



Billings Refinery

May 30, 2016

Dear Council Member:

Please find attached a copy of the minutes from our **May 10, 2016** CAC meeting. Just a reminder that the next CAC meeting will be **TUESDAY, JUNE 14, 2016** at the Phillips 66 Learning Center. Dinner will be served from 5:00 to 5:30 p.m. The meeting will run from 5:30-7:30.

Sincerely,

Ann L. Clancy, Ph.D.
Meeting Facilitator

**Meeting Location: Phillips 66 Learning Center
415 South 24th Street**

**PHILLIPS 66 BILLINGS REFINERY
CITIZENS ADVISORY COUNCIL
May 10, 2016**

MEETING MINUTES

- Present:** Council members: Keith Beartusk, Lucas Blehm, Paul Dextras, Dave Fincel, Ralph Hanser, Travis Harris, Bob Hoar, Gregory Neill, Shirley McDermott, John Pulasky, Jim Ronquillo, Heather Schwab, Melanie Schwarz, Emily Shaffer, Andrew Sullivan, Mike Yakawich, Stella Ziegler *(Note: In Ann's absence, CAC member attendance was not taken. Those listed as "absent" indicated via email they would not be present.)*
Phillips 66 management: --
Midstream: Mark Hilbert
Facilitator: --
- Absent:** Ann Clancy, Colin Franks, Rob Lowe, Bruce MacIntyre, Ray Rigdon
- Guests:** David Hobbs, EEG, Inc.
City College Students: Brad Cash, Mark Godfrey, Alex Songstad

AGENDA

- Welcome/Introductions
- Refinery 101 presentation
- Vacuum Improvements Project
- Refinery tour
- Next CAC Meeting: June 14, 2016

WELCOME/INTRODUCTIONS

Mark Cohn and Justin Mecham from the refinery welcomed members and introduced Andy Holman, Process Engineer, who would be giving the Refinery 101 presentation. Also in attendance from the refinery were Steve Kelley and Ron Gonzales. The refinery tour was cancelled due to inclement weather.

REFINERY 101 PRESENTATION

Andy Holman started off with comparing photos of the refinery when it opened in 1949 to the present day and providing a history of the refinery's growth.

Expansion Projects	Barrels per Day
1949 Start-up	7,500
1956 Expansion	10,200
1963 Expansion	32,000
1967 Expansion	52,500
1992 Coker project	
1994 FCC feed hydrotreaters	
2006 Ultra low sulfur diesel	
2009 Low sulfur gasoline	60,000

Andy described the refinery as an integrated business that uses a value chain to move raw product from oil well to refinery for processing to gas pump for sale. According to Andy, this chain has to be balanced in order to succeed. The chain begins with the crude oil being drilled and then stored in containers to be shipped via pipeline to another crude oil storage location at the refinery. Once refined, the oil product is stored and then sent via pipeline to a terminal storage unit where it is then distributed to retail stores for consumption. He shared a map of the Rockies crude oil pipelines of which a number move through Billings heading west and south.

The Chemistry of Refining

Andy explained how crude oil is a mixture of hydrocarbons which can be refined into different products.

A Mixture of Hydrocarbons		
Smallest	Methane	$C + 2H_2 = CH_4$
Bigger	Propane	$3C + 4H_2 = C_3H_8$
Bigger	Gasoline	$6C + 7H_2 = C_6H_{14}$
Bigger	Diesel	$12C + 13H_2 = C_{12}H_{26}$
Biggest	Asphalt	$\sim 100C + 101H_2 = C_{100}H_{2}$

These mixtures are characterized by region, density, sulfur, and acid content so that each crude has its unique “fingerprint.” The poorer the crude quality, said Andy, the more complex the refinery. At the Billings Refinery, crude oil is converted through the refining process into: fuel gas (burned), LPGs (propane and butane), gasoline, jet fuel (kerosene), diesel fuel and coke (fuel).

The Refiner’s Challenge

The challenge for refiners, stated Andy, is to maximize output because less than a third of each crude oil barrel is directly useable as a fuel. For example, gasoline (10%), jet fuel (5%) and diesel (15th) account for only 30% of all light oils. Thus refiners have developed processes to transform up to 94% of each barrel of crude into more valuable fuels including: gasoline (55%), jet fuel (7%), and diesel (32%) to account for 94% of all light oils. This is accomplished through the judicious use of chemistry in the refining process in the following ways:

Sorting	Fractional distillation <ul style="list-style-type: none"> • Crude oil is heated to 700°F (<i>Max temperature before cracking</i>). • Fractionator separates into rough "cuts" according to boiling point ranges (cuts or fractions drawn at different locations in tower). <ul style="list-style-type: none"> ○ Lightest compounds (Fuel Gas) vaporize and rise to the top of the Fractionator. ○ Heaviest materials (asphalt/residuals) remain a liquid and drop to the bottom of the Fractionator. • Some refinery stacks are actually fractionators.
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Breaking	Cracking & coking <ul style="list-style-type: none"> Fired heaters (>900°F) convert residue (asphalt) into gasoline and diesel. Petroleum coke is a solid byproduct blended with coal to be used as fuel. Fluidized catalytic cracking converts low-valued heavy fuel oil (gas oil) into gasoline, diesel, & alkylation feedstock. It uses a powered catalyst that behaves like a liquid when fluidized with air.
Rearranging	Reforming & isomerization <ul style="list-style-type: none"> Catalytic reforming rearranges the shape of a gasoline molecule to improve the octane & liberate hydrogen. It uses a precious metal catalyst. It is a branched chain of ring (high octane) molecules plus hydrogen.
Recombining	Alkylation <ul style="list-style-type: none"> Combines isobutene and olefins (from FCC & coker) into high octane gasoline. Uses a hydrofluoric acid catalyst.
Purifying	Desulfurization & treating <ul style="list-style-type: none"> Impurities are removed using heat & pressure, hydrogen, catalysts. Benefits include reducing harmful emissions from vehicles, reducing refinery emissions, and recovering sulfur for use in other products like fertilizer, paint, textiles, rubber & medicines. Purification processes include desulfurizers (hydrotreaters), treating & sulfur recovery.
Product blending	<ul style="list-style-type: none"> Combines “intermediate” products from fractionation, cracking, coking, alkylation, reforming & treating units into finished products. Product specifications need to be met: octane, cetane, sulfur content, vapor pressure, flash temperature, boiling points.

Interesting Facts

Andy shared some interesting facts about the refinery:

- How much gasoline is in our largest storage tank?
 - 120,000 barrels (42 gallons/barrel)
 - 5 million gallons
 - 333,333 fill-ups (15 gallons)
 - Lifetime supply for 100 people (at a cost of \$10 million)
- How high is the pressure in our hydrotreating units?

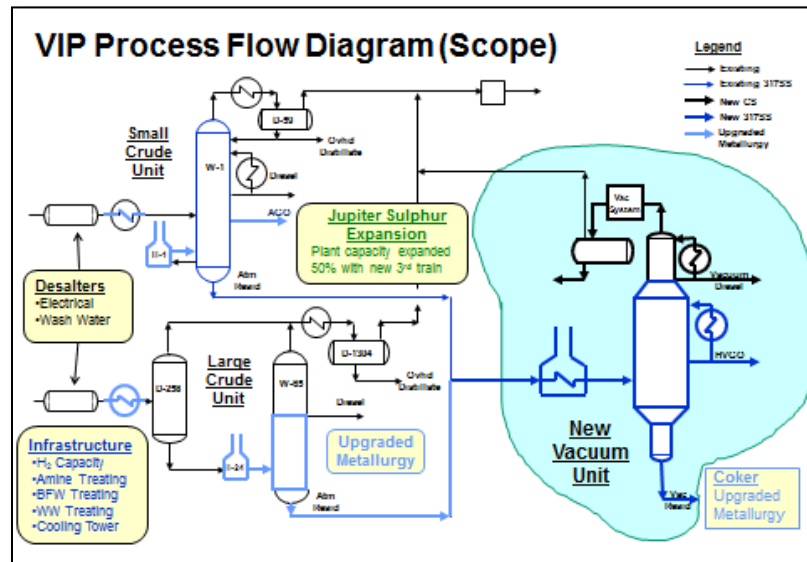
- 1200 psig (pounds/square inch)
- It would take a very large cow standing on one's thumb to create that kind of pressure.
- Besides fuels, what are some other uses for oil?
 - Petrochemicals like:
 - Clothing (synthetic fibers)
 - Waxes (in candy bars)
 - Vinyl seat covers
 - Make-up (lip gloss)
 - Plastics
 - Cooking wear (Teflon)
 - Chewing gum
 - Detergents
 - Medicines

VACUUM IMPROVEMENTS PROJECT

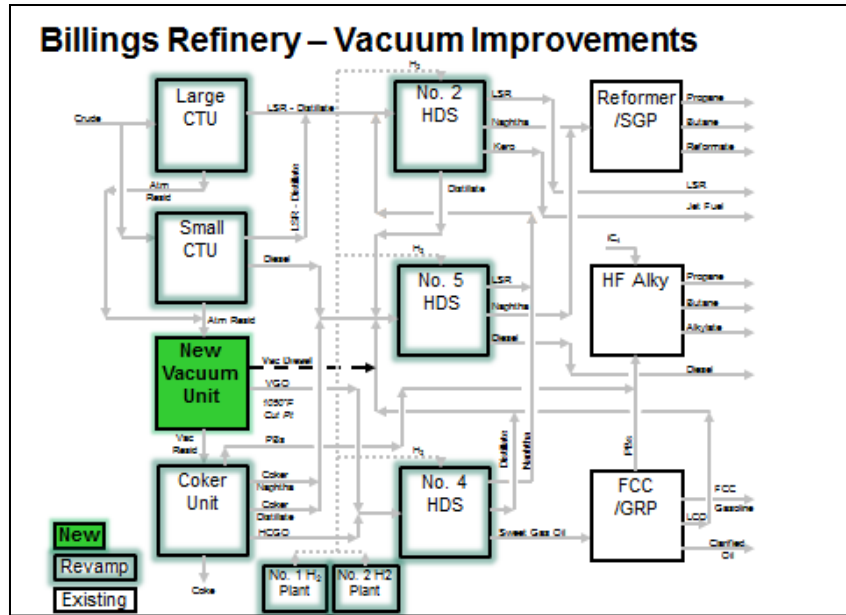
CAC members were updated regarding the status of the Vacuum Improvements Project. The results of the completed project are expected to be:

- Improvement of crude slate flexibility for refinery
- Improvement of finished product flexibility
- Increase of refinery's long-term competitiveness
- Improvement of major equipment reliability

The scope of the project is outlined below showing how the new vacuum unit will improve the flow of the refining process.



The following diagram shows where the new vacuum unit will be located and which of the other units will be revamped for improved processing.



Planned Project Milestones

The following outline tracks the key milestones in the development of the improvements project so far including estimated completion dates. A 3-dimensional model was also shown of the construction project.

AFD Approval	Feb 2015
Order Long Lead Equipment	Feb 2015
Start Detailed Engineering	Feb 2015
Environmental Permit Received	Feb 2015
Begin Site Prep Activities	Aug 2015
AFE Approval	Aug 2015
Construction Start	Aug 2015
Mechanical Completion	May 2017 (Spring TA)
Startup Complete	June 2017

NEXT MEETING: June 14, 2016

Location: Phillips 66 Learning Center

- Welcome/Introductions
- P66 Midstream Presentation
- P66 Midstream Tours
- Refinery & Midstream Updates
- Next Meeting: Meet in the Park on September 8