

UNITED STATES PATENT AND TRADEMARK OFFICE

SCOUT ENERGY MANAGEMENT, LLC, and
CHEVRON U.S.A. INC.,
Petitioners,

v.

PILOT INTELLECTUAL PROPERTY, LLC,
Patent Owner.

IPR2024-00385
U.S. Patent No. 8,505,332 B1



Patent Owner's Demonstratives

Instituted Claims/Grounds

Ground	References	Basis	Instituted Claims
1	Aycaguer	§ 103	1
2	Aycaguer, Arand	§ 103	1
3	Aycaguer, Soldati	§ 103	1-4, 6, 7
4	Aycaguer, Soldati, Ryan	§ 103	2
5	Aycaguer, Soldati, Arand	§ 103	1-4, 6, 7
6	Aycaguer, Soldati, Ryan, Arand	§ 103	2

Claim Construction

- “Cryogenic Conditions”

cryogenic plant

A gas processing plant which is capable of producing natural gas liquid products, including ethane, at very low operating temperatures, usually below minus 50°F.

GPA Engineering Data Book (EX2025 at 20).

- “Carbon Dioxide Recovery Solvents”

- plain and ordinary meaning: “solvents used for recovery of carbon dioxide.”
- Not limited to “carbon dioxide solvents,” which Petitioners refer to as “solvents having CO₂ affinity” (Petition at 35).

(Response at 6-11.)

Overview of the '332 Patent

“Natural Gas Liquid Recovery Process”

- Recovery of Natural Gas Liquids (“NGLs”) from the “carbon dioxide recycle stream” in an Enhanced Oil Recovery (“EOR”) field.
- NGLs defined as C3-C8 (C3 Propane, C4 Butane, ...) not C1 Methane, Not C2 Ethane.
- Negative Limitations: no use of “cryogenic conditions” or “carbon dioxide recovery solvents”

(Response at 2.)

Overview of the '332 Patent

“Natural Gas Liquid Recovery Process”

- Bridged the gap between two existing technologies, which were the Ryan/Holmes process and the Mechanical Refrigeration Unit (“MRU”).
- Provides a middle ground between the Cadillac Ryan/Holmes process and the budget MRU process.
- Disregards recovery of C1 Methane and C2 Ethane to recover NGLs “with relatively little process equipment or energy” (EX1001, 4:55-60).

(Response at 1; Sur-Reply at 1-2.)

Overview of the '332 Patent

“Natural Gas Liquid Recovery Process”

- The disregard for recovery of methane and ethane is found in independent Claim 1 in at least four places, which are:
 - 1) reciting the hydrocarbon feed stream as including “natural gas liquid (NGL)” (defined in the specification as “C3-C8 hydrocarbons”), then reciting the NGL to comprise “C3-C8 hydrocarbons” - not C1 methane, and not C2 ethane;
 - 2) reciting the sweet and sour NGL streams as “Rich” (“sweet NGL rich stream” and “sour NGL rich stream”). “NGL rich” meaning “relatively lean with respect to methane, ethane, and acid gases” (5:1-2); and
 - 3-4) excluding cryogenic conditions and carbon dioxide recovery solvents from the process, which are necessary for recovery of methane and ethane.

(Sur-Reply at 1-2.)

NGL Rich Streams

- The disregard for recovery of methane and ethane is further recited with specific limits for methane and ethane in dependent Claims 4 and 7.
 - Claim 4 limits the amount of methane and ethane in the “sweet NGL rich stream” to “no more than 1 molar percent” each.
 - Claim 7 limits the amount of methane and ethane in the “sour NGL rich stream” to “no more than 1 molar percent methane, and no more than 5 molar percent ethane.”
- Claim 1 specifies that the NGL Streams are “Rich” - meaning that the streams have relatively high amounts of NGLs (C3-C8) compared to the non-C3-C8 components in the stream (C1 methane, C2 ethane, and acid gases), with the corresponding relatively lower amounts of methane, ethane, and acid gasses contrasted to be “lean” (5:1-2).
 - Claims 4 and 7 specify particular levels of richness for the NGL Rich Streams, specifying very low upper limits for the percentages of methane and ethane in the Sweet and Sour NGL Rich Streams.

(Sur-Reply at 1-2.)

Ryan/Holmes Teaches Away from the Challenged Claims

- Petitioners rely on their refusal to recognize this disregard for recovery of methane and ethane in the Challenged Claims to argue that the Ryan/Holmes process (“Ryan/Holmes”) does not teach away from the Challenged Claims, to assert that Ryan/Holmes renders obvious the Challenged Claims, and to assert that the tremendous commercial success of Pilot’s CO2Flex® process lacks a nexus with the Challenged Claims.
- Ryan/Holmes, which is the basis for all six of the obviousness Grounds asserted in the Petition, teaches away from the Prim ‘332 Patent.
- Ryan/Holmes uses hydrocarbon solvents (“additives”), and an extensive amount of process equipment (up to four distillation columns), to solve two particular problems in the separation of methane and ethane from carbon dioxide recycle streams, making possible the recovery of methane and ethane.

(Sur-Reply at 3.)

Ryan/Holmes Teaches Away from the Challenged Claims

- In contrast, the Prim '332 Patent CO2Flex® process, as recited in each of the Challenged Claims, disregards recovery of methane and ethane, to allow for a significantly more economical recovery of NGLs, by using relatively little process equipment or energy.
- A proper recognition that the Challenged Claims do recite the disregard for recovery of methane and ethane as part of the claimed process steps, confirms that Ryan/Holmes teaches away and cannot serve as the basis for asserting obviousness of the Challenged Claims.
- Ryan/Holmes, which was developed and implemented to maximize recoveries of methane and ethane, does not render obvious the Challenged Claims which each recite the disregard for recovery of methane and ethane.

(Sur-Reply at 3.)

Pilot's '332 Patent CO2Flex® Process

Processing Options

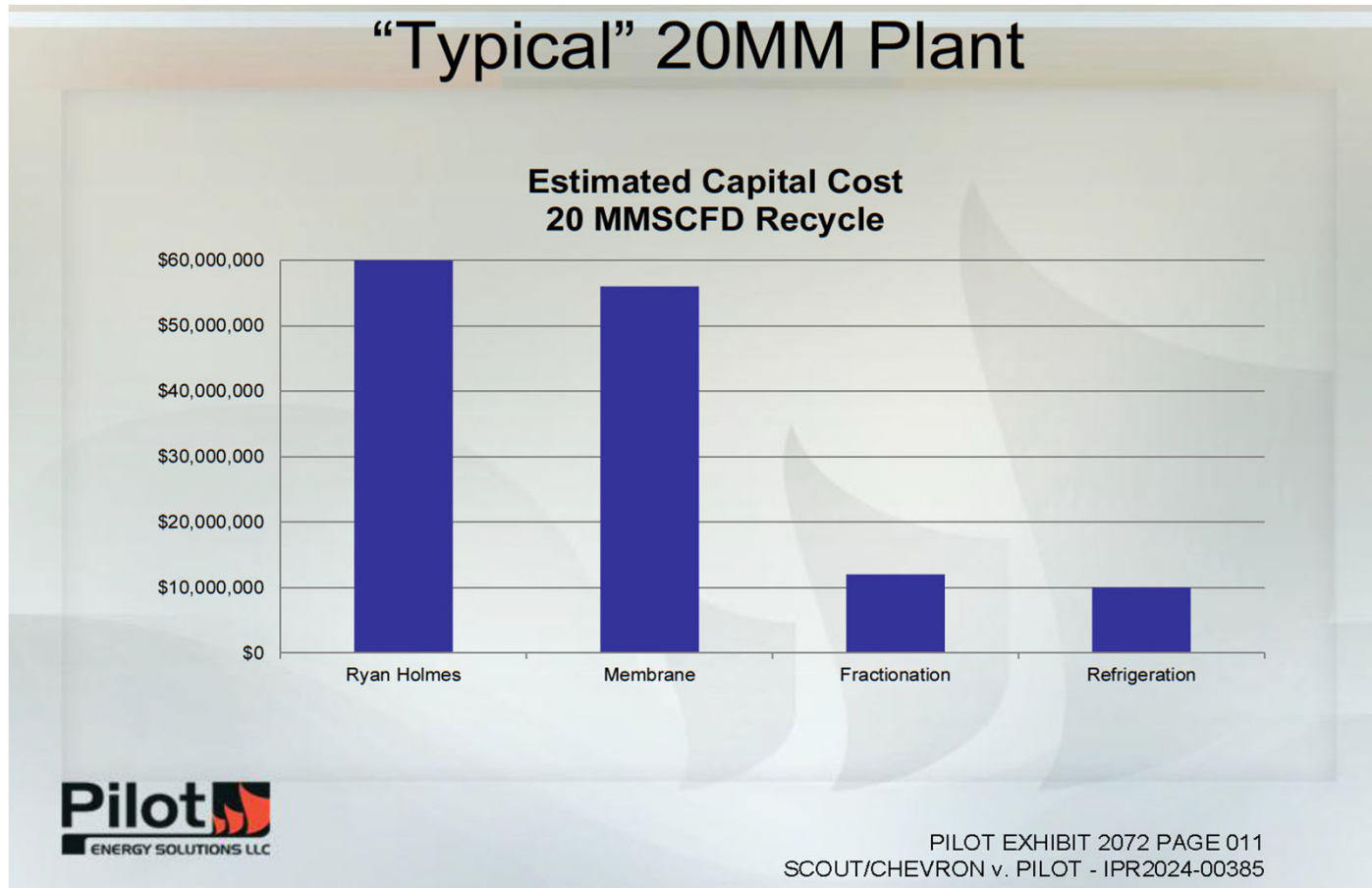
- Ryan Holmes – most expensive
 - Membrane/Amine – close to most expensive
 - Bulk Fractionation (Pilot)– way less expensive
 - Refrigeration – least expensive
-
- **All are more expensive than conventional gas processing**



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Prim describes Ryan/Holmes as the “most expensive,” CO2Flex® as “way less expensive,” and MRU as the “least expensive.”
(EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process

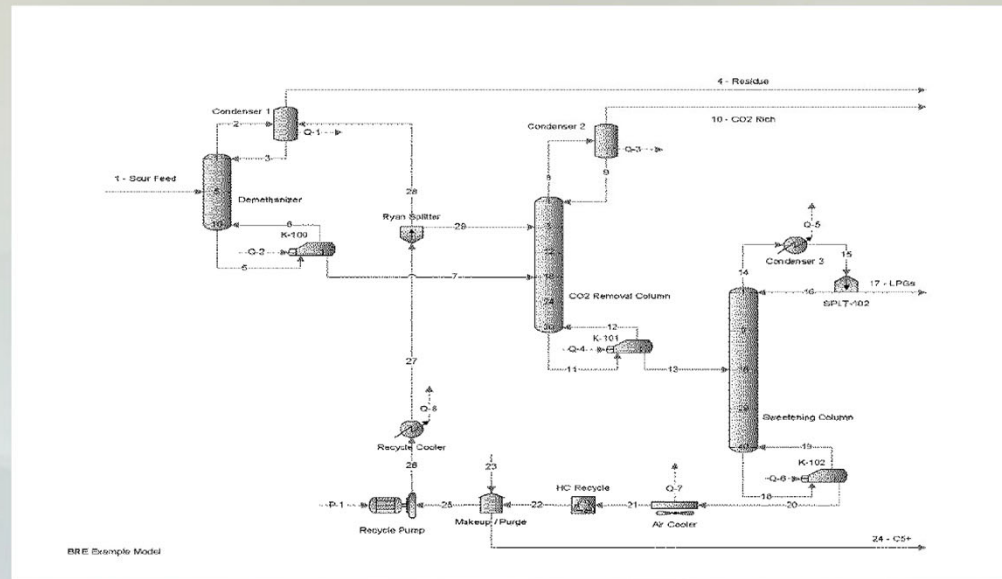


Prim then describes the estimated capital costs for each alternative, with Ryan/Holmes as the highest to build (\$60 million), while CO2Flex® costs way less (\$10 million), slightly more expensive than MRU. (EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process

Ryan Holmes Process

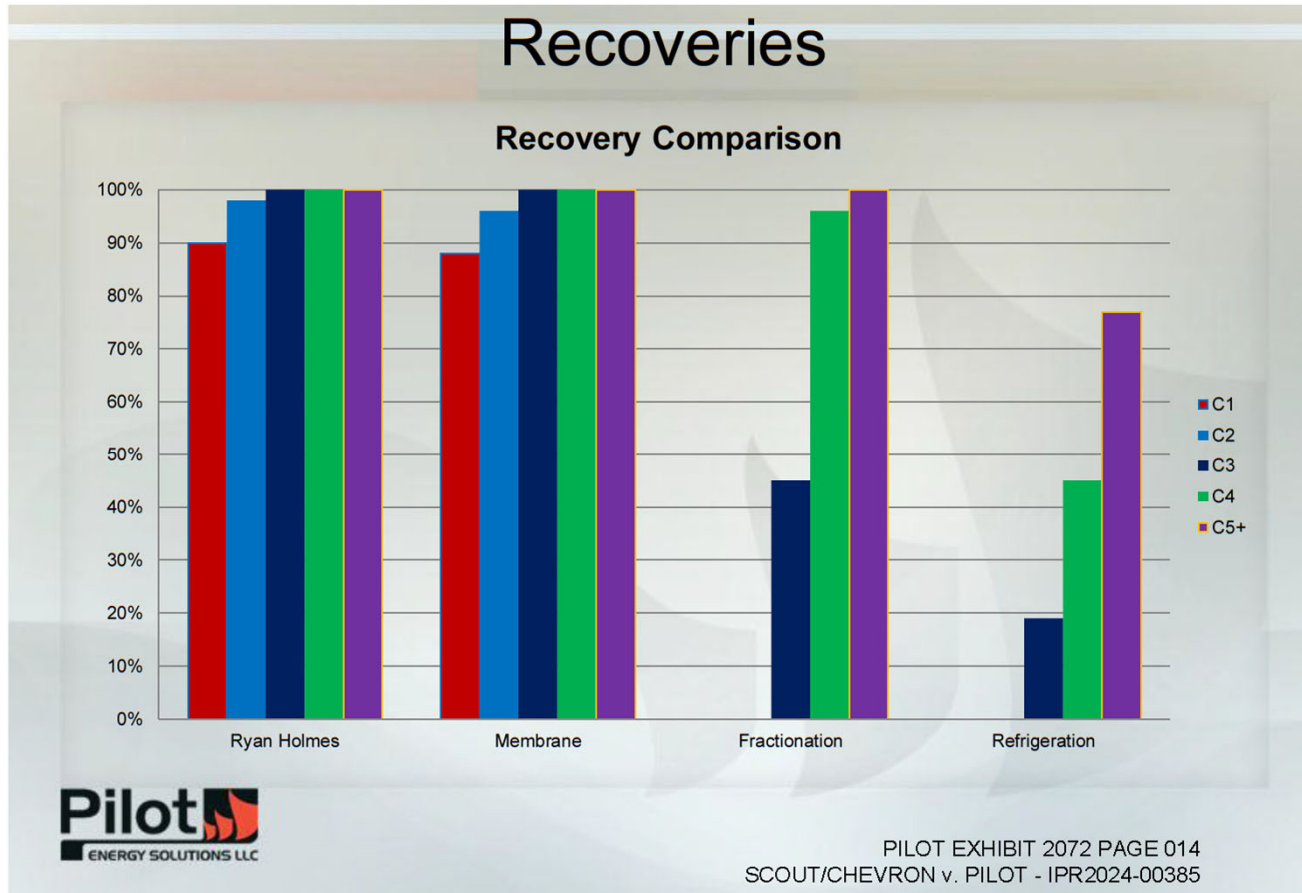
Does anybody Remember Lean Oil Plants



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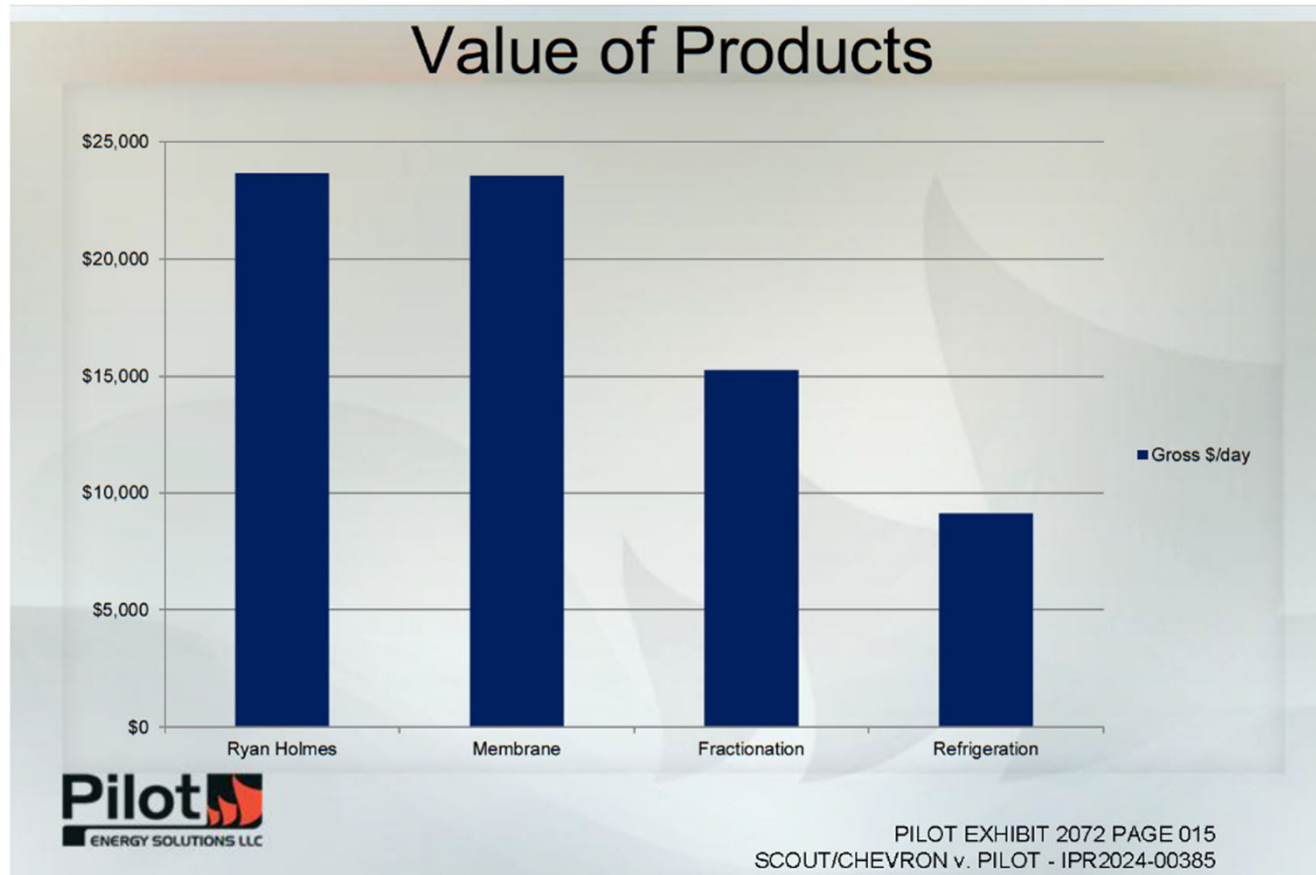
Prim then describes Ryan/Holmes to give an understanding of the reasons why its capital costs are so high, including up to four distillation columns for recovering methane and ethane. (EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process



Prim then describes the differences in recoveries, including Ryan/Holmes' focus on recovering very high levels of methane (90%) and ethane (almost 100%), while CO2Flex® disregards the recovery of C1 methane and C2 ethane, limiting its recoveries to C3-C8 NGLs. (EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process



Prim then describes the value of the products recovered, with Ryan/Holmes recovering dollars per day of products substantially higher than CO2Flex®, due to Ryan/Holmes' near complete recovery of methane and ethane, while CO2Flex® disregards the recovery of methane and ethane to allow for a more economical recovery of products, as will be shown in the upcoming "Economic Comparison" slide. (EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process

Just Because You Can, Doesn't Mean You Should

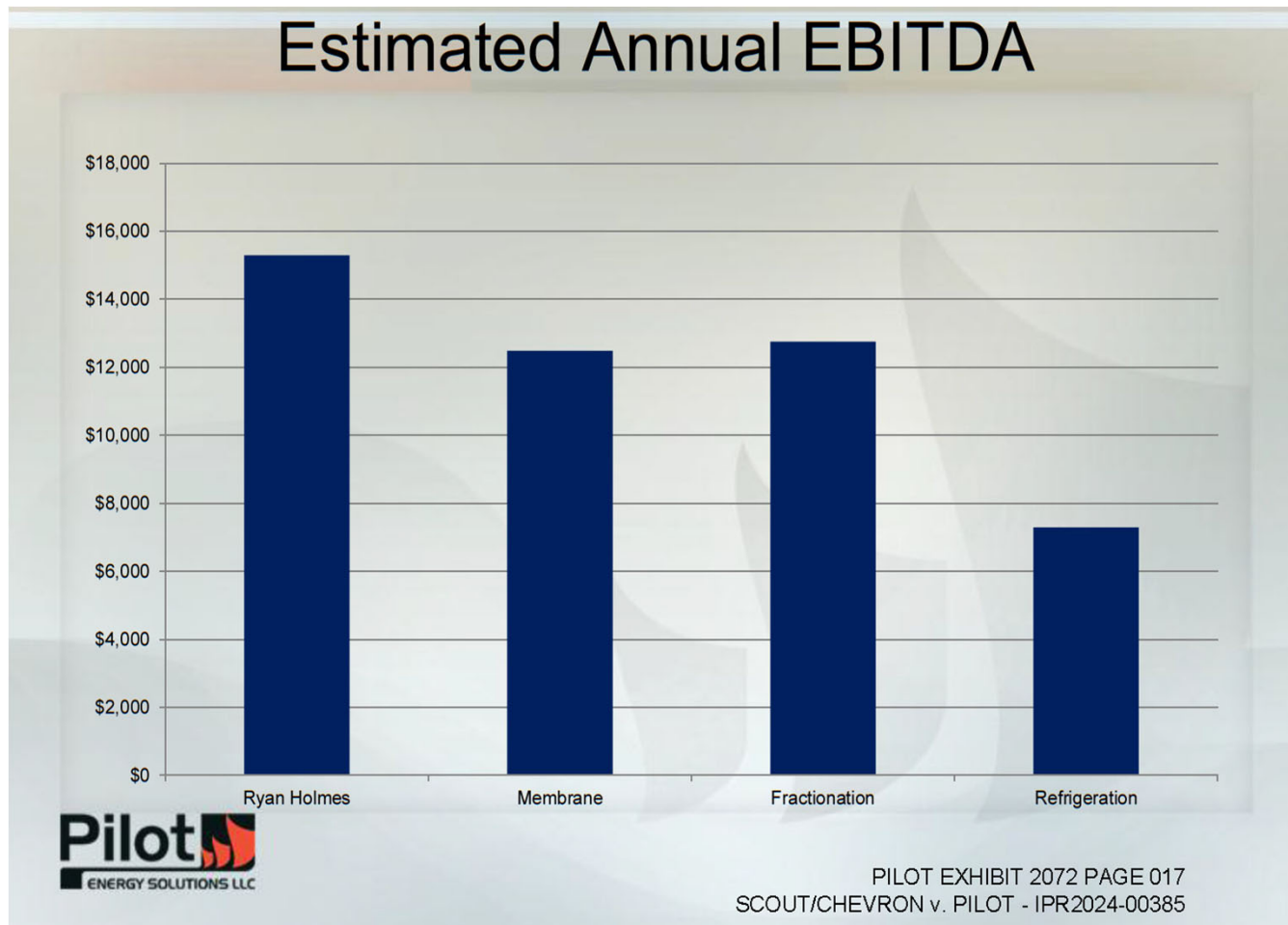
- Methane content worth \$600K/Yr, Most/all is consumed to extract. Payout = ∞
- Ethane: Worth more, but hard to market – Unless you have access to an NGL pipeline, you can't keep it.



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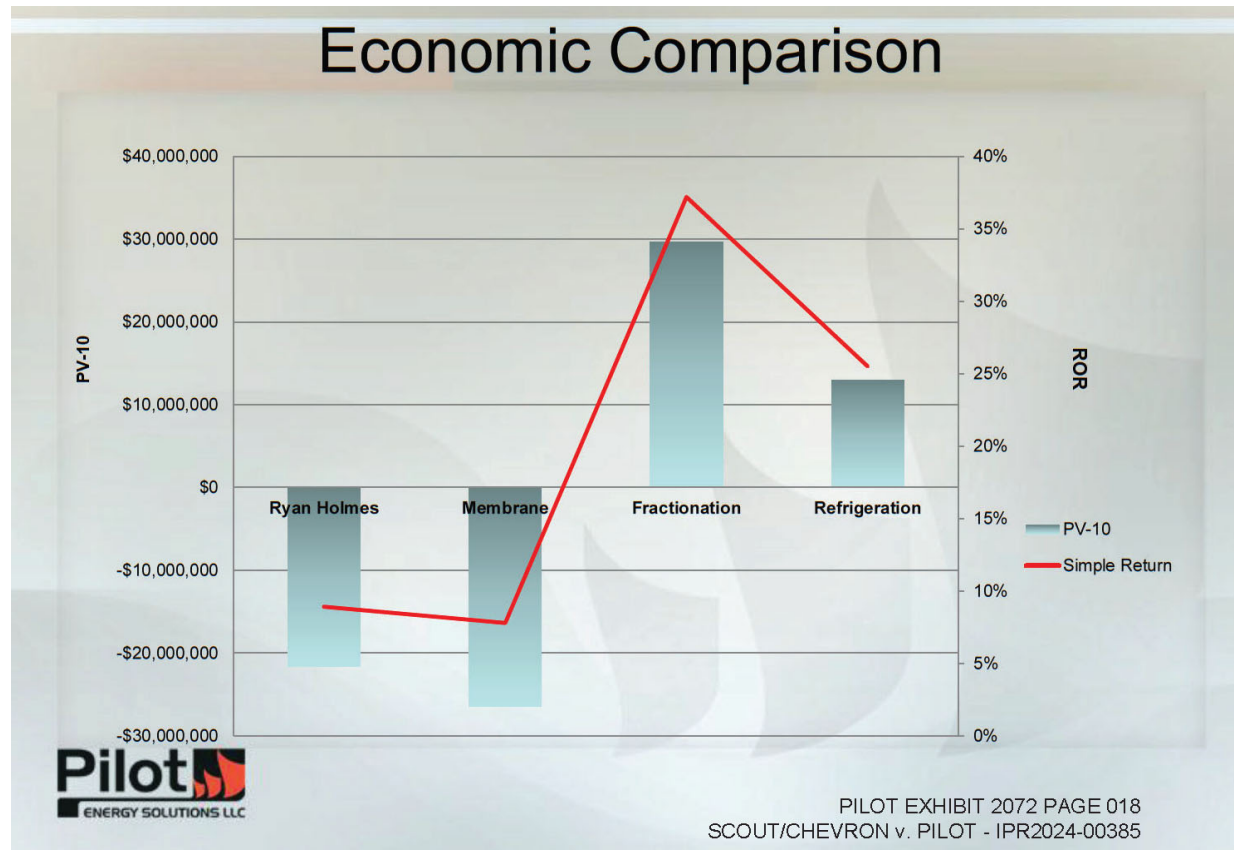
Prim then provides the reasons why CO2Flex® disregards the recovery of methane and ethane to provide a more economical alternative. Prim explains that while the methane products Ryan/Holmes recovers can be worth \$600K per year, most/all of that value is consumed to extract it, leaving no payout. And although the ethane Ryan/Holmes recovers is worth more, it's hard to market, and unless one has access to an NGL pipeline, you can't keep it. (EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process



Prim then describes the estimated annual EBITDA for each alternative, with Ryan/Holmes being the highest. (EX2049, 8-18; Sur-Reply at 24-32.)

Pilot's '332 Patent CO2Flex® Process



And finally, Prim provides the resulting economic comparison which demonstrates why CO2Flex® is the most economical approach, by disregarding the recovery of methane and ethane, blowing away Ryan/Holmes and its focus on near complete recovery of methane and ethane. The key is in the resulting economics, with Ryan/Holmes in the negative for both PV-10 and ROR, while CO2Flex® beats all of the alternatives by far. (EX2049, 8-18; Sur-Reply at 24-32.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **Nexus – between the Challenged Claims and the Objective Evidence**
 - **Rebuttable Presumption:** evidence is tied to a specific process, Pilot's CO2Flex® process, and that process is the invention disclosed in the '332 Patent and claimed in the Challenged Claims.
Pilot's CO2Flex® process embodies the claimed features and is “coextensive” with the Challenged Claims.
 - Secondary evidence is not due to extraneous factors, other than the patented invention, such as unclaimed features.

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **Nexus Even Without Rebuttable Presumption:**
 - evidence of secondary considerations is the “direct result of the unique characteristics of the claimed invention.”
 - the unique characteristics of the claimed invention, providing a bridge for the gap between the two existing technologies (Ryan/Holmes and MRUs), by disregarding recovery of methane and ethane to allow for a significantly more economical recovery of NGLs by using relatively little process equipment or energy, is the alternative solution that CO2 recycle facilities need, and what led them to implement the CO2Flex[®] process.
(Response at 44-45; Sur-Reply at 17-18.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **1. Long Felt but Unmet Need**
- **2. Failure of Others**
- **3. Skepticism of Experts**
- **4. Industry Acclaim/Praise**
- **5. Commercial Success**
- **6. Copying (by Petitioner Chevron)**

(Response at 33-57; Sur-Reply at 18-35.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **1. Long Felt but Unmet Need**
 - Petitioner Chevron (in its 1986 Pastor '666 Patent) described the long felt need to develop a more economical alternative to the Ryan/Holmes and Mechanical Refrigeration Unit technologies for processing carbon dioxide recycle streams in enhanced oil recovery (“EOR”) operations.
 - Chevron described the disadvantages of the Ryan/Holmes process as having “several inherent disadvantages” (“extremely expensive”).
 - Chevron also described the “inherent disadvantages” of the Mechanical Refrigeration Unit process (requires “extremely high refrigeration capacity” and “C4+ . . . unnecessarily wasted”).

(Response at 33-36; Sur-Reply at 18-19.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **2. Failure of Others (including Petitioner Chevron)**
 - After describing the long felt but unmet need in its 1986 Pastor '666 Patent, failed to come up with the Prim '332 Patent process, which recovers C3 Propane.
 - The Pastor '666 Patent solution was to forego recovery of C3 Propane for the NGL product, leaving “substantially all” of the C3 Propane in the CO2 injection gas, in order to address what the patent describes as “miscibility problems.”

(Response at 35-37; Sur-Reply at 18-20.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **3. Skepticism of Experts**

- Initial Rejection of “Unproven Process” by Exxon.
(Response at 37-38; Sur-Reply at 20-21.)

- **4. Industry Acclaim/Praise**

- Praise from Chevron’s reservoir engineer
(Response at 40-41; Sur-Reply at 21-23.)

Initial skepticism turned to acceptance, industry praise,
and commercial success.

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **5. Commercial Success (by Patent Owner)**
 - Since the successful building and operation of the Monell 20 “proof of concept” CO2Flex® plant, a total of five additional CO2Flex® plants have been built, which are:
 - 1) Mentone “Mini Plant” – 2011
 - 2) Goldsmith – 2012
 - 3) Weyburn – 2013
 - 4) Wellman – 2015
 - 5) Monell 120/160 – 2016/2021

(Response at 41-43; Sur-Reply at 23-33.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **5. Commercial Success (by Patent Owner)**

- Revenue (through 2023) - \$330 million
- Operating Profits (through 2023) - \$245 million
- Annual Revenue (2023) - \$23 million.
- Annual Operating Profits (2023) - \$16 million.
- Projected total Revenue (through expected life of reservoirs) - \$760 million
- Projected total Operating Profits (through expected life of reservoirs) - \$540 million.

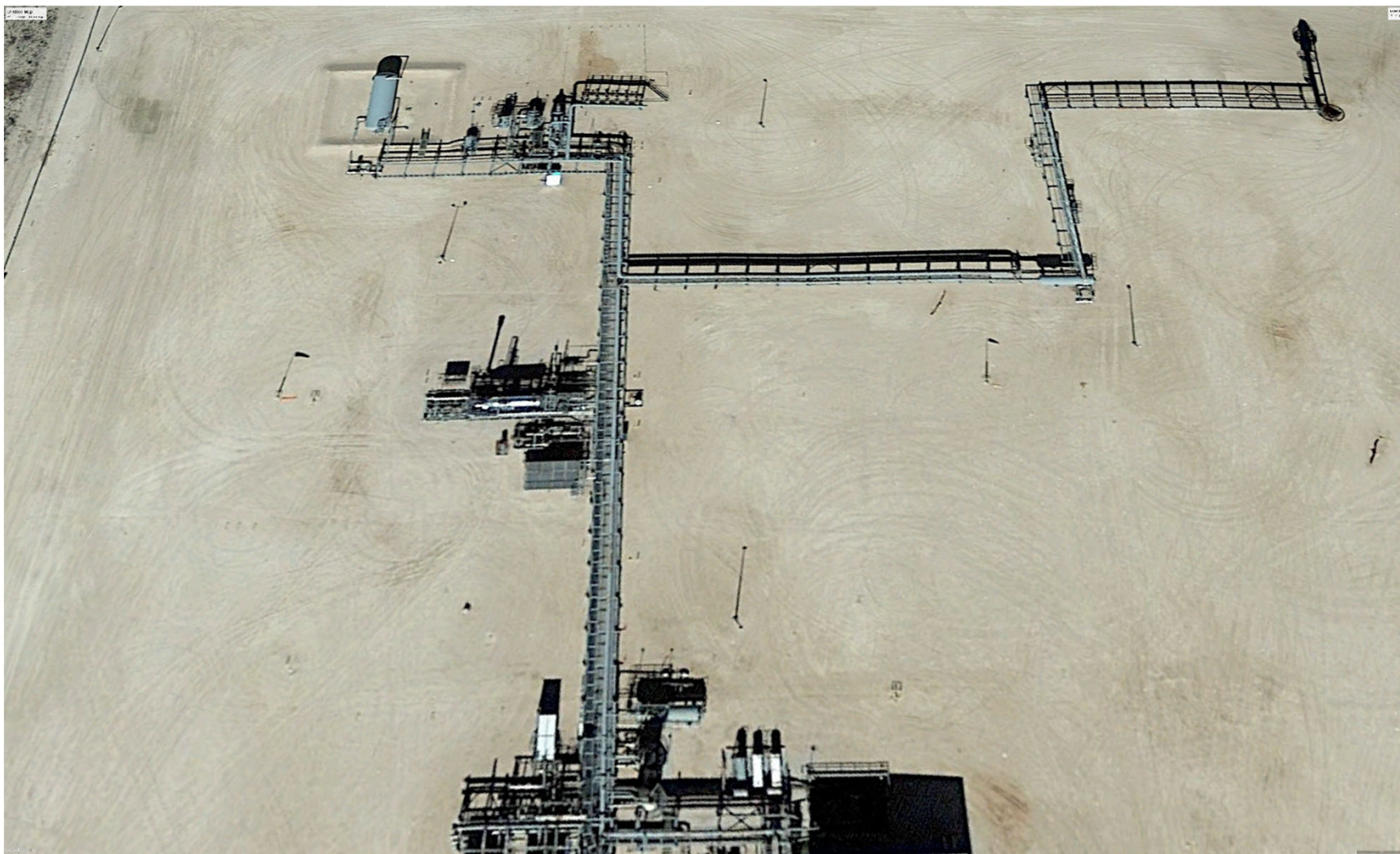
(Response at 42-43; EX2072.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **6. Copying (by Petitioner Chevron)**
 - Petitioner Chevron copied Pilot's Wyoming Monell 20 CO2Flex® plant.
 - Pilot confronted Chevron when Pilot first suspected that Chevron had copied (Chevron Air Permit).
 - Chevron responded by asserting that its Texas Mabee CO2 recycle facility process was based on the Pastor '666 Patent process, not the Pilot '332 Patent CO2Flex® process.
 - Several years later Pilot found an industry publication (Hydrate Formation Paper) describing the Mabee process, which confirms that Chevron was operating the facility according to the Pilot '332 Patent CO2Flex® process (recovering C3 Propane) rather than the Pastor '666 Patent process (which does not recover C3 Propane).
- (Response at 45-57; Sur-Reply at 33-34.)

Comparison of Pilot Monell 20 CO2Flex® Plant to Chevron Mabee NGL Recovery Plant (EX2076)

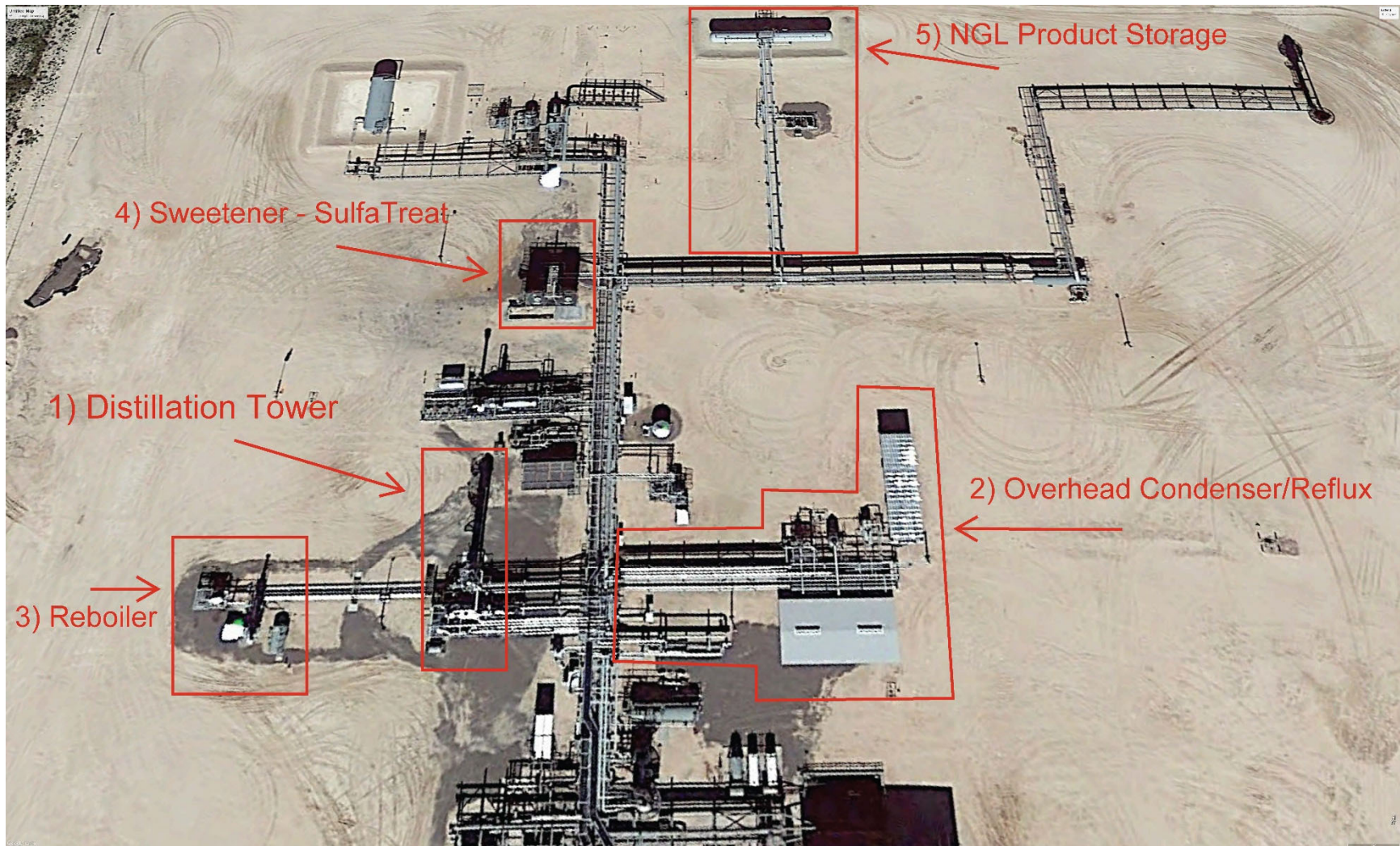
CO2Flex® Process Steps	Monell 20 CO2Flex® Plant Ex. 2055, Process Flow Diagrams Ex. 2056 HYSYS Chemical Process Simulation, Monell 20 (May 3, 2007 [regenerated November 11, 2024])	Chevron Mabee NGL Recovery Plant Ex. 2012, Hydrate Formation Paper; Ex. 2023, Air Permit; Exs. 2074-75, Google Earth Images
1) Distillation Tower Separation of NGLs from CO2 Recycle Stream	Distillation Tower	Distillation Tower
2) Overhead Condenser/Reflux Reflux – Condensing part of the overhead stream from the top of the Distillation Tower	Overhead Condenser/Reflux	Overhead Condenser/Reflux
3) Reboiler Reboiling the bottoms stream from the Distillation Tower	Reboiler	Reboiler
4) Sweetener Removing the H2S acid gas from the NGL Product	Amine Unit Sweetener	SulfaTreat Tower Sweetener
5) NGL Product to Storage/Sales	NGL Product to Sales	NGL Product Storage/Sales
NGL Recovery includes C3 Propane	Stream Composition Table shows significant amount of C3 Propane in the NGL Product	Stream Composition Table shows significant amount of C3 Propane in the NGL Product



EX2074, Google Earth Image – Chevron Mabee CO2 Recycle Facility (02/21/2013) (before addition of NGL Recovery Plant).



EX2075, Google Earth Image – Chevron Mabee CO2 Recycle Facility (10/4/2014) (after addition of NGL Recovery Plant).



EX2075, Google Earth Image – Chevron Mabee CO2 Recycle Facility (10/4/2014) (after addition of NGL Recovery Plant) (Annotated to show equipment added for NGL Recovery Plant).

Hydrate Formation Paper, Figure 3 (Annotated to show equipment for adding NGL Recovery Plant to Chevron Mabee CO2 Recycle Facility).

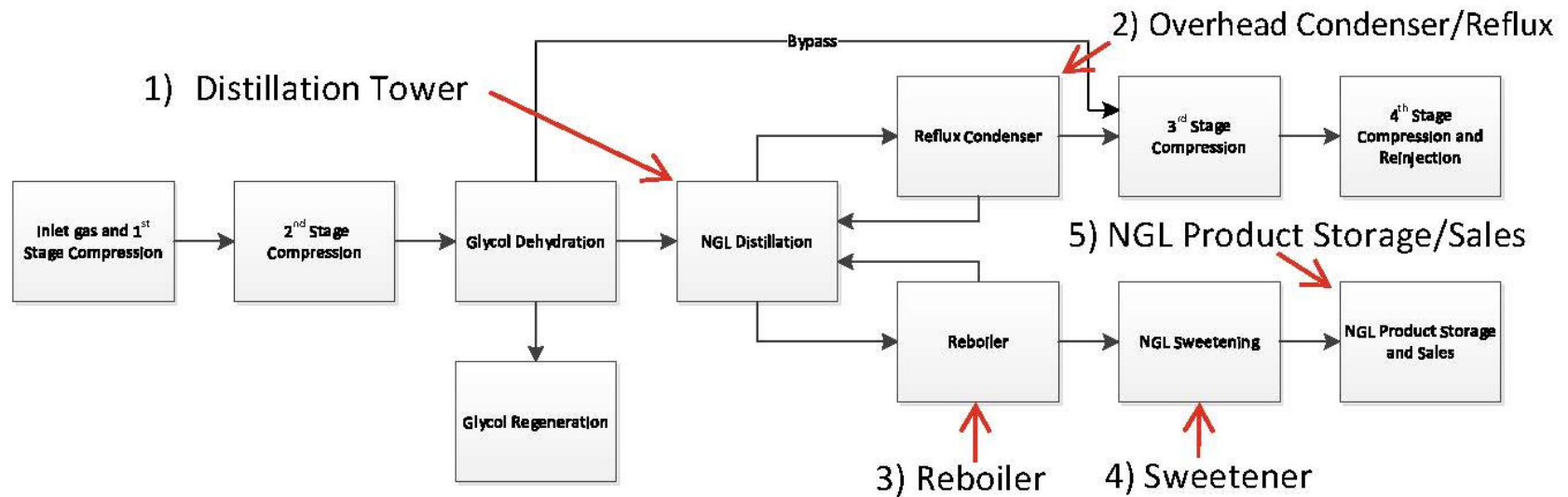
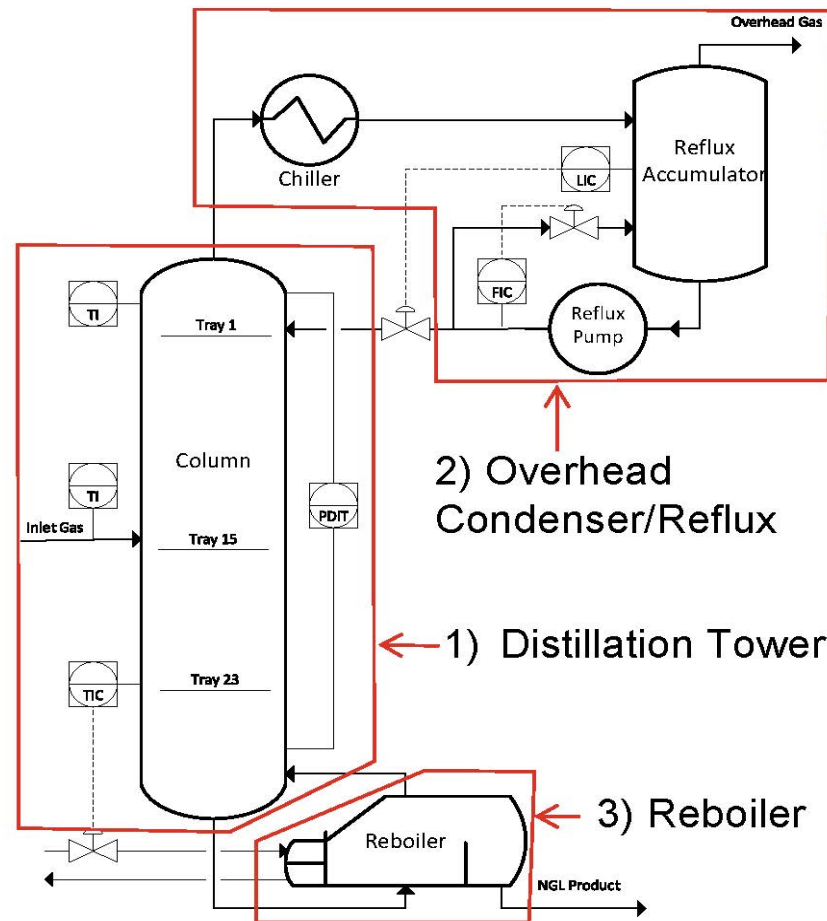


Figure 3: Mabee Gas Plant Block Flow Diagram

EX2012, Page 4.

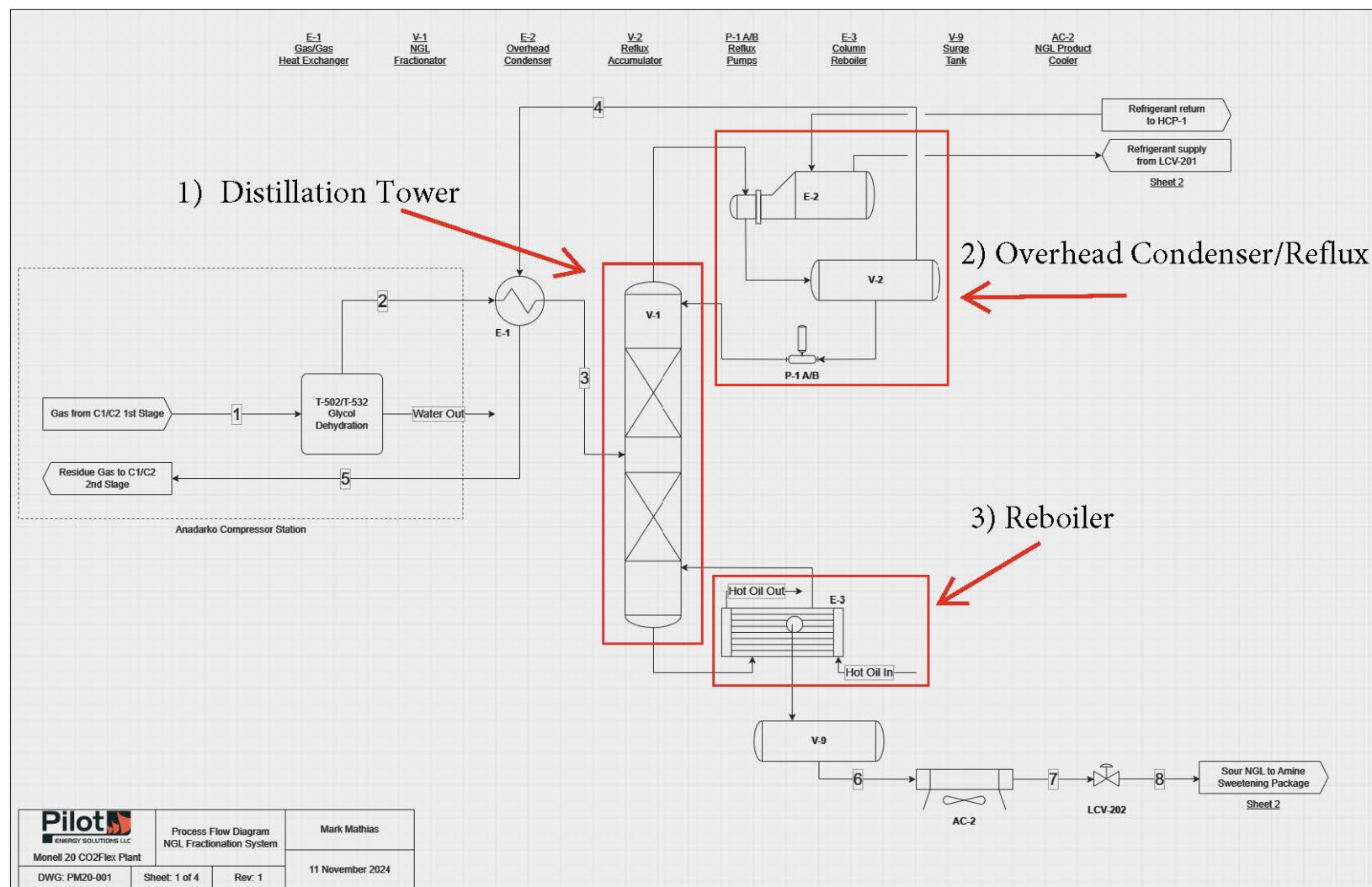
Hydrate Formation Paper, Figure 1
(Annotated to show equipment for adding NGL Recovery Plant to
Chevron Mabee CO2 Recycle Facility).



EX2012, Page 2.

Figure 1: Process Flow Diagram of Distillation Column and Reflux

Monell 20 CO2Flex® Plant, Process Flow Diagram, NGL Fractionation System
(Annotated to show CO2Flex® process equipment matching equipment added to Chevron Mabee CO2 Recycle Facility for adding NGL Recovery Plant) (EX2055, Page 1).



Monell 20 CO2Flex® Plant, Process Flow Diagram, NGL Fractionation System
 (Annotated to show CO2Flex® process equipment matching equipment added to
 Chevron Mabee CO2 Recycle Facility for adding NGL Recovery Plant) (EX2055, Page 2)

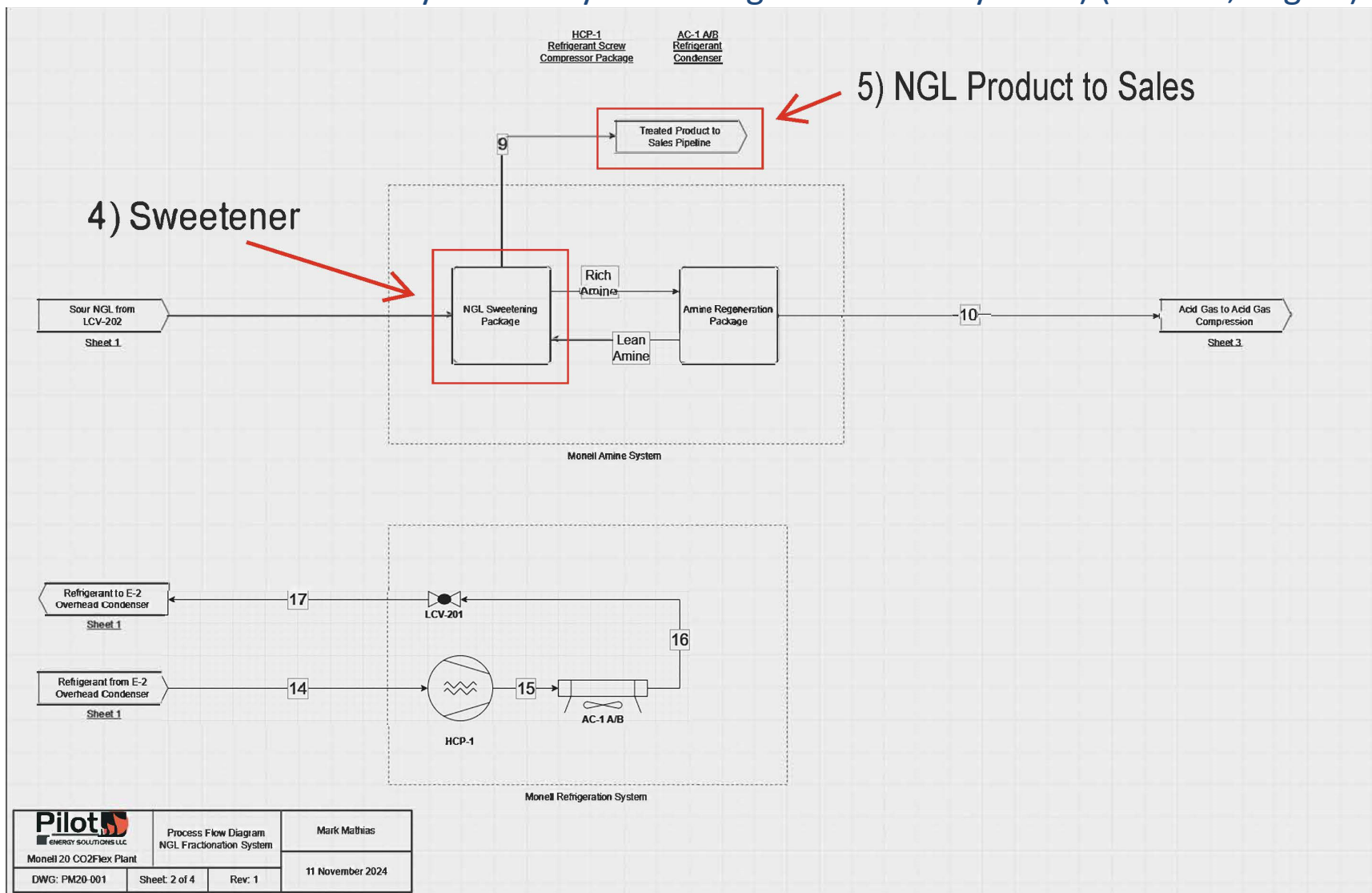


Table 1: Model Validation of Plant Data

	Field	Model
Condenser Temp, F	5.7	5.7
Reboiler Temp, F	260	260
NGL Composition, mol %		
Propane	6.02	5.48
i-Butane	17.11	16.75
n-Butane	41.78	38.39
i-Pentane	14.57	14.20
n-Pentane	9.50	8.96
Hexane +	10.84	10.96

Composition, mol%	Treated Product
H2S	0.0000
Nitrogen	0.0000
CO2	0.0000
Methane	0.0000
Ethane	0.0000
Propane	0.2968
i-Butane	0.1366
n-Butane	0.3166
i-Pentane	0.0728
n-Pentane	0.0624
n-Hexane	0.0520
n-Octane	0.0624
H2O	0.0004

EX2012, Page 4, Hydrate Formation Paper, Table 1
Chevron Mabee NGL Recovery Plant Stream
Composition for NGL Product
(shows significant amount of C3 Propane in the NGL
Product)

EX2056, HYSYS Chemical Process
Simulation, Monell 20 Stream Composition for
NGL Product (shows significant amount of C3
Propane in the NGL Product)

	Stream Name		
	Feed	Overhead Product	Bottoms Product
Rate	110 MMSCF	107 MMSCF	2620 BPD
H ₂ S (ppmv)	500	514	—
	Mole Percent		
N ₂	3.4	3.5	—
CO ₂	83.9	86.3	—
C ₁	6.6	6.9	—
C ₂	1.4	1.4	—
C ₃	1.1	1.1	0.02
iC ₄	0.5	0.4	3.1
nC ₄	0.7	0.3	16.7
iC ₅	0.4	0.001	16.0
nC ₅	0.6	—	23.3
C ₆	0.6	—	24.4
C ₇ +	0.4	—	16.4

EX2016, Page 6, Pastor ‘666 Patent at 5:12-27, Table I, Stream Composition for NGL Product (“Bottoms Product”) (showing essentially no C3 Propane in the NGL Product, and essentially all of the C3 Propane from the Feed stream remaining in the CO2 recycle stream (“Overhead Product”).

Hydrate Formation Paper, Figure 3
(Annotated to show equipment for adding NGL Recovery Plant to Chevron Mabee CO2 Recycle Facility, including Sweetener [4], which would not be needed if this was a Pastor '666 Rangely Plant) (EX2012, Page 4).

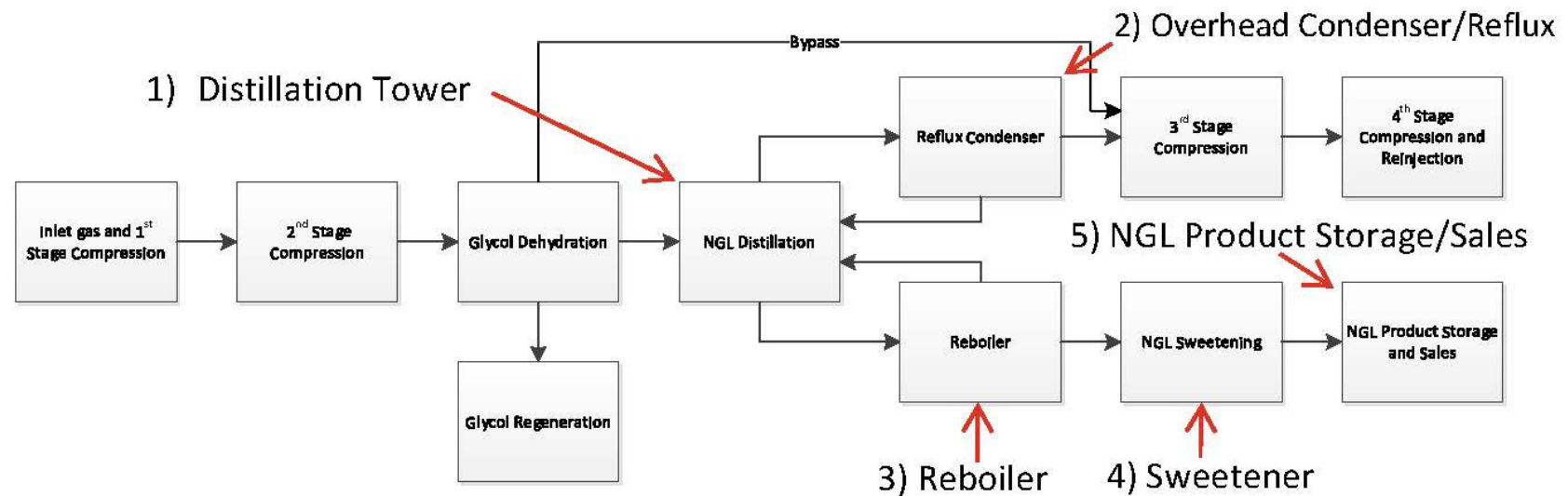


Figure 3: Mabee Gas Plant Block Flow Diagram

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **Nexus – between the Challenged Claims and the Objective Evidence**
 - **Rebuttable Presumption:** evidence is tied to a specific process, Pilot's CO2Flex® process, and that process is the invention disclosed in the '332 Patent and claimed in the Challenged Claims.
Pilot's CO2Flex® process embodies the claimed features and is “coextensive” with the Challenged Claims.
 - Secondary evidence is not due to extraneous factors, other than the patented invention, such as unclaimed features.

REBUTTABLE PRESUMPTION OF NEXUS

- **Coextensive – charts demonstrating one-to-one correspondence between the Challenged ‘332 Patent Claims 1-4, 6-7 and each of these five CO2Flex® plants. (EX2029 ¶69.)**
 - Monell 20 (EX2053)
 - Goldsmith (EX2057)
 - Weyburn (EX2061)
 - Wellman (EX2064)
 - Monell 120 (EX2069)

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
Claim 1 [1.P] A method comprising: [1.1] receiving a hydrocarbon feed stream, wherein the hydrocarbon feed stream comprises carbon dioxide, natural gas liquid (NGL), heavy hydrocarbons, and acid gas, wherein the NGL comprises C ₃ -C ₈ hydrocarbons, and wherein the heavy hydrocarbons comprise C ₉₊ hydrocarbons;	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[1.2] separating the hydrocarbon feed stream into a heavy hydrocarbon rich stream and a carbon dioxide recycle stream, wherein the heavy hydrocarbon rich stream comprises the C ₉₊ hydrocarbons, and wherein the carbon dioxide recycle stream comprises the carbon dioxide, the C ₃ -C ₈ hydrocarbons, and the acid gas;	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[1.3] separating the carbon dioxide recycle stream into a sour NGL rich stream and a purified carbon dioxide recycle stream, wherein the sour NGL rich stream comprises the C ₃ -C ₈ hydrocarbons and the acid gas, and wherein the purified carbon dioxide recycle stream comprises the carbon dioxide; and	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[1.4] separating the sour NGL rich stream into a sweet NGL rich stream and an acid gas stream, wherein the sweet NGL rich stream comprises the C ₃ -C ₈ hydrocarbons, and wherein the acid gas stream comprises the acid gas,	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[1.5] wherein the carbon dioxide is not removed from the hydrocarbon feed stream and is not removed from the carbon dioxide recycle stream prior to separating the carbon dioxide recycle stream into the sour NGL rich stream and the purified carbon dioxide recycle stream, and	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[1.6] wherein the hydrocarbon feed stream, the carbon dioxide recycle stream, and the sour NGL rich stream are not subjected to cryogenic conditions, membranes, and carbon dioxide recovery solvents between being received and being separated into the heavy hydrocarbon rich stream, the purified carbon dioxide recycle stream, the sweet NGL rich stream, and the acid gas stream.	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
Claim 2 [2.1] The method of claim 1, further comprising: compressing the carbon dioxide recycle stream prior to separating the carbon dioxide recycle stream;	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[2.2] dehydrating at least part of the carbon dioxide recycle stream using a dehydration solvent prior to separating the carbon dioxide recycle stream;	✓	✓	✗ Reg. Gas Scrubber /Mole Sieve Dehydrat ion. Not solvents.	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
[2.3] combining a carbon dioxide makeup stream external to the method with the purified carbon dioxide recycle stream; and	✓	✓	✓	✓	✓	✓
[2.4] injecting the combined carbon dioxide makeup stream and the purified carbon dioxide recycle stream into a subterranean formation.	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
Claim 3 [3] The method of claim 1, further comprising cooling the carbon dioxide recycle stream with the purified carbon dioxide recycle stream.	✓	✓	✓	✗ no Inlet Exchanger to cool the CO2 recycle stream with the purified CO2 recycle stream	✗ no Inlet Exchanger to cool the CO2 recycle stream with the purified CO2 recycle stream	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
Claim 4 [4] The method of claim 3, wherein the sweet NGL rich stream comprises no more than 1 molar percent methane, no more than 1 molar percent ethane, and no more than 1 molar percent acid gases.	✓	✓	✓	✗ slightly more than 1 molar percent Ethane	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
Claim 6						
[6.1] The method of claim 1, wherein separating the carbon dioxide recycle stream into the sour NGL rich stream and the purified carbon dioxide recycle stream comprises: refluxing part of the purified carbon dioxide recycle stream;	✓	✓	✓	✓	✓	✓
[6.2] reboiling part of the sour NGL rich stream; and	✓	✓	✓	✓	✓	✓
[6.3] cooling and throttling the sour NGL rich stream.	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Summary of Charts Demonstrating the Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants (EX2052).

Claims 1-4, 6-7	Monell 20	Goldsmith	Weyburn	Wellman	Monell 120	Monell 160
Claim 7 [7] The method of claim 6, wherein the sour NGL rich stream comprises no more than 5 molar percent carbon dioxide, no more than 1 molar percent methane, and no more than 5 molar percent ethane, and wherein the sweet NGL rich stream is substantially free of carbon dioxide.	✓	✓	✗ more than 5 molar percent carbon dioxide	✗ more than 5 molar percent carbon dioxide	✗ more than 5 molar percent carbon dioxide	✗ more than 5 molar percent carbon dioxide
	✓	✓	✓	✓	✓	✓

REBUTTABLE PRESUMPTION OF NEXUS

Near Perfect Correspondence between Each of the Elements of the Challenged Patent Claims and the Five Commercially Successful CO2Flex® Plants, with a relatively small number of exceptions for a few of the claim elements and some of the CO2Flex® plants, which are:

- i) One of the five CO2Flex® plants (Weyburn) does not use solvents for dehydrating the CO2 recycle stream as recited in Claim 2 [2.2]. Weyburn uses a regenerative scrubber and molecular sieves for the dehydration step, which are not solvents.
- ii) One of the five CO2Flex® plants (Wellman) does not use an Inlet Heat Exchanger as recited in Claim 3. And Monell 120 did not use an Inlet Heat Exchanger until the plant was expanded to be able to process 160 MMSCFD in 2021 (expansion from Monell 120 to Monell 160), at which time an Inlet Heat Exchanger was installed.
- iii) One of the five CO2Flex® plants (Weyburn) operates with slightly more than 1 molar percent C2 ethane in the “Sweet NGL Rich Stream,” which is over the “no more than 1 molar percent ethane” limit recited in Claim 4.
- iv) Three of the five CO2Flex® plants (Weyburn, Wellman, and Monell 120/160) operate with more than 5 molar percent carbon dioxide in the “Sour NGL Rich Stream,” which is over the “no more than 5 molar percent carbon dioxide” limit recited in Claim 7.

(Response at 44.)

SECONDARY CONSIDERATION EVIDENCE OF NON-OBVIOUSNESS

- **Nexus – between the Challenged Claims and the Objective Evidence**
 - **Rebuttable Presumption:**
 - Secondary evidence is not due to extraneous factors, other than the patented invention, such as unclaimed features.
 - 1. All Challenged Claims recite disregard for recovery of C1 Methane and C2 Ethane.
 - 2. None of the commercially successful CO2Flex[®] Plants perform the Claim 5 process steps.

Each of the Challenged Claims Recites the Disregard for Recovery of Methane and Ethane

- **The disregarding of Methane and Ethane is recited in at least four places in independent Claim 1, including:**
 - The sweet and sour “NGL Rich” streams, defined in the specification to mean that the NGL streams are “rich” in C3-C8, and “relatively lean with respect to methane, ethane, and acid gases” (EX1001 5:1-2).

(Sur-Reply at 1-2, 13.)

Each of the Challenged Claims Recites the Disregard for Recovery of Methane and Ethane

- The disregard for recovery of Methane and Ethane is further recited with specific limits for Methane and Ethane in dependent Claims 4 and 7 (specifying particular levels of richness for the NGL Rich streams).
 - Claim 4 limits the amount of methane and ethane in the “sweet NGL rich stream” to “no more than 1 molar percent” each.
 - Claim 7 limits the amount of methane and ethane in the “sour NGL rich stream” to “no more than 1 molar percent methane, and no more than 5 molar percent ethane.”

(Sur-Reply at 2, 13-14.)

Secondary Evidence is Not Due to Extraneous Factors, Other than the Patented Invention, Such as Unclaimed Features

- **None of the commercially successful CO2Flex® Plants use the alternative Claim 5 “less aggressive cut.”**
 - Petitioners assert that the “less aggressive cut” feature recited in Claim 5 is “critical” to the commercial success of CO2Flex®, and that this “critical feature” is not recited in the Challenged Claims (therefore an “unclaimed feature”).
 - Claim 5 recites this alternative feature, specifying a range 20-40% C3+ recovery. (EX1001, 18:40-42.)
 - All of the CO2Flex® plants operate at C3+ recoveries above 50%, and the most commercially successful CO2Flex® plant (Weyburn) operates at over 88% C3+ recovery.

(Sur-Reply at 14-16.)

Secondary Evidence is Not Due to Extraneous Factors, Other than the Patented Invention, Such as Unclaimed Features

- All of the CO2Flex® plants operate at C3+ recoveries above 50%, and the most commercially successful CO2Flex® plant (Weyburn) operates at over 88% C3+ recovery.

• <u>CO2Flex® Plants</u>	<u>C3+ Recoveries</u>	<u>Exhibits</u>
• Monell 20	50.8%	EX2079
• Goldsmith	76.5%	EX2080
• Weyburn	88.1%	EX2081
• Wellman	57.4%	EX2082
• Monell 120/160	59.7%	EX2083

- Petitioners’ assertion that the commercial success of the CO2Flex® plants is due to the “less aggressive cut” feature recited in Claim 5 is incorrect because the CO2Flex® plants do not use this alternative feature.
(Sur-Reply at 16.)

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e), I hereby certify that on May 7, 2025 the foregoing *Patent Owner's Demonstratives* was served electronically by agreement of the parties, by e-mail to the following counsel of record.

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