ProTreat®

The mass transfer rate based gas treating simulator

Sour Water Stripping WWT Technology

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REFCOMM GALVESTON

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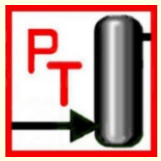
Refinery Sour Water Systems

- Phenolic
  - FCCs & Cokers
- Non-phenolic
  - Hydro-treating/HDS
- Organic & Inorganic impurities
  - Hydrocarbons, phenols
  - HSSs



Why 2-Stage WWT Process?

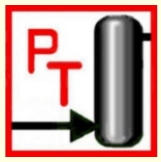
- Historically NH_3 sent to Claus SRU to be thermally destroyed
- Today's high-nitrogen, high-sulphur crudes can sometimes make NH_3-recovery worthwhile
- Removing NH_3 unloads the Claus SRU hydraulically, removes front-end air requirement, thermodynamically higher sulphur recovery
- 2-Stage process allows for NH_3 and H_2S to be removed separately

Two Simulation Cases

- Two-stage Sour Water Stripping
  - WWT Process – developed by Chevron, recently acquired by Bechtel
  - Recoveries H_2S and NH_3 separately
  - Purity of products
- Ammonia Purification (2-stage)

About the *ProTreat*® Simulator

- Same basis as ProTreat® for amines
- Mass transfer rate-based for H_2S, CO_2, NH_3, $R_{1-4}SH$, H_2O transport; equilibrium for inerts; includes kinetics
- All separations equipment characterized by individual phase mass transfer coefficient and interfacial area correlations — similar to HTXR calculations
- Fully predictive — NO GUESSWORK, no efficiencies, no HETPs, no ideal stages, don't have to know the answer first!!!
- Right answers out of the box without fitting — just data from P&IDs and internals vendor data sheets

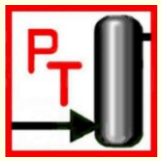


Case 1: 2-Stage Stripping

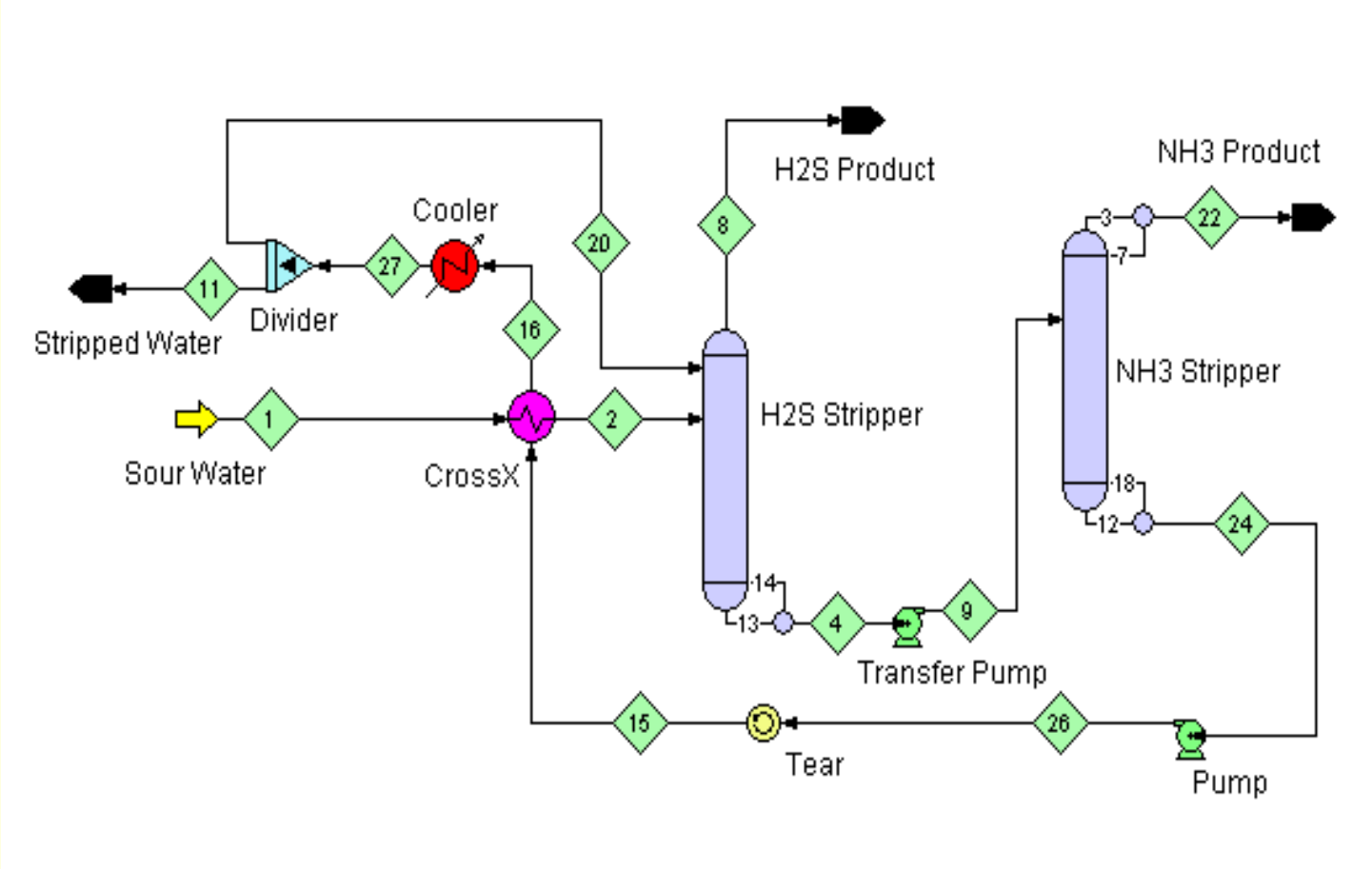
Sour Water Feed Conditions

Stream 1

Temperature (°F)	100
Pressure (psig)	90
Total flow (USgpm)	200
Hydrogen sulphide (wt %)	0.90
Carbon dioxide (wt %)	0.05
Ammonia (wt %)	1.00

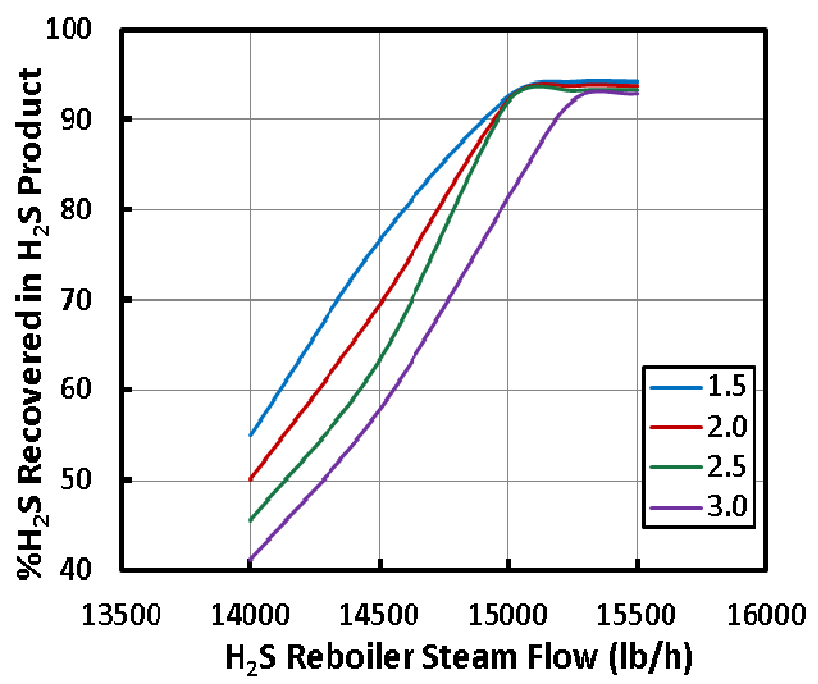


Simplified Chevron WWT Process Flowsheet

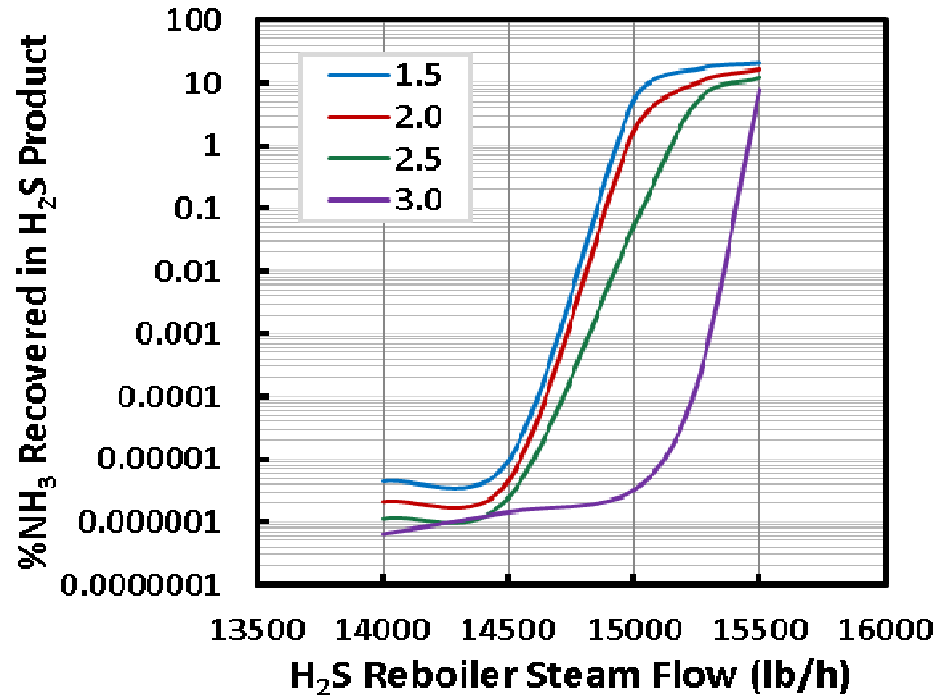


H_2S Product Stream

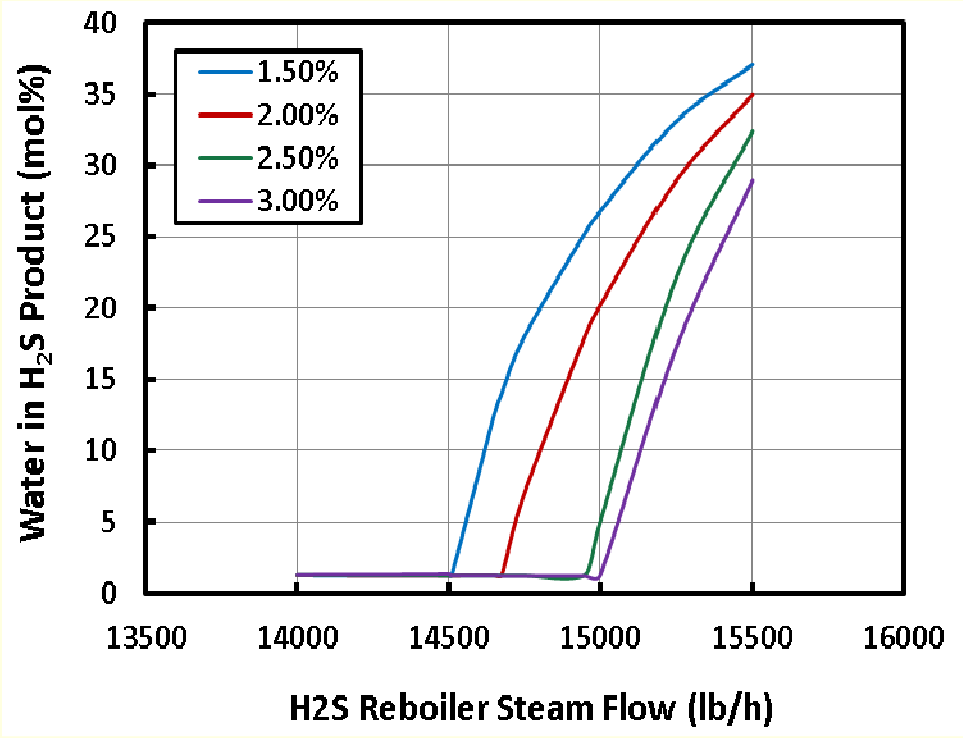
H_2S Recovery



NH_3 Recovery

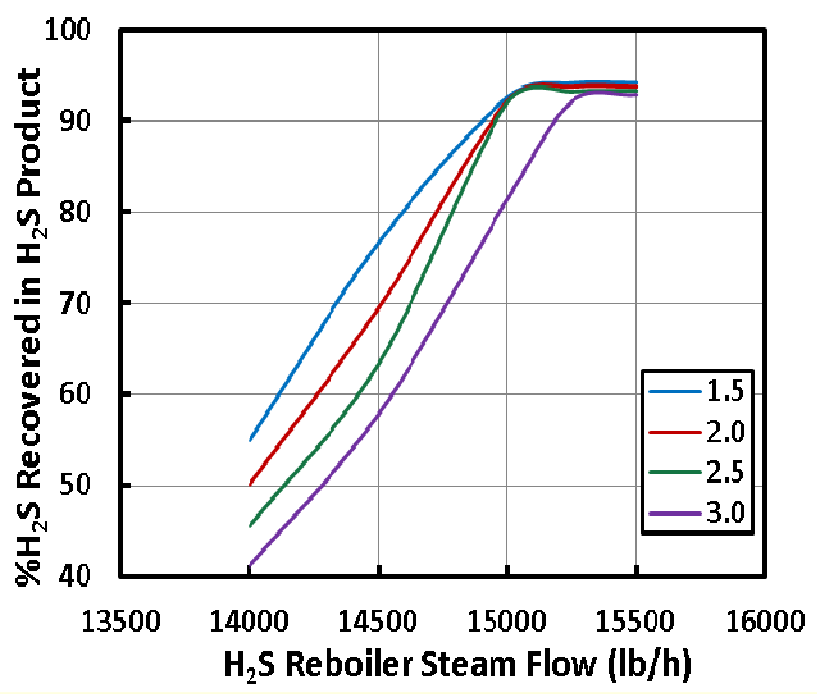


H_2S Product Stream

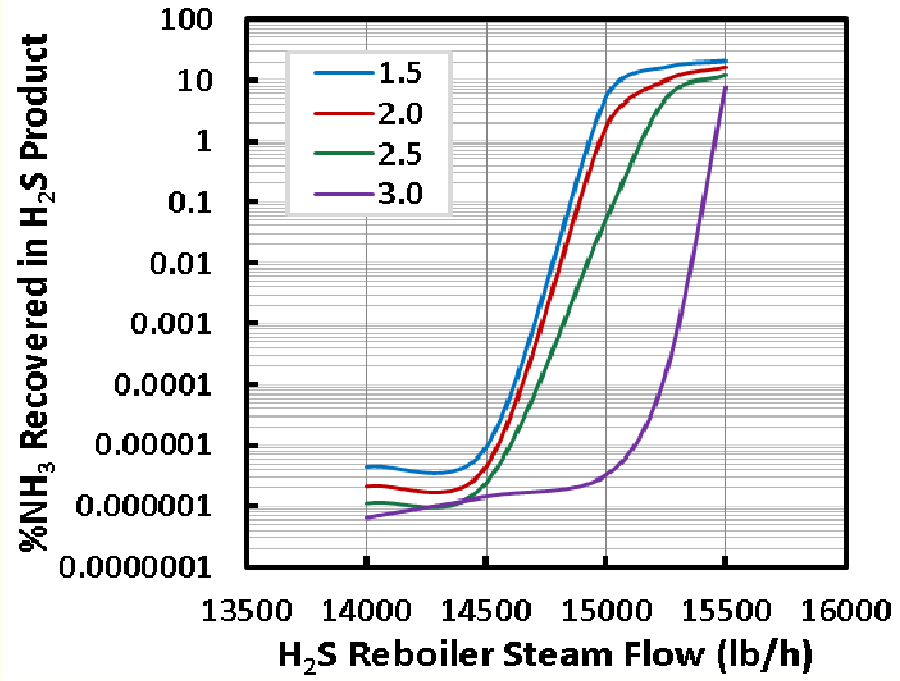


H_2S Product Stream

H_2S Recovery

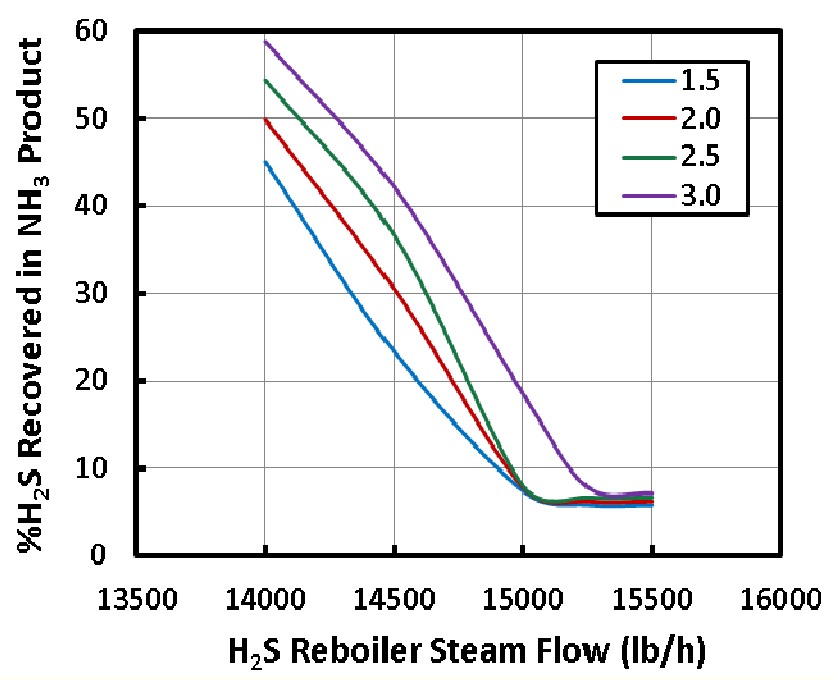


NH_3 Recovery

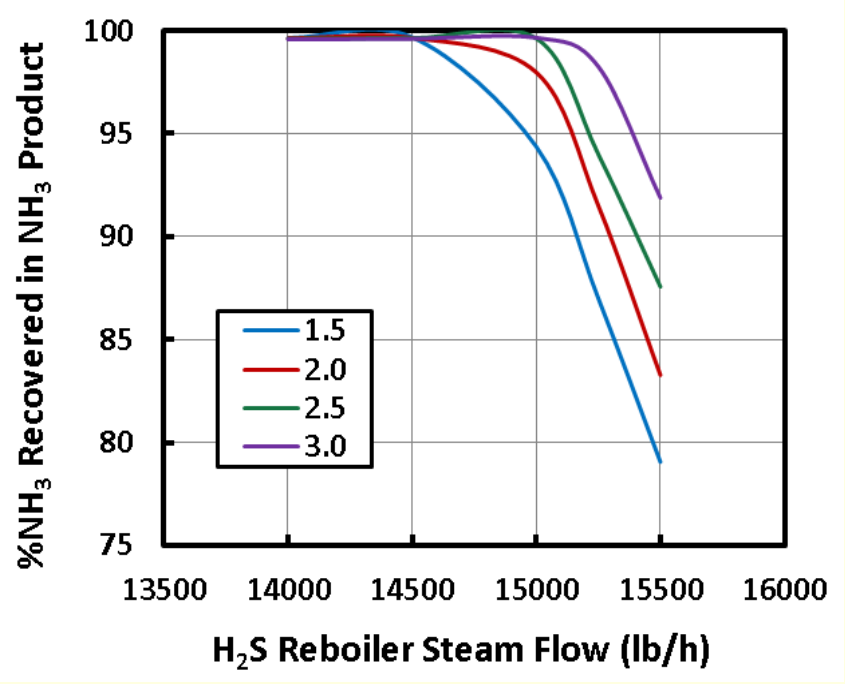


NH_3 Product Stream

H_2S Recovery

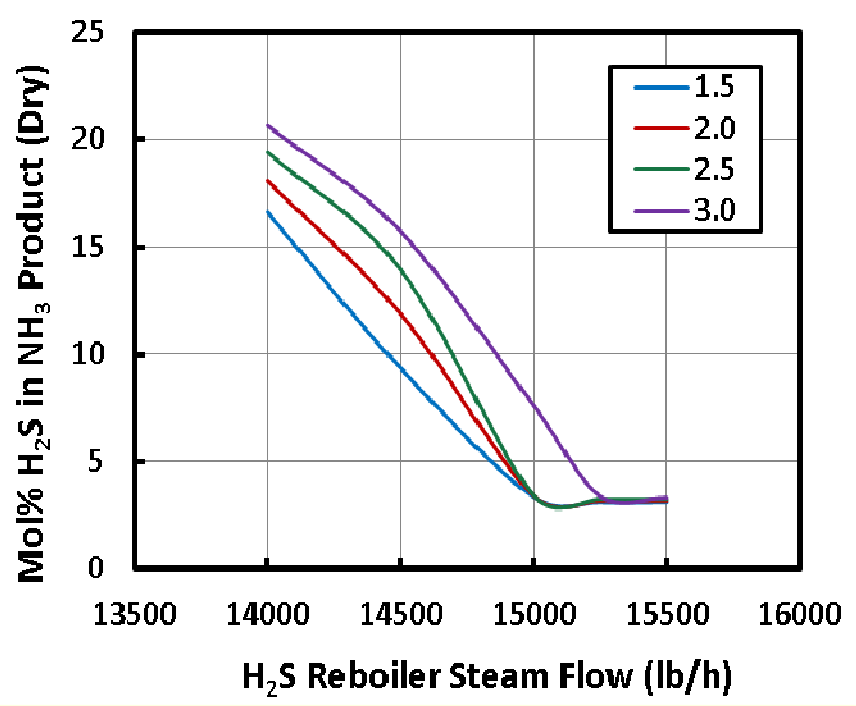


NH_3 Recovery

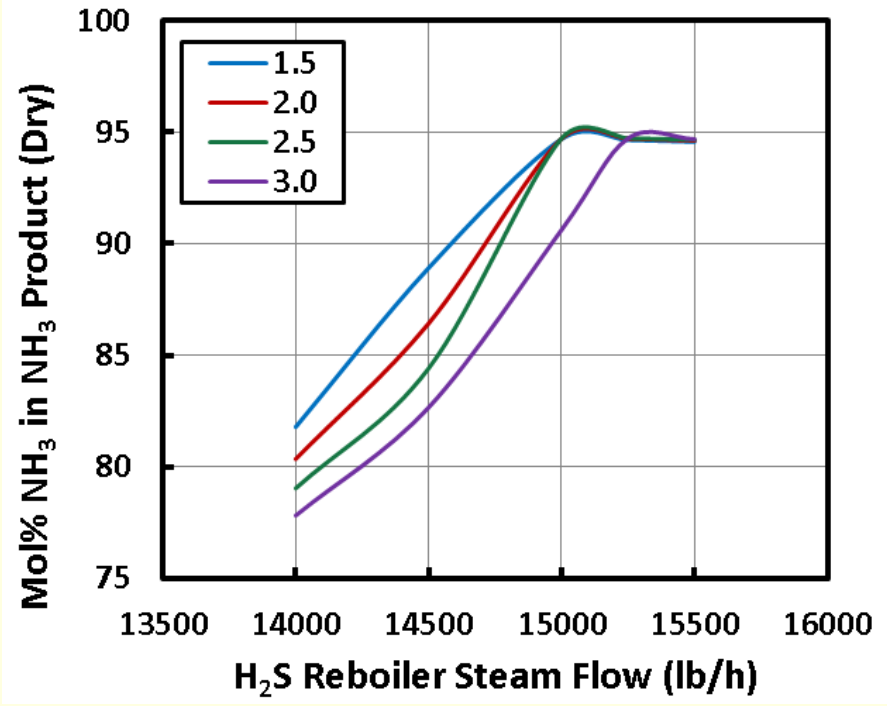


NH_3 Product Stream

H_2S in NH_3 Product



NH_3 in NH_3 Product

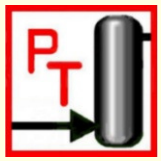


Case 2: Ammonia Purification

Crude Ammonia to Purification

Stream 2

Temperature (°F)	160
Pressure (psia)	26.4
Water (lbmol/h)	10.1
Hydrogen sulphide (lbmol/h)	2.1
Ammonia (lbmol/h)	57.7



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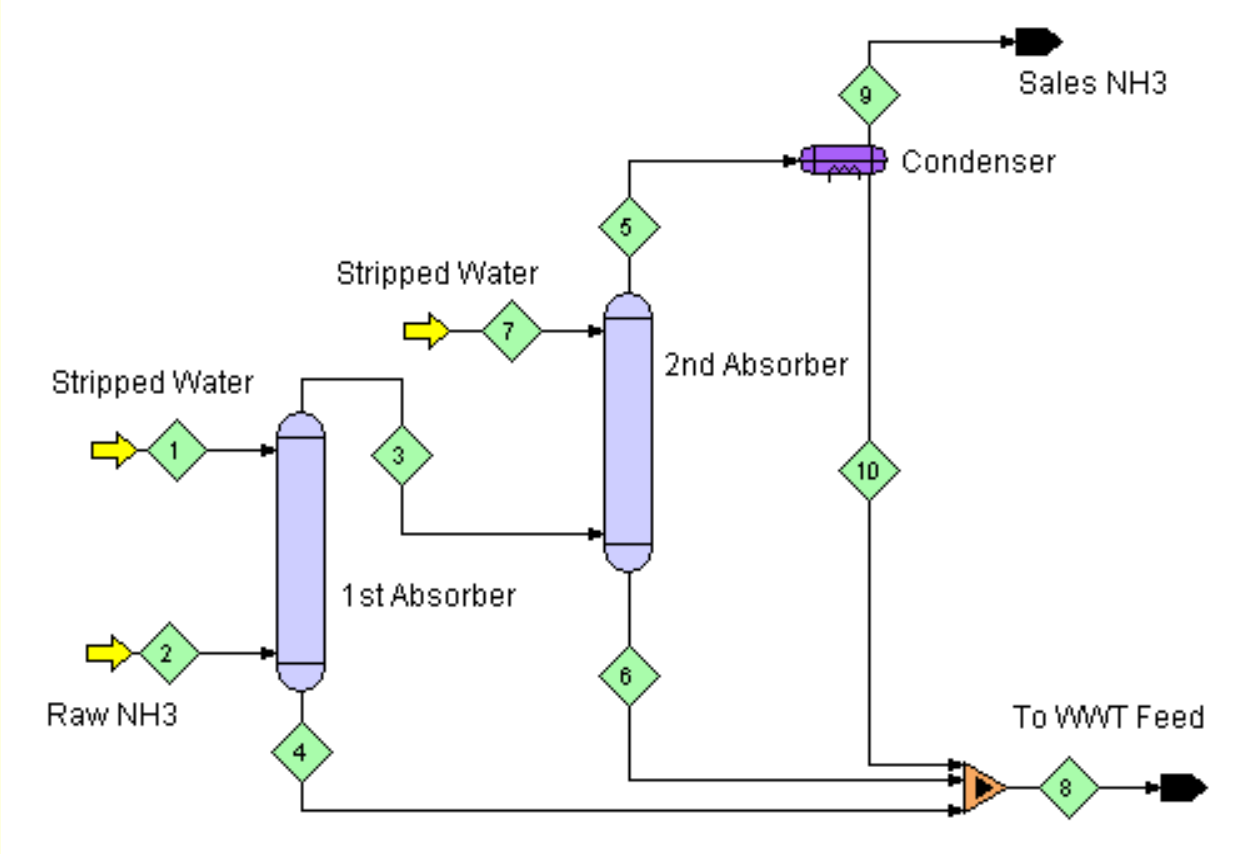
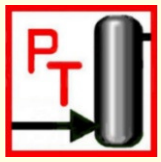


Summary

- WWT technology can produce valuable products from the gases in sour water
- The overall process is controlled entirely by the performance of the H_2S-stripper
- H_2S Stripper at 80 to 100 psig produced far poorer separations than the pressure of 60 psig actually used in the plant that served as a prototype for our study

Summary (con'd)

- The purpose of the NH_3 stripper is to produce acceptable treated water
- External reflux and reboiler heat load work together to produce a surprisingly sharp transition in water content
- Assessing the economic viability of this process is possible with ProTreat®, the mass-transfer-rate based simulator.



Thank you!

Optimized Gas Treating, Inc.

www.protreat.com

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