IDAHO OIL AND GAS CONSERVATION COMMISSION
May 29, 2019
Information Agenda

SUBJECT

Update on the ongoing Allocation Investigation for hydrocarbons from wells in Payette County operated by Alta Mesa Services. A glossary of capitalized terms follows this memo.

BACKGROUND

The wells produce two hydrocarbon streams generically referred to as gas and condensate. The two streams are processed into three marketable products: Residue Gas, Natural Gas Plant Liquids, and Plant Condensate. The volumes of these three products are then allocated back to each well completion.

In 2018, the Idaho Oil and Gas Conservation Commission (Commission) noted discrepancies in reported volumes for Residue Gas and Plant Condensate. Residue Gas is derived from Rich Gas. Rich Gas is transported from wellheads through the Little Willow Gathering Facility (Little Willow Facility), through the 11-mile long gas pipeline, and through the Northwest Gas Processing Highway 30 Plant (Highway 30 Plant). The Highway 30 Plant extracts Natural Gas Plant Liquids from Rich Gas. The remaining processed gas at the outlet of the Highway 30 Plant is Residue Gas. Plant Condensate is derived from Well Condensate. Well Condensate is transported from wellheads through the Little Willow Facility, through the 11-mile long condensate pipeline, and through the Highway 30 Plant. The remaining processed condensate at the outlet of the Highway 30 Plant is Plant Condensate.

Alta Mesa was informed of the discrepancies. They discovered a systematic error in an equation used in some steps of the allocation process. The error affected the volumes of Plant Condensate allocated to the gas and liquid streams leaving the Little Willow Facility and entering the Highway 30 Plant. Allocations of Natural Gas Plant Liquids were not affected by the error.

The error was a mismatched stream analysis reference within an equation.

- The incorrect reference applied the equivalent liquid volume percentage of each individual hydrocarbon component derived from each individual laboratory analysis.

- The correct reference applied the molecular percentage of each individual hydrocarbon component derived from each individual laboratory analysis.

Table 1 is a textbook example laboratory hydrocarbon analysis data table of chromatographic results using test method GPA 2186M. It lists the "Mole %" (molecular %) and the "Liq. Vol. %" (liquid volume percent) for 21 components. Highlighted in yellow are the Mole % and the Liq. Vol. % for methane. Note the difference in percentages for methane. Differences also occur for the other individual components.

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide............	0.0853	0.1450	0.0687
Nitrogen.....................	0.0281	0.0304	0.0146
Methane.....................	64.2964	39.8359	51.4398
Ethane.......................	14.4191	16.7445	18.1980
Propane......................	11.9911	20.4207	15.5901
iso-Butane..................	2.5568	5.7392	3.9483
n-Butane.....................	3.8382	8.6156	5.7104
iso-Pentane.................	0.9367	2.6100	1.6166
n-Pentane...................	0.9036	2.5178	1.5457
Cyclopentane..............	0.0519	0.1405	0.0725
n-Hexane....................	0.2551	0.8490	0.4950
Cyclohexane...............	0.0463	0.1505	0.0743
Other Hexanes	0.2743	0.9130	0.5324
Heptanes....................	0.0865	0.3347	0.1883
Methylcyclohexane........	0.0301	0.1141	0.0571
2,2,4-Trimethylpentane...	0.0951	0.4195	0.2332
Benzene.....................	0.0247	0.0745	0.0326
Toluene......................	0.0104	0.0370	0.0164
Ethylbenzene..............	0.0007	0.0029	0.0013
Xylenes......................	0.0062	0.0254	0.0113
C8+ Heavies...............	0.0634	0.2797	0.1533
Totals	100.0000	100.0000	100.0000

GENERAL ALLOCATION METHOD

The individual well completions are allocated their shares of hydrocarbon products (Plant Condensate, Residue Gas, and Natural Gas Plant Liquids) produced by the Highway 30 Plant by a one-, two-, or three-step allocation method. The allocation methods differ in the number of steps because of various technical, operational, or financial constraints associated primarily with the location of each well in relation to the production process. Each individual step uses the component volumes derived from the laboratory analyses that are used to scale the contribution of each well completion to the total of each product.

- <u>One Step Allocation</u>. Only well completion DJS 1-15 uses a one-step allocation process. The fluid stream from DJS 1-15 undergo three-phase gravity separation and metering at the well pad. The two liquid hydrocarbon streams from DJS 1-15 go into the two separate pipelines that transport Well Condensate and Rich Gas from the Little Willow Facility to the Highway 30 Plant. Therefore, the Highway 30 Plant totals are allocated ***to*** DJS 1-15 in one step.

- <u>Two Step Allocation</u>. Seven well completions (Kauffman 1-9 LT ("lower tube"), Kauffman 1-9 UT ("upper tube"), ML 1-10, ML 1-11 UT, ML 1-11 LT, ML 2-10, and ML 3-10) use a two-step allocation process.

    - Step 1: Highway 30 Plant totals ***to*** Little Willow Facility totals;

- Step 2: Little Willow Facility totals (minus totals from the "multi wells" discussed below) ***to*** these individual well completions.

- Three Step Allocation. The three wells with partial federal mineral ownership (ML 1-3, ML 2-3, and Kauffman 1-34) use a three step allocation process.

  - Step 1: Highway 30 Plant totals ***to*** Little Willow Facility totals;

  - Step 2: Little Willow Facility totals ***to*** the "multi well" totals. For well completions K 1-34, ML 1-3, and ML 2-3, each well fluid stream undergoes three-phase gravity separation and metering for each well at each well pad, and not at the Little Willow Facility. Then, the three fluid streams (water, hydrocarbon liquids, and hydrocarbon gases) from the three wells (nine total fluid streams) are combined into one gathering line, which runs to the multi-well three-phase separator located at the Little Willow Facility. The multi-well separator creates three fluid streams (water, hydrocarbon liquids, and hydrocarbon gases), each individually metered.

  - Step 3: The multi-well hydrocarbon stream totals are allocated ***to*** individual well completions.

DISCUSSION

Attachment 1 (McFarland datasets) comprises several allocation datasets produced for Alta Mesa by contract petroleum engineer S. McFarland. The Oil and Gas Division received these datasets on April 1, 2019. The McFarland datasets contain the monthly results and yearly summations of the original ("old") allocation method (2015-2018), the results of the corrected ("new") allocation method (2016-2018), and the differences between the two methods (2016-2018).

Attachment 2 (IDL Review datasets) is a year-by-year summary of the McFarland datasets. It is color-coded for ease of review. The IDL Review datasets also include a summary of Plant Condensate volumes and Residue Gas volumes using both allocation methods (new and old), as well as the difference and percent difference between these methods.

The bottom of the IDL Review dataset includes the 2016-2018 grand totals of volumes for all well completions for Plant Condensate (new, old, difference) and for Residue Gas (new, old, difference). The grand totals of volumes for new versus old are equal. In addition, the IDL Review datasets suggest that the new corrected allocation has reasonable variances of plus or minus five percent by well completion as shown by the percent differences to the old allocation results. The exception is the Kauffman 1-9 LT, which shows a negative 28 percent difference in Plant Condensate. At this point in our investigation, the variances in percent differences, including Kauffman 1-9 LT, are presumed to be related to the allocation error summarized above.

GLOSSARY

Allocation is a term used to describe the system by which ownership of oil, gas, and produced water is determined and tracked from the point of production to a point of sale or discharge. Allocation is also known as hydrocarbon accounting, hydrocarbon value realization, product measurement and allocation, and production management and reporting. Although the principles of allocation are straightforward, the details are highly complex.

Natural Gas Plant Liquids means hydrocarbon compounds in Rich Gas that are extracted as liquids at processing plants, gas processing plants, gas plants, gasoline processing plants, fractionating plants, cryogenic plants, and cycling plants. Natural Gas Plant Liquids may include ethane, propane, the butanes, the pentanes, and hydrocarbon compounds of higher molecular weight. Hydrocarbon components may be fractionated and sold as an individual hydrocarbon (such as propane), or mixed together (referred to as Y-grade or raw mix) and sold, depending on the purchaser's sales agreement.

Plant Condensate is also referred to as stabilized condensate and means the processed liquid hydrocarbon product from a processing plant. The processing decreases the quantity of methane and ethane, which reduces the vapor pressure of the liquid, thereby preventing the production of vapor phase upon flashing the liquid, which ensures safe storage in atmospheric transportation and storage tanks.

Residue Gas is also referred to as tailgate gas, burner gas, or pipeline-quality natural gas and means 87.0 - 97.0 molecular percentage of methane that is merchantable and marketable, and meets an interstate or intrastate transmission company's minimum specifications per American Gas Association Bulletin No. 36.

Rich Gas means all hydrocarbon compounds and gaseous substances in a raw, unprocessed liquids-rich gas (minus formation water) that is gaseous at the conditions under which its volume is measured or estimated. Rich Gas is typically recovered from the wellhead or at the surface by use of a gravity separator or similar equipment. Rich Gas typically consists mostly of methane, ethane, propane, the butanes, and minor amounts of the pentanes plus hydrocarbon compounds of higher molecular weight.

Well Condensate means undifferentiated crude oil or condensate as a mixture of raw liquid hydrocarbon components, the majority of which range from pentanes and hydrocarbon compounds of higher molecular weight recovered after the wellhead by gravity separation or a similar process, and is liquid at the conditions under which its volume is measured or estimated. Well Condensate (also called lease condensate) can be derived directly after the wellhead with no separation (historically called casinghead gasoline). Well Condensate is typically unstable for truck transport and must be processed at a specialized facility to remove specific hydrocarbon compounds or various impurities; it is then referred to as Plant Condensate.

ATTACHMENTS

1. McFarland Allocation Datasets
2. IDL Review Datasets
3. PowerPoint – "Allocation Investigation"

Meter No.	Meter Name	Prod	Allo approach	8/1/15	9/1/15	10/1/15	11/1/15	12/1/15	2015 Total	1/1/16	2/1/16	3/1/16	4/1/16	5/1/16	6/1/16	7/1/16	8/1/16	9/1/16	10/1/16	11/1/16	12/1/16	2016 Total
FE-103C	ML 1-3 Condensate	Cond	New							-	58.82	1.743.97	1.097.64	1.284.73	1.351.83	1.663.22	1.126.17	2.574.83	2.421.69	3.330.20	2.125.08	18.778.18
FE-103C	ML 1-3 Condensate	Cond	Old							-	57.42	1.677.22	1.276.79	2.904.07	1.437.10	1.747.82	1.131.92	2.824.32	2.364.26	3.148.31	2.136.85	20.706.08
FE-103C	ML 1-3 Condensate	Cond	diff							-	1.40	66.75	(179.15)	(1.619.34)	(85.28)	(84.60)	(5.74)	(249.49)	57.43	181.88	(11.77)	(1.927.90)
FE-103C	ML 1-3 Condensate	Gas	New							-	19.04	977.37	803.58	1.052.04	854.55	765.67	810.01	1.207.65	972.03	1.137.79	1.373.81	9.973.54
FE-103C	ML 1-3 Condensate	Gas	Old							-	19.87	1.052.04	817.71	1.088.61	876.66	774.99	819.15	1.184.16	966.89	1.125.71	1.359.37	10.085.16
FE-103C	ML 1-3 Condensate	Gas	diff							-	(0.83)	(74.67)	(14.12)	(36.58)	(22.11)	(9.32)	(9.15)	23.49	5.15	12.07	14.44	(111.62)
FE-103G	ML 1-3 Gas	Cond	New							-	186.19	1.123.74	1.163.33	913.83	1.929.99	1.245.01	1.924.08	2.632.53	1.609.12	2.911.08	3.891.68	19.530.59
FE-103G	ML 1-3 Gas	Cond	Old							-	209.23	1.169.32	1.287.97	983.25	2.153.42	1.323.21	1.897.80	2.613.28	1.615.86	2.861.63	4.208.56	20.323.54
FE-103G	ML 1-3 Gas	Cond	diff							-	(23.04)	(45.57)	(124.64)	(69.42)	(223.43)	(78.20)	26.28	19.25	(6.74)	49.44	(316.88)	(792.94)
FE-103G	ML 1-3 Gas	Gas	New							-	5.917.18	93.976.86	87.027.61	130.399.27	128.019.59	125.607.85	133.224.27	235.896.48	149.682.59	256.127.98	263.733.87	1.609.613.55
FE-103G	ML 1-3 Gas	Gas	Old							-	5.925.68	93.898.27	90.048.60	134.653.01	131.282.67	126.601.84	134.365.46	231.776.89	148.754.03	253.596.11	261.570.90	1.612.473.48
FE-103G	ML 1-3 Gas	Gas	diff							-	(8.50)	78.59	(3.020.99)	(4.253.74)	(3.263.09)	(994.00)	(1.141.19)	4.119.58	928.56	2.531.87	2.162.97	(2.859.92)

Meter No.	1/1/17	2/1/17	3/1/17	4/1/17	5/1/17	6/1/17	7/1/17	8/1/17	9/1/17	10/1/17	11/1/17	12/1/17	2017 Total
FE-103C	2.212	792	1.053	1.551	2.017	1.429	1.071	1.291	254	786	868	111	13.435
FE-103C	952	330	478	582	736	516	287	391	92	230	302	40	4.936
FE-103C	1.260	462	575	969	1.281	913	784	900	162	555	567	72	8.498
FE-103C	843	515	686	1.254	1.319	990	777	621	309	448	295	70	8.128
FE-103C	2.358	1.115	1.655	3.097	3.172	2.453	2.531	2.063	803	1.439	1.036	176	21.898
FE-103C	(1.515)	(600)	(969)	(1.844)	(1.853)	(1.464)	(1.754)	(1.441)	(494)	(991)	(741)	(105)	(13.771)
FE-103G	3.210	1.724	2.274	1.669	1.648	2.010	2.177	1.766	310	1.107	798	91	18.784
FE-103G	4.840	2.076	3.638	2.873	3.019	3.092	2.914	2.870	553	1.596	1.290	215	28.978
FE-103G	(1.630)	(352)	(1.364)	(1.205)	(1.371)	(1.083)	(737)	(1.104)	(244)	(489)	(492)	(124)	(10.193)
FE-103G	207.992	77.980	141.902	127.882	116.985	142.218	144.635	145.525	47.453	79.680	56.806	12.076	1.301.134
FE-103G	205.844	77.575	138.360	123.293	114.979	140.558	143.507	143.664	46.717	78.917	56.155	11.856	1.281.423
FE-103G	2.147	406	3.542	4.589	2.006	1.659	1.128	1.862	737	764	650	220	19.711

Meter No.	1/1/18	2/1/18	3/1/18	4/1/18	5/1/18	6/1/18	7/1/18	8/1/18	9/1/18	10/1/18	11/1/18	12/1/18	2018 Total	Grand Total
FE-103C	51	15	-	72	78	17	33	27	0	-	258	120	671	32.884
FE-103C	20	7	-	27	34	7	13	10	0	-	150	61	328	25.970
FE-103C	(31)	(8)	-	(45)	(44)	(10)	(20)	(18)	(0)	-	(108)	(59)	(343)	6.228
FE-103C	37	3	-	242	41	10	14	5	0	-	32	2	387	18.488
FE-103C	85	11	-	545	135	37	66	28	0	-	199	62	1.168	33.152
FE-103C	(48)	(8)	-	(303)	(94)	(27)	(52)	(23)	(0)	-	(167)	(60)	(781)	(14.664)
FE-103G	50	12	1	77	82	31	109	63	-	-	91	76	592	38.907
FE-103G	72	19	1	173	156	59	164	84	-	-	188	96	1.013	50.314
FE-103G	23	7	0	95	74	29	55	21	-	-	96	20	421	(10.566)
FE-103G	3.683	585	29	19.104	7.584	3.878	8.594	3.782	-	-	10.727	2.669	60.634	2.971.382
FE-103G	3.648	575	28	18.627	7.366	3.788	8.478	3.721	-	-	10.579	2.657	59.468	2.953.365
FE-103G	35	9	1	476	218	90	116	61	-	-	148	12	1.167	18.017

IDAHO OIL AND GAS CONSERVATION COMMISSION
April 23, 2019* Information Agenda Allocation Update
ATTACHMENT 1. McFarland Allocation Datasets
*Postponed until May 29, 2019 Meeting

NOTE: THIS SHEET USES A DIFFERENT ORDER OF WELLS, VERSUS ORIGINAL, AND ONLY SHOWS YEARLY SUMMARIES OF ORIGINAL (hidden monthly columns)

EXPLANATION TO COLORS OF FONTS AND HIGHLIGHTS		
Plant Condensate	New	Corrected Allocation Method
Residue Gas	Old	Original Allocation Method
NGPL were not affected by the allocation error	diff	Difference from Corrected to Original

Note: Variance in % Difference from Plant Condensate to Residue Gas is due to the allocation error (see Memo). Eg, Methane mole % = 10.3642 vs Liquid Volume % = 3.410.

2016 - 2018 Totals by Well Completion

Meter No.	Meter Name	Product Produced	Allocation Method	2015 Total	2016 Total	2017 Total	2018 Total	row	2016-2018 Total by Well	Plant Condensate (BBL) New (1+7)	Plant Condensate (BBL) Old (2+8)	Plant Condensate (BBL) Difference (3+9)	Plant Condensate (BBL) % Difference	Residue Gas (MMBtu) New (4+10)	Residue Gas (MMBtu) Old (5+11)	Residue Gas (MMBtu) Difference (6+12)	Residue Gas (MMBtu) % Difference	
FE-103C	ML 1-3 Condensate	Cond	New		18,778	13,435	671	1	32,884									Allocation (=>) by 3 Steps: Plant Total => Little Willow Total => Multi-Well Separator => Well
		Cond	Old		20,706	4,936	328	2	25,970									
		Cond	diff		(1,928)	8,498	(343)	3	6,228									
		Gas	New		9,974	8,128	387	4	18,488									
		Gas	Old		10,085	21,898	1,168	5	33,152									
		Gas	diff		(112)	(13,771)	(781)	6	(14,664)									
FE-103G	ML 1-3 Gas	Cond	New		19,531	18,784	592	7	38,907	71,791								
		Cond	Old		20,324	28,978	1,013	8	50,314		76,285							
		Cond	diff		(793)	(10,193)	421	9	(10,566)			(4,338)	-6%					
		Gas	New		1,609,614	1,301,134	60,634	10	2,971,382					2,989,870				
		Gas	Old		1,612,473	1,281,423	59,468	11	2,953,365						2,986,516			
		Gas	diff		(2,860)	19,711	1,167	12	18,017							3,354	0%	
FE-134C	Kauffman 1-34 Condensate	Cond	New		17,061	5,738	493	1	23,292									Allocation (=>) by 3 Steps: Plant Total => Little Willow Total => Multi-Well Separator => Well
		Cond	Old	4,147	17,571	2,674	228	2	20,473									
		Cond	diff		(510)	3,064	(265)	3	2,289									
		Gas	New		15,426	3,942	179	4	19,547									
		Gas	Old		15,550	11,356	604	5	27,510									
		Gas	diff		(124)	(7,414)	(425)	6	(7,963)									
FE-134G	Kauffman 1-34 Gas	Cond	New		6,525	3,074	231	7	9,830	33,122								
		Cond	Old	204	6,832	4,177	337	8	11,345		31,819							
		Cond	diff		(307)	(1,102)	106	9	(1,303)			986	3%					
		Gas	New		407,500	142,906	12,823	10	563,228					582,775				
		Gas	Old		410,537	144,085	12,757	11	567,379						594,889			
		Gas	diff		(3,037)	(1,179)	65	12	(4,151)							(12,114)	-2%	
FE-203C	ML 2-3 Condensate	Cond	New		6,054	3,522	587	1	10,163									Allocation (=>) by 3 Steps: Plant Total => Little Willow Total => Multi-Well Separator => Well
		Cond	Old		6,442	1,498	237	2	8,177									
		Cond	diff		(388)	2,023	(351)	3	1,285									
		Gas	New		4,442	2,382	213	4	7,037									
		Gas	Old		4,540	6,063	725	5	11,328									
		Gas	diff		(98)	(3,681)	(512)	6	(4,291)									
FE-203G	ML 2-3 Gas	Cond	New		5,309	4,082	681	7	10,071	20,234								
		Cond	Old		5,620	6,204	1,172	8	12,997		21,173							
		Cond	diff		(311)	(2,123)	491	9	(1,943)			(658)	-3%					
		Gas	New		358,181	263,960	47,583	10	669,724					676,762				
		Gas	Old		361,450	260,154	46,938	11	668,541						679,869			
		Gas	diff		(3,269)	3,807	645	12	1,183							(3,107)	0%	
FE-115C	DJS 1-15 Condensate	Cond	New		-	1,228	903	1	2,130									Allocation (=>) by One Step: Plant Total => DJS 1-15
		Cond	Old		-	1,228	501	2	1,729									
		Cond	diff		-	0	(401)	3	(401)									
		Gas	New		-	871	483	4	1,354									
		Gas	Old		-	68,018	59,323	5	127,342									
		Gas	diff		-	(67,147)	(58,840)	6	(125,987)									
FE-115G	DJS 1-15 Gas	Cond	New		-	690	501	7	1,192	3,322								
		Cond	Old		-	690	903	8	1,593		3,322							
		Cond	diff		-	0	401	9	401			0	0%					
		Gas	New		-	68,018	59,323	10	127,342					128,696				
		Gas	Old		-	871	483	11	1,354						128,696			
		Gas	diff		-	67,147	58,840	12	125,987							0	0%	
FE-109AC	Kauffman 1-9 LT Oil	Cond	New		-	-	6,496	1	6,496									Allocation (=>) by 2 Steps: Plant Total => Little Willow Total (excluding Multi-Well Total) => Well
		Cond	Old		-	-	4,454	2	4,454									
		Cond	diff		-	-	(2,042)	3	(2,042)									
		Gas	New		-	-	4,468	4	4,468									
		Gas	Old		-	-	8,561	5	8,561									
		Gas	diff		-	-	(4,092)	6	(4,092)									
FE-109AG	Kauffman 1-9 LT Gas	Cond	New		1,627	-	207	7	1,834	8,330								
		Cond	Old		1,511	-	369	8	1,881		6,335							
		Cond	diff		115	-	162	9	277			(1,765)	-28%					
		Gas	New		125,289	-	22,485	10	147,774					152,242				
		Gas	Old		124,013	-	22,210	11	146,222						154,783			
		Gas	diff		1,276	-	275	12	1,552							(2,541)	-2%	
FE-109BC	Kauffman 1-9 UT Condensate	Cond	New		740	1,128	4,656	1	6,524									
		Cond	Old	684	649	782	3,183	2	4,614									
		Cond	diff		91	346	(1,473)	3	(1,036)									
		Gas	New		145	588	5,009	4	5,741									
		Gas	Old	804	147	1,115	8,386	5	9,648									
		Gas	diff		(2)	(528)	(3,377)	6	(3,906)									
FE-109BG	Kauffman 1-9 UT Gas	Cond	New		741	725	1,182	7	2,648	9,172								
		Cond	Old	323	740	970	1,978	8	3,688		8,302							
		Cond	diff		1	(245)	796	9	552			(484)	-6%					
		Gas	New		67,976	64,964	113,509	10	246,449					252,190				
		Gas	Old	50,940	67,695	64,433	112,097	11	244,225						253,873			
		Gas	diff		281	531	1,411	12	2,224							(1,682)	-1%	
FE-110C	ML 1-10 Condensate	Cond	New		518	-	-	1	518									
		Cond	Old	3,260	508	-	-	2	508									
		Cond	diff		10	-	-	3	10									
		Gas	New		314	-	-	4	314									
		Gas	Old	2,711	268	-	-	5	268									
		Gas	diff		46	-	-	6	46									
FE-110G	ML 1-10 Gas	Cond	New		334	-	-	7	334	852								
		Cond	Old	1,930	349	-	-	8	349		857							
		Cond	diff		(15)	-	-	9	(15)			(5)	-1%					
		Gas	New		39,998	-	-	10	39,998					40,311				
		Gas	Old	253,771	40,071	-	-	11	40,071						40,339			
		Gas	diff		(73)	-	-	12	(73)							(28)	0%	
FE-111AC	ML 1-11 UT Condensate	Cond	New		12,804	8,807	7,033	1	28,645									
		Cond	Old	3,907	11,979	6,114	4,645	2	22,738									
		Cond	diff		825	2,693	(2,389)	3	1,130									
		Gas	New		7,953	3,661	2,590	4	14,204									
		Gas	Old	5,423	7,685	7,892	6,222	5	21,798									
		Gas	diff		268	(4,230)	(3,632)	6	(7,594)									
FE-111AG	ML 1-11 UT Gas	Cond	New		8,996	7,672	6,194	7	22,861	51,506								
		Cond	Old	1,739	8,742	10,695	9,569	8	29,006		51,744							
		Cond	diff		254	(3,024)	3,376	9	606			1,735	3%					
		Gas	New		828,451	721,620	559,782	10	2,109,853					2,124,058				
		Gas	Old	256,638	826,762	716,022	554,359	11	2,097,143						2,118,941			
		Gas	diff		1,689	5,598	5,423	12	12,710							5,116	0%	
FE-111BC	ML 1-11 LT Condensate	Cond	New		11,559	4,140	1,180	1	16,879									
		Cond	Old	4,431	10,016	2,741	805	2	13,562									
		Cond	diff		1,543	1,399	(374)	3	2,568									
		Gas	New		6,203	1,870	324	4	8,397									
		Gas	Old	4,213	5,915	4,512	774	5	11,201									
		Gas	diff		288	(2,642)	(451)	6	(2,804)									
FE-111BG	ML 1-11 LT Gas	Cond	New		6,027	3,198	534	7	9,759	26,637								
		Cond	Old	1,631	5,960	4,591	735	8	11,287		24,849							
		Cond	diff		67	(1,394)	201	9	(1,125)			1,443	6%					
		Gas	New		554,891	314,652	33,701	10	903,244					911,640				
		Gas	Old	260,992	550,962	311,809	33,442	11	896,213						907,414			
		Gas	diff		3,929	2,843	259	12	7,031							4,226	0%	
FE-210C	ML 2-10 Condensate	Cond	New		21,143	15,668	5,845	1	42,657									
		Cond	Old	5,897	20,133	11,081	3,940	2	35,154									
		Cond	diff		1,011	4,587	(1,906)	3	3,692									
		Gas	New		11,830	7,773	4,449	4	24,052									
		Gas	Old	3,738	11,584	15,397	8,138	5	35,119									
		Gas	diff		247	(7,625)	(3,689)	6	(11,068)									
FE-210G	ML 2-10 Gas	Cond	New		12,080	13,219	3,697	7	28,995	71,652								
		Cond	Old	1,912	11,745	17,750	6,138	8	35,632		70,786							
		Cond	diff		336	(4,531)	2,441	9	(1,755)			1,937	3%					
		Gas	New		1,155,526	1,178,830	387,340	10	2,721,696					2,745,748				
		Gas	Old	273,202	1,153,978	1,170,250	382,976	11	2,707,204						2,742,323			
		Gas	diff		1,549	8,580	4,364	12	14,492							3,425	0%	
FE-310C	ML 3-10 Condensate	Cond	New		-	-	10,914	1	10,914									
		Cond	Old		-	-	7,287	2	7,287									
		Cond	diff		-	-	(3,627)	3	(3,627)									
		Gas	New		-	-	7,525	4	7,525									
		Gas	Old		-	-	13,814	5	13,814									
		Gas	diff		-	-	(6,288)	6	(6,288)									
FE-310G	ML 3-10 Gas	Cond	New		-	-	5,824	7	5,824	16,738								
		Cond	Old		-	-	10,599	8	10,599		17,886							
		Cond	diff		-	-	4,775	9	4,775			1,148	6%					
		Gas	New		-	-	692,847	10	692,847					700,372				
		Gas	Old		-	-	683,209	11	683,209						697,023			
		Gas	diff		-	-	9,638	12	9,638							3,349	0%	

	2015 Total	2016 Total	2017 Total	2018 Total
Total By Year All Wells Plant Condensate (BBL)				
New		149,827	105,109	58,421
Old	30,067	149,827	105,109	58,421
diff		0	(0)	0
Total All Wells Residue Gas (MMBtu)				
New		5,203,712	4,085,300	2,015,653
Old	1,112,433	5,203,714	4,085,300	2,015,653
diff		(2)	(0)	0

2016-2018 Totals All Wells of Plant Condensate (BBL)		
New	Old	Difference
313,357	313,357	0

2016-2018 Totals All Wells of Residue Gas (MMBtu)		
New	Old	Difference
11,304,665	11,304,667	(2)

IDAHO OIL AND GAS CONSERVATION COMMISSION
April 23, 2019* Information Agenda Allocation Update
ATTACHMENT 2. IDL Review Datasets
*Postponed until May 29, 2019 Meeting

ALLOCATION INVESTIGATION

IDAHO OIL & GAS
CONSERVATION COMMISSION

May 29, 2019

DAVE SCHWARZ

OIL & GAS FIELD INSPECTOR

IDAHO DEPARTMENT OF LANDS

ATTACHMENT 3

GENERAL BACKGROUND

Wells produce

2 hydrocarbon streams generically referred to as

gas & condensate

2 streams are processed into **3 marketable products**:

Residue Gas

Natural Gas Plant Liquids

Plant Condensate

Volumes of these 3 products are then **ALLOCATED**

back to each well completion

ALLOCATION : The system by which ownership of oil, gas, & produced water is determined & tracked from point of production to a point of sale or discharge

Although the principles of allocation are straightforward, the **details are highly complex**

equivalent volume of source x *attributable to the inlet of tier* K *delivered to sink* y *on the outlet of tier* K:

$$V_{x_{K-1}\to y_K} = \sum_{i=1}^{I} \frac{V_{x_{K-1},i}}{\sum_{x_{K-1}=1}^{X_{K-1}} V_{x_{K-1},i}} \cdot V_{y_K,i}$$

In 2018, OGCC noted discrepancies in reported volumes of Residue Gas & Plant Condensate

Residue Gas*: derived from *Rich Gas

Rich Gas: transported from wellheads thru Little Willow Gathering Facility, thru the 11 mile long gas pipeline, to Hwy 30 Plant

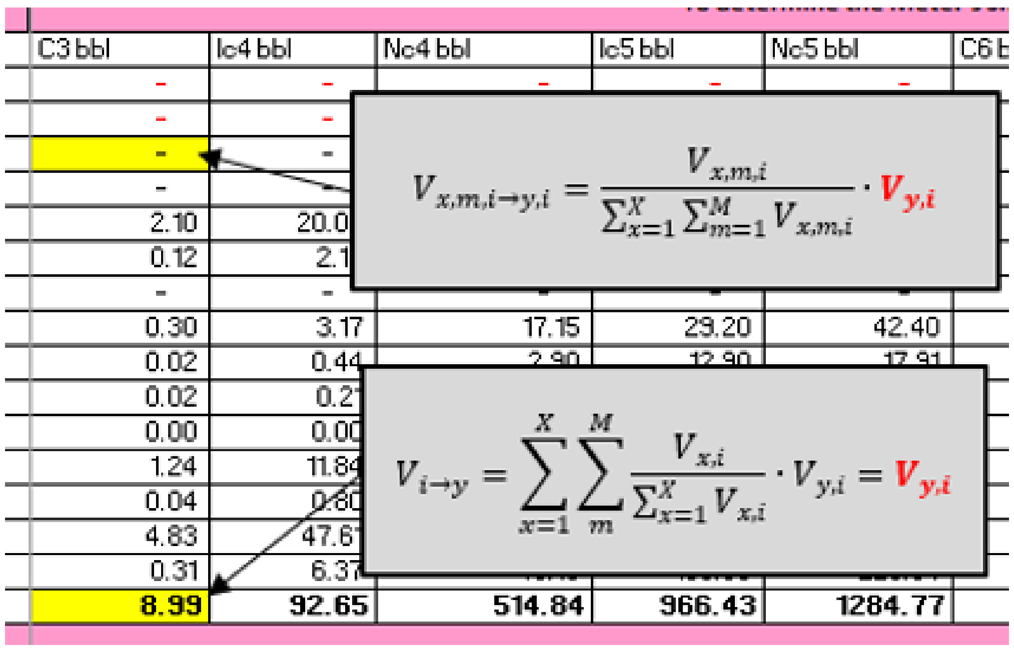
Hwy 30 Plant extracts *Natural Gas Plant Liquids* from *Rich Gas*, & delivers Residue Gas at outlet

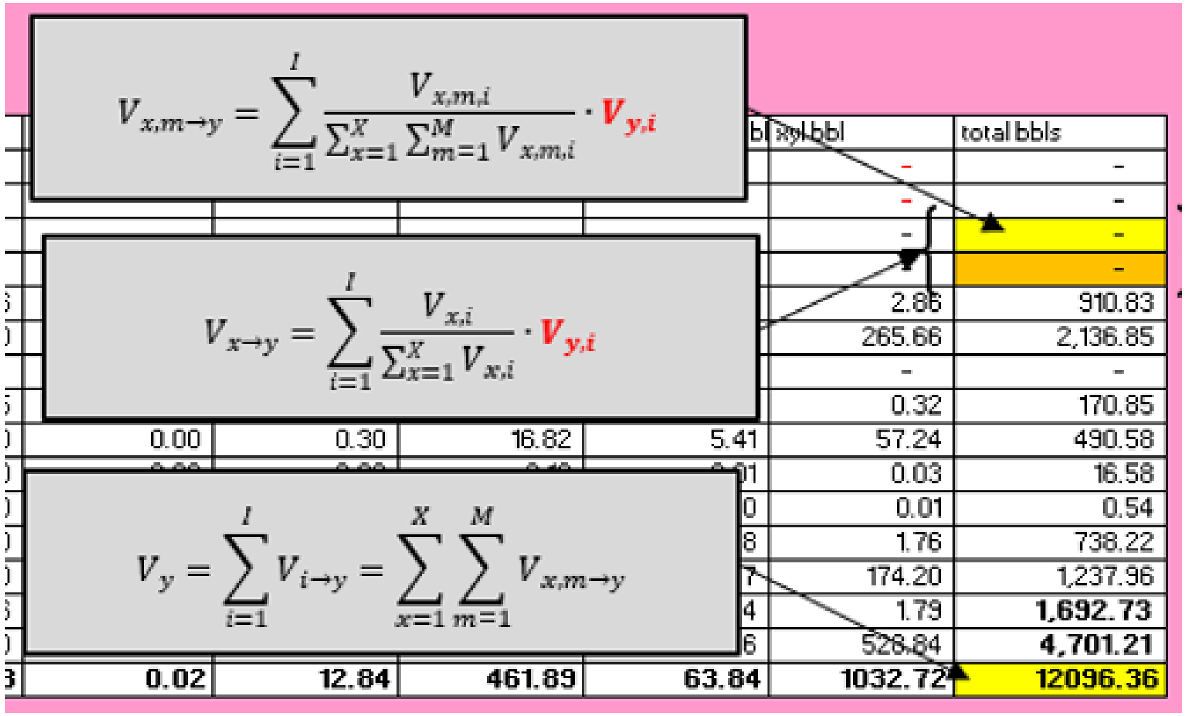
Plant Condensate*: derived from *Well Condensate

Well Condensate: transported from wellheads thru Little Willow Facility, thru 11 mile long condensate pipeline, thru Hwy 30 Plant

Alta Mesa discovered a systematic error in an equation used in some steps of allocation process

- Eq. scales vols of Plant Condensate allocated to gas & liquid streams leaving Little Willow Facility & entering Hwy 30 Plant
- Allocations of Natural Gas Plant Liquids not affected by error





Error = Mismatched Stream Analysis Reference of Components From Lab Analyses

Example Hydrocarbon Analysis

closeup next slide

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide............	0.0853	0.1450	0.0687
Nitrogen.....................	0.0281	0.0304	0.0146
Methane......................	64.2964	39.8359	51.4398
Ethane........................	14.4191	16.7445	18.1980
Propane......................	11.9911	20.4207	15.5901
iso-Butane..................	2.5568	5.7392	3.9483
n-Butane.....................	3.8382	8.6156	5.7104
iso-Pentane.................	0.9367	2.6100	1.6166
n-Pentane...................	0.9036	2.5178	1.5457
Cyclopentane...............	0.0519	0.1405	0.0725
n-Hexane....................	0.2551	0.8490	0.4950
Cyclohexane...............	0.0463	0.1505	0.0743
Other Hexanes	0.2743	0.9130	0.5324
Heptanes....................	0.0865	0.3347	0.1883
Methylcyclohexane........	0.0301	0.1141	0.0571
2,2,4-Trimethylpentane...	0.0951	0.4195	0.2332
Benzene.....................	0.0247	0.0745	0.0326
Toluene......................	0.0104	0.0370	0.0164
Ethylbenzene..............	0.0007	0.0029	0.0013
Xylenes......................	0.0062	0.0254	0.0113
C8+ Heavies...............	0.0634	0.2797	0.1533
Totals	100.0000	100.0000	100.0000

Error = Mismatched Stream Analysis Reference of Components From Lab Analyses

Incorrect Allocation: applied equiv. Liq. Vol. %

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide..............	0.0853	0.1450	0.0687
Nitrogen......................	0.0281	0.0304	0.0146
Methane......................	64.2964	39.8359	51.4398

Correct Allocation: applied Mole %

GENERAL ALLOCATION METHOD

Individual well completions are allocated their shares of products (Plant Cond, Residue Gas, & NGPL) produced by Hwy 30 Plant by a **1-, 2-, or 3-step allocation method**

Methods differ in # of steps because of technical, operational, or financial constraints assoc. with location of each well in relation to production process

Each step uses component volumes derived from lab analyses that are used to scale the contribution of each well completion to total of each product

One Step Allocation = DJS 1-15

Hwy 30 Plant totals are allocated ***to*** DJS 1-15 in a one-step process

Fluid stream from DJS 1-15 undergo 3-phase gravity separation & metering at the well pad

The 2 liquid hydrocarbon streams **do not** go to Little Willow

But directly into the 2 separate pipelines that transport Well Condensate & Rich Gas from Little Willow to Hwy 30 Plant

Two Step Allocation: Kauffman **1-9 LT, Kauffman 1-9 UT, ML 1-10, ML 1-11 UT, ML 1-11 LT, ML 2-10 & ML 3-10**

Step 1: Hwy 30 Plant totals ***to*** Little Willow Facility totals

Step 2: Little Willow Facility totals (minus totals from the "multi wells" discussed next) ***to*** these individual well completions

3 Step Allocation. 3 wells with partial federal mineral ownership: ML 1-3, ML 2-3, & Kauffman 1-34

Step 1: Hwy 30 Plant totals ***to*** Little Willow Facility totals

Step 2: Little Willow totals ***to*** "multi well" totals. Each well fluid stream undergoes 3-phase grav. sep. & metering for each well at each well pad -- *not* at Little Willow Facility. Then, the 3 streams (water, HC liquids, & HC gases) from the 3 wells (9 total fluid streams) are combined into 1 gathering line, which runs to the Multi-Well (MW) 3-phase sep. located at Little Willow Facility. MW separator creates 3 fluid streams (water, HC liquids, & HC gases), each individually metered.

Step 3: The MW HC stream totals are allocated ***to*** individual well completions

Attachment 1 ("McFarland datasets")

Allocation datasets produced for Alta Mesa by petroleum engineer S. McFarland. Received on Apr 1, 2019 by O & G Div

McFarland datasets contain:

Monthly results & yearly summations of:

- original ("old") allocation method (2015-18)
- corrected ("new") allocation method (2016-18)
- differences between the two methods (2016-18)

Attachment 2 (“IDL Review datasets”)

- Only the yearly summations of the McFarland datasets
- color-coding of datasets for ease of review,

Meter No.	Meter Name	Product Produc	Allocation Metho	2016 Total	2017 Total	2018 Total	row	2016-2018 Total by We
FE-111AC	ML 1-11 UT Condensate	Cond	New	12,804	8,807	7,033	1	28,645
FE-111AC	ML 1-11 UT Condensate	Cond	Old	11,979	6,114	4,645	2	22,738
FE-111AC	ML 1-11 UT Condensate	Cond	diff	825	2,693	(2,389)	3	1,130
FE-111AC	ML 1-11 UT Condensate	Gas	New	7,953	3,661	2,590	4	14,204
FE-111AC	ML 1-11 UT Condensate	Gas	Old	7,685	7,892	6,222	5	21,798
FE-111AC	ML 1-11 UT Condensate	Gas	diff	268	(4,230)	(3,632)	6	(7,594)
FE-111AG	ML 1-11 UT Gas	Cond	New	8,996	7,672	6,194	7	22,861
FE-111AG	ML 1-11 UT Gas	Cond	Old	8,742	10,695	9,569	8	29,006
FE-111AG	ML 1-11 UT Gas	Cond	diff	254	(3,024)	3,376	9	606
FE-111AG	ML 1-11 UT Gas	Gas	New	828,451	721,620	559,782	10	2,109,853
FE-111AG	ML 1-11 UT Gas	Gas	Old	826,762	716,022	554,359	11	2,097,143
FE-111AG	ML 1-11 UT Gas	Gas	diff	1,689	5,598	5,423	12	12,710

Attach. 2 ("IDL Review datasets")

additional summations by Plant Condensate & Residue Gas

new, old, difference, % difference

2016 - 2018 Totals by Well Completion							
Plant Condensate (BBL)				Residue Gas (MMBtu)			
New (1+7)	Old (2+8)	Difference (3+9)	% Difference	New (4+10)	Old (5+11)	Difference (6+12)	% Difference
51,506							
	51,744						
		1,735	3%				
				2,124,058			
					2,118,941		
						5,116	0%

Bottom of Attach. 2 shows 2016-18 grand totals of all wells for:

2016-2018 Totals All Wells of Plant Condensate (BBL)		
New	Old	Difference
313,357	313,357	0

2016-2018 Totals All Wells of Residue Gas (MMBtu)		
New	Old	Difference
11,304,665	11,304,667	(2)

Attach. 2 : new corrected allocation shows reasonable variances by well completion in % differences to old allocation results

Except for Kauffman 1-9 LT: -28 % difference in Plant Condensate

Plant Condensate (BBL)			
New (1+7)	Old (2+8)	Difference (3+9)	% Difference
8,330			
	6,335		
		(1,765)	-28%

At this point in our investigation, the variances in % differences, including Kauffman 1-9 LT, are presumed to be related to the allocation error

QUESTIONS?

THANK YOU

$$V_x = \sum_{m=1}^{M} \sum_{i=1}^{I} V_{x,m,i} = \sum_{i=1}^{I} V_{x,i} = \sum_{i=1}^{I} V_{x,i} \cdot \frac{V_i}{V_i} = \sum_{i=1}^{I} V_{x,i} \cdot \frac{\sum_{y=1}^{Y} V_{y,i}}{\sum_{x=1}^{X} V_{x,i}}$$

$$V_x = \sum_{i=1}^{I} \frac{V_{x,i}}{\sum_{x=1}^{X} V_{x,i}} \cdot \sum_{y=1}^{Y} V_{y,i}$$

The equivalent volume contributed by source x is equal to the contribution of component i from source x relative to the contributions of component i from all sources, multiplied by the receipts of component i by all sinks, summed over all stream components.