The New Normal for the Normalization of "Type Well Profiles"

&

a bit about using allocated production data from public sources

OKC-SPEE
October 25, 2018

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SPEE
SOCIETY OF PETROLEUM EVALUATION ENGINEERS

Problems associated with using allocated production data

or

Green = DI Allocated Oil

Red = IHS Allocated Oil

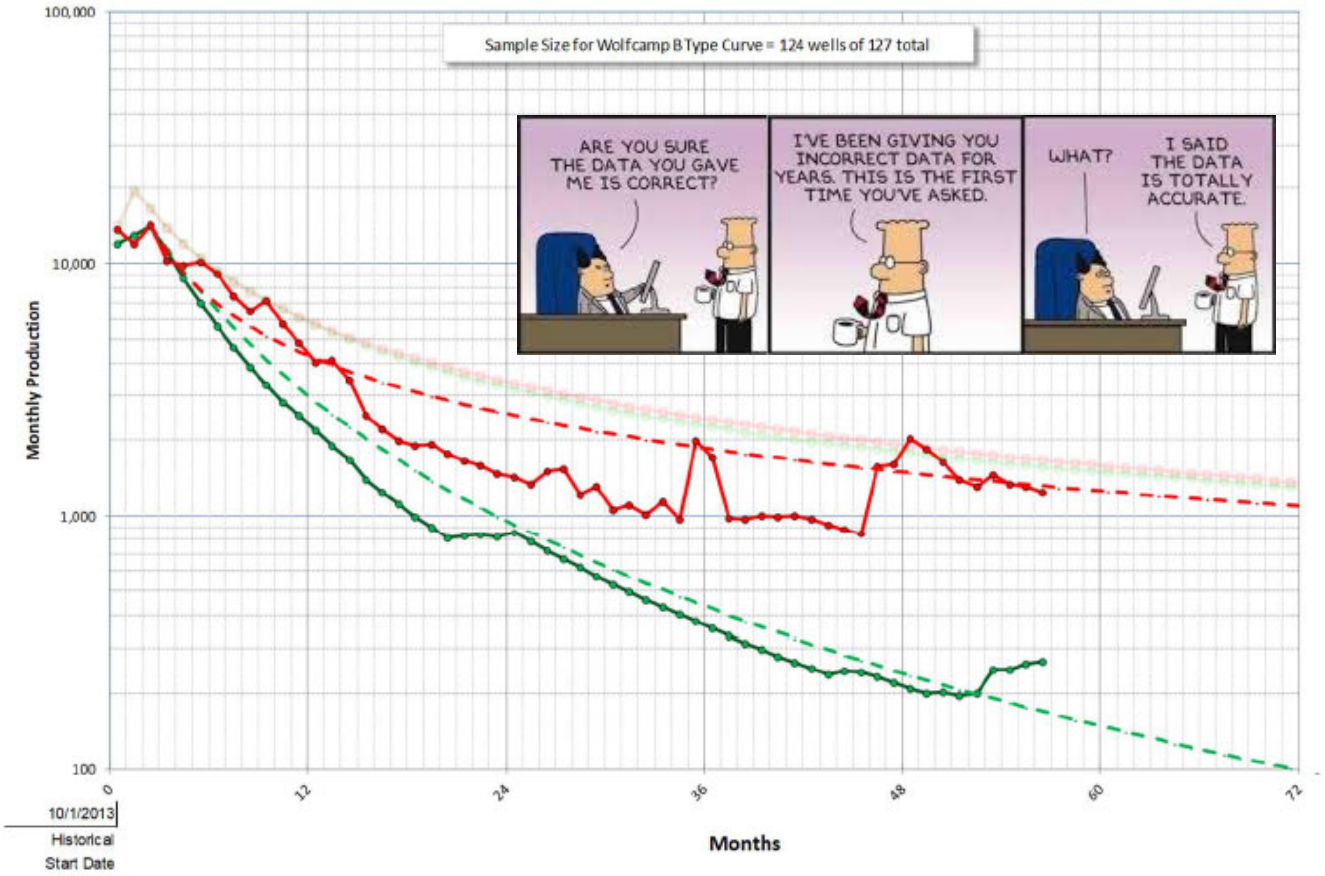
Monday, September 17, 2018
11:21 AM

EUR 1/2 life ~ 80% NPV = 9 mo.
TC EUR 1/2 life ~ 80% NPV = 44 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
8,342

API# : 42317384470000



STRONGHOLD RESOURCE PARTNERS

PIONEER NATURAL RESOURCES COMPANY
SCHARBAUER RANCH 202H
Wolfcamp B
Well # 2 of 127 Wells Posted

Years Modelled (50)

Oil Phase

IP (30), BOPD	464
b	0.40
Di	84%
Exp	7%
Abdn	1
Prior Cum, Bbls	24,942
Rem Oil, Bbls	109,223
DI - OIL EUR, Bbls	**134,165**

Gas Phase

IP (30), MCFD	470
b	1.30
Di	74%
Exp	7%
Abdn	1.0
Prior Cum, MCF	25,608
Rem Gas, MCF	348,703
IHS - OIL EUR, Bbls	**374,311**

NGL Phase

NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**

GOR = 1012 SCF/Bbl
Most likely - Volatile Oil

Green = DI Allocated Oil

Red = IHS Allocated Oil

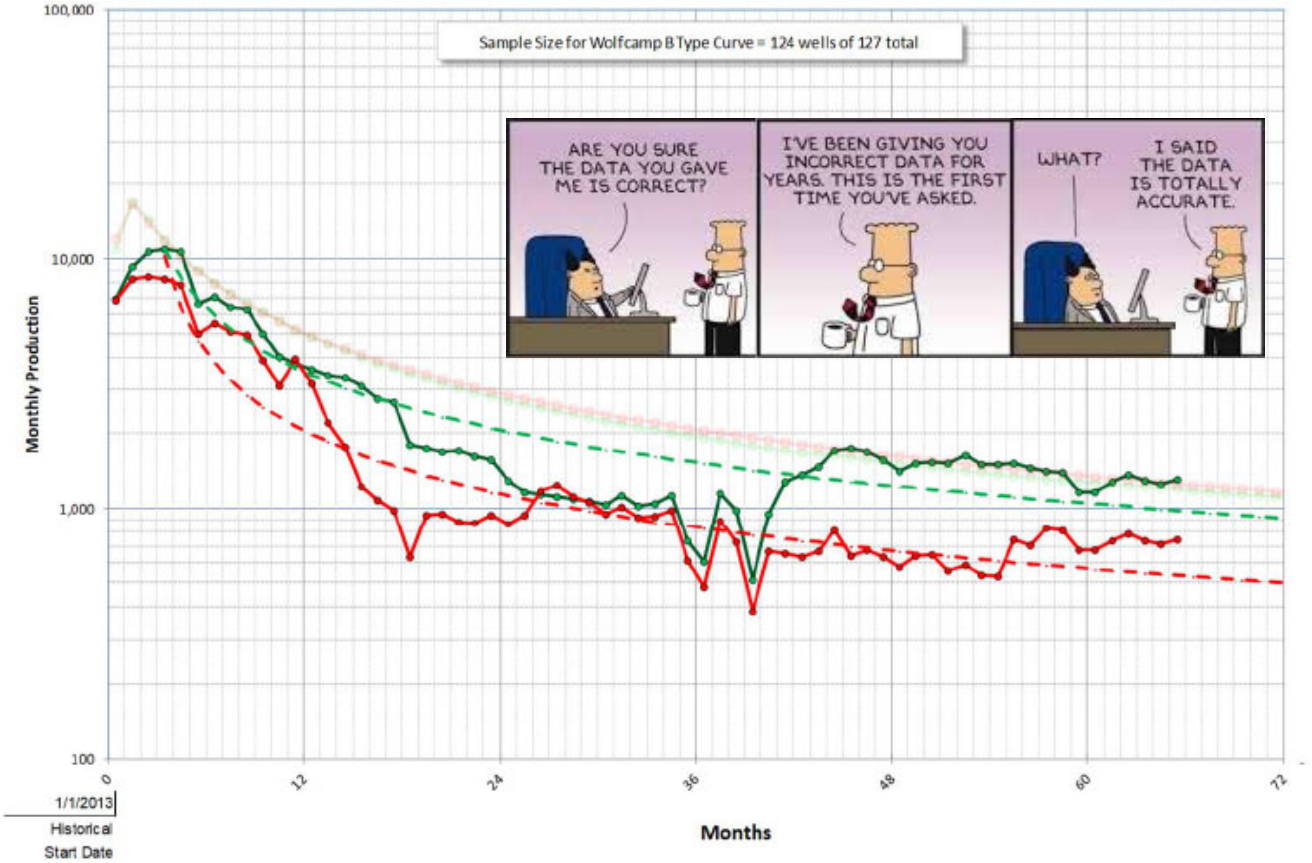
Monday, September 17, 2018
11:12 AM

EUR 1/2 life ~ 80% NPV = 52 mo.
TC EUR 1/2 life ~ 80% NPV = 44 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
7,112

API# : 42317381570000



STRONGHOLD RESOURCE PARTNERS

AJAX RESOURCES, LLC
CHABLIS 5H
Wolfcamp B
Well # 1 of 127 Wells Posted

Years Modelled (50)

Oil Phase

IP (30), BOPD	360
b	1.40
Di	74%
Exp	7%
Abdn	0.1
Prior Cum, Bbls	26,841
Rem Oil, Bbls	284,193
DI - OIL EUR, Bbls	**311,034**

Gas Phase

IP (30), MCFD	338
b	1.40
Di	84%
Exp	7%
Abdn	0.1
Prior Cum, MCF	23,614
Rem Gas, MCF	163,451
IHS - OIL EUR, Bbls	**187,065**

NGL Phase

NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**

GOR = 938 SCF/Bbl
Most likely - Black Oil

Green = DI Allocated Oil

Red = IHS Allocated Oil

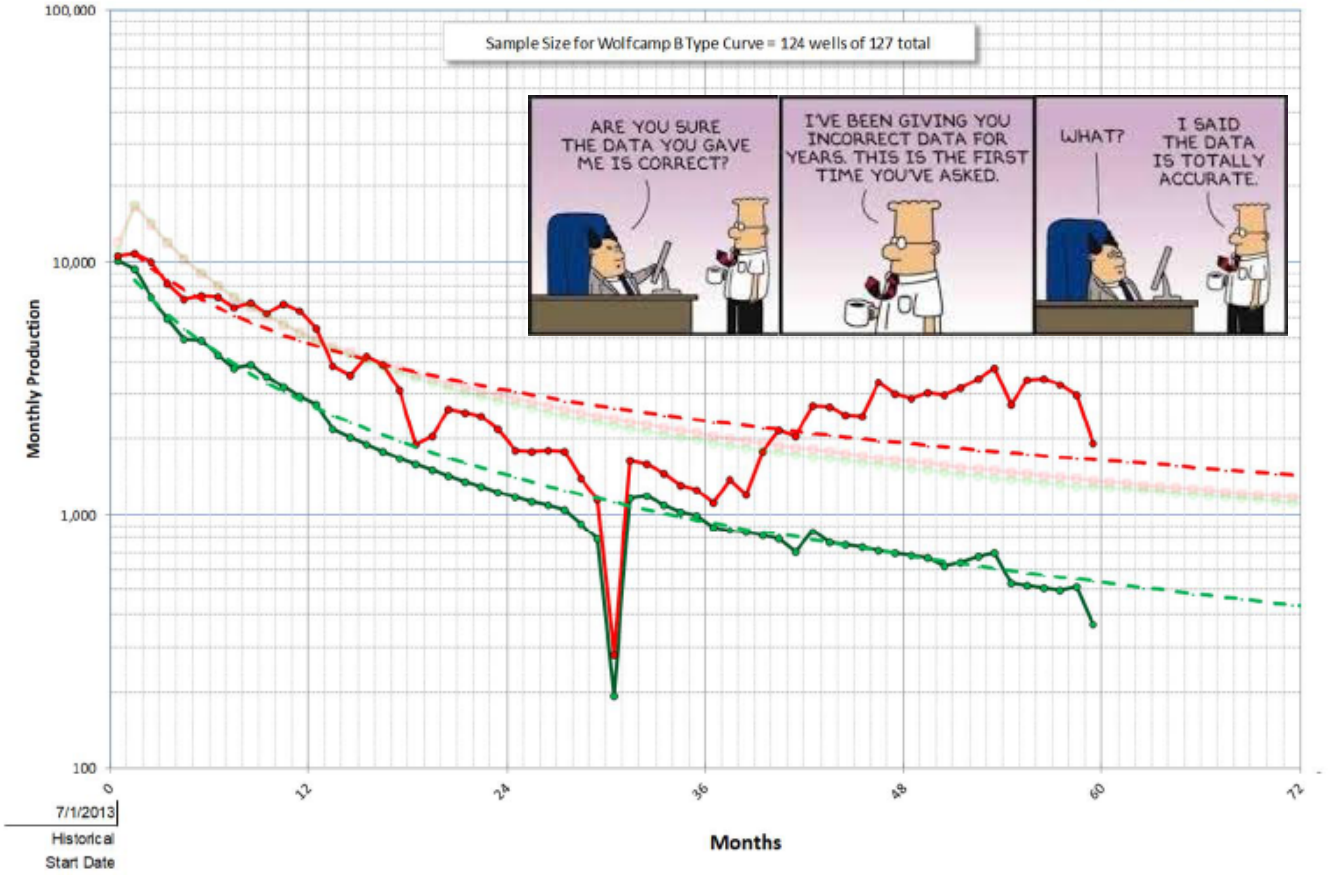
Monday, September 17, 2018
11:21 AM

EUR 1/2 life ~ 80% NPV = 31 mo.
TC EUR 1/2 life ~ 80% NPV = 44 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
7,153

API# : 42317384650000



STRONGHOLD RESOURCE PARTNERS

CONCHO RESOURCES INC.
CROSS BAR RANCH 1811WB
Wolfcamp B
Well # 3 of 127 Wells Posted

Years Modelled (50)

Oil Phase

IP (30), BOPD	335
b	0.80
Di	74%
Exp	7%
Abdn	1
Prior Cum, Bbls	0
Rem Oil, Bbls	168,635
DI - OIL EUR, Bbls	**168,635**

Gas Phase

IP (30), MCFD	356
b	1.30
Di	59%
Exp	7%
Abdn	1.0
Prior Cum, MCF	10,566
Rem Gas, MCF	432,024
IHS - OIL EUR, Bbls	**442,590**

NGL Phase

NGL Yield, Bbls/MMcf	0
Gas Shrink	100%

NGL EUR, Bbls	**0**

GOR = 1063 SCF/Bbl
Most likely - Volatile Oil

Green = DI Allocated Oil

Red = IHS Allocated Oil

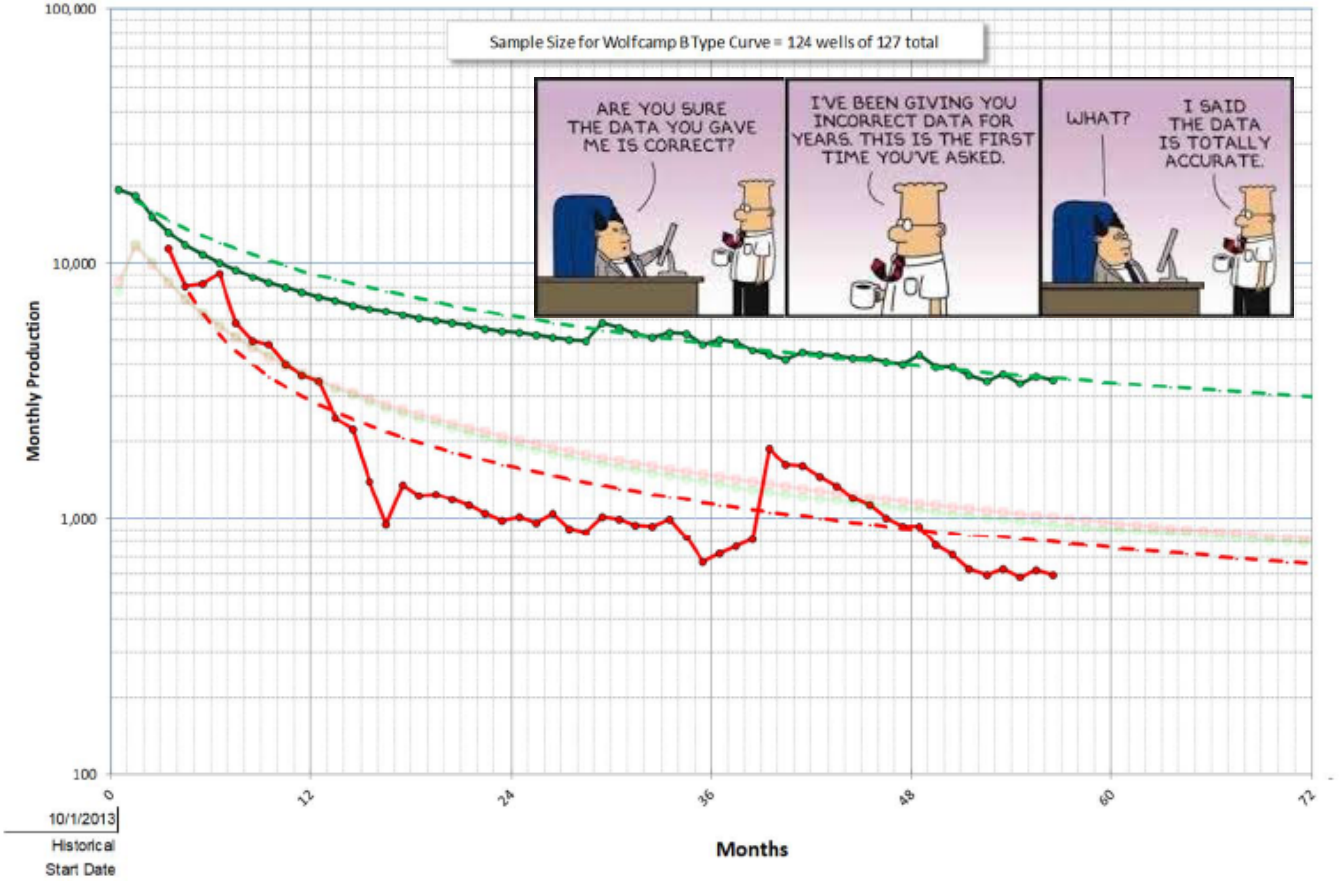
Monday, September 17, 2018
11:22 AM

TC EUR 1/2 life ~ 80% NPV = 44 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
5,044

API# : 42317386790000



STRONGHOLD RESOURCE PARTNERS

OCCIDENTAL ENERGY COMPANY,INC.
SOUTH CURTIS RANCH 2316H
Wolfcamp B
Well # 4 of 127 Wells Posted

Years Modelled (50)

Oil Phase

IP (30), BOPD	641
b	1.30
Di	54%
Exp	7%
Abdn	1
Prior Cum, Bbls	0
Rem Oil, Bbls	891,930
DI - OIL EUR, Bbls	**891,930**

Gas Phase

IP (30), MCFD	375
b	1.30
Di	80%
Exp	7%
Abdn	1.0
Prior Cum, MCF	0
Rem Gas, MCF	214,388
IHS - OIL EUR, Bbls	**214,388**

NGL Phase

NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**

GOR = 585 SCF/Bbl
Most likely - Black Oil

Green = DI Allocated Oil

Red = IHS Allocated Oil

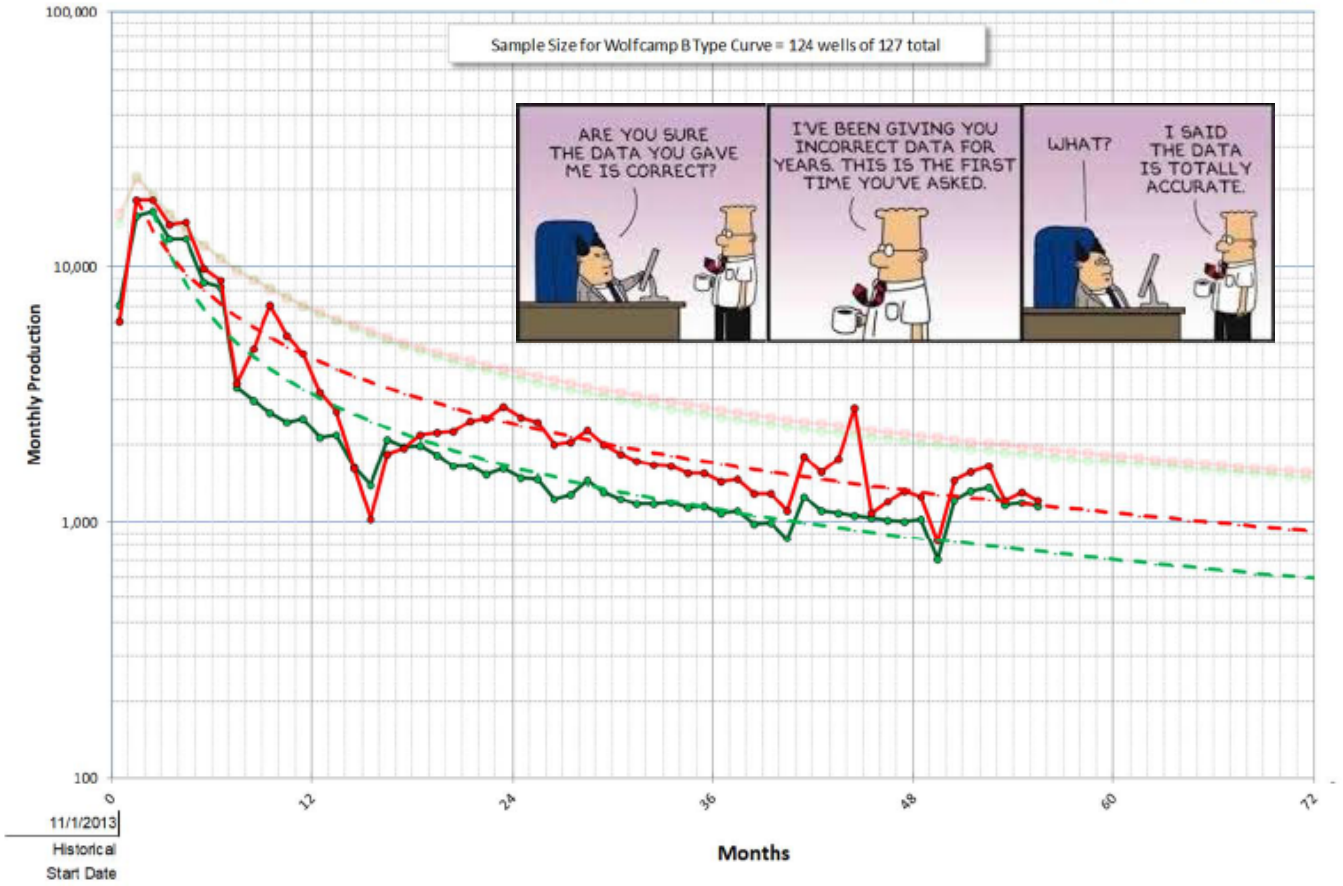
Monday, September 17, 2018
11:22 AM

EUR 1/2 life ~ 80% NPV = 28 mo.
TC EUR 1/2 life ~ 80% NPV = 44 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
9,542

API# : 42317387520000



STRONGHOLD RESOURCE PARTNERS

PIONEER NATURAL RESOURCES COMPANY
MABEE 'K' 4H
Wolfcamp B
Well # 5 of 127 Wells Posted

Years Modelled (50)

Oil Phase

IP (30), BOPD	538
b	1.10
Di	84%
Exp	7%
Abdn	1
Prior Cum, Bbls	22,821
Rem Oil, Bbls	218,275
DI - OIL EUR, Bbls	**241,096**

Gas Phase

IP (30), MCFD	602
b	1.10
Di	78%
Exp	7%
Abdn	1.0
Prior Cum, MCF	6,061
Rem Gas, MCF	325,673
IHS - OIL EUR, Bbls	**331,734**

NGL Phase

NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**

GOR = 1120 SCF/Bbl
Most likely - Volatile Oil

Green = DI Allocated Oil

Red = IHS Allocated Oil

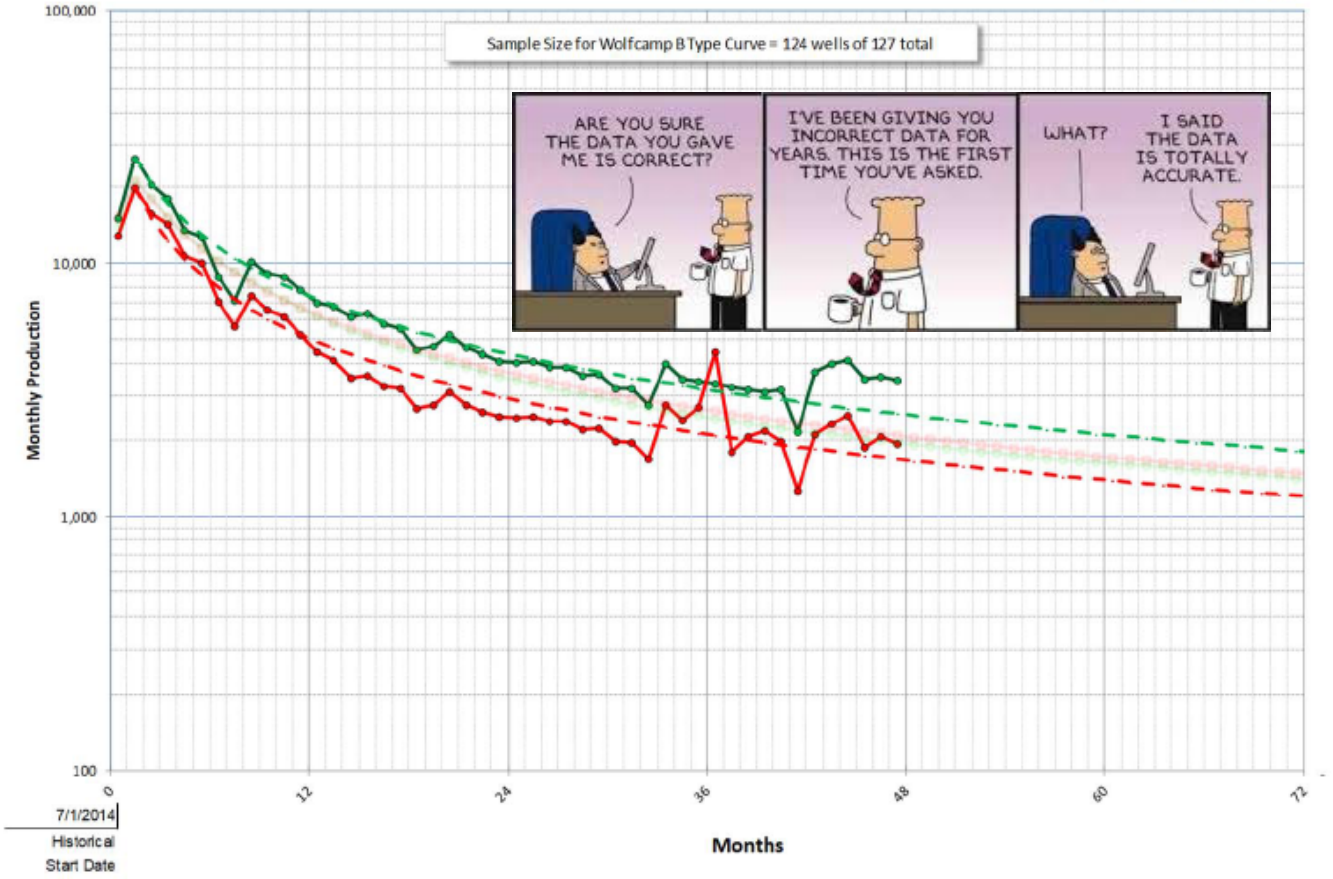
Monday, September 17, 2018
11:24 AM

EUR 1/2 life ~ 80% NPV = 48 mo.
TC EUR 1/2 life ~ 80% NPV = 44 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
9,056

API# : 42317387650000



STRONGHOLD RESOURCE PARTNERS

PIONEER NATURAL RESOURCES COMPANY
MABEE 'K' 5H
Wolfcamp B
Well # 6 of 127 Wells Posted

Years Modelled (50)

Oil Phase	
IP (30), BOPD	863
b	1.20
Di	74%
Exp	7%
Abdn	1
Prior Cum, Bbls	15,070
Rem Oil, Bbls	601,121
DI - OIL EUR, Bbls	**616,191**

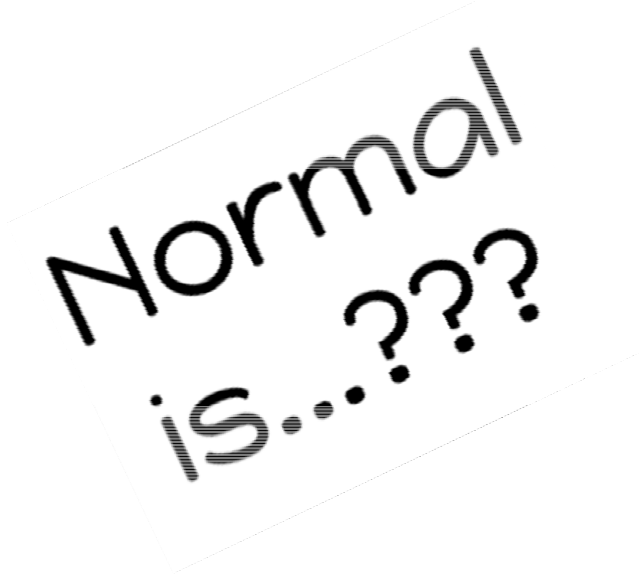
Gas Phase	
IP (30), MCFD	653
b	1.20
Di	77%
Exp	7%
Abdn	1.0
Prior Cum, MCF	12,829
Rem Gas, MCF	405,553
IHS - OIL EUR, Bbls	**418,382**

NGL Phase	
NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**

GOR = 757 SCF/Bbl
Most likely - Black Oil

It makes me CRAZY!

Moving on to normalizing type well profiles



Definition

Type Well Profiles (TWP)

"average monthly" performance in a developmental program over time

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- **Type Well Profiles are just another tool for the purpose of solving CRITICAL TASKS in the oil and gas industry.**
  - **Help in forecasting economics on new wells.**
  - **Planning a development program**

Building Type Well Profiles the Hard Way

- This method is laborious and time consuming, but
  - It will certainly be the most accurate if you can get through the next few pages

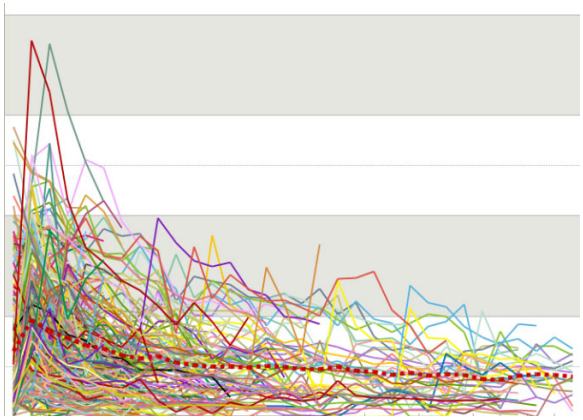
"The guy you replaced died of old age right there at his desk. He was only 36."

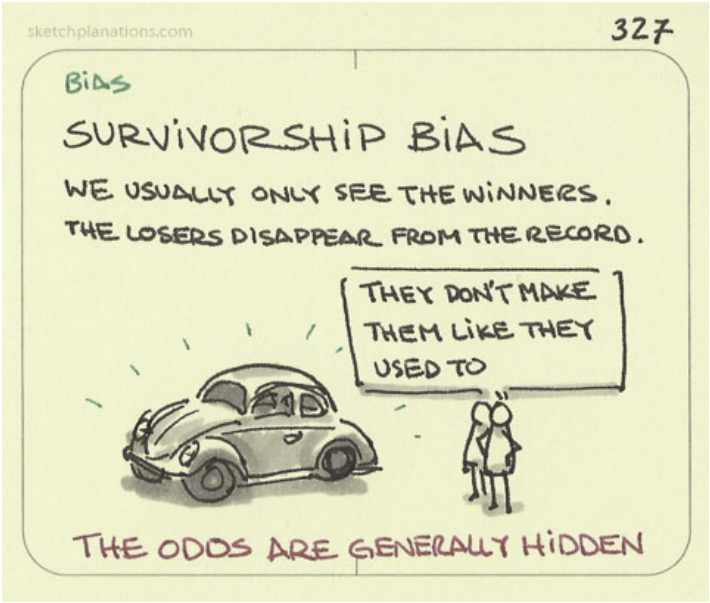
Construction of a Type Well Profile

- Type Well Profiles must be representative of the pre-determined purpose using pre-determined goals.

  - Choose formation of interest
  - Choose well type
    - Horizontal
    - Vertical
  - Choose fluid type
    - Dead oil
    - Volatile oil
    - Condensate
    - Wet gas
    - Dry gas
  - Do traditional decline curve analysis on each well used in the Type Well Profile.
  - Do Statistical Distribution of all individual well results
    - Oil IP
    - Gas IP
    - Oil EUR
    - Gas EUR
  - Average monthly forecasts of all wells
    - Type Well Profile EUR equals average of the underlying well EURs

Survivor Bias ?





Survivor bias is the tendency to give more weight to the longest surviving wells when averaging production.

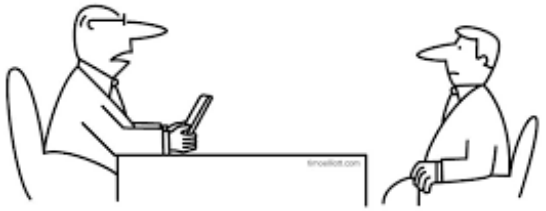
Solving the problem;

- Forecast all wells first

Normalization Methods

- Normalize to date of first production or the primary phase
  - When summing all forecasts together this will give a valuable look at the ramp up period that can be expected and should give more reasonable economic results when entering monthly data into your economic model.

- Normalize to month of high production of the primary phase
  - When summing all forecasts together this will yield results that are much easier to enter into an economic model.
    - Initial Rates, Declines, bfactors, etc.



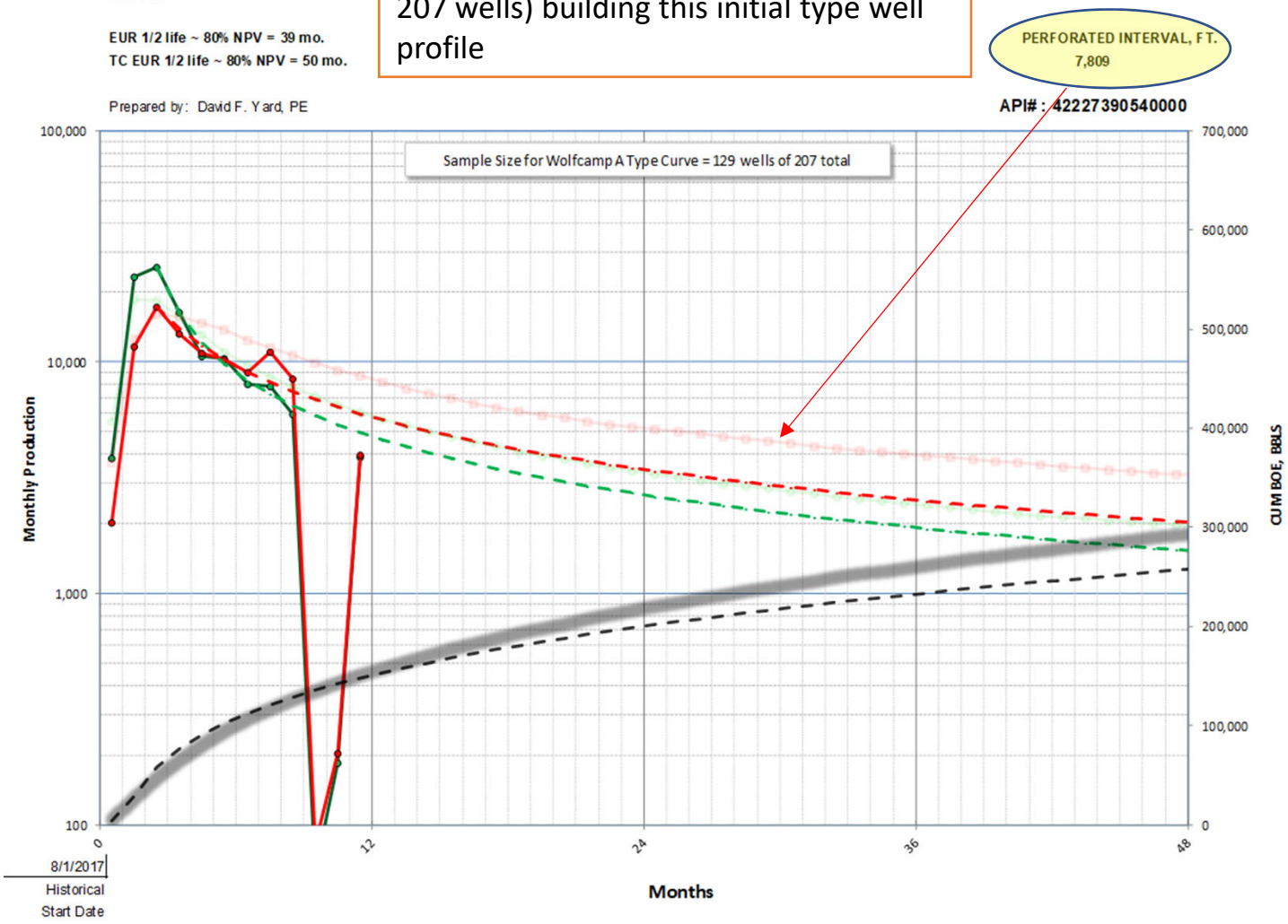
"No, I'm afraid we can't 'just make the data up' —this is business, not politics..."

- Normalize by.
  - Lateral Length
  - Completion Practices
    - Stages
    - Clusters
    - Proppant
    - Frac Fluids
    - Etc.

We solve this problem by doing "vintage" normalization

The only way you can make this work is if you use only wells with modern completion practices…usually HZ wells newer than mid-2015

I used 129 WCA wells (total data set was 207 wells) building this initial type well profile



STRONGHOLD RESOURCE PARTNERS

CALLON PETROLEUM COMPANY
BARCLAYS UNIT 2AH
Wolfcamp A
Well # 3 of 273 Wells Posted

Years Modelled (30)

Oil Phase	
IP (30), BOPD	846
b	1.30
Di	84%
Exp	6%
Abdn	0.1
Prior Cum, Bbls	27,211
Rem Oil, Bbls	368,040
OIL EUR, Bbls	**395,251**

Gas Phase	
IP (30), MCFD	572
b	1.30
Di	71%
Exp	6%
Abdn	0.1
Prior Cum, MCF	13,700
Rem Gas, MCF	450,037
Gas EUR, MCF (NO NGLs)	**463,737**

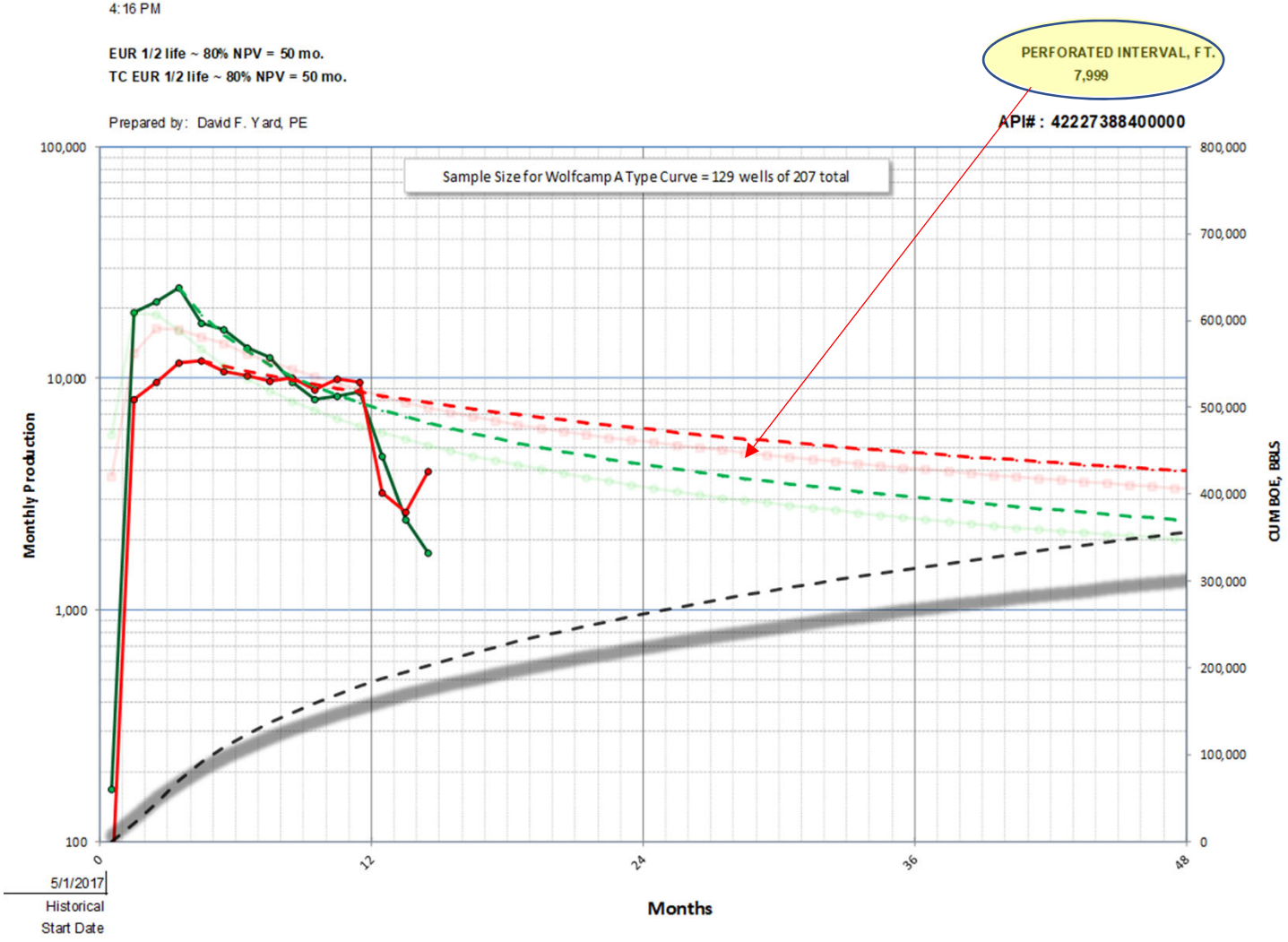
NGL Phase	
NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**
BOE EUR, Bbls	**472,541**
TC BOE EUR, Bbls	**595,095**

GOR = 676 SCF/Bbl
Most likely - Volatile Oil

Wednesday, September 26, 2018
4:16 PM

EUR 1/2 life ~ 80% NPV = 50 mo.
TC EUR 1/2 life ~ 80% NPV = 50 mo.

Prepared by: David F. Yard, PE



STRONGHOLD RESOURCE PARTNERS

CALLON PETROLEUM COMPANY
COLONIAL UNIT 1AH
Wolfcamp A
Well # 4 of 273 Wells Posted

Years Modelled (30)

Oil Phase	
IP (30), BOPD	812
b	1.30
Di	75%
Exp	6%
Abdn	0.1
Prior Cum, Bbls	40,891
Rem Oil, Bbls	541,796
OIL EUR, Bbls	**582,687**

Gas Phase	
IP (30), MCFD	393
b	1.30
Di	38%
Exp	6%
Abdn	0.1
Prior Cum, MCF	29,523
Rem Gas, MCF	779,567
Gas EUR, MCF (NO NGLs)	**809,090**

NGL Phase	
NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**

BOE EUR, Bbls	**717,536**
TC BOE EUR, Bbls	**609,622**

GOR = 483 SCF/Bbl
Most likely - Volatile Oil

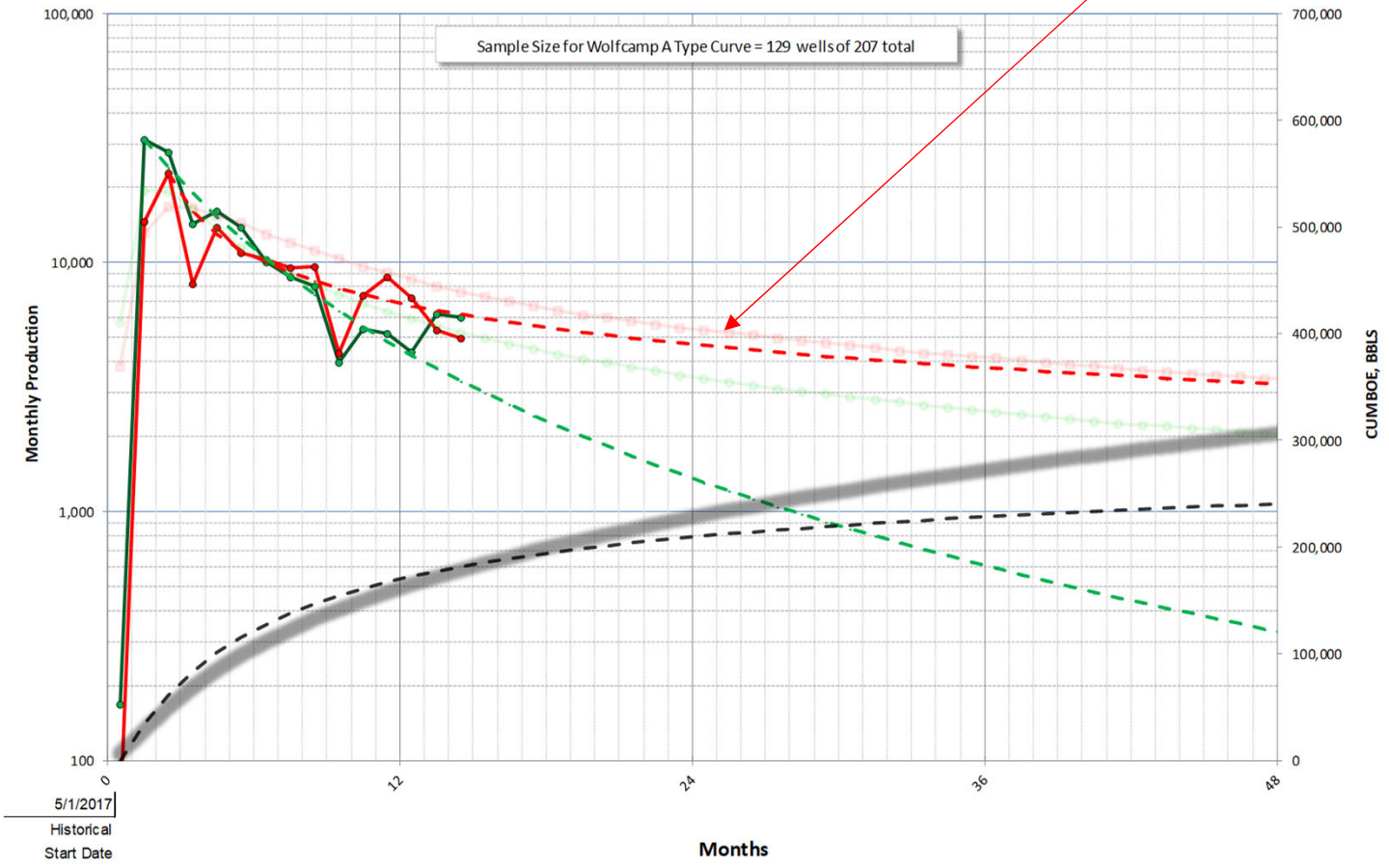
Wednesday, September 26, 2018
4:16 PM

EUR 1/2 life ~ 80% NPV = 12 mo.
TC EUR 1/2 life ~ 80% NPV = 50 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
8,161

API# : 42227388450000



5/1/2017
Historical
Start Date

STRONGHOLD RESOURCE PARTNERS

CALLON PETROLEUM COMPANY
COLONIAL UNIT A2 2AH
Wolfcamp A
Well # 5 of 273 Wells Posted

Years Modelled (30)

Oil Phase	
IP (30), BOPD	1030
b	0.40
Di	88%
Exp	6%
Abdn	0.1
Prior Cum, Bbls	168
Rem Oil, Bbls	203,615
OIL EUR, Bbls	**203,783**

Gas Phase	
IP (30), MCFD	753
b	2.00
Di	73%
Exp	6%
Abdn	0.1
Prior Cum, MCF	14,604
Rem Gas, MCF	732,079
Gas EUR, MCF (NO NGLs)	**746,683**

NGL Phase	
NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	**0**
BOE EUR, Bbls	**328,230**
TC BOE EUR, Bbls	**621,938**

GOR = 730 SCF/Bbl
Most likely - Gas Condensate

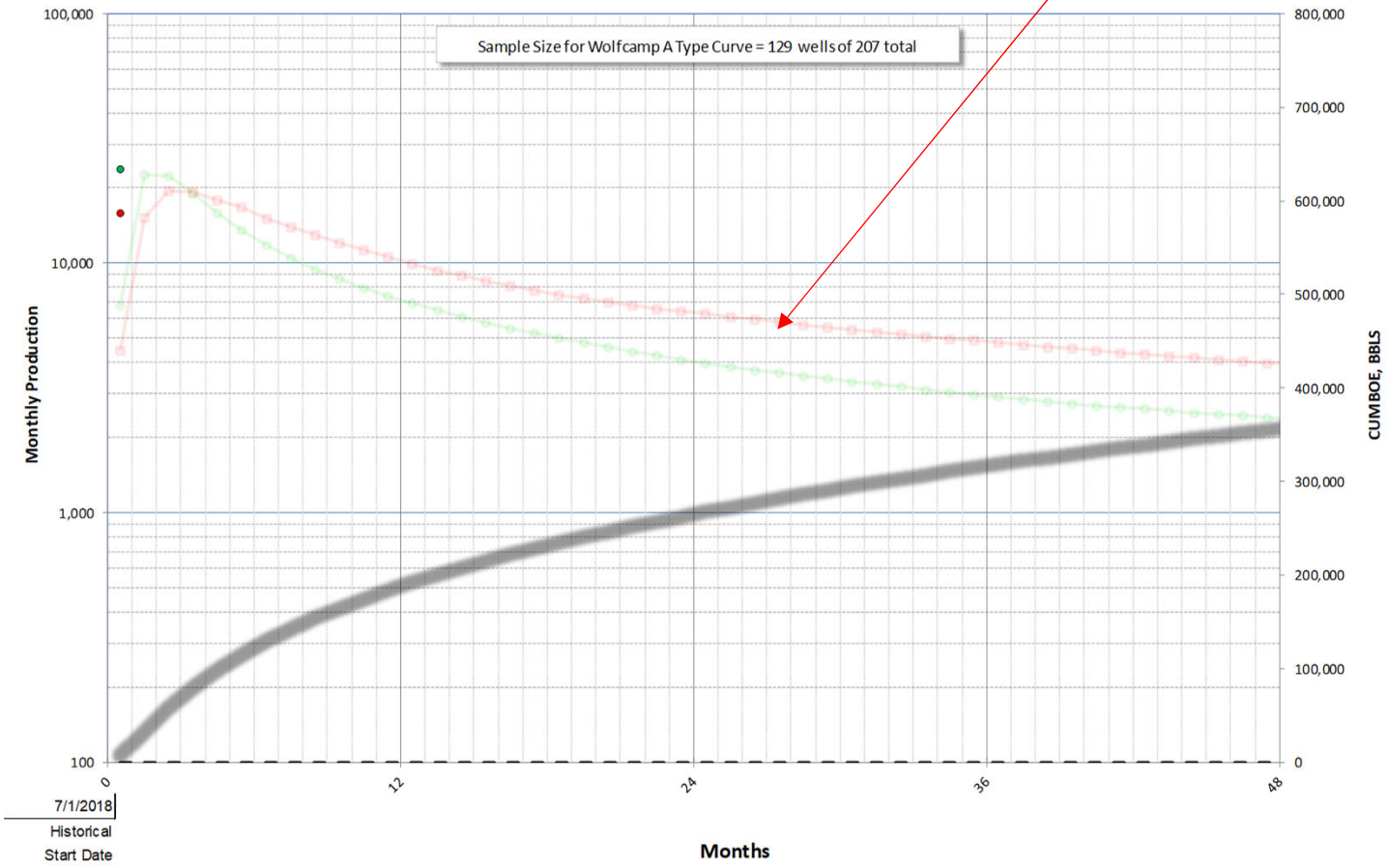
Wednesday, September 26, 2018
4:25 PM

TC EUR 1/2 life ~ 80% NPV = 50 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
9,495

API# : 42227394060000



7/1/2018
Historical
Start Date

STRONGHOLD
RESOURCE PARTNERS

CALLON PETROLEUM COMPANY
PLAYERS A3 6AH
Wolfcamp A
Well # 19 of 273 Wells Posted

Years Modelled (30)

Oil Phase

IP (30), BOPD	
b	
Di	
Exp	
Abdn	
Prior Cum, Bbls	
Rem Oil, Bbls	
OIL EUR, Bbls	

No Forecast

Gas Phase

IP (30), MCFD	
b	
Di	
Exp	
Abdn	
Prior Cum, MCF	
Rem Gas, MCF	
Gas EUR, MCF (NO NGLs)	

No Forecast

NGL Phase

NGL Yield, Bbls/MMcf	0
Gas Shrink	100%
NGL EUR, Bbls	
BOE EUR, Bbls	
TC BOE EUR, Bbls	**723,601**

GOR = 1000 SCF/Bbl

Wednesday, September 26, 2018
3:36 PM

Results of the 129 WCA well set

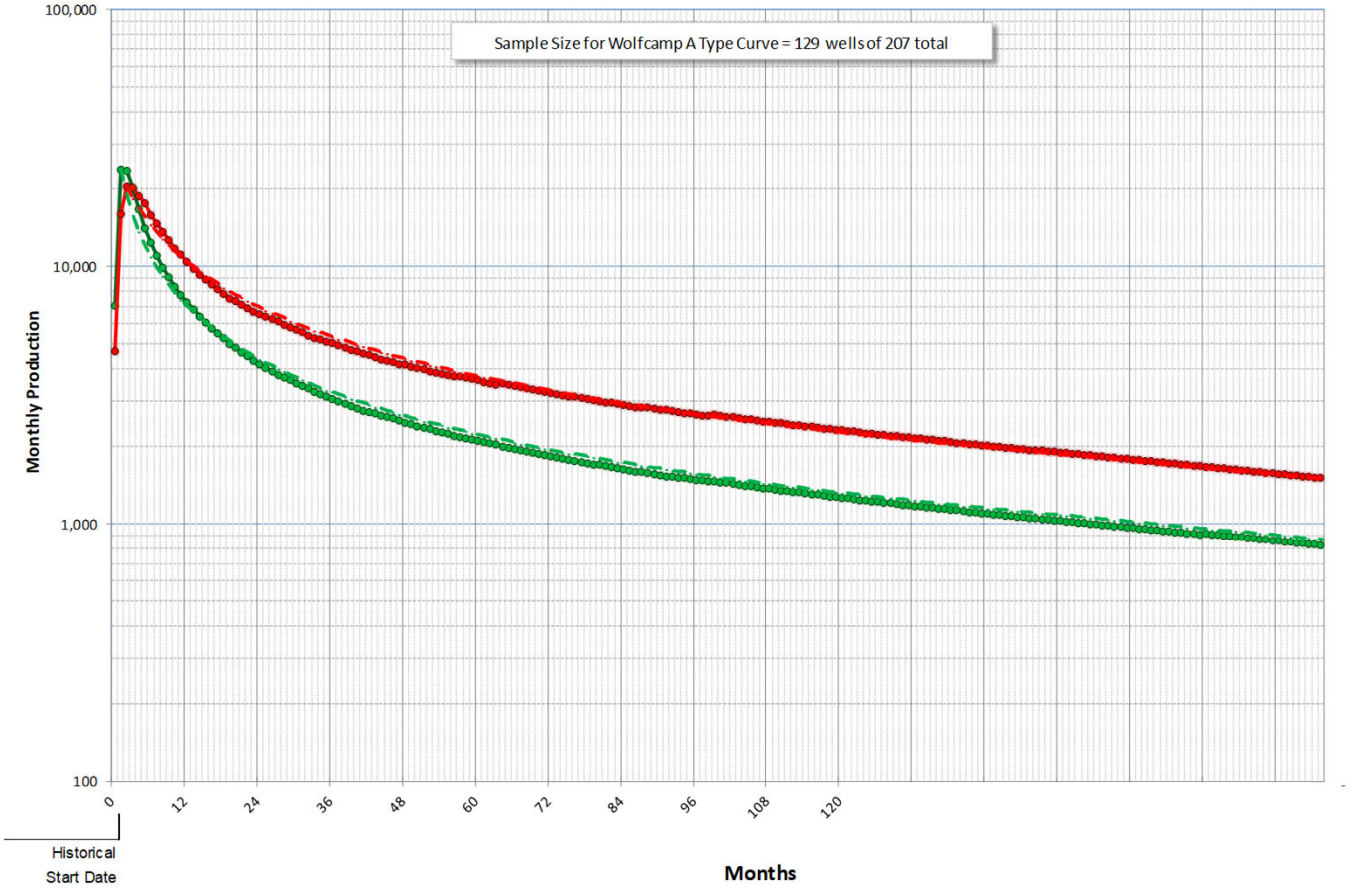
STRONGHOLD RESOURCE PARTNERS

TC EUR 1/2 life ~ 80% NPV = 50 mo.

Prepared by: David F. Yard, PE

PERFORATED INTERVAL, FT.
10,000

TYPE WELL



Wolfcamp A

Years Modelled (30)

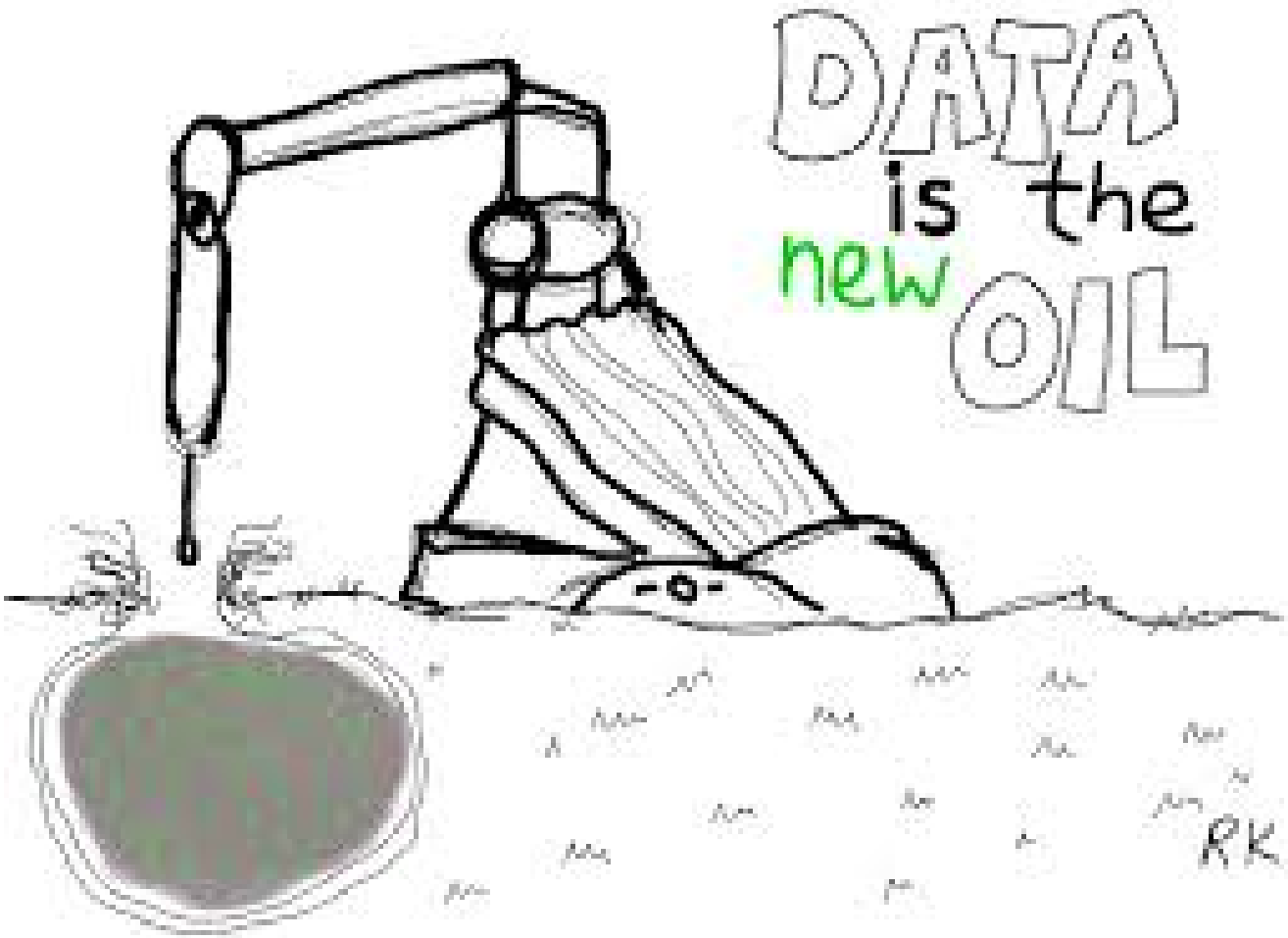
	Oil Phase
IP (30), BOPD	786
b	1.30
Di	72%
Exp	6%
Abdn	0.1
Prior Cum, Bbls	7,096
Rem Oil, Bbls	598,748
OIL EUR, Bbls	**605,844**

	Gas Phase
IP (30), MCFD	674
b	1.30
Di	53%
Exp	6%
Abdn	0.1
Prior Cum, MCF	20,786
Rem Gas, MCF	916,769
Gas EUR, MCF (NO NGLs)	**937,555**

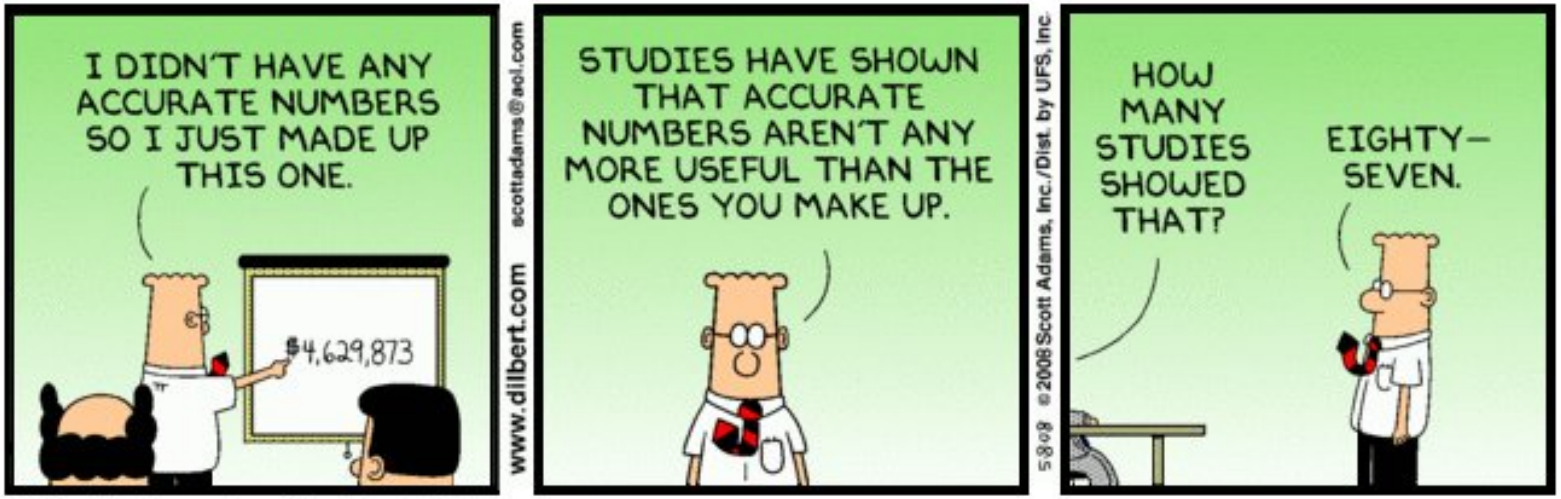
	NGL Phase
NGL Yield, Bbls/MMcf	0
Gas Shrink	100%

NGL EUR, Bbls	**0**
BOE EUR, Bbls	**762,104**
TC BOE EUR, Bbls	**762,104**

GOR = 856 SCF/Bbl
Most likely - Volatile Oil

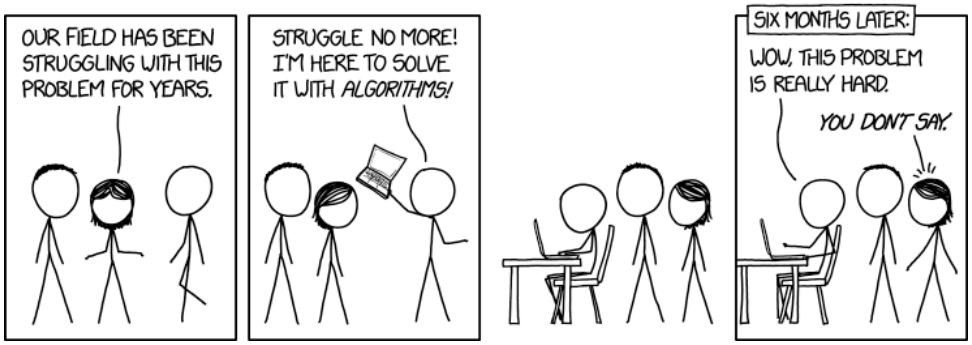

DATA
is the
new OIL
RK

Building Statistical Type Well Profiles



apinum	DI Landing Zone or Target Formation	First Prod Date	Perf Interval	Peak Gas PER DAY per foot LL	Gas EUR per foot LL	Peak Oil PER DAY per foot LL	Oil EUR per foot LL
42329402110000	Spraberry Lower Shale	11/1/2015	5,822	0.14		0.23	
42329402080000	Wolfcamp B	1/1/2016	7,142	0.12	122	0.08	43
42329401980000	Wolfcamp A	9/1/2016	6,476	0.16	202	0.18	76
42329401970000	Spraberry Lower Shale	9/1/2016	6,266	0.23	298	0.20	87
42329401960000	Wolfcamp B	9/1/2016	6,476	0.19	242	0.16	66
42329401950000	Spraberry Lower Shale	9/1/2016	6,476	0.17	228	0.16	69
42329401890000	Wolfcamp B	11/1/2015	4,914	0.05	50	0.05	9
42329401880000	Wolfcamp A	2/1/2016	5,247	0.10	146	0.09	104
42329401870000	Wolfcamp B	2/1/2016	7,552	0.06	83	0.05	56
42329401860000	Wolfcamp A	2/1/2016	7,557	0.08	113	0.08	86
42329401850000	Spraberry Lower	4/1/2016	4,102	0.05	55	0.02	10
42329401830000	Wolfcamp B	10/1/2015	4,203	0.23	227	0.10	100
42329401820000	Wolfcamp B	1/1/2016	6,447	0.09	84	0.12	53
42329401810000	Wolfcamp B	1/1/2016	6,538	0.15	12	0.07	26
42329401800000	Wolfcamp B	1/1/2016	6,722	0.16	390	0.10	94
42329401790000	Spraberry Lower Shale	12/1/2015	8,619	0.01	78	0.13	77
42329401770000	Wolfcamp B	9/1/2016	4,232	0.07	108	0.06	59
42329401750000	Spraberry Middle	1/1/2015	5,362	0.36	107	0.15	36
42329401740000	Wolfcamp B	11/1/2015	5,[illegible]	0.32	92	0.14	32
42329401730000	Spraberry Middle	9/1/2015	7,503	0.04	3	0.08	16
42329401720000	Spraberry Lower	9/1/2015	7,713	0.09	7	0.09	17
42329401700000	Spraberry Lower Shale	9/1/2015	5,303	0.17	99	0.13	93
42329401660000	Wolfcamp B	10/1/2015	5,636	0.31	89	0.11	25
42329401650000	Wolfcamp B	10/1/2015	5,492	0.41	122	0.16	37
42329401610000	Wolfcamp A	10/1/2015	5,046	0.41	438	0.15	74
42329401520000	Spraberry Lower Shale	9/1/2015	4,741	0.07	38	0.14	97
42329401510000	Wolfcamp B	5/1/2015	4,452	0.28	455	0.18	133
42329401450000	Spraberry Lower Shale	10/1/2015	5,215	0.22		0.16	
42329401440000	Spraberry Lower Shale	10/1/2015	5,412	0.16		0.22	
42329401430000	Spraberry Lower Shale	10/1/2015	7,503	0.09	28	0.14	38
42329401400000	Wolfcamp B	8/1/2015	5,769	0.14	222	0.14	74
42329401390000	Wolfcamp B	8/1/2015	5,806	0.13	136	0.13	47
42329401380000	Wolfcamp B	8/1/2015	5,805	0.10	102	0.09	30
42329401370000	Wolfcamp B	8/1/2015	5,769	0.11	101	0.10	53

We start by acquiring big data from Drilling Info or IHS



apinum	DI Landing Zone or Target Formation	First Prod Date	Perf Interval	Peak Gas PER DAY per foot LL	Gas EUR per foot LL	Peak Oil PER DAY per foot LL	Oil EUR per foot LL
42329402110000	Spraberry Lower Shale	11/1/2015	5,822	0.14		0.23	
42329402080000	Wolfcamp B	1/1/2016	7,142	0.12	122	0.08	43
42329401980000	Wolfcamp A	9/1/2016	6,476	0.16	202	0.18	76
42329401970000	Spraberry Lower Shale	9/1/2016	6,266	0.23	298	0.20	87
42329401960000	Wolfcamp B	9/1/2016	6,476	0.19	242	0.16	66
42329401950000	Spraberry Lower Shale	9/1/2016	6,476	0.17	228	0.16	69
42329401890000	Wolfcamp B	11/1/2015	4,914	0.05	50	0.05	9
42329401880000	Wolfcamp A	2/1/2016	5,247	0.10	146	0.10	104
42329401870000	Wolfcamp B	2/1/2016	7,552	0.06		0.05	56
42329401860000	Wolfcamp A	2/1/2016	7,557	0.08		0.08	86
42329401850000	Spraberry Lower	4/1/2016	4,102	0.05		0.02	10
42329401830000	Wolfcamp B	10/1/2015	4,203		227	0.10	100
42329401820000	Wolfcamp B	1/1/2016	6,447		424	0.12	53
42329401810000	Wolfcamp B	1/1/2016	6,5	.15	120	0.07	26
42329401800000	Wolfcamp B	1/1/2016		0.16	390	0.10	94
42329401790000	Spraberry Lower Shale	12/1/2015		0.07	78	0.13	77
42329401770000	Wolfcamp B	2/1	4,232	0.07	108	0.06	59
42329401750000	Spraberry Middle		5,492	0.36	107	0.15	36
42329401740000	Wolfcamp B		5,492	0.32	92	0.14	32
42329401730000	Spraberry Middle	9/1/2015	7,503	0.04	3	0.08	16
42329401720000	Spraberry Lower	9/1/2015	7,713	0.09	7	0.09	17
42329401700000	Spraberry Lo	9/1/2015	5,303	0.17	99	0.13	93
42329401660000	Wolfca	10/1/2015	5,636	0.31	89	0.11	25
42329401650000	W	10/1/2015	5,492	0.41	122	0.16	37
4232940161	A	10/1/2015	5,046	0.41	438	0.15	74
4232940152	berry Lower Shale	9/1/2015	4,741	0.07	38	0.14	97
4232940151	Wolfcamp B	5/1/2015	4,452	0.28	455	0.18	133
42329401450000	Spraberry Lower Shale	10/1/2015	5,215	0.22		0.16	
42329401440000	Spraberry Lower Shale	10/1/2015	5,412	0.16		0.22	
42329401430000	Spraberry Lower Shale	10/1/2015	7,503	0.09	28	0.14	38
42329401400000	Wolfcamp B	8/1/2015	5,769	0.14	222	0.14	74
42329401390000	Wolfcamp B	8/1/2015	5,806	0.13	136	0.13	47
42329401380000	Wolfcamp B	8/1/2015	5,805	0.10	102	0.09	30
42329401370000	Wolfcamp B	8/1/2015	5,769	0.11	101	0.10	53

All of the data was captured from the DI Well Table

Drilling Info has created algorithms to calculate EURs for every well in America with greater than 6 months of analyzable data.

I have scrutinized their algorithms and believe they are among the best I have seen.

I have developed in-house algorithm to do the same and we are consistently within 10% or so of each other.

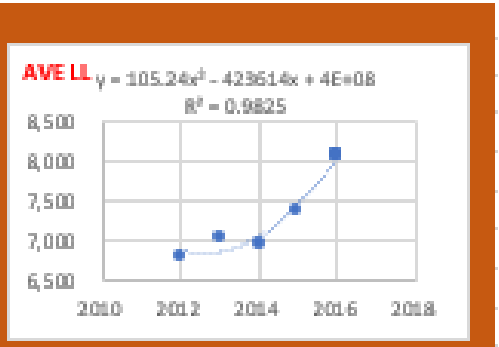
Manual history matches will also be within that range of accuracy.

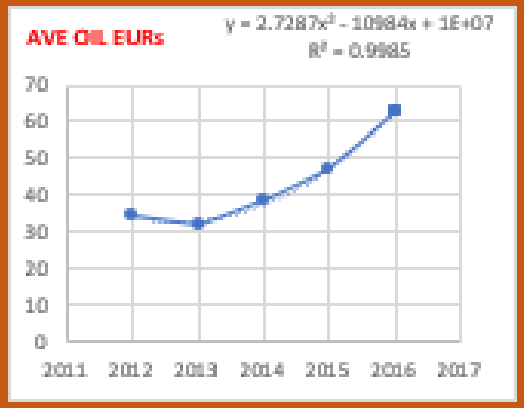
However, allocated data is the biggest problem and it can only be fixed by the TXRRC and other State Agencies.

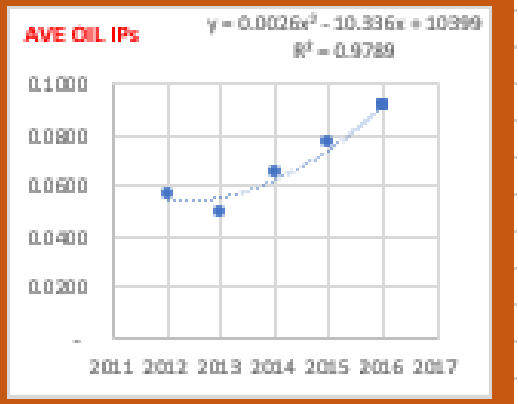
"The boss wants me to create a computer algorithm that converts hindsight into foresight."

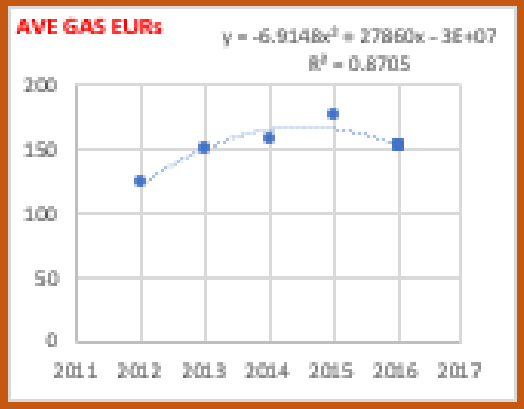
Vintage Normalization

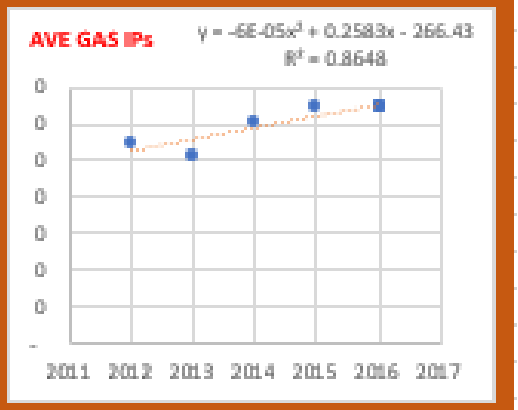
Average by year of 1st production



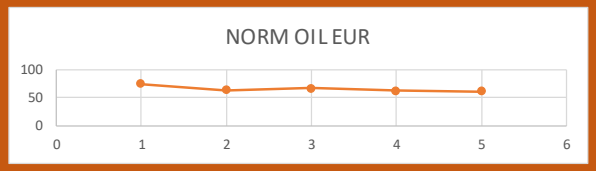


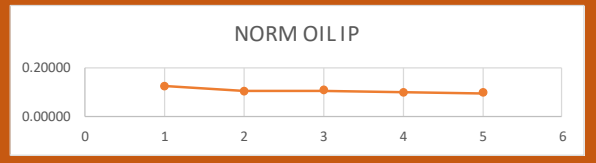


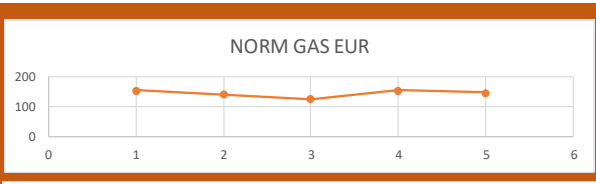


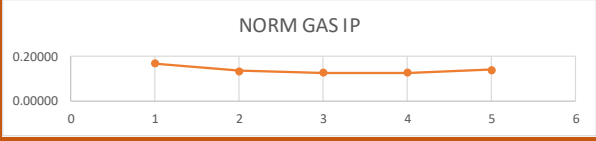


Resulting normalized annual averages should produce a straight line



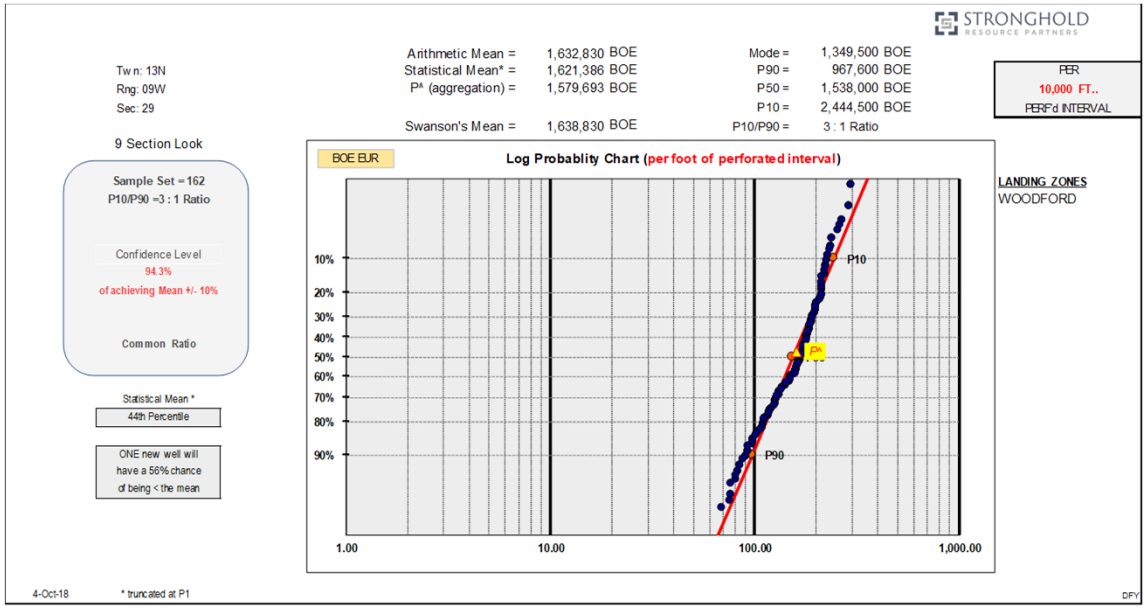






With this method of creating “Type Well Profiles” we can quickly and easily produce curves;

1. By County
2. By Twn-Rng
3. By 9-Section area
4. By varying the radius around any Lat/Long in any basin.



Oil IP	Oil Di	b factor	Min De	Gas IP	Gas Di	bfactor	Min De	Oil EUR	Gas EUR
347	71.8%	1.30	6%	7,569	65.7%	1.30	6%	285,559	7,679,487