

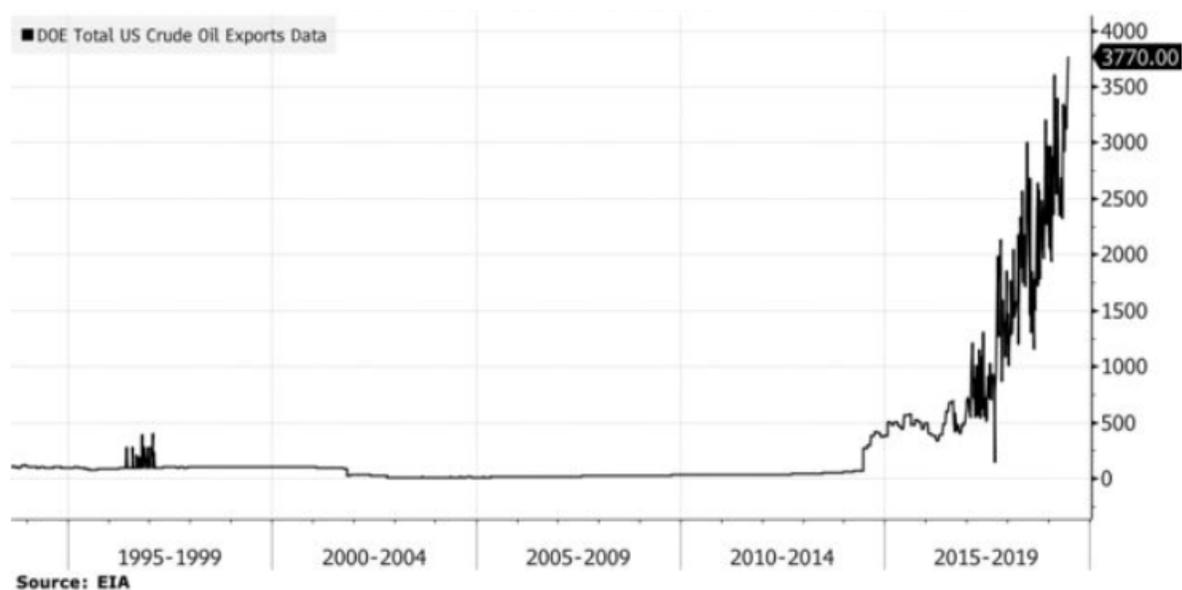
# Suspicious Minds- Quality Challenges and Crude Oil Exports

*The following Turning Point blog is provided by Dennis Sutton. Following a 40-year career with Marathon Petroleum, Dennis is now Principal of the consulting firm, PetroQual and serves as the Executive Director of the Crude Oil Quality Association (COQA).*

Elvis Presley's 1969 number 1 hit "Suspicious Minds", which was more recently covered by Dwight Yoakam, speaks of a mistrusting and dysfunctional relationship and the need of the characters to overcome the issues in order for the relationship to be maintained and flourish. This is a timeless theme that is reflective of the current issues as increasing volumes of US crude oil leave our ports for new destinations, and new refiners are unfamiliar with the characteristics and challenges of these unfamiliar grades. It is a topic that has received much attention at meetings of the Crude Oil Quality Association (COQA), [www.coqa-inc.org](http://www.coqa-inc.org), and at the first ever European Crude Quality Forum, held in July 2018 in Aberdeen, Scotland.

***We're caught in a trap  
I can't walk out  
Because I love you too much baby***

With the Brent WTI spread running in the \$6- \$10 range the last few years, it is easy to see the appeal for foreign refiners, whether they be in Europe, Asia, or South America, to run crude oil produced in the US. The most recent EIA data shows the US exports steadily rising, to over 3.5 million b/d last month.



While the price is appealing and transaction prices quite transparent, readily available and well publicized, the quality characteristics of this material are more obscure and less well understood.

In the case of finished petroleum products, e.g. gasoline, and diesel fuel, there are very comprehensive, well- defined specifications, upon which the material is traded. Certificates of analysis are part of the transaction and both buyer and seller know exactly what they are transferring.

In contrast, crude oil is a raw material and tends to have very minimal specifications. Some crude oil contracts may have as little as “Normal Export Quality” in the quality section. Often times, the quality language includes specs for API gravity, sulfur, and BS&W, and a general statement about “no deleterious material” that is intended to broadly address things that “shouldn’t” be in crude oil. Only rarely do crude oil contracts include specifications for parameters such as the metals content, or the yield distribution.

There are however a few grades that have more comprehensive specifications. LLS has had comprehensive specs, including metals, and boiling range distribution, for about 20 years. Drawing on this success, the COQA worked with CME/NYMEX for about a decade in developing the WTI- Cushing specs that were announced in December 2017, <https://www.cmegroup.com/content/dam/cmegroup/notices/ser/2017/12/SER-8050.pdf>, and became effective at the beginning of this year.

Even with WTI, there are different specs set by different groups, resulting in additional confusion. As discussed above, the CME/NYMEX WTI specs are at Cushing, OK. CME has also set WTI specs at Houston and the Intercontinental Exchange (ICE) has published specs that reference Magellan’s pipeline specs for BridgeTex and Longhorn.

A summary of the different quality specifications (for the relevant properties) is as follows:

	<b><u>CME’s WTI- Cushing</u></b>	<b><u>CME’s WTI- Houston</u></b>	<b><u>ICE’s Permian WTI (Houston)</u></b>
<b>API Gravity</b>	37-42	40- 44	36-44
<b>Sulfur, wt %</b>	0.42% or less	0.275% or less	<0.45%
<b>RVP, psi</b>	<9.5	<9.5	<9.5
<b>MicroCarbon Residue (MCR), wt %</b>	2.40% or less	2.40% or less	
<b>Total Acid Number (TAN)</b>	0.28 mg KOH/g or less	0.28 mg KOH/g or less	
<b>Nickel, wt ppm</b>	8 ppm or less	4 ppm or less	
<b>Vanadium, wt ppm</b>	15 ppm or less	4 ppm or less	
<b>HTSD: Light Ends &lt; 220°F</b>	Not more than 19 wt %		
<b>HTSD: 50% point, °F</b>	470°F- 570°F		
<b>HTSD: Vacuum Resid &gt; 1020°F</b>	Not more than 16 wt %		

It is quickly apparent that they are not identical.

While many have called for better specs, crude oil traders, who are motivated by economic opportunities, generally are not inclined towards adding quality specifications to contracts as it can limit their flexibility in trading. In contrast, refiners are the ones tasked with transforming the raw crude oil into on spec finished products, while prioritizing environmental and safety concerns, together with smooth, ratable operations. Thus, refiners are much more risk averse when it comes to running new crudes at their facilities. Refiners will therefore push for more comprehensive specifications and more information prior to running the new crude.

Another challenge for refiners tasked with processing “new” US export grade crudes is that crude names can be confusing. In contrast to chemical compounds that have globally accepted, unique and systematic names, crude oil names convey little definitive information. For example, Arab Heavy is about 29 API, while Tia Juana Heavy is 11 API. West Texas Intermediate (WTI) and Light Louisiana Sweet (LLS) are both about 40 API though one is called Light and one Intermediate.

So, with growing US export volumes, less than comprehensive specifications, non-uniform WTI specs, and imprecise names, it’s no surprise that foreign buyers may find the price appealing but have expressed reluctance and concern over the quality of what they receive. Add to that, another factor...

***Here we go again  
Asking where I've been***

Usually when purchasing crude oil, it is not necessary to probe as to how the crude was produced and transported, prior to its arrival at the refinery. However, with the complex midstream networks and blending in the US, this is indeed a concern and worth the effort to understand. For example, is WTI- Midland, the same as WTI- Cushing or WTI- Houston?

Familiarity with the pipeline systems is imperative in understanding quality characteristics. For example, the Cushing terminal now has close to 100 million barrels of capacity, and at least 9 incoming crude lines. Crude oil from Canada, Colorado, North Dakota, Kansas, Oklahoma, and (yes) Texas, can potentially be blended into WTI at Cushing.

When crude oil is blended to only API gravity and sulfur specifications, it gives rise to “dumbbell” crudes, that are rich in the less expensive light naphtha and the heavy vacuum resid components. The addition of the new, more comprehensive, CME/NYMEX specs will help preclude this, providing greater clarity to the buyer. A recent COQA presentation by Hillary Stevenson, titled “Cushing Infrastructure, Prices, and Quality” provides detailed information on Cushing. [https://www.coqa-inc.org/docs/default-source/oklahoma-city-2019/053019-stevenson-cushing-infrastructure-price-quality.pdf?sfvrsn=b9994bbb\\_2](https://www.coqa-inc.org/docs/default-source/oklahoma-city-2019/053019-stevenson-cushing-infrastructure-price-quality.pdf?sfvrsn=b9994bbb_2)

To emphasize the handling differences between finished petroleum products and raw crude oil, with finished products the delivery of on-spec product demands that there be no compromises to quality in the transmission system. Thus, there are dedicated tanks for each grade of product and any pipeline interfaces are cut out, and returned to the refinery for reprocessing. With crude oil, tanks cannot be segregated for only one grade but are used for “similar” grades. Pipeline interfaces between two dissimilar crude grades are not removed. Instead midpoint

cuts are made. Both of these factors lead to some commingling of crude batches as they move from source to receipt point. Depending on batch sizes, tankage constraints, and number of terminal break outs, this commingling can significantly affect delivered quality.

***Why can't you see***

***What you're doing to me***

***When you don't believe a word I say?***

Two recent, highly publicized crude quality incidents have created additional alarm about the quality of US crude exports.

Just a few months ago, Bloomberg reported that South Korean refiners had rejected two cargoes of US crude due to unacceptably high levels of oxygenates. The crude in question was Eagle Ford, a light, tight oil crude produced in Texas and moved to the Texas coast for loading on ships. Some reports even used the pejorative term “infected” to refer to the crude. While parties involved are understandably reluctant to address details of the situation, a few things are clear. “Oxygenates” refer to a class of compounds containing oxygen and are not naturally occurring in crude oil. Thus, they had to be introduced into the crude through the handling or transportation of the crude oil from production point to receipt point. Without knowing details, one can only speculate that the oxygenate in question was ethanol, a common blending component in gasoline. Eagle Ford is a well-established crude grade, processed for over a decade and this is the first reported incidence of this issue. Thus, it is not a systemic issue, but the impact on buyers is significant.

Another recent crude quality incident that received worldwide attention was the Russian Urals crude that was found to have up to 200 ppm organic chlorides, resulting in pipeline stoppage, and containment issues. Similar to oxygenates, organic chlorides are not naturally occurring in crude oil. Normally, chemical analyses on crude will yield <1 ppm of organic chlorides. These compounds, such as chloroform, carbon tetrachloride, and tetrachloroethylene, are often used as cleaning solvents and dewaxers. While inorganic chlorides, i.e. salts, are separated and go into the water phase in the refinery's desalter, the organic chlorides remain soluble in the crude, are carried into the main distillation unit, and form HCL, resulting in significant corrosion. Again, details are limited but this too is a one-time episode, and not reflective of the overall quality of Urals crude. There have been similar incidents involving North American crudes in the past. While this incident did not involve US crude, it further exacerbated concerns about crude quality.

***We can't go on together***

***With suspicious minds***

***And we can't build our dreams***

***On suspicious minds***

While crude oil quality is often overlooked, at least until something negative happens, it is certainly important for optimal refinery operations. Thus, what can be done to build a better path forward?

For Producers/Sellers:

- Realize that real or perceived quality concerns exist. Communicate with customers, openly and honestly. Provide data that will be useful to buyers. [www.crudemonitor.ca](http://www.crudemonitor.ca) was initially facilitated by the Canadian Association of Petroleum Producers (CAPP) over 20 years ago (and continues today through funding of shippers and producers) to better communicate the quality characteristics of Canadian crude oil to buyers/refiners, many of whom were unfamiliar with these new grades. In collaboration with the COQA, [www.crudemonitor.us](http://www.crudemonitor.us) has been established to communicate quality information on US crudes. Currently, it only has WTI and DSW data for samples taken at Cushing, but we are working with producers and mid-stream companies to use this as a platform for transparently providing data on other important export grades. In addition, the ICE web page, <https://www.theice.com/crude-oil/futures/permian-wti>, includes monthly average data from BridgeTex and Longhorn pipelines.

For Buyers/Refiners:

- Better educate yourselves about the crudes being procured; ask questions; attend COQA meetings; if necessary, create multiple crude assays to be used in the crude evaluation models; push for more comprehensive quality language in contracts.
- Employ commercial laboratories using standardized ASTM test methods for obtaining crude quality data of the actual material being loaded. Obtain more comprehensive data than just API, BS&W, and sulfur. Compare that data to discharge data. Build a database of crude quality data, including crude grade, load port, seller company, and infrastructure that delivered the crude to the load port.

Finally, billions of barrels of light tight oil have been smoothly, and efficiently processed over the past decade. With additional understanding and communication, new buyers and refiners throughout the world will see the same results.

We would like to thank Dennis for today's blog and support the work COQA is doing in coordinating efforts in the crude oil quality arena. In the course of our business, Turner, Mason & Company has been involved in a variety of studies and engagements where crude quality issues have been of primary or secondary interest. These issues are only becoming more vital to refiners due to the light tight oil boom, other developments in the upstream, and an environment where product specifications are becoming ever more stringent and wide ranging. We have assisted all segments of the oil industry in responding to these and other developments which impact petroleum markets and also provide in-depth analysis of the impacts in our subscription products.