	Mixing	2 Hour Reaction Period	Determination of Mercury Functional Species	
Controls (duplicate)						Volatile/Elemental Hg Non-volatile Soluble Hg Insoluble Hg
Chemical (duplicate)						Volatile/Elemental Hg Non-volatile Soluble Hg Insoluble Hg

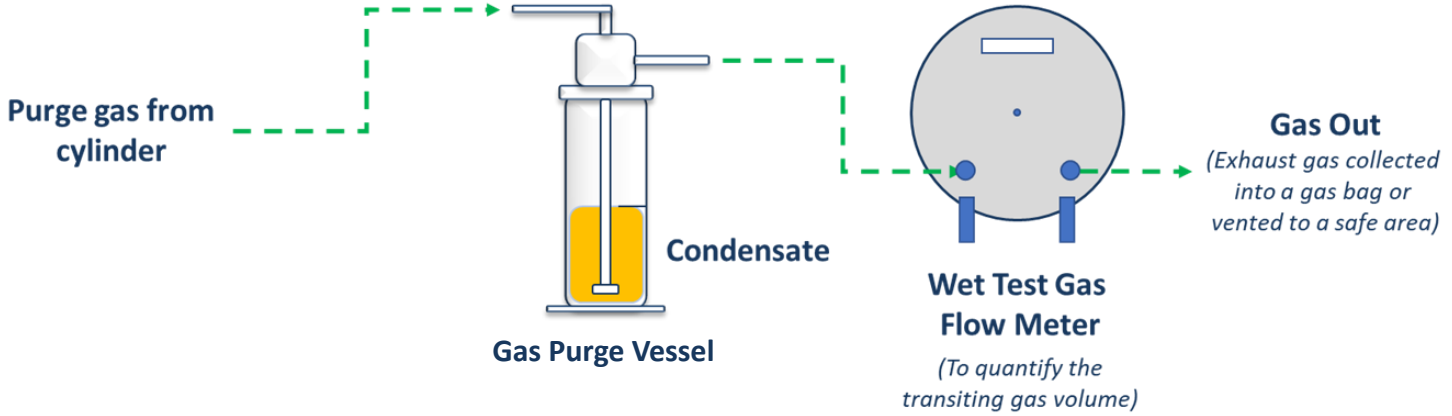
Trials to Reduce Mercury by Chemical Treatment

Chemical Tested	Success at Converting Signficant % of Volatile/Soluble Mercury to Insoluble Mercury (greater than 20% conversion)
Chemical A	✗
Chemical B	✗
Chemical C	✗
Chemical D	✗
Chemical E	✗

Trials to Reduce Mercury Using Gas Purge Technology

Laboratory analysis showed that after last stage of separation during stable production > 90% of the mercury is in the form of volatile mercury that can be removed by purging with either inert gas or hydrocarbon gas.





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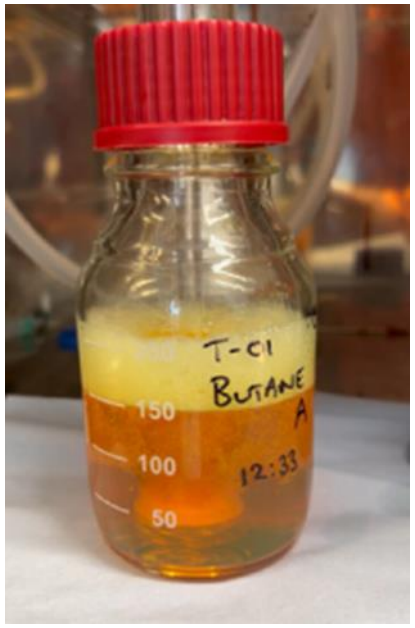


Extended Purge		
Mercury (µg/kg)		Mercury Removal %
Initial	Post Purge	
381	14	*96%*
448	12	*97%*
414	***13***	***97%***

Trials to Reduce Mercury Using Gas Purge Technology

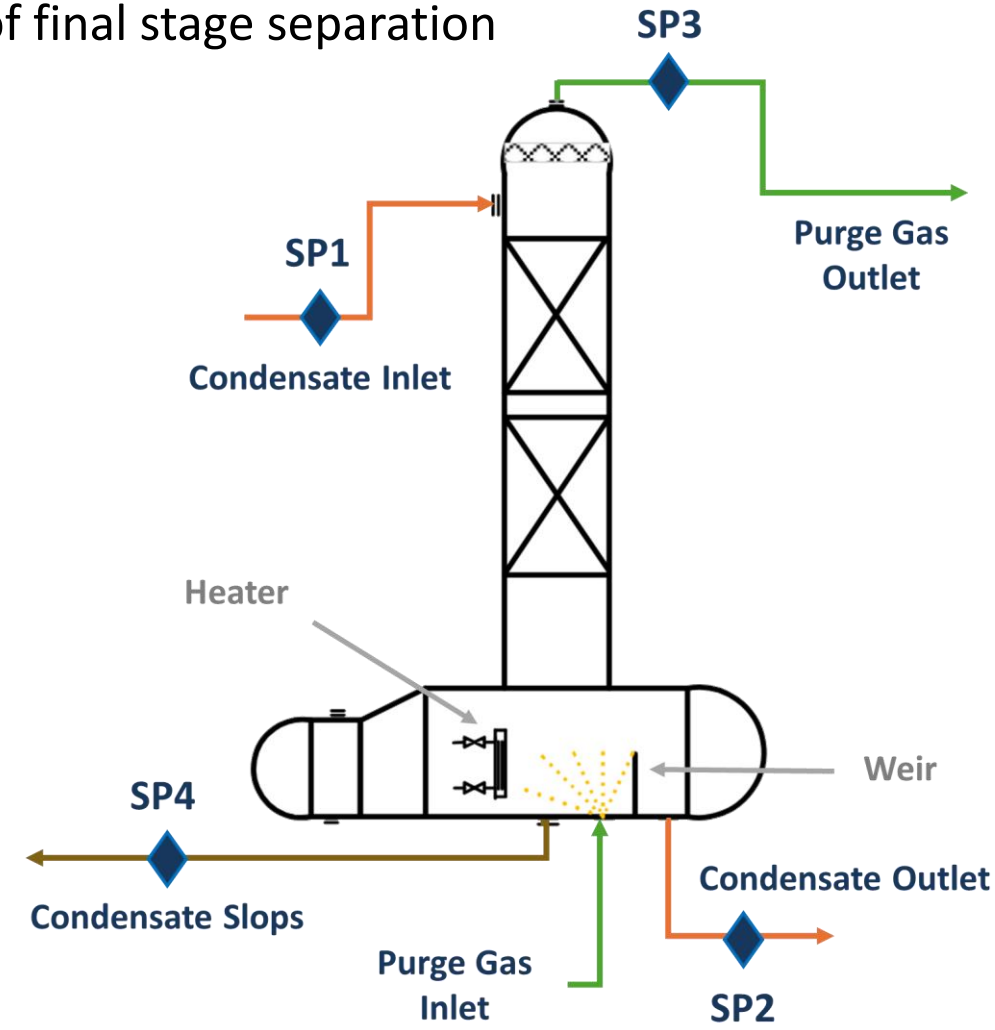
A prototype ‘stripping tower’ was installed downstream of final stage separation

Design:

- Counter-current gas flow
- Weir system
- Heater
- Bespoke tray design

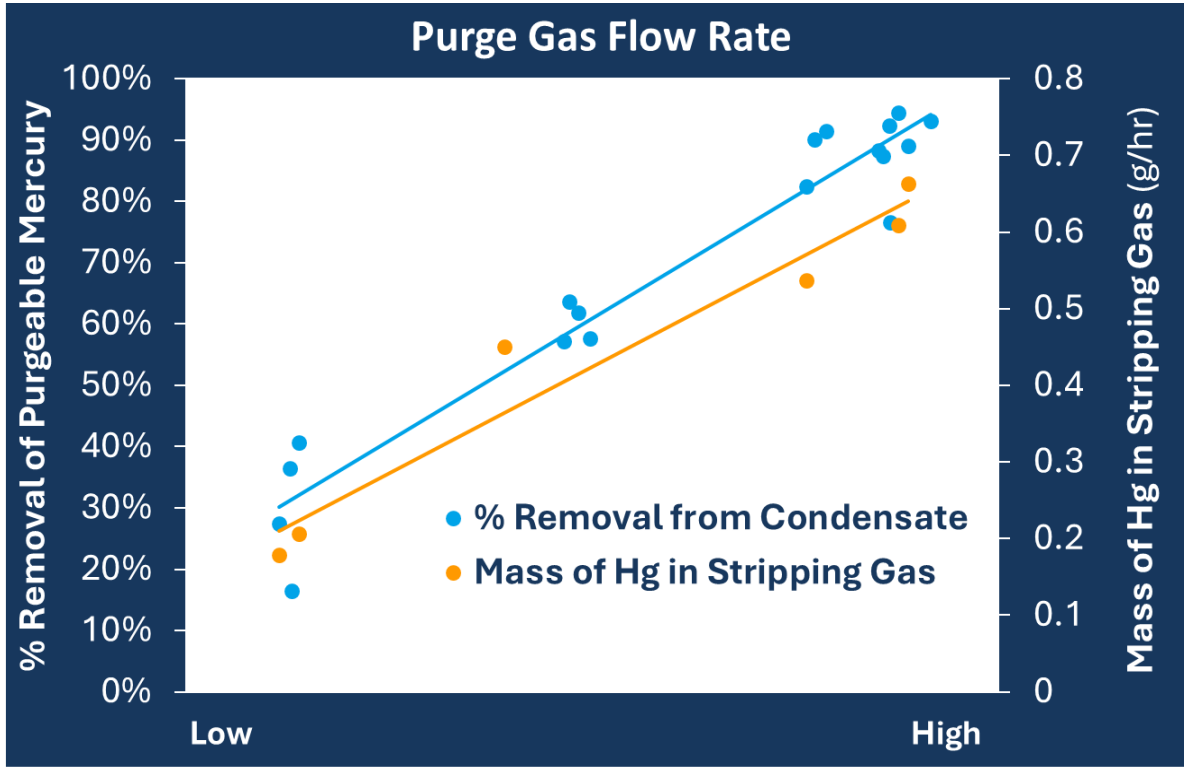
Parameters to consider:

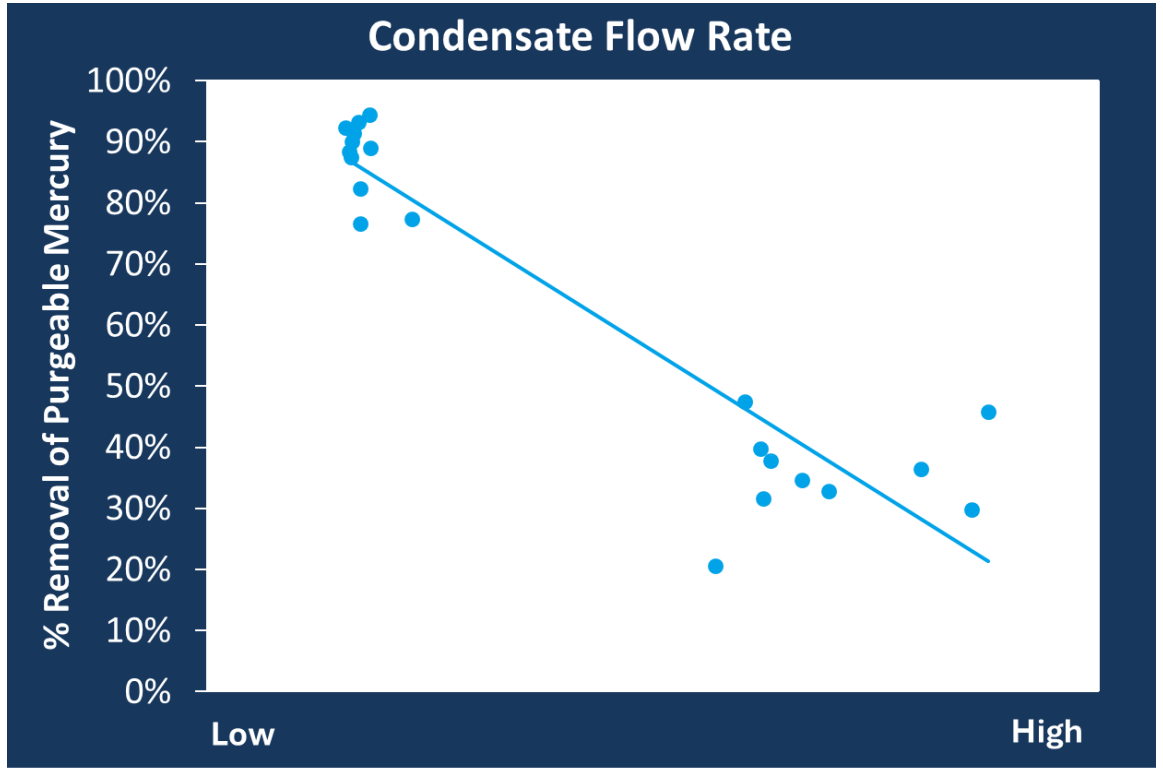
- Condensate temperature
- Condensate flow rate
- Purge gas flow rate
- Pressure
- Purge Gas (Commercial Propane / Export Gas)



Trials to Reduce Mercury Using Gas Purge Technology

How Parameters Affect % Removal of Purgeable Mercury





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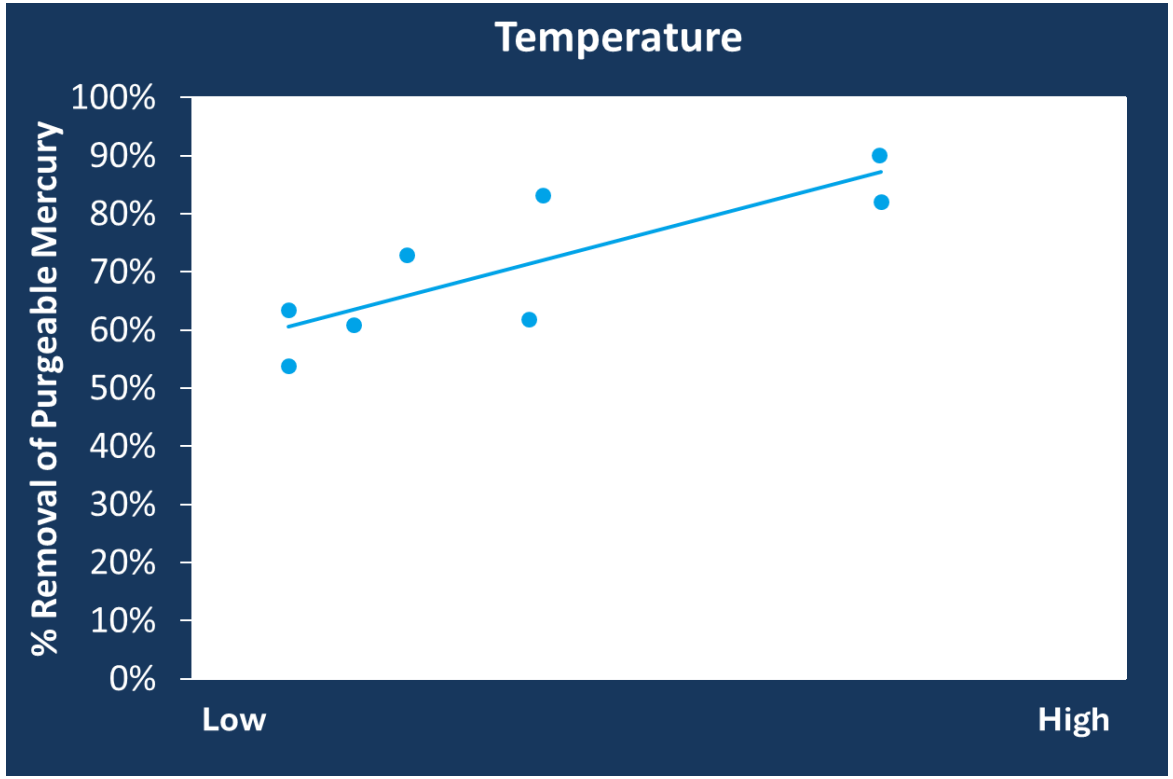
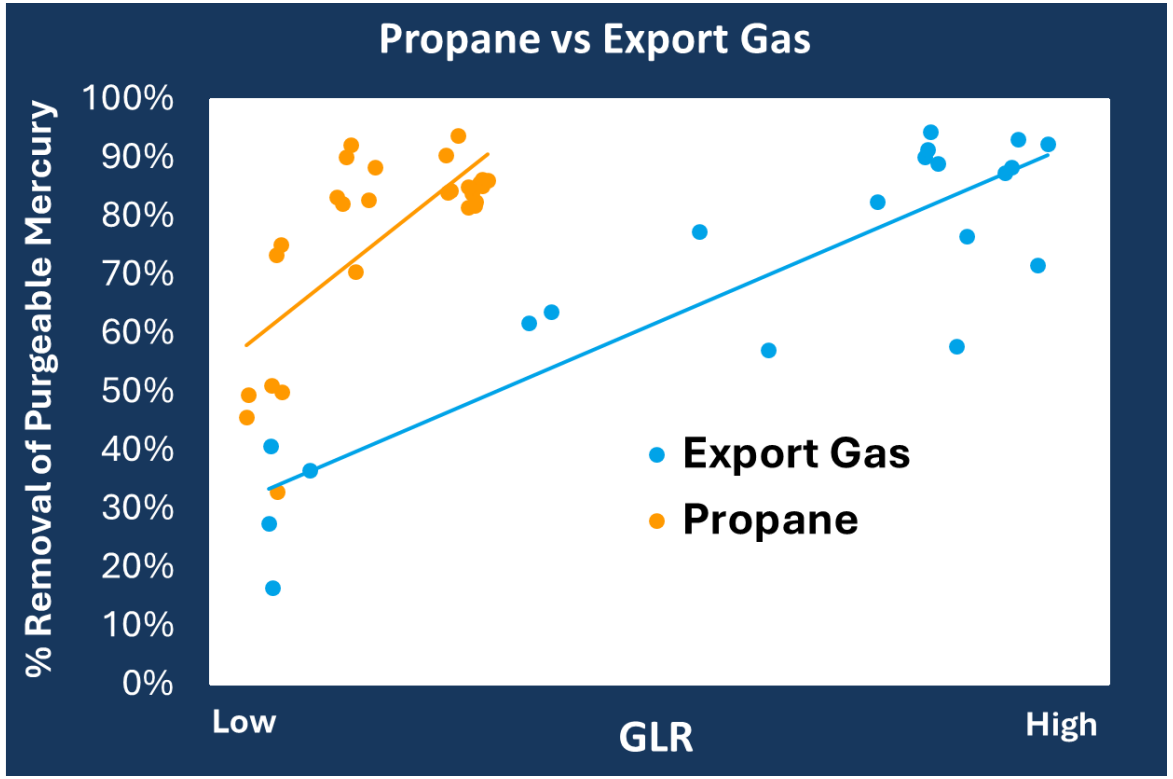
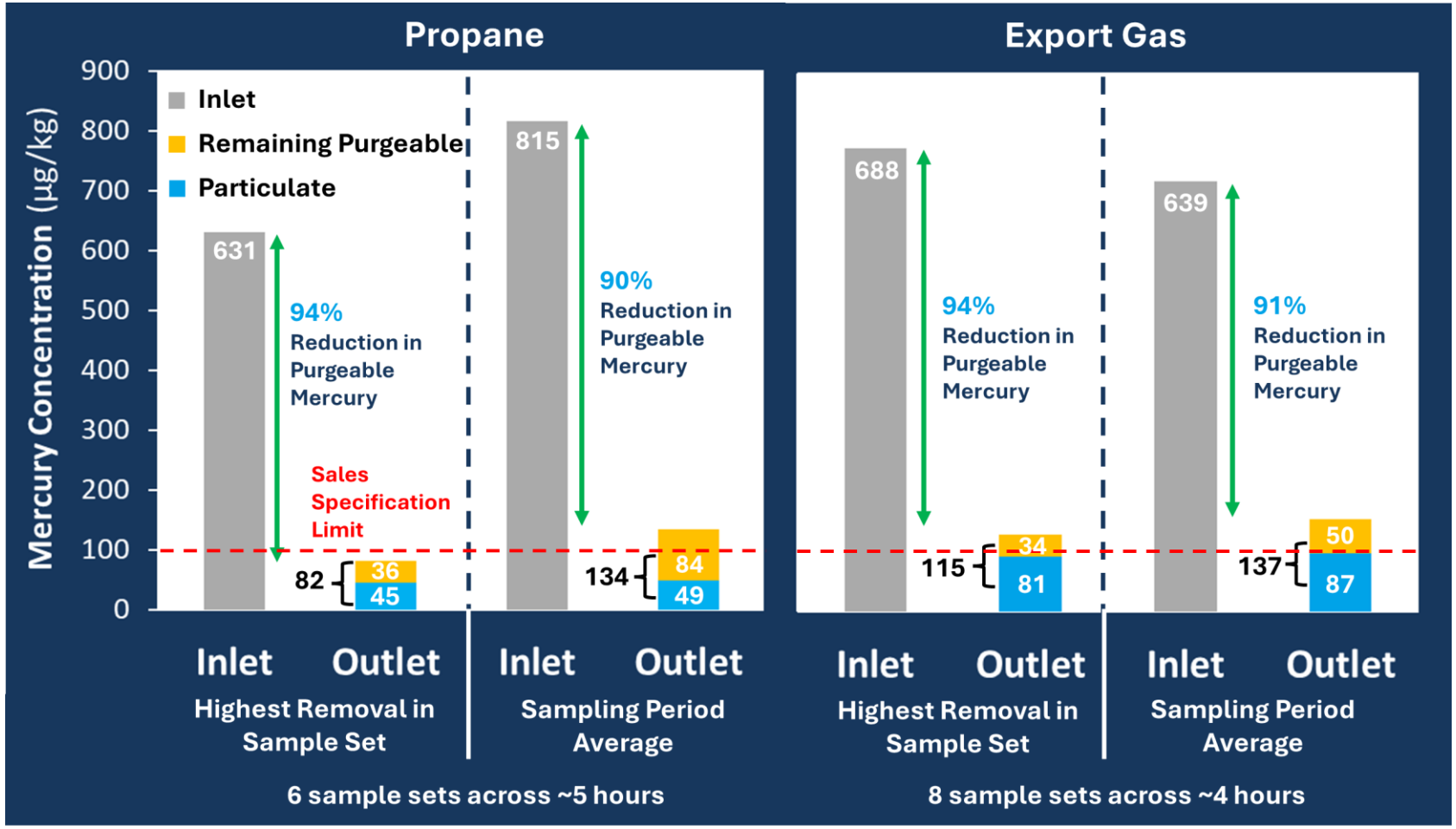




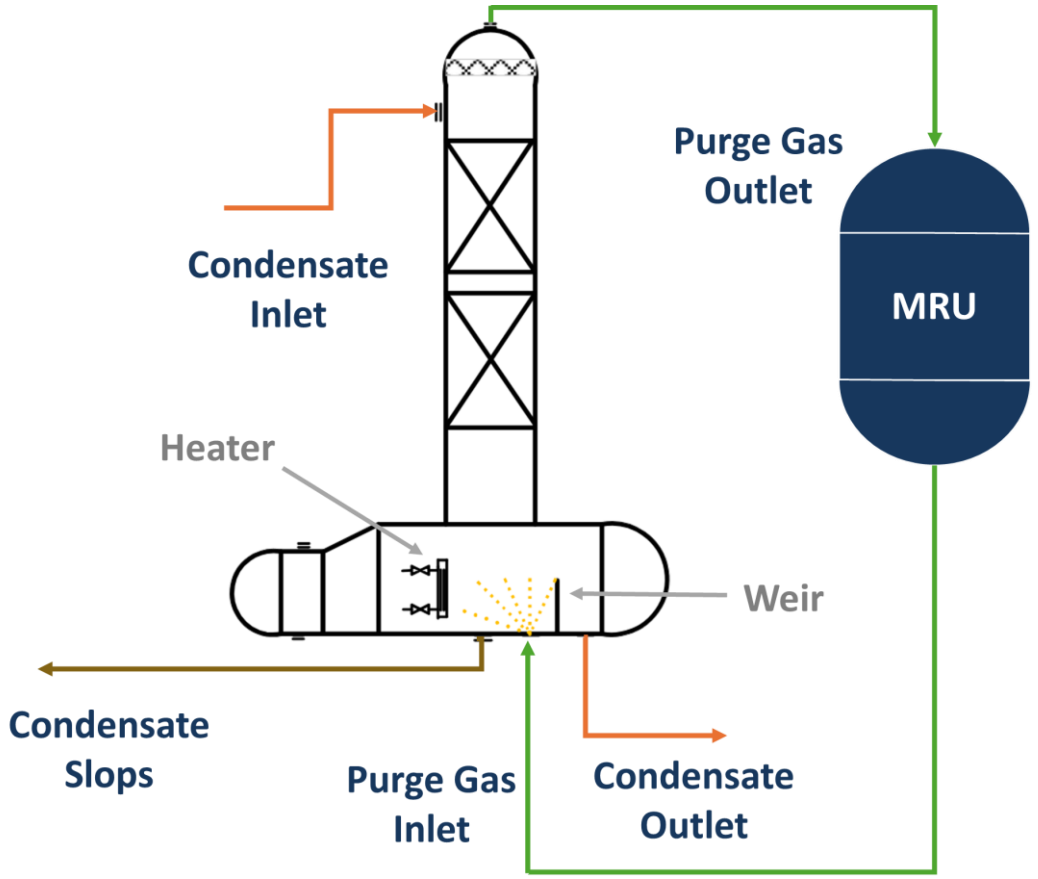
Trials to Reduce Mercury Using Gas Purge Technology

Stripping Tower Optimal Performance



Next Steps

- Due to install a larger stripping tower with the capacity to process all of production
- The new design incorporates a gas MRU on the purge gas outlet
- A filter system for the removal of particulate mercury



Thank you for your attention

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