Appendix K.

McGovern Report for City of Benicia Valero Crude by Rail Project

SJ McGovern Report for City of Benicia
Valero Crude by Rail Project

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Contents

I have been retained by the City of Benicia in connection with the City's review of the Valero Crude by Rail (CBR) Project under the California Environmental Quality Act.

I have worked in and around the petroleum refining and/or renewable fuels industries for over 40 years. I have a Doctorate in Chemical Engineering from Princeton University and am a licensed Professional Engineer in New Jersey. I have recently served on two different National Research Council Committees regarding conventional and alternative fuels. I teach industry recognized courses on various aspects of refining technology. My Curriculum Vitae is attached as Appendix A.

Last summer, the City circulated a mitigated negative declaration for the CBR Project before deciding to prepare an EIR. During the public comment period on the negative declaration, the City received comments from, among other individuals and groups, the Natural Resources Defense Council, Communities for a Better Environment, the Goodman Group, and J. Phyllis Fox. The City has asked me to consider the following three issues raised in these comments:

1. Would the quality of the crudes delivered to the Valero refinery change significantly as a result of the CBR Project? Would the crudes delivered by rail, for example, be significantly heavier and/or contain more sulfur and be more acidic than the crudes that they would replace? Or would they be significantly lighter and/or contain more volatile organic hydrocarbons than the crudes they would replace?

2. If the quality of the crudes delivered to the Valero refinery will change significantly as a result of the CBR Project, would the changes cause an increase in air pollutants emitted from the refinery during the refining process?

3. What information about crude sources and refinery operations must Valero keep confidential?

In short, my conclusions are as follows:

1. The CBR Project will allow Valero to access a variety of North American crudes that are not readily available in Benicia. Like other crudes that Valero currently processes, the quality of these crudes varies widely, from very heavy sour crudes to very light sweet crudes. Valero will decide which crudes to purchase in the future at any given time based on a variety of factors, such as the quality and price of crudes on the market, the market demand for different products such as gasoline, jet fuel, or diesel fuel, the market prices for different products, and the refinery's unique processing configuration. There is no way to predict with any certainty what crudes Valero will purchase at any given time in the future because there are so many variables. The CBR project does not change the

refining capabilities of Valero's Benicia refinery. Therefore, the average quality of the crudes processed by the refinery will not change as a result of the CBR project.

2. Although the sources of the crudes delivered to the Valero refinery could change significantly as a result of the CBR Project, the changes would not cause an increase in air pollutants. The refinery's processing configuration limits the instantaneous quality of the crude mix that can be processed and the refinery processing configuration will not be changed. Valero will continue to blend crudes of varying quality to match the refinery's existing limitations in API gravity and sulfur content before processing them. Valero will continue to blend crudes to this small range in the future, regardless of any change in the sources or methods of delivery of crudes. Therefore, the air emissions from process equipment will remain substantially the same.

3. The detailed information concerning the quality and potential sources of crude oil both processed in the past and contemplated to be processed in the future at Valero's Benicia refinery are business confidential information and therefore are not included in the EIR. Furthermore information defining Valero Benicia's processing capabilities, other than information included in operating permits and other public documents is also confidential.

I. To What Extent Will the CBR Project Change the Quality of Crudes Delivered to the Refinery?

A. How Do Refiners Decide Which Crudes to Purchase?

Crude oil is a complex mixture of thousands of individual chemical compounds (molecules). An oil refinery separates and transforms these complex mixtures into the different, saleable specification products that consumers demand such as gasoline, jet fuel, diesel fuel, asphalt, and lubricating oils. Refineries also produce byproducts such as liquefied petroleum gas (LPG), pet coke, and sulfur.

The "oil industry" consists of producers of crude oil, refiners of crude oil and distributors, transporters and marketers of crude oil and finished products. Very few US oil companies perform all of these tasks. For example, Valero is the largest independent oil refiner in the world, but does not drill for crude oil. It purchases most of its crude oil through both short and long term contracts and on the spot market. Thus, Valero must rely on other entities (oil producing companies and countries) to ensure that the quality of the crude oil it purchases meets agreed specifications. Crude oils are produced and sold by various entities including governmental organizations such as member nations of the Organization of Petroleum Exporting Countries (OPEC), private companies under license to various governments and private companies producing oil from privately owned land.

Crudes are generally categorized based on weight or "gravity" and sulfur content. Gravity (API gravity) is an indirect measure of the amount of gasoline and distillate (diesel fuel, jet fuel and home heating oil are collectively referred to as distillates) that exist in the crude as it is delivered to the refinery. Lower gravity crudes contain less gasoline and distillate and larger amounts of heavy tar-like components that require more complex refineries to convert these heavy molecules into gasoline and distillate. Current governmental regulations require gasoline and diesel fuel to be essentially sulfur free, so processing higher sulfur crudes also requires more complex refineries and additional costs to remove the sulfur from the final product. Since it requires less refinery equipment and operating expenses to convert light sweet crudes into gasoline and distillates than it does to convert heavy sour crudes, light sweet crudes are more valuable (higher priced) than heavy sour crudes. Crude traders generally price crude oils based on their relative weight and sulfur content. The Energy Information Administration of the US Department of Energy publishes monthly average costs of imported crude oils as a function of API gravity. Lower gravity crudes generally cost less for refineries to purchase than higher gravity crudes.

Gasoline typically has an API gravity of about 50, while diesel has an API gravity of about 35. Vacuum gas oil (VGO) and residue (the other major components of crude oil) have gravities of about 22 and 10 respectively. The gasoline that is native to crude oil has a low octane and must be “reformed” in a naphtha reformer to increase its octane. The vacuum gas oil is “cracked” in a Fluid Catalytic Cracking (FCC) unit to convert most of it to gasoline and diesel fuel. The residue is either sold as asphalt or heavy fuel oil or is cracked in a coker to produce additional gasoline and diesel fuel and pet coke. Lower gravity crudes with more VGO and residue require more processing in more complex and expensive refineries.

There are many different crude oils available on the world market. In addition to gravity and sulfur, samples of each crude are analyzed in more detail by both producers and refiners. These detailed analyses are called crude assays. A crude assay on a single sample of crude oil can cost anywhere from $5,000 to more than $100,000. The cost of the crude assay increases with the level of detail desired. Refiners use these more detailed crude assays to determine the blends of various crudes that can be economically processed in their refinery.

When a refinery is first built, the types and sizes of the various process units are chosen to match the characteristics of the specific “design” crude oil based on a detailed crude assay of that oil. The Benicia refinery, for example, was originally designed to process Alaskan North Slope (ANS) crudes, because Valero's predecessor Humble (and then Exxon) had easy access to ANS crudes.

As new crude sources become available and sources of the design crude decline, refiners must purchase different crudes and blend them together to match refinery processing capabilities as closely as possible. Refiners do this with computer programs know as LPs. (Linear Programing

Optimization Routines). After it purchased the Benicia refinery in 2000, for example, Valero had to process crude oil blends that were similar to Alaskan North Slope crudes. The Valero Improvement Project, however, allowed Valero to process crude blends that were heavier and/or contained more sulfur than a typical ANS crude. The Valero Improvement Project was completed in 2011.

Linear Programing is a complex mathematical tool that can be purchased from several different companies. Many refiners use the PIMS model offered by AspenTech. These models have mathematical representations of each refinery process unit and track essentially every major input, intermediate stream, and product stream within the refinery. The basic model is licensed from AspenTech, but the refiner must then modify it to include all of the capabilities and constraints of the individual refinery being modeled. The constraints include operational, economic, logistical and environmental factors. The unit specific information only changes when hardware or environmental requirements change. Product demand and pricing, as well as crude oil price and availability change every day.

The refinery and the corporate planning groups run these LP models every day. The models are used to determine the optimal crude mix the refinery should purchase from the crudes that are available to it. Once the crudes arrive at the refinery (this could be several weeks or months after the purchase decision is made), the model is run again to determine the most profitable product mix that can be made from the crudes "on-hand", given "today's" prices and product demands. The models are also used as longer term planning tools to determine if an investment such as the CBR or VIP project will be beneficial to the refinery.

These models also use crude assay information to represent the crude oil input into the refinery. The refiners must either develop the crude assay information themselves or purchase the information from other sources. Some limited crude assay information is available from the internet, but the detailed information that is required to run a refinery LP is copyrighted and cannot be distributed to the public without compensating the copyright owner. Detailed crude assays developed by refiners for use in their own LP modeling have competitive value and are therefore considered trade secret information.

Although each crude oil has a specific name and generally accepted quality, every cargo is a blend of various oils produced from a number of individual wells, each well producing a slightly different quality oil. Therefore, a single crude assay is only an approximation of the actual quality of crude oil delivered to a refinery. For example, Crude Oil Quality, Inc. maintains a website (www.crudemonitor.ca) that published limited analytical data on shipments of a number of Canadian crude oils. Figures 1 and 2 show the variability in Gravity, Sulfur, Total Acid Number (TAN) and Benzene of Western Canadian Select and Christina Dilbit, two heavy, sour Canadian crudes that could be available to Valero Benicia by rail.

Figure 1: Selected Properties of Western Canadian Select

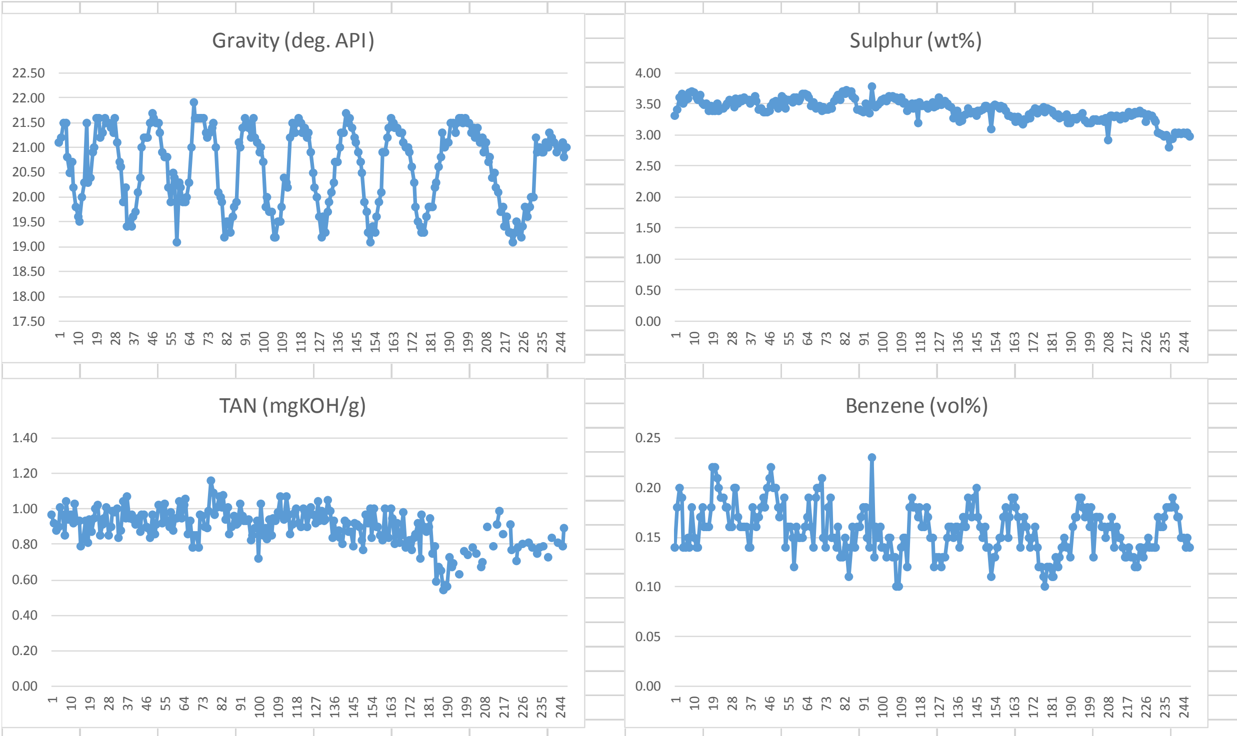
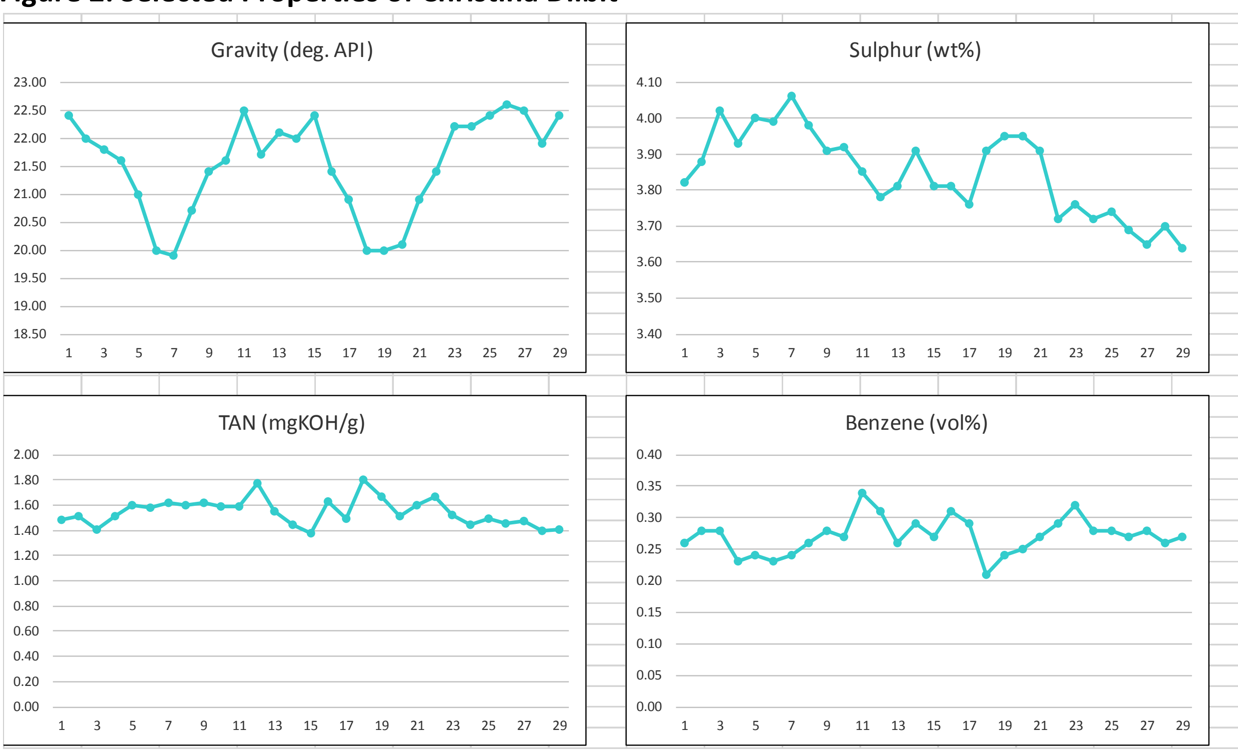


Figure 2: Selected Properties of Christina Dilbit



Refinery configuration, economic considerations (crude price, relative product prices and operating costs) determine the actual crude mix and crude rates that the refinery will run to maximize profits. Each refinery has a different configuration and therefore is limited in the types of crude that can be economically processed in that particular refinery.[1] The major processing units typically found in most refineries include: Crude unit, naphtha pretreater and reformer, jet fuel and distillate desulfurization units, fluid catalytic cracking unit, alkylation unit and a gas recovery/treating facility. Some refineries might also have a hydrocracker, a heavy gas oil hydrotreater, a coker, a catalytic polymerization unit, a hydrogen plant, lube oil and/or asphalt production facilities as well as other specialty units such as a benzene conversion unit.[2] Each of these units operates on a different fraction of the crude oil. The exact refinery configuration determines the crude oils that the refinery is capable of processing. For example, the size of the naphtha reformer limits the average naphtha content of the crude oil that the refinery can process. Most of the sulfur that enters a refinery with the crude oil is removed by the various processing units and converted to elemental sulfur by the sulfur plant. The size of the sulfur plant relative to the crude processing capacity of the refinery ultimately determines the maximum average crude sulfur content that the refinery can process. The size of the FCC unit and coker determine the amounts of VGO and residue that the refinery can process.

B. What Crudes are Currently Delivered to the Benicia Refinery?

The Benicia refinery was originally designed and built by Humble Oil Company (later renamed Exxon) to refine ANS, the oil that Humble was going to produce from its oil fields on the North Slope of Alaska. Shortly after Exxon and Mobil merged in 1999, the Benicia refinery was sold to Valero. Because of the declining production from the Alaskan oil fields and the captive use of this production by the various producers, Valero buys crude on the open market as a substitute for ANS. Some of this purchased crude is domestic production and some is imported from as far away as the Middle-East.

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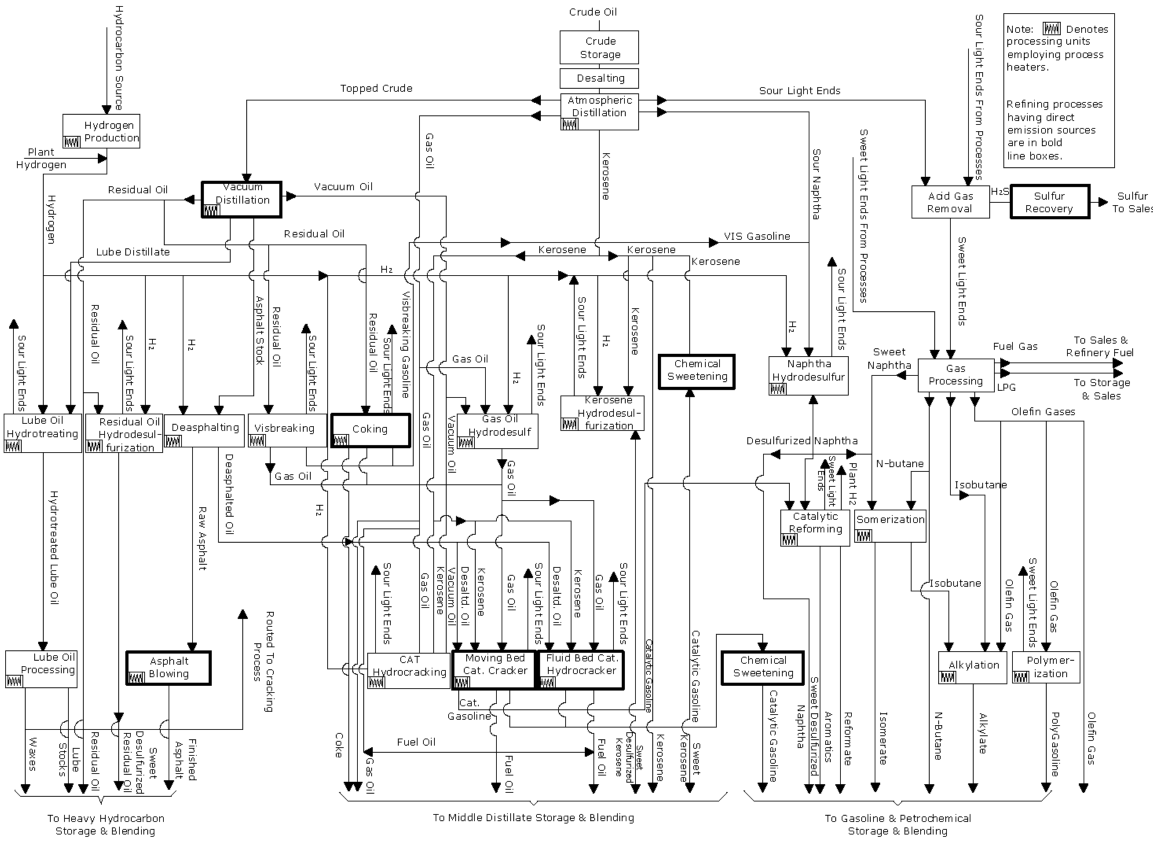
[1] Both the US Department of Energy (DOE) and the Oil and Gas Journal publish annual listings of the processing capacities of every US refinery and the major processing units within each refinery. The DOE listing is available for download from the EIA website, free of charge. The Oil and Gas Journal survey is available for a nominal fee.

[2] Refineries also have support facilities to generate steam and electricity, to produce boiler feed water, to recovery and produce elemental sulfur. A refinery also includes units whose specific function is to minimize the release of potential contaminants into the environment. A schematic of a typical complex oil refinery can be found in AP-42 Figure 5.1.1 on the EPA website and is reproduced herein as Figure 3. A tutorial on refinery operations is attached as Appendix B.

Figure 3: Schematic of a Complex Oil Refinery

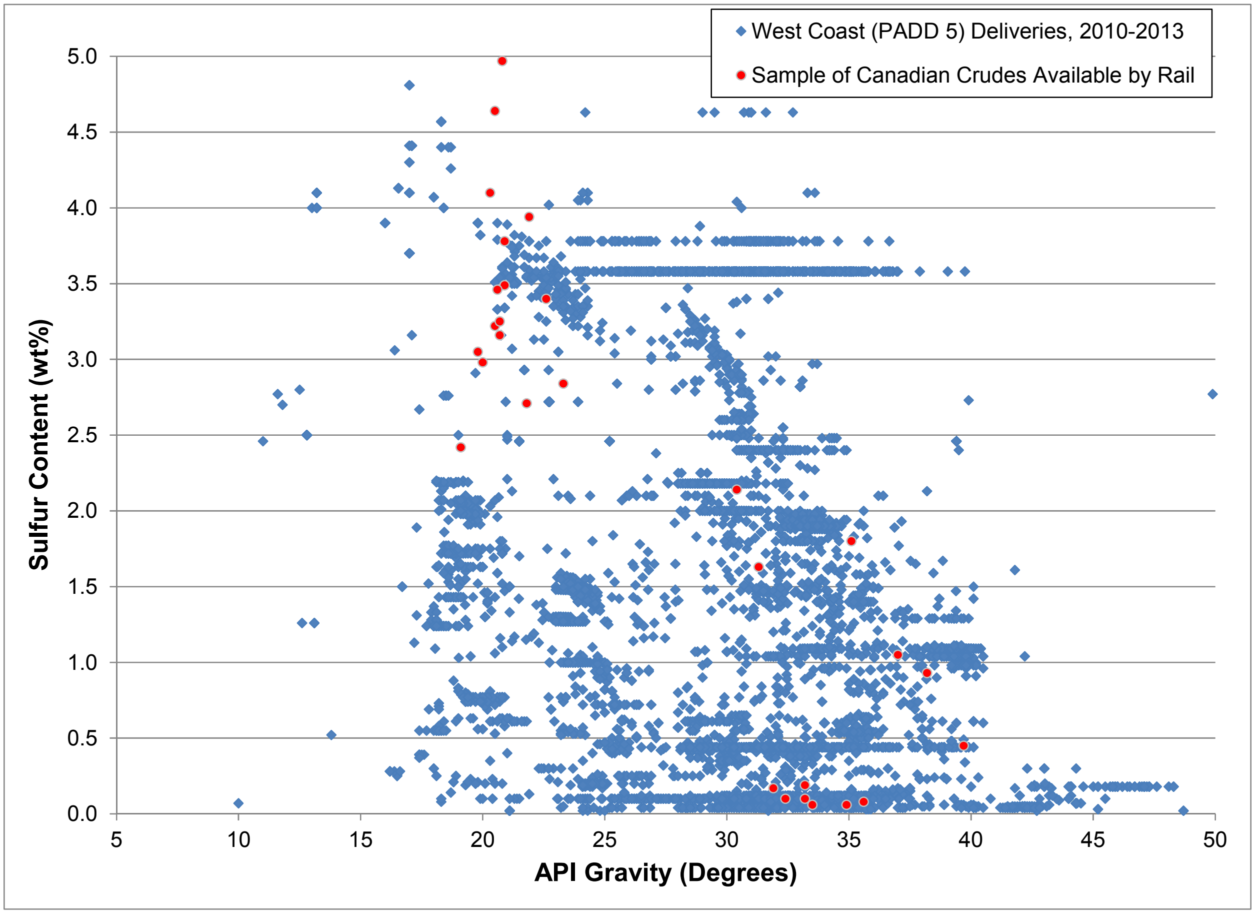


Source: EPA AP-42, Chapter 5 Petroleum Refining

The Energy Information Administration of the US Department of Energy publishes much information concerning the types of crudes that are imported into the US, produced within the US and processed within US refineries. The information, however, is aggregated to avoid revealing the input to individual refineries. DOE recognizes that the crudes purchased and processed by individual refineries is valuable company confidential information and does not release this information.

Figure 4 shows the gravity and sulfur contents of crudes that have been delivered to West coast (PADD 5) refineries in the recent past, along with the same properties of various Canadian crudes that could be available by rail as reported by Crude Quality, Inc. The figure also includes a box that defines Valero Benicia's normal operating window for blended crude sulfur and gravity. Although Valero might purchase individual crudes that are outside the box, it must blend them with other crudes to ensure that the blend fits the operating limitations of the refinery.

Figure 4: West Coast Refinery Crude Quality



Valero Benicia currently receives about 20% heavy sour crude via pipeline from the San Joaquin Valley of California. It also receives both light sweet and heavy sour crudes via ship. All of these various crudes are blended within the refinery to match the operating constraints of the refinery.

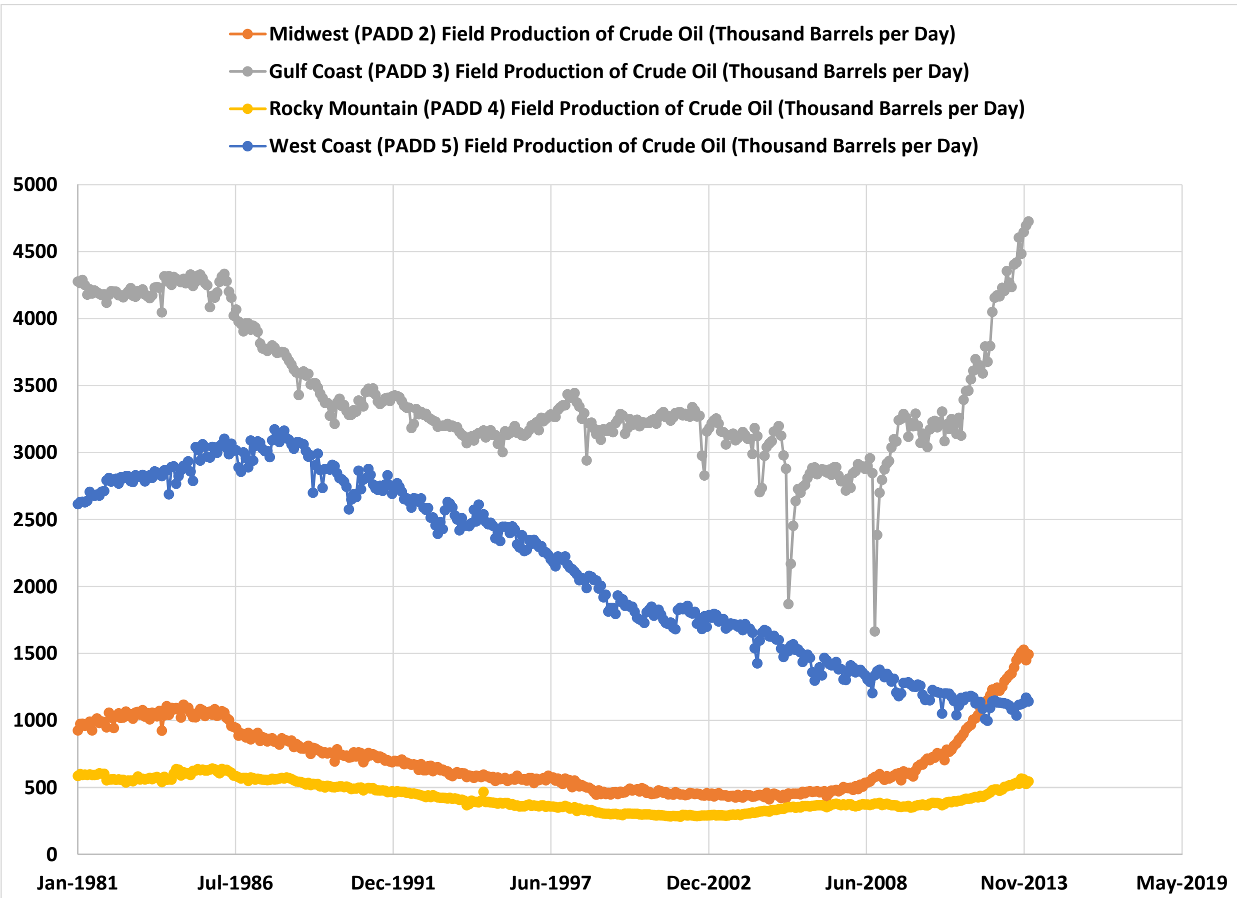
C. What Crudes Will be Delivered to the Benicia Refinery as a Result of the CBR Project?

The Valero refinery is subject to a variety of operating constraints.

The operating constraints of the refinery are not being changed by the CBR project, so the average quality of the crude that can be processed within the refinery will not change. The sources of the crudes will most likely change, but the average quality will not.

Valero will use the CBR project to obtain North American crudes. In recent years, large volumes of crude oil have become available both domestically and from Canada. Figure 5 shows historic crude oil production rates from various parts of the US. It is easy to see that West Coast crude production continues to decline while production from the mid-continent and gulf coast of the US is rapidly increasing. This increased production is mostly lighter crudes such as Bakken, WTI and WTS. This new production is often available at a discount because it is produced in regions of the country that are not connected to the major refining centers by crude oil pipeline. Shipment by rail is the current preferred shipping method for crude such as Bakken being produced in North Dakota.

Figure 5: US Crude Oil Production



Through the mid-1990's PADD 5 was a net exporter of oil products to other parts of the US, Figure 6. Since then, the west coast and especially California has been a net importer of petroleum. Much of this oil has come from other countries. The CBR project will give Valero Benicia access to the increasing domestic and Canadian crude oil production reducing the need to import crude from outside North America.

Figure 6: PADD 5 Petroleum Balance

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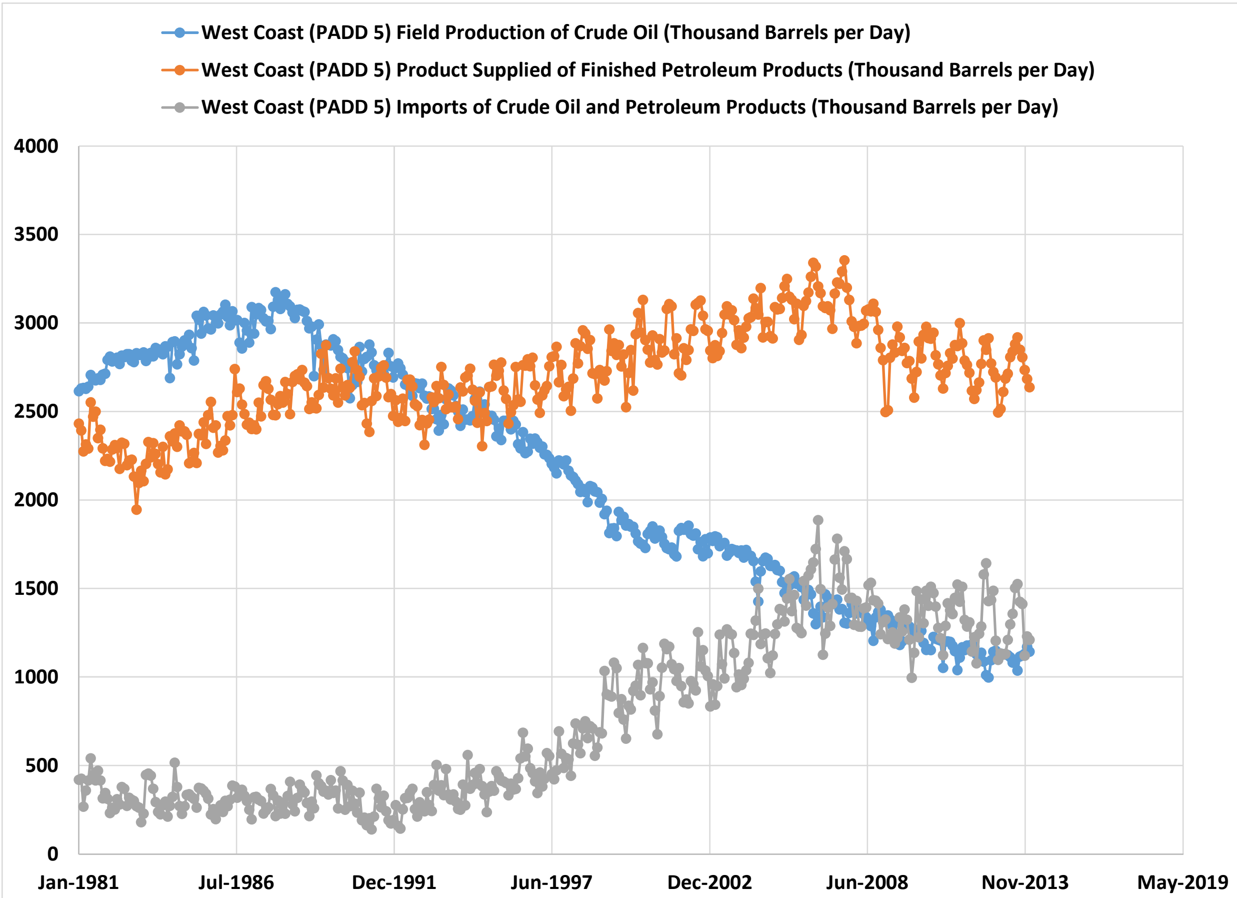


Table 1 below sets forth the North American crudes that are available on the market today.

Available North American crudes range widely in API gravities and sulfur content. Dilbits have been available on the world market for more than 40 years and have been processed in many US refineries including Valero Benicia. They are one of many types of heavy, high sulfur crudes that are available. The diluents range from natural gas condensates to light sweet crudes such as Bakken. Dilbits are nothing more than pre-blended crudes to facilitate transport.

At the light end, large volumes of Bakken type crude have recently become available from the north central United States and southern Canada. Unlike the heavy high sulfur Canadian crudes, the Bakken crudes are light, sweet (low sulfur) crudes. Bakken is a crude that could potentially be delivered to Valero Benicia.

Table 1 Available North American Crudes

Type	Crude	Origin
Light Sweet	New Mexico Sweet	New Mexico
Light Sweet	Utah Sweet	Utah
Light Sweet	Bakken	North Dakota
Light Sweet	Canadian Manitoba Sweet	Canada
Light Sweet	Light Sweet Synthetic	Canada
Light Sweet	Husky Synthetic Blend	Canada
Light Sweet	Mixed Sweet Blend	Canada
Light Sweet	Niobar	Colorado
Light Sweet	Suncor Synthetic A	Canada
Light Sweet	Premium Albian Synthetic	Canada
Light Sweet	Long Lake Light Synthetic	Canada
Light Sweet	Sour Light Edmonton	Canada
Light Sweet	Shell Synthetic Light	Canada
Light Sweet	Syncrude Synthetic	Canada
Light Sweet	West Texas Intermediate	Texas
Light Sweet	Wyoming Sweet	Wyoming
Light Sour	Light Sour Blend	Canada
Light Sour	Peace River Sour	Canada
Medium Sour	Bow River South	Canada
Medium Sour	Sour High Edmonton	Canada
Medium Sour	Kearl Lake	Canada
Medium Sour	Midale	Canada
Medium Sour	Mixed Sour Blend	Canada
Heavy Sour	Albian Heavy Synthetic	Canada
Heavy Sour	Access Western Blend	Canada
Heavy Sour	Bow River North	Canada
Heavy Sour	Cold Lake	Canada
Heavy Sour	Cold Lake	Canada
Heavy Sour	Fosterton	Canada
Heavy Sour	Lloyd Blend	Canada
Heavy Sour	Lloyd Kerrobert	Canada
Heavy Sour	Suncor Synthetic H	Canada
Heavy Sour	Peace River Heavy	Canada
Heavy Sour	Smiley-Coleville	Canada
Heavy Sour	SHE	Canada
Heavy Sour	Western Canadian Blend	Canada
Heavy Sour	Western Canadian Select	Canada
Heavy Sour	Wabasca Heavy	Canada

II. Would Any Changes in Crude Sources Result in Increased Emissions?

Phyllis Fox and other commenters assumed that, if heavy sour Canadian crude is the cheapest crude on the market in the future, Valero would purchase a lot of this material. The commenters further assumed that emissions would therefore increase because heavier crudes require more processing than light crudes and sour crudes require more processing than sweet crudes. At the same time, these commenters also expressed a concern that, if a light North American crude like Bakken is the cheapest crude on the market in the future, Valero would purchase a lot of that crude. The commenters further assumed that VOC emissions from storage tanks and equipment leaks would therefore increase if Valero's crude slate became significantly lighter.

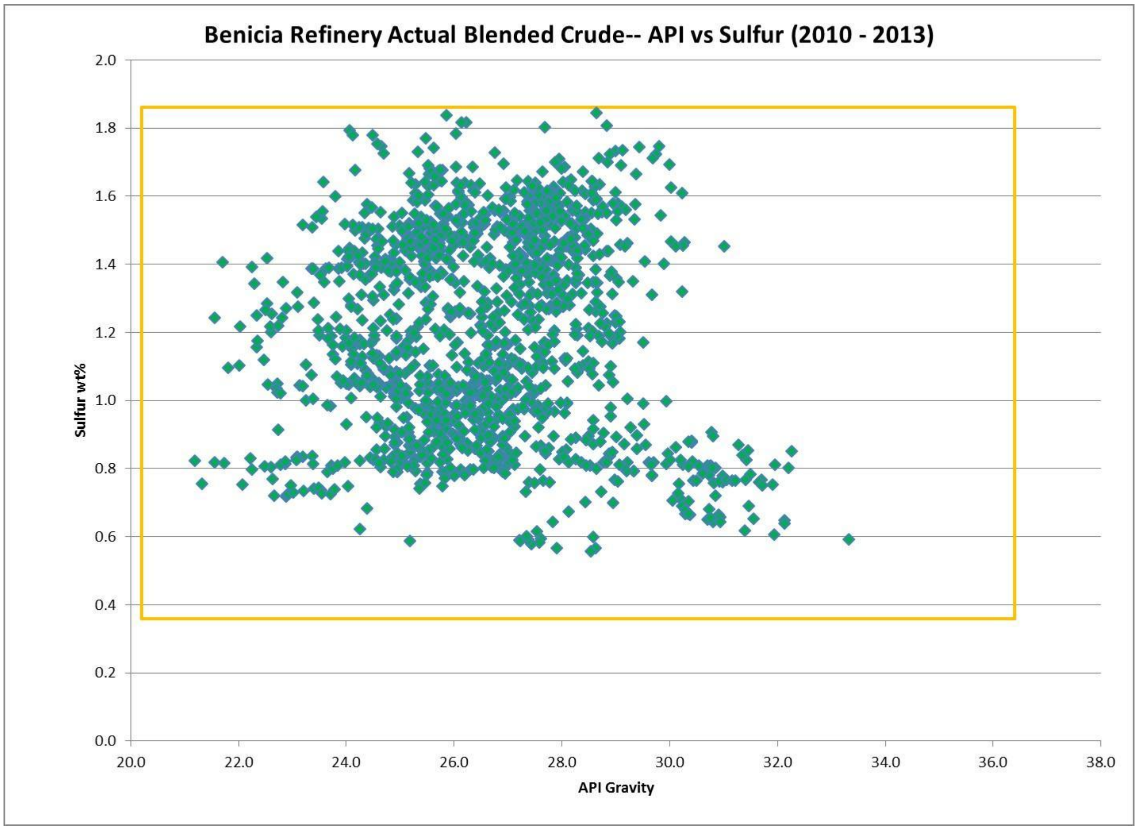
These concerns are baseless because, even though the sources of crude oil could change as a result of the CBR project, the crude blends processed at the Refinery must fall within a narrow range of gravity and sulfur content. This will not change as a result of the project. Therefore, the crude blends processed, as well as the average of all crude feedstocks delivered, will fall within the same narrow range.

The "yellow box" in Figure 7 reflects the physical constraints of the Refinery's configuration. Valero cannot efficiently operate the Refinery process units and other equipment if the crude blend were to fall outside the yellow box. Based on the size of the various processing units in the Benicia refinery as reported in the 2014 Oil and Gas Journal Annual Refining Survey, for example, the maximum average crude oil sulfur content that Valero could process in its Benicia refinery is about 1.9 wt%. The CBR project will not change this value. The capacities of the Coker and FCC units (the units that upgrade the “tars” in the crude) will not change as a result of the CBR project, so the amount of heavy low gravity crude that the refinery can process will also not change as a result of the CBR project. The capacity of the naphtha reformer will not change as a result of the CBR project, so the amount of light, high gravity crude that the refinery can process will not change as a result of the CBR project.

The second operating “window” is represented by the concentrated “cluster” of crude blends inFigure 7.

Figure 7 shows the actual blended crude API gravity and sulfur content processed in the Valero Benicia refinery in the three years from 2011 to 2013, after completion of most of the Valero Improvement Project. Although the yellow box defines the “feasible” operating window, the normal “profitable” operating window is actually smaller. This is exemplified by the pattern of data in Figure 7.

Figure 7: Quality of Crude Blends Processed at Valero Benicia



The operating window exists because of Valero Benicia's configuration of process units. Its ability to remove sulfur from the various refinery products and air emission streams limits the maximum sulfur content of the crude oil blend that can be processed to about 1.9wt%. Attempting to process a higher sulfur blend could result in violation of its BAAQMD operating permits. Processing blends with less than about 0.4 wt% sulfur causes inefficient operation of the refineries equipment and is very unlikely to occur.

Valero Benicia must also operate within a relatively narrow range of blended crude gravities as shown in Figure 7. The capacities of the coker and FCC, as defined by BAAQMD operating permits, limit the amounts of heavy crude with high quantities of low gravity tar-like substances that can be run without producing excessive amounts of very low value heavy fuel oil. The capacities of these units determine the ability of the refinery to convert these tar-like crude fractions into specification gasoline and distillates. Excess low gravity material must be blended with distillate and sold as high sulfur heavy fuel oil. Not only is the world market for high sulfur heavy fuel oil continuing to decline, producing high sulfur heavy fuel oil reduces distillate production making the production and sale of high sulfur heavy fuel oil very unprofitable.

The rated capacity of the naphtha reformer at Valero Benicia is 36, 000 BPD. Crude blends with gravities that exceed about 32 API can exceed the capacity of the naphtha reformer and light stream hydrodesulfurization units at full refinery utilization. The refinery must then either export the excess intermediate streams to other refineries at distressed prices or reduce crude run to bring the refinery back into balance. Both of these options reduce refinery profitability and are highly unlikely as demonstrated by the lower actual crude gravities processed during the previous 3 years.

Even though the “hard” operating limits are defined by the box in Figure 7, most of the actual crude blends that have been processed in the past three years are well inside the box. The refinery requires some amount of operating “cushion” to ensure that it does not violate any true operating permit limits or other constraints. Furthermore, operating at a “limit” does not always produce the most profitable operation. The optimal crude mix, as determined by the LP, is a function of the price and availability of various crudes as well as the price and demand for the various products. Thus, most of the crude blends that the refinery processed during the three year period fell between about 0.8 and 1.7 wt% sulfur, while the gravities ranged between 24 and 30 degrees API.

Neither Bakken, nor the heavy Canadian crudes could be profitably run by themselves at Valero Benicia. The refinery could not run at full capacity on either crude alone. When running pure Bakken, it would be limited by its ability to process the amount of naphtha contained in the crude and the units designed to process the heavy portion of the crude would be under-utilized. When running pure heavy Canadian crude, the refinery would be limited in its ability to handle the sulfur and residue in the crude and the units designed to process the lighter portions of the crude would be under-utilized.

All refinery units have minimum practical as well as maximum permitted operating limits. If a unit reaches its minimum operating limit it must be shut down. Thus, there are limits to how light or heavy a crude mix any refinery can run. Crudes like Bakken or heavy Canadian crudes must be blended together or with other crudes to optimize the refinery operation. By blending these crudes with other crudes, the refinery can run more efficiently and profitably at higher sustained rates than on either crude alone.

Table 1, extracted from a presentation given by John Auers of Turner, Mason & Co. at the Platts Crude Marketing Conference in Houston, TX on March 1, 2013 shows how a blend of Western Canadian Select and Bakken crudes can give the same yields as ANS. Thus, refineries that were designed for ANS, like Benicia, can substitute blends of WCS and Bakken for ANS. This table also shows that the light hydrocarbons (those contributing most to VOCs) in the blend are lower than those in ANS. Although the sulfur content of the blend is higher, the VIP was permitted under CEQA and additional desulfurization facilities were added to the refinery to allow the processing of higher sulfur crude oil blends while controlling emissions at or below previous levels.

Table 1: Crude oil comparison

Yield, vol%	Alaskan North Slope	WCS/Bakken Blend
API Gravity	32.1	32.1
Sulfur, wt%	0.9	1.4
TAN, mgKOH/g	0.6	0.1
Butanes and Lighter	4	3
Naphtha	26	26
Kero/Diesel	27	27
Gas Oil (FCC feed)	27	27
Residue (Coker feed or Asphalt)	16	16

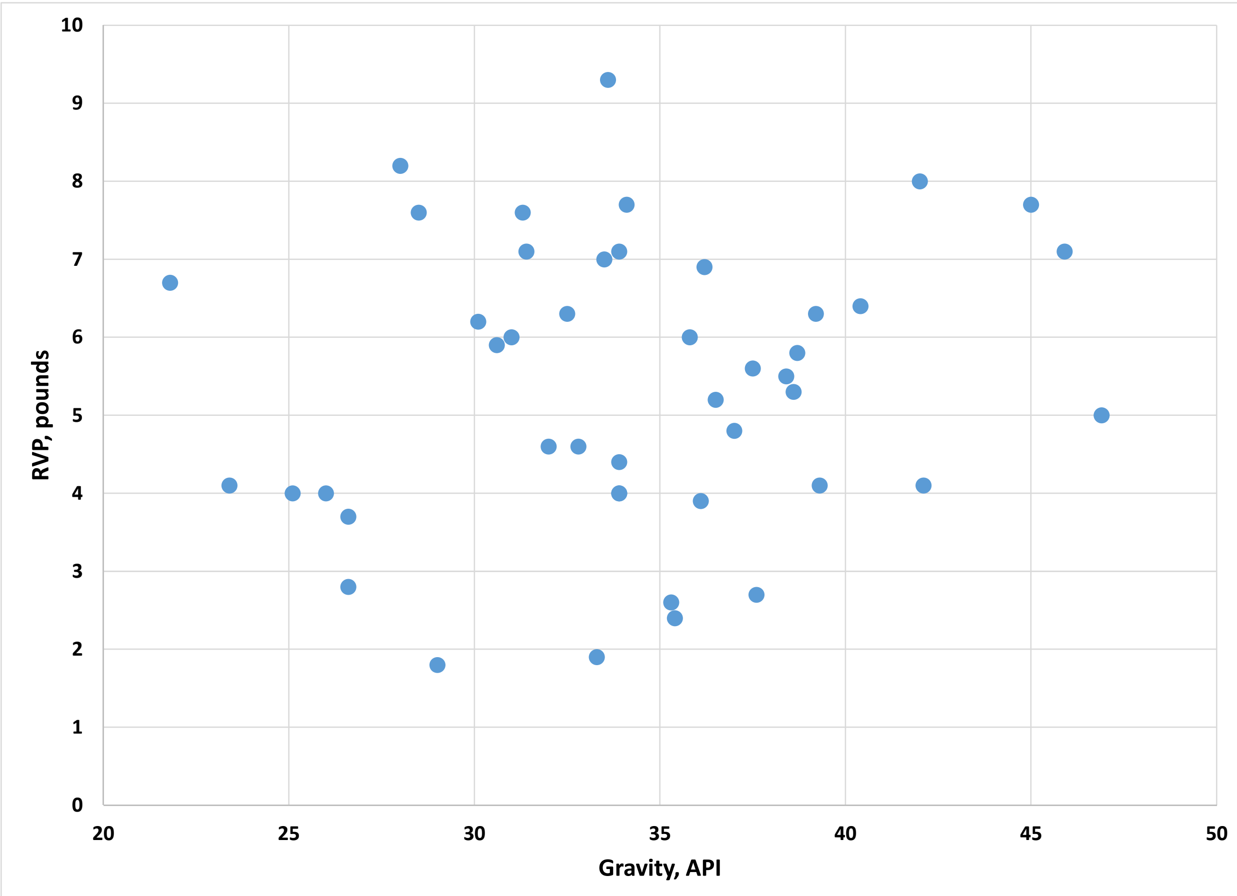
Several commenters were concerned that the crude by rail project would increase the benzene content or the acidity of the crudes run in the refinery or potentially increase the VOC emissions from lighter crudes. The benzene content of Alaskan North Slope, the design crude for the refinery has been reported as 0.33% while two Canadian crudes suspected of being higher in benzene (Figures 1 and 2) are actually on average lower in benzene. Crude Quality, Inc. also reports the benzene content of Canadian light sweet crudes as less than 0.25%, again less than ANS, the design crude for the Benicia refinery.

Crude oil volatility (vapor pressure or potential VOC emissions) has recently received increased scrutiny by various governmental agencies. Most of the focus has been on proper labeling/classification of crude oil shipped by rail from the Bakken formation. Crude oil is a flammable liquid as defined by the Code of Federal Regulations Title 46 (30.10) for Marine shipments and Title 49 (172.101) for land and air shipments. Both sections define three subclasses of flammable liquids although the definitions are slightly different. Title 46 defines Grades A, B and C based on Reid Vapor Pressures (RVP, ASTM D323) of > or = to 14 pounds, under14 and over 8.5 pounds and less than or equal to 8.5 pounds, respectively. Title 49 defines three Packing Groups based on initial boiling point by ASTM D86 distillation and flash point. These are: Packing Groups I, II and III based on IBP<95 F (PG I), IBP >95F and Flash Point <73F (PG II) and Flash Point >73F and <149F and IBP>95F (PG III).

In addition to these shipping requirements, refiners also limit the volatility of crude they purchase. Most of the volatility or vapor pressure of crude oil is due to the small amounts of propane and butanes that are dissolved in the crude oil. Refineries are very limited in their ability to convert these light materials into gasoline. CARB gasoline has an RVP limit of 7 pounds, so most of the propane and some of the butane contained in the crude oil must be sold at a loss as LPG. Recent LPG spot prices are only 1/3 of CARB gasoline prices.

There is no universal relationship between crude gravity and volatility or vapor pressure of the crude oil as shown in Figure 8 for 45 different crude oils. Based on the factors discussed above, there is no valid reason to believe that the crudes that arrive by rail will be higher volatility than those currently processed. Valero has large financial incentives to minimize the volatility of crudes that it purchases.

Figure 8: Crude oil volatility



Would Any Changes in Crude Sources Lead to Increased Corrosion of Refinery Equipment Resulting in Accidental Releases?

Phyllis Fox and other commenters expressed concern that, as a result of the CBR project, future crude feedstocks could become more acidic. As a result, the commenters stated, the Refinery's equipment would suffer increased corrosion, leading to accidental releases.

The acidity of the Canadian crudes is also lower than that of typical California crudes and other heavy sour crudes. San Joaquin Valley crudes have acidities above 2 (as shown in the Califorinia Energy Commission report attached as Appendix C), while Figures 1 and 2 show values below 2 for heavy Canadian crudes. The acidity of the light sweet Canadian crudes is not reported because of its low value. The acidity of Bakken crude has a low value of <0.2 mgKOH/g. Valero actively monitors and controls the acidity of the crude blends it processes to stay within equipment capabilities. Valero also conducts an equipment inspection program that exceeds state and federal requirements.

III. What Information Must Valero Keep Confidential?

The various commenters have asked for additional information to be included in the EIR. Some of the requested information is included in the EIR and this report, while other information is business confidential information or copyrighted information with restrictive rights that limit its public dissemination without proper compensation. Valero has designated as confidential the following information:

- The specific North American crudes that Valero plans to purchase and ship by rail;
- The properties (weight, sulfur content, vapor pressure, and acidity) of specific crudes delivered to Valero in the past;
- The properties (weight, sulfur content, vapor pressure, and acidity) of specific crude blends processed at the refinery;
- Data purchased by Valero showing the weight and sulfur content of specific crudes, including North American crudes;
- Data generated by Valero showing the weight and sulfur content of specific crudes, including North American crudes;
- Detailed information regarding the weight and sulfur content of crude blends suitable for processing at the Benicia refinery based on the refinery's unique configuration; and
- Detailed daily measurements of the weight and sulfur content of crude blends processed at the Benicia refinery in the past.

Basic properties of most Canadian crudes such as gravity, sulfur, benzene and acidity are available on www.crudemonitor.ca. Representative data have been included in this report. Similar properties on Bakken crude could not be found in public documents; although, the North Dakota Petroleum Council released results of a study of Bakken crude volatility on May 20, 2014. Crude assay compositional data can be purchased from companies such as AspenTech; however, this information is copyrighted and cannot be distributed to the general public. Several of the commenters also requested detailed information concerning the capabilities of the various refinery process units, the crudes that have been and will be run in the refinery and the planning tools that the refinery uses to make crude purchase decisions.

As discussed above, the USDOE has determined that refineries do not have to release specific crude purchase information to the public nor do they have to release detailed information on the capabilities of the various processing units within the refinery. It is sufficient to release only unit capacities aggregated by unit type. This information is available on the DOE website and also by purchase through the Oil and Gas Journal. Although the refineries report more detailed information on crude purchases to the DOE, the agency aggregates the data prior to publication to avoid revealing company confidential information.

Crude oils are a commodity that is heavily traded by oil companies as well as trading companies. Publishing what specific crudes Valero purchases or intends to purchase allows competitor refiners to bid on similar crudes and allows traders to purchase futures of these crudes. Both of these actions would increase the price Valero would then pay for future cargoes of these specific crudes. Releasing information on the specific crudes that Valero intends to purchase would put it at a disadvantage against it competitors.

The planning tools that a refinery uses can be purchased by anyone; however, they are copyrighted and cannot be redistributed without compensating the copyright owner. Furthermore, much of the value of these programs comes from configuring them and customizing them to closely match the capacities, capabilities, limitations and performance of the individual units in a particular refinery. This latter type of information would be of particular value to a competitor and is business confidential.

Commenters also requested public dissemination of construction details for the unloading rack that were submitted to the permitting agency. These documents contain sufficient detail to allow a competitor to build a similar facility without contracting for the detailed engineering that Valero required to develop the project. Releasing this information would allow a competitor to build a similar facility at a lower cost and put Valero at a competitive disadvantage. This detailed design information is clearly business confidential information. Furthermore, only a skilled process engineer would find these drawings useful.

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Date Stephen J. McGovern, P.E., PhD