

U.S. Patent No. 8,505,332
Claims 1-4, 6-7
Weyburn Processing Plant
(Saskatchewan, Canada)

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
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 C₃-C₈ hydrocarbons, and wherein the heavy hydrocarbons comprise C₉₊ hydrocarbons;	As do most all Enhanced Oil Recovery (“EOR”) processes, the Weyburn EOR hydrocarbon feed stream includes carbon dioxide, natural gas liquid (NGL), heavy hydrocarbons, and acid gas. (Ex. 2063, Page 1, Weyburn Plant Gas Analysis, Extended Gas Analysis (showing inlet to gas processing Plant for Weyburn having Carbon Dioxide (83.91%), C3-C8 hydrocarbons (8.99%), and Hydrogen Sulfide acid gas (1.86%).) The NGL includes C3-C8 hydrocarbons (Ex. 2063, Page 1, Weyburn Plant Gas Analysis, Extended Gas Analysis (showing inlet to gas processing Plant for Weyburn having C3-C8 hydrocarbons); and The heavy hydrocarbons include C₉₊ hydrocarbons. (Ex. 2063, Pages 1-2, Weyburn Plant Gas Analysis, Extended Gas Analysis (Composition and

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
	Component tables showing Weyburn inlet gas having significant amounts of C9+ hydrocarbons).)

[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 C₉₊ hydrocarbons, and wherein the carbon dioxide recycle stream comprises the carbon dioxide, the C₃-C₈ hydrocarbons, and the acid gas;	The Weyburn EOR separates the “Hydrocarbon Feed Stream” into a “Heavy Hydrocarbon Rich Stream” and a “Carbon Dioxide Recycle Stream.” This initial separation step is performed prior to the Stream No. 603 “Dehydrated Gas to NGL Frac Tower” entering the NGL recovery gas processing plant, so is not shown on the Process Flow Diagrams (“PFDs”) exhibit used for the following steps in the process. The Weyburn EOR performs this initial separation step using a Three-Phase Separator that separates the “Hydrocarbon Feed Stream” into water, oil, and gaseous components. Water exits the bottom of the Three-Phase Separator, Oil (“Heavy Hydrocarbon Rich Stream” C₉₊ hydrocarbons) out the middle, and gas (“Carbon Dioxide Recycle Stream”) out the top. The “Heavy Hydrocarbon Rich Stream” includes C₉₊ hydrocarbons The “Carbon Dioxide Recycle Stream” includes Carbon Dioxide, C₃-C₈ hydrocarbons, and acid gas Carbon Dioxide Recycle Stream = Stream No. 603 “Dehydrated Gas to NGL Frac Tower” (Ex. 2062, Page 2). Stream No. 603 “Dehydrated Gas to NGL Frac Tower” composition (Ex. 2062, Page 12) includes:
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Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)		
	carbon dioxide	Carbon Dioxide (kgmole/h)	489.70
	C3-C8 hydrocarbons:		
	C3	Propane (kgmole/h)	22.60
	C4	i-Butane (kgmole/h)	4.33
		n-Butane (kgmole/h)	10.82
	C5	i-Pentane (kgmole/h)	2.53
		n-Pentane (kgmole/h)	2.33
	C6	n-Hexane (kgmole/h)	0.66
	C7	n-Heptane (kgmole/h)	0.24
	C8	n-Octane (kgmole/h)	0.07
	acid gas (H2S/CO2)	Hydrogen Sulfide (kgmole/h)	15.28
	which accounts for 95.4% (548.56/574.99). Other components are: Nitrogen (2.25), Methane (11.30), Ethane (12.55), COS (0.04), and M- Mercaptan (0.08), which accounts for 100%		
[1.3] separating the carbon dioxide recycle stream into a sour NGL rich stream and a purified carbon dioxide recycle stream,	The Stream No. 603 “Carbon Dioxide Recycle Stream” flows into the T-610 NGL Fractionator Tower where this [1.3] separating step is performed. (Ex. 2062, Page 2.) The T-610 NGL Fractionator Tower separates the Stream No. 603 “Carbon Dioxide Recycle Stream” into a bottoms “Sour NGL Rich Stream” (Stream No. 615) and an overhead “Purified Carbon Dioxide Recycle Stream” (Stream No. 611). (Ex. 2062, Page 3.)		

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)																														
wherein the sour NGL rich stream comprises the C ₃ -C ₈ hydrocarbons and the acid gas, and	Stream No. 613 exits the bottom of the T-610 NGL Fractionator Tower and flows to the E-611 NGL Reboiler, exiting as the “Sour NGL Rich Stream” (Stream No. 615). (Ex. 2062, Page 3.) Stream No. 615 “Sour NGL Rich Stream” composition (Ex. 2062, Page 10) includes C3-C8 hydrocarbons and acid gas: C3-C8 hydrocarbons: <table><tr><td>C3</td><td>Propane (kgmole/h)</td><td>17.91</td></tr><tr><td>C4</td><td>i-Butane (kgmole/h)</td><td>5.55</td></tr><tr><td></td><td>n-Butane (kgmole/h)</td><td>15.31</td></tr><tr><td>C5</td><td>i-Pentane (kgmole/h)</td><td>4.99</td></tr><tr><td></td><td>n-Pentane (kgmole/h)</td><td>5.12</td></tr><tr><td>C6</td><td>n-Hexane (kgmole/h)</td><td>4.26</td></tr><tr><td>C7</td><td>n-Heptane (kgmole/h)</td><td>2.80</td></tr><tr><td>C8</td><td>n-Octane (kgmole/h)</td><td>2.37</td></tr></table> acid gas (H2S/CO2): <table><tr><td>H2S</td><td>Hydrogen Sulfide (kgmole/h)</td><td>3.72</td></tr><tr><td>CO2</td><td>Carbon Dioxide (kgmole/h)</td><td>7.02</td></tr></table> which accounts for 98.5% (69.05/70.17). Other components are: Ethane (0.92), Water (0.02), COS (0.05), M-Mercaptan (0.11), and E-Mercaptan (0.01), which accounts for 100%	C3	Propane (kgmole/h)	17.91	C4	i-Butane (kgmole/h)	5.55		n-Butane (kgmole/h)	15.31	C5	i-Pentane (kgmole/h)	4.99		n-Pentane (kgmole/h)	5.12	C6	n-Hexane (kgmole/h)	4.26	C7	n-Heptane (kgmole/h)	2.80	C8	n-Octane (kgmole/h)	2.37	H2S	Hydrogen Sulfide (kgmole/h)	3.72	CO2	Carbon Dioxide (kgmole/h)	7.02
C3	Propane (kgmole/h)	17.91																													
C4	i-Butane (kgmole/h)	5.55																													
	n-Butane (kgmole/h)	15.31																													
C5	i-Pentane (kgmole/h)	4.99																													
	n-Pentane (kgmole/h)	5.12																													
C6	n-Hexane (kgmole/h)	4.26																													
C7	n-Heptane (kgmole/h)	2.80																													
C8	n-Octane (kgmole/h)	2.37																													
H2S	Hydrogen Sulfide (kgmole/h)	3.72																													
CO2	Carbon Dioxide (kgmole/h)	7.02																													

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)			
wherein the purified carbon dioxide recycle stream comprises the carbon dioxide; and	Stream No. 610 exits the top of the T-610 NGL Fractionator Tower as the overhead stream and enters the E-613 NGL Overhead Condenser, exiting as a non-numbered stream, which enters the V-614 NGL Reflux Accumulator, exiting as the cooled “Purified Carbon Dioxide Recycle Stream” (Stream No. 611), which flows to the E-601 Inlet Gas/Gas [Heat] Exchanger (Ex. 2062, Page 2), exiting as the “Purified Carbon Dioxide Recycle Stream” (Stream No. 606), which flows to the “V730/740 Inlet Separators” (Ex. 2062, Page 1), then flows to compression and re-injection. Stream No. 606 “Purified Carbon Dioxide Recycle Stream” composition (Ex. 2062, Page 14) includes carbon dioxide: <table><tr><td>CO2</td><td>Carbon Dioxide (kgmole/h)</td><td>91.5% (410.81/448.95)</td></tr></table> other components are: Methane (9.50), Ethane (10.24), Propane (6.40), and EGlycol (9.93), which accounts for 99.54% (446.88/448.95), and C4 (0.12 % & 0.06 %) and N2 (1.88), to account for 100%.	CO2	Carbon Dioxide (kgmole/h)	91.5% (410.81/448.95)
CO2	Carbon Dioxide (kgmole/h)	91.5% (410.81/448.95)		

[1.4] separating the sour NGL rich stream into a sweet NGL rich stream and an acid gas stream,	The Stream No. 615 “Sour NGL Rich Stream” flows through the C-624 NGL Product Cooler, and a throttling valve, exiting as the Stream No. 615 low pressure “Sour NGL Rich Stream.” Stream No. 615 low pressure “Sour NGL Rich Stream” flows to the T-625 Amine Contactor, (Ex.2062, Page 2), and enters the T-625 Amine Contactor (Ex. 2062, Page 3).
	The Stream No. 615 low pressure “Sour NGL Rich Stream” is separated into a “Sweet NGL Rich Stream” (Stream No. 617) and an “Acid Gas Stream” (Stream No. 626) by the T-625 Amine Contactor. (Ex. 2062, Page 3.)
wherein the sweet NGL rich stream comprises the C ₃ -C ₈ hydrocarbons, and	Stream No. 616 exits the top of the T-625 Amine Contactor as the overhead stream, which enters the F-626 C3+ Coalescing Filter, exiting as the Stream No. 617 “Sweet NGL Rich Stream,” which flows to the T-666 De-Propanizer Tower. (Ex. 2062, Page 3.)
	Stream No. 617 “Sweet NGL Rich Stream” composition (Ex. 2062, Page 13) includes C3-C8 hydrocarbons:
	C3-C8 hydrocarbons:
C3	Propane (kgmole/h) 17.91
C4	i-Butane (kgmole/h) 5.55
	n-Butane (kgmole/h) 15.31
C5	i-Pentane (kgmole/h) 4.99
	n-Pentane (kgmole/h) 5.12
C6	n-Hexane (kgmole/h) 4.26

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)		
wherein the acid gas stream comprises the acid gas,	C7	n-Heptane (kgmole/h)	2.80
	C8	n-Octane (kgmole/h)	2.37
	which accounts for 98.1% (58.31/59.46) other components are: CO2 (0.09), Ethane (0.92), Water (0.05), and M-Mercaptan (0.06), to account for 100%.		
	A non-numbered stream exits the bottom of the T-625 Amine Contactor and enters V-647 (Amine Flash Drum), exiting as Stream No. 618, which enters E-627A/B (Amine Lean/Rich Exchangers), exiting as Stream No. 619 (Ex. 2062, Page 3), which enters T-628 (Amine Regenerator), exiting as the “Acid Gas Stream” (Stream No. 626), which flows to the V-652 1st Stage Suction Scrubber (Ex. 2062, Page 4).		
	Stream No. 626 “Acid Gas Stream” composition (Ex. 2062, Page 14) includes the acid gas CO2 and H2S:		
CO2	Carbon Dioxide (kgmole/h)	6.38	
H2S	Hydrogen Sulfide (kgmole/h)	3.81	
	which accounts for 92.97% (10.19/10.96). Other components are: Water (0.64) and Propane (0.07), which accounts for 99.45% (10.90/10.96), and miniscule amounts of C4+, to account for 100%.		

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
[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	(CO₂ is not removed from the hydrocarbon feed stream and CO₂ 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 The only CO₂ removal steps are the [1.3] separation of the carbon dioxide recycle stream into the sour NGL rich stream and the purified carbon dioxide recycle stream, and <u>after</u> that step [1.3] separation, removal of the CO₂/H₂S acid gas from the sour NGL rich stream.
[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.	There are no cryogenic conditions in this process. The coldest temperatures in the process are the overhead Stream No. 610 exiting the top of the T-610 NGL Fractionator Tower (-16.8°C / 1.76°F), Stream No. 611 exiting the top of the V-614 NGL Reflux Accumulator (-17.6°C / 0.32°F), and the reflux Stream No. 612 exiting the bottom of the V-614 NGL Reflux Accumulator (-17.2°C / 1.04°F), which is the return to the top of the T-610 NGL Fractionator Tower. (Ex. 2062, Pages 2, 13.) There are no membranes in this process. There are no “carbon dioxide recovery solvents” in this process.

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
	The only solvents in the process are the amine solvents (DEA) in the sweetening step, which is not a solvent used for recovery of carbon dioxide. The amine solvents are used in the sweetening step to remove acid gas (CO₂/H₂S) from the “Sour NGL Rich Stream,” not to recover carbon dioxide. The “Carbon Dioxide Recycle Stream” is dehydrated using a Regeneration Gas Scrubber process, then a molecular sieve dehydration (aka mole sieve dehydration) (Ex. 2062, Page 1.) Neither of these dehydration processes use a dehydration solvent.

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
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;	The “Carbon Dioxide Recycle Stream” is compressed by the K-502 Battery Gas Compressor, then flows through the Inlet Separation, Regeneration Gas Scrubber, and Mole Sieve Dehydration as Stream Nos. 600, 601, 602, then 603 (Ex. 2062, Page 1), then flows to the T-610 NGL Fractionation Tower for separating the Stream No. 603 “Carbon Dioxide Recycle Stream” (Ex. 2062, Page 2).

[2.2] dehydrating at least part of the carbon dioxide recycle stream using a dehydration solvent prior to separating the carbon dioxide recycle stream;	The Stream No. 603 “Carbon Dioxide Recycle Stream” is dehydrated using a Regeneration Gas Scrubber process that removes most all of the water from this stream, then a molecular sieve dehydration (aka mole sieve dehydration) process removes the relatively small remaining amount of water in this stream, prior to separating the “Carbon Dioxide Recycle Stream.” (Ex. 2062, Page 1.) Neither of these dehydration processes use a dehydration solvent. After Stream No. 600 “Carbon Dioxide Recycle Stream” is cooled by the E-601 Inlet Gas/Gas [Heat] Exchanger, it flows through the V-608 Regeneration Gas Scrubber, exiting as Stream No. 601. Most of the water in this stream is removed by the V-608 Regeneration Gas Scrubber, and the relatively small remaining amount of water in the stream is removed by the V-604/605 Mole Sieve Dehydrators. (Ex. 2062, Page 1.) Stream No. 602 enters the V-604/605 Mole Sieve Dehydrators, in which the “Carbon Dioxide Recycle Stream” passes through a bed of molecular sieves, where water is adsorbed onto the sieves. Once the sieves are saturated with water, they are regenerated to remove the water from the sieves. This adsorption dehydration process does not use solvents. The Stream No. 601 that exits the V-608 Regeneration Gas Scrubber then flows through the F-603 Inlet Filter/Coalescer, exiting as Stream No. 602, which enters the V-604/605 Mole Sieve Dehydrators, exiting as the Stream No. 603 dehydrated “Carbon Dioxide Recycle Stream,” which flows to the T-610 NGL Fractionation Tower for separating the “Carbon Dioxide Recycle Stream.”
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Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
	Comparison of the stream composition for the Stream No. 600 that enters the V-608 Regeneration Gas Scrubber (38.02 kgmole/h H₂O), with the Stream No. 601 that exits (0.72 kgmole/h H₂O), confirms that most of the water is removed by the V-608 Regeneration Gas Scrubber. The water removed can be seen in the Stream No. 605 “Water to Hydrocarbon Drain” exiting the bottom of the V-608 Regeneration Gas Scrubber (37.26 kgmole/h H₂O). (Ex. 2062, Page 12.) Comparison of the stream composition for the Stream No. 602 that enters the V-604/605 Mole Sieve Dehydrators (0.71 kgmole/h H₂O), with the Stream No. 603 that exits (0.00 kgmole/h H₂O), confirms that the V-604/605 Mole Sieve Dehydrators removes the relatively small amount of remaining water in the stream. (Ex. 2062, Page 12.)
[2.3] combining a carbon dioxide makeup stream external to the method with the purified carbon dioxide recycle stream; and	As do most all Enhanced Oil Recovery (“EOR”) processes, the Weyburn EOR uses a “Carbon Dioxide Makeup Stream” external to the NGL recovery process, and combines that makeup stream with the Stream No. 603 “Purified Carbon Dioxide Recycle Stream.”
[2.4] injecting the combined carbon dioxide makeup stream and the purified carbon dioxide recycle stream into a subterranean formation.	The Weyburn EOR injects the combined “Carbon Dioxide Makeup Stream” and “Purified Carbon Dioxide Recycle Stream” into the subterranean formation.

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
Claim 3 [3] The method of claim 1, further comprising cooling the carbon dioxide recycle stream with the purified carbon dioxide recycle stream.	The Stream No. 603 “Carbon Dioxide Recycle Stream” is cooled with the Stream No. 611 cooled “Purified Carbon Dioxide Recycle Stream” by the E-601 Inlet Gas/Gas [heat] Exchanger. (Ex. 2062, Page 1.) The Stream No. 600 “Carbon Dioxide Recycle Stream” enters the E-601 Inlet Gas/Gas [heat] Exchanger at 42.8 °C (109.4 °F), exits as a non-numbered stream that enters the V-608 Regeneration Gas Scrubber, exiting as the Stream No. 601 cooled “Carbon Dioxide Recycle Stream” at 18.3 °C (64.94 °F). (Ex. 2062, Page 12 (showing Stream No. 600 as 42.8 °C (109.4 °F), and Stream No. 601 as 18.3 °C (64.94 °F).) The Stream No. 611 cooled “Purified Carbon Dioxide Recycle Stream” enters the E-601 Inlet Gas/Gas [heat] Exchanger at -17.6 °C (0.32 °F), cools the Stream No. 600 “Carbon Dioxide Recycle Stream,” exiting as the Stream No. 606 “Purified Carbon Dioxide Recycle Stream” at 37.4 °C (99.32 °F), then flowing to the V730/740 Inlet Separators for compression and re-injection into the subterranean formation. (Ex. 2062, Page 13 (showing Stream No. 611 as -17.6 °C (0.32 °F)); Page 12 (showing Stream No. 606 as 37.4 °C (99.32 °F).)

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)												
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.	The Stream No. 617 “Sweet NGL Rich Stream” composition for Methane, Ethane, and Acid Gases (H2S/CO2) is (Ex. 2062, Page 13): The Stream No. 617 “Sweet NGL Rich Stream” has much less than 1 molar percent Methane and Acid Gases, but slightly more than 1 molar percent Ethane. <table><tr><td>C1</td><td>Methane (kgmole/h)</td><td>0.00% (0.00/59.46)</td></tr><tr><td>C2</td><td>Ethane (kgmole/h)</td><td>1.55% (0.92/59.46)</td></tr></table> Acid gases: <table><tr><td>H2S</td><td>Hydrogen Sulfide (kgmole/h)</td><td>0.00% (0.00/59.46)</td></tr><tr><td>CO2</td><td>Carbon Dioxide (kgmole/h)</td><td>0.15% (0.09/59.46)</td></tr></table>	C1	Methane (kgmole/h)	0.00% (0.00/59.46)	C2	Ethane (kgmole/h)	1.55% (0.92/59.46)	H2S	Hydrogen Sulfide (kgmole/h)	0.00% (0.00/59.46)	CO2	Carbon Dioxide (kgmole/h)	0.15% (0.09/59.46)
C1	Methane (kgmole/h)	0.00% (0.00/59.46)											
C2	Ethane (kgmole/h)	1.55% (0.92/59.46)											
H2S	Hydrogen Sulfide (kgmole/h)	0.00% (0.00/59.46)											
CO2	Carbon Dioxide (kgmole/h)	0.15% (0.09/59.46)											
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;	The T-610 NGL Fractionation Tower that separates the Stream No. 603 “Carbon Dioxide Recycle Stream” into the Stream No. 615 “Sour NGL Rich Stream” and the Stream No. 611 “Purified Carbon Dioxide Recycle Stream” uses the E-613 NGL Overhead Condenser and the V-614 NGL Reflux Accumulator to reflux part of the overhead Stream No. 610, and uses the E-611 NGL Reboiler to reboil part of the Stream No. 615 “Sour NGL Rich Stream.” (Ex. 2062, Page 2.) The T-610 NGL Fractionation Tower overhead Stream No. 610 enters the E-613 NGL Overhead Condenser and exits as the partially condensed non-												

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
	numbered stream that enters the V-614 NGL Reflux Accumulator. Non-numbered reflux stream exits the bottom of V-614 NGL Reflux Accumulator and is pressured up by P-615A/B NGL Reflux Pumps and returned to the top of the T-610 NGL Fractionation Tower as Stream No. 612. Stream No. 611 exits the top of the V-614 NGL Reflux Accumulator as the cooled “Purified Carbon Dioxide Recycle Stream” and flows to the E-601 Inlet Gas/Gas [heat] Exchanger (Ex. 2062, Page 2), cooling the Stream No. 600 “Carbon Dioxide Recycle Stream,” and exiting as the Stream No. 606 “Purified Carbon Dioxide Recycle Stream” for compression and re-injection into the subterranean formation (Ex. 2062, Page 1).
[6.2] reboiling part of the sour NGL rich stream; and	The T-610 NGL Fractionation Tower bottoms Stream No. 613 enters the E-611 NGL Reboiler. Boil-up Stream No. 614 exits the top of the E-611 NGL Reboiler and is returned to the bottom of the T-610 NGL Fractionation Tower. The Stream No. 615 “Sour NGL Rich Stream” exits the bottom of the E-206 NGL Reboiler and flows to the C-624 NGL Product Cooler for cooling. (Ex. 2062, Page 3.)
[6.3] cooling and throttling the sour NGL rich stream.	The Stream No. 615 “Sour NGL Rich Stream” is cooled by the C-624 NGL Product Cooler and exits as Stream No. 615 cooled “Sour NGL Rich Stream.” (Ex. 2062, Page 2). The Material Balance Table shows the temperature for Boil-up Stream No. 614 as 59.9 °C (139.82°F), and the temperature for Stream No. 615 cooled “Sour NGL Rich Stream” as 37.8 °C (100.4°F), confirming the cooling done by the C-624 NGL Product

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)									
	Cooler. (Ex. 2062, Page 13.) The Stream No. 615 cooled “Sour NGL Rich Stream” is throttled by the “Throttling Valve” downstream of the C-624 NGL Product Cooler (Ex. 2062, Page 2), which reduces the pressure of the stream so it can enter the T-625 Amine Contactor at the operating pressure of the Amine Contactor as the Stream No. 615 low pressure “Sour NGL Rich Stream.” (Ex. 2062, Page 3).									
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.	The Stream No. 615 “Sour NGL Rich Stream” composition for Carbon Dioxide, Methane, and Ethane is (Ex. 2062, Page 13): The Stream No. 615 “Sour NGL Rich Stream” has more than 5 molar percent Carbon Dioxide, much less than 1 molar percent Methane, and much less than 5 molar percent Ethane. <table><tr><td>CO2</td><td>Carbon Dioxide (kgmole/h)</td><td>10.00% (7.02/70.17)</td></tr><tr><td>C1</td><td>Methane (kgmole/h)</td><td>0.00% (0.00/70.17)</td></tr><tr><td>C2</td><td>Ethane (kgmole/h)</td><td>1.31% (0.92/70.17)</td></tr></table> The Stream No. 617 “Sweet NGL Rich Stream” composition for Carbon Dioxide is (Ex. 2062, Page 12):	CO2	Carbon Dioxide (kgmole/h)	10.00% (7.02/70.17)	C1	Methane (kgmole/h)	0.00% (0.00/70.17)	C2	Ethane (kgmole/h)	1.31% (0.92/70.17)
CO2	Carbon Dioxide (kgmole/h)	10.00% (7.02/70.17)								
C1	Methane (kgmole/h)	0.00% (0.00/70.17)								
C2	Ethane (kgmole/h)	1.31% (0.92/70.17)								

Claims 1-4, 6-7	Weyburn Processing Plant (Saskatchewan, Canada) Ex. 2062, Weyburn NGL Recovery Plant, Process Flow Diagram and Material Balance (April 23, 2012 – Approved)
	The Stream No. 617 “Sweet NGL Rich Stream” is substantially free of Carbon Dioxide. CO ₂ Carbon Dioxide (kgmole/h) 0.15% (0.09/59.46)

Streams:

Stream No. 600 “Carbon Dioxide Recycle Stream” enters the E-601 Inlet Gas/Gas [heat] Exchanger at 42.8 °C (109.4 °F), exits as a non-numbered stream that enters the V-608 Regeneration Gas Scrubber, exiting as the Stream No. 601 cooled “Carbon Dioxide Recycle Stream”

The Stream No. 601 that exits the V-608 Regeneration Gas Scrubber then flows through the F-603 Inlet Filter/Coalescer, exiting as Stream No. 602, which enters the V-604/605 Mole Sieve Dehydrators, exiting as the Stream No. 603 dehydrated “Carbon Dioxide Recycle Stream,” which flows to the T-610 NGL Fractionation Tower for separating the “Carbon Dioxide Recycle Stream.”

The Stream No. 603 “Carbon Dioxide Recycle Stream” flows into the T-610 NGL Fractionator Tower where this [1.3] separating step is performed

The T-610 NGL Fractionator Tower separates the Stream No. 603 “Carbon Dioxide Recycle Stream” into a bottoms “Sour NGL Rich Stream” (Stream No. 615) and an overhead “Purified Carbon Dioxide Recycle Stream” (Stream No. 611)

Stream No. 610 exits the top of the T-610 NGL Fractionator Tower as the overhead stream and enters the E-613 NGL Overhead Condenser, exiting as a non-numbered stream, which enters the V-614 NGL Reflux Accumulator, exiting as the

Non-numbered reflux stream exits the bottom of V-614 NGL Reflux Accumulator and is pressured up by P-615A/B NGL Reflux Pumps and returned to the top of the T-610 NGL Fractionation Tower as Stream No. 612.

cooled “Purified Carbon Dioxide Recycle Stream” (Stream No. 611), which flows to the E-601 Inlet Gas/Gas [Heat] Exchanger (Ex. 2062, Page 2), exiting as the

“Purified Carbon Dioxide Recycle Stream” (Stream No. 606), which flows to the “V730/740 Inlet Separators” (Ex.

2062, Page 1), then flows to compression and re-injection

Stream No. 613 exits the bottom of the T-610 NGL Fractionator Tower and flows to the E-611 NGL Reboiler, exiting as the “Sour NGL Rich Stream” (Stream No. 615)

Boil-up Stream No. 614 exits the top of the E-611 NGL Reboiler and is returned to the bottom of the T-610 NGL Fractionation Tower.

Stream No. 615 “Sour NGL Rich Stream” exits the bottom of the E-206 NGL Reboiler and flows to the C-624 NGL Product Cooler for cooling

Stream No. 615 “Sour NGL Rich Stream” flows through the C-624 NGL Product Cooler, and a throttling valve, exiting as the Stream No. 615 low pressure “Sour NGL Rich Stream.”

Stream No. 615 low pressure “Sour NGL Rich Stream” flows to the T-625 Amine Contactor, (Ex.2062, Page 2), and enters the T-625 Amine Contactor

Stream No. 616 exits the top of the T-625 Amine Contactor as the overhead stream, which enters the F-626 C3+ Coalescing Filter, exiting as the Stream No. 617 “Sweet NGL Rich Stream,” which flows to the T-666 De-Propanizer Tower

A non-numbered stream exits the bottom of the T-625 Amine Contactor and enters V-647 (Amine Flash Drum), exiting as

Stream No. 618, which enters E-627A/B (Amine Lean/Rich Exchangers), exiting as

Stream No. 619 (Ex. 2062, Page 3), which enters T-628 (Amine Regenerator), exiting as the “Acid Gas Stream” (Stream No. 626), which flows to the V-652 1st Stage Suction Scrubber