
Domestic Sweet / WTI Specifications

COQA- October 2009

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Domestic Sweet / WTI Specifications

- Brief Review of the History
- Current Work
- Future Plans

A Decade Ago

- Development of LLS Specifications
 - API Gravity, Sulfur, Metals, MCRT, HTSD, Light Ends, TAN (added later)

- Extensive Basin Quality Work Led by Aaron Dillard and Others

COQG Efforts

- January 2005 - John Maurer of Valero initiated discussion on specs for major crudes at Domestic Trading Centers
- A subcommittee was formed to pursue this work
- West Texas Intermediate (WTI) and Cushing, OK were agreed to be our greatest interest and impact
- High Temperature Simulated Distillation (HTSD), acidity (TAN), API gravity, sulfur, carbon residue (MCRT) and metals were identified as important quality parameters

2006 - 2008

- Data was obtained that showed Domestic sweet to be a light, sweet, very low TAN stream but there was a great deal of variability in the metals and HTSD data. Also, some uncertainty about exactly where and how some samples were obtained.
- An article in the July 17, 2008 Oil Daily highlighted COQG's efforts in developing more comprehensive Domestic Sweet specifications
- Clifford Mills (consultant) has been invaluable in handling the data

2009

- John Maurer reassigned within Valero
- In 2009, conference calls have been used to complement the COQG meetings to progress in a more timely manner.
- In order to set appropriate specification limits, we agreed further analytical testing was needed with tightly defined sampling and lab procedures.
- Commercial labs were surveyed to determine their capabilities and interest in conducting analyses.

2009 March ASTM Crude Oil Sample (CO0903) was WTI/Domestic Sweet

- Over 80 labs worldwide submitted data on this sample
- Data was provided for a wide slate of parameters by multiple test methods including all of the tests we are interested in
- While only one sample, this provided excellent information on the reproducibility of the methods

CO0903 Results - API & Sulfur

Sample: CO0903					
	Mean	Number of Valid Results	ASTM Reproducibility	Reproducibility This Sample	Comments
API Gravity, by D287	39.4	64	0.50	0.44	NYMEX has 37-42; no concern.
Sulfur, wt %, by D4294	0.424	86	0.042	0.037	NYMEX has ≤ 0.42 wt%; no desire to change; what happens when it exceeds 0.42%? Over half the labs reported $>0.42\%$.

- API Gravity and Sulfur are tests we are concerned about that currently have specifications defined by NYMEX.

CO0903 Results - RVP & Pour Point

Sample: CO0903					
	Mean	Number of Valid Results	ASTM Reproducibility	Reproducibility This Sample	Comments
RVP, by D5191	6.07	32	0.296	1.479	This sample reproducibility is much worse than quoted ASTM value; NYMEX has a published spec of <9.5 psi
Pour Point, °F, by D97	-3	61	9.0	16.3	NYMEX has a published spec of $\leq 50^{\circ}\text{F}$. WTI should be nowhere near this limit.

- While we are not seeking to add specifications for Viscosity, RVP, or Pour Point, NYMEX does have published specs for these parameters. Are these monitored at Cushing?

CO0903 Results - Yields

Sample: CO0903 - HTSD by D7169					
	Mean	Number of Valid Results	ASTM Reproducibility	Reproducibility This Sample	Comments
20% point (°F)	264	28		52	Reproducibility is large.
50% point (°F)	554	27		79	Reproducibility is large.
% at 1020°F	85.7	26			Value interpolated since % at 1020°F is not directly reported.
% >1020°F	14.3	26			This is just 100 - (% at 1020°F).

- While the precision from this large group is poor, some labs do quite well.

CO0903 Results - Others

Sample: CO0903					
	Mean	Number of Valid Results	ASTM Reproducibility	Reproducibility This Sample	Comments
TAN by D664	0.11	80	0.16	0.11	
MCR by D4530	1.94	66	0.23	0.26	
Nickel by D5708B	5.9	18	Only stated for values >10 ppm	2.1	The small number of valid results is due to the fact that not all labs use D5708B.
Vanadium by D5708B	12.9	17	Only stated for values >50 ppm	2.9	

- TAN, Carbon Residue (MCR) and Metals (Nickel & Vanadium) are parameters for which we desire to implement specifications. These four parameters are part of the LLS specifications.

In Progress

- Thanks to the efforts of various companies, we are collecting and analyzing approximately 40 Domestic Sweet/WTI samples, taken at Cushing.
- Samples are being collected from multiple operators, over several weeks time, utilizing three different commercial labs.
- Data is flowing to Clifford Mills for workup. Clifford has received about half of the data so far.



Domestic Sweet - Lab Testing

- The following slate of analytical testing is being conducted on the whole crude sample as received:
 1. API Gravity by ASTM D287
 2. Total sulfur by ASTM D4294
 - Centrifuge to eliminate free water
 3. Total Acid Number (TAN) by ASTM D664 using the first inflection point
 4. Nickel by ASTM D5708B
 5. Vanadium by ASTM D5708B
 6. MCRT by D4530
 7. High Temperature GC Simulated Distillation (HTSD) by ASTM D7169. Report 20% point, 50% point, and Recovery @ 1020F.



COQG Domestic Sweet Project

Preliminary Data Review



Status of project

- Some data received from four sources
- Data was obtained at four different laboratories (Three were slated in the project)
- Data development continues

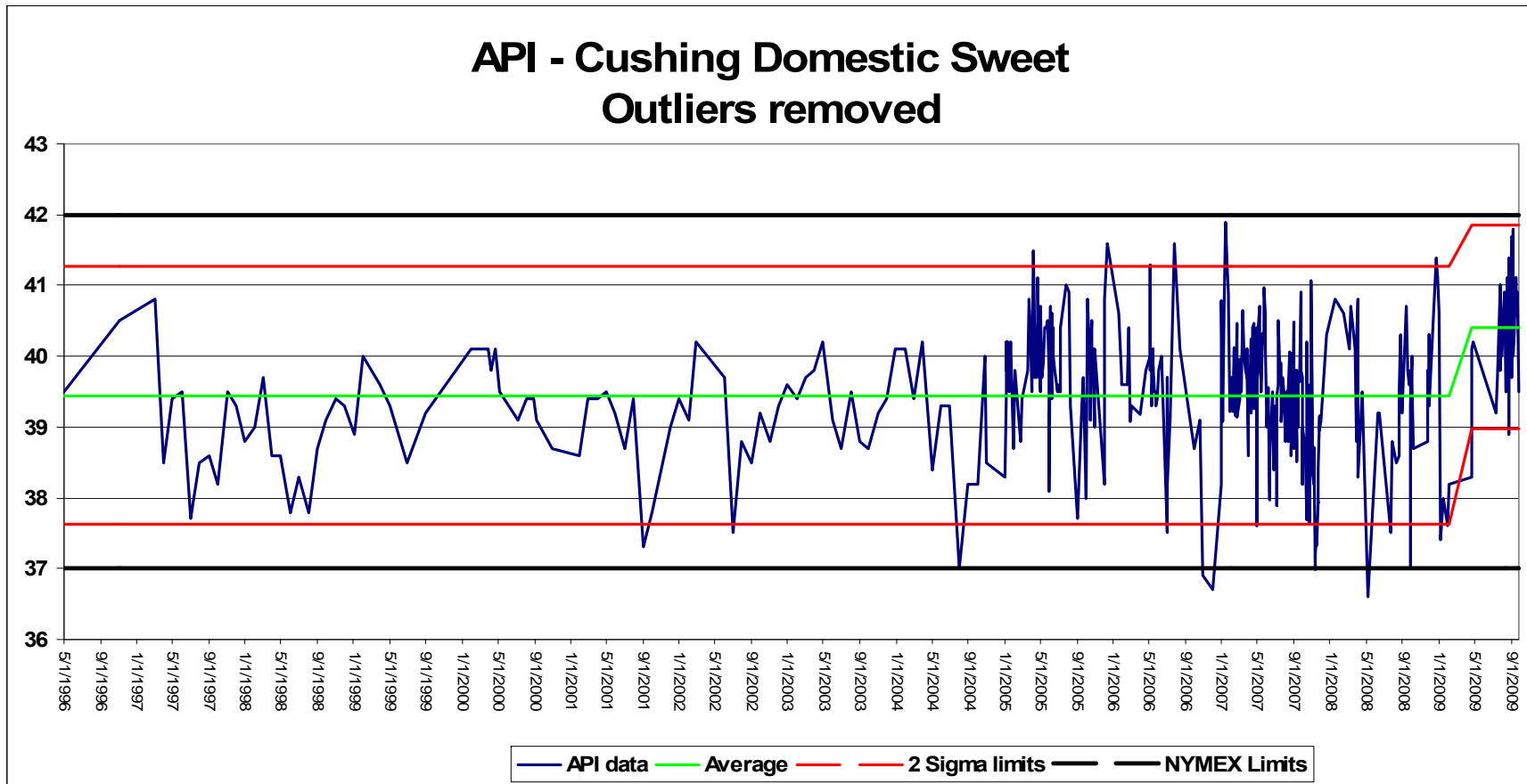


Preliminary Observations

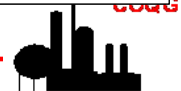
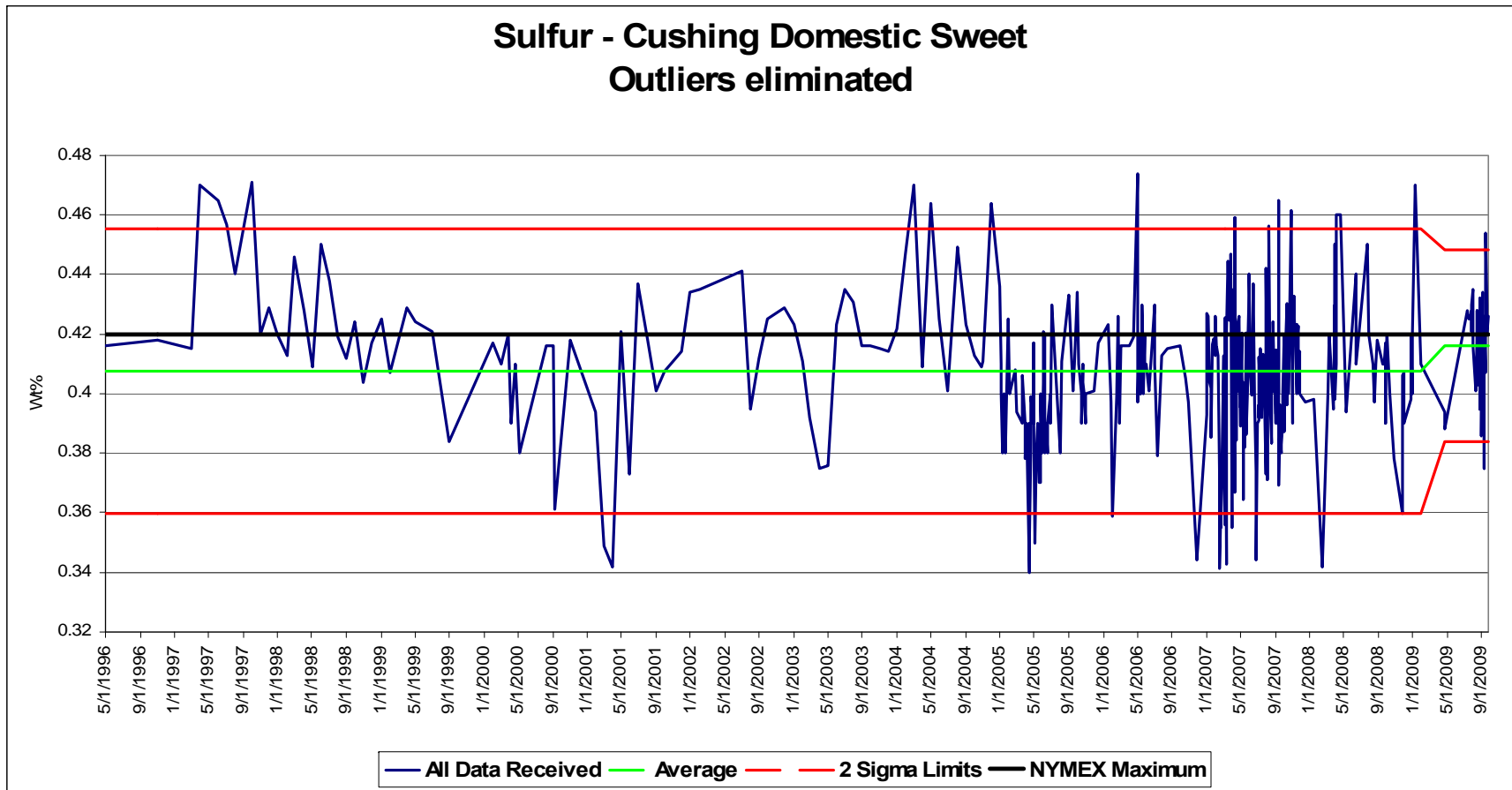
- API Gravity levels have trended up since the previous study
- Sulfur levels continue to exceed the NYMEX maximum on many samples and have increased slightly since the previous study
- TAN values are consistent with the previous study
 - There appears to be some between laboratory bias
- MCRT values are consistent with the previous study
- Ni & V data significantly lower than previous study and less variable
- Simulated distillation data is still suspect



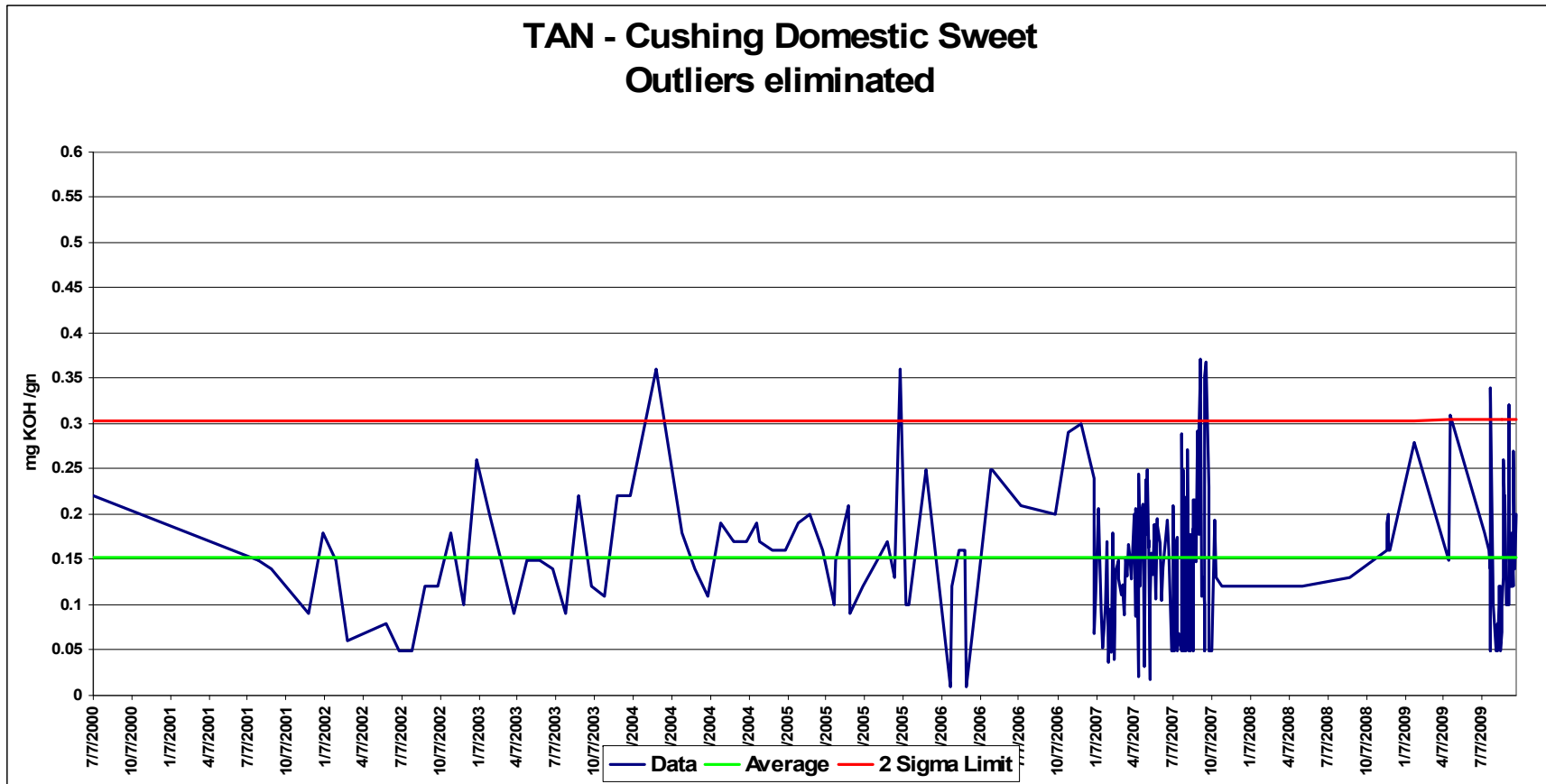
Preliminary API Data



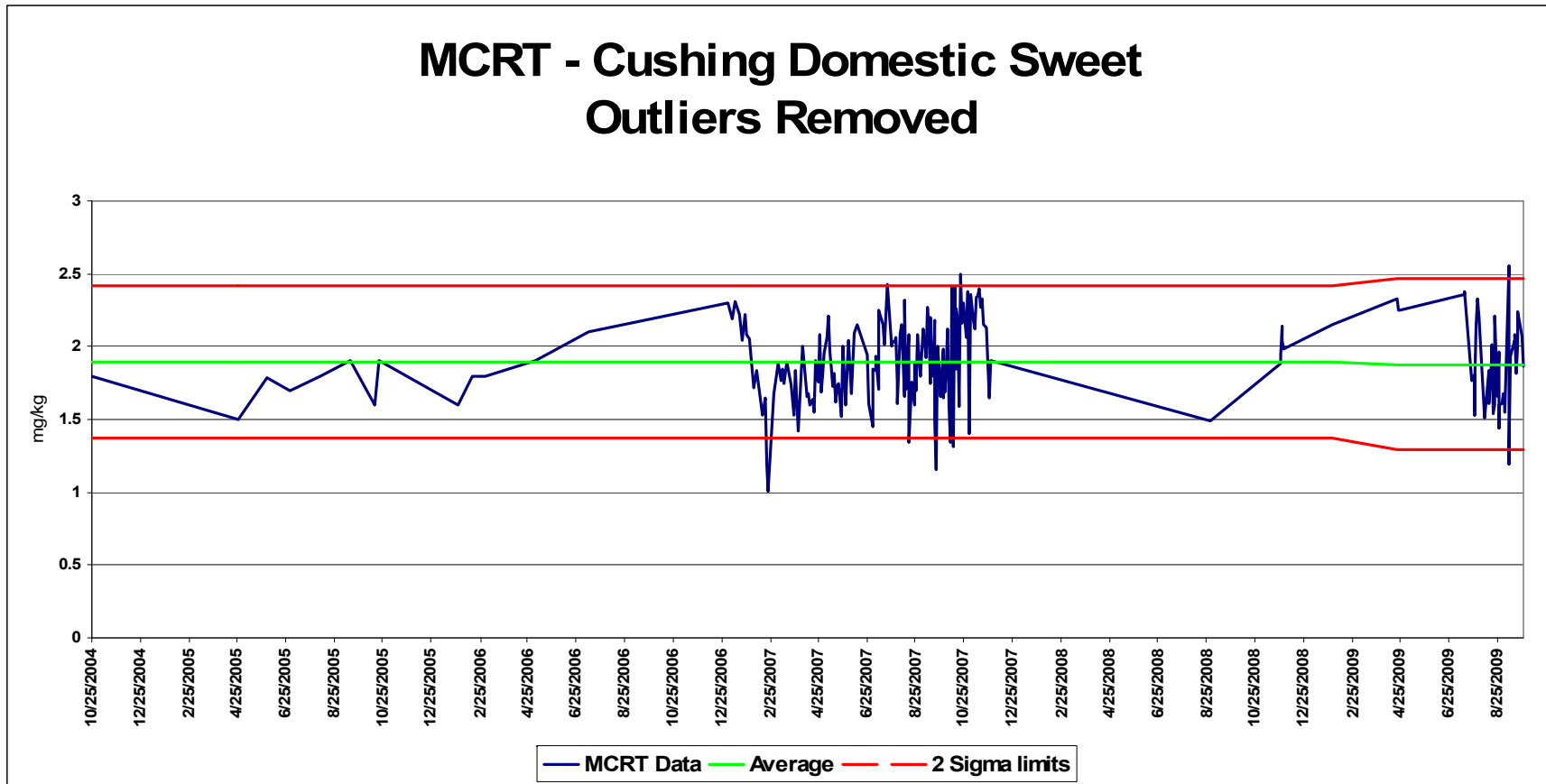
Preliminary Sulfur Data



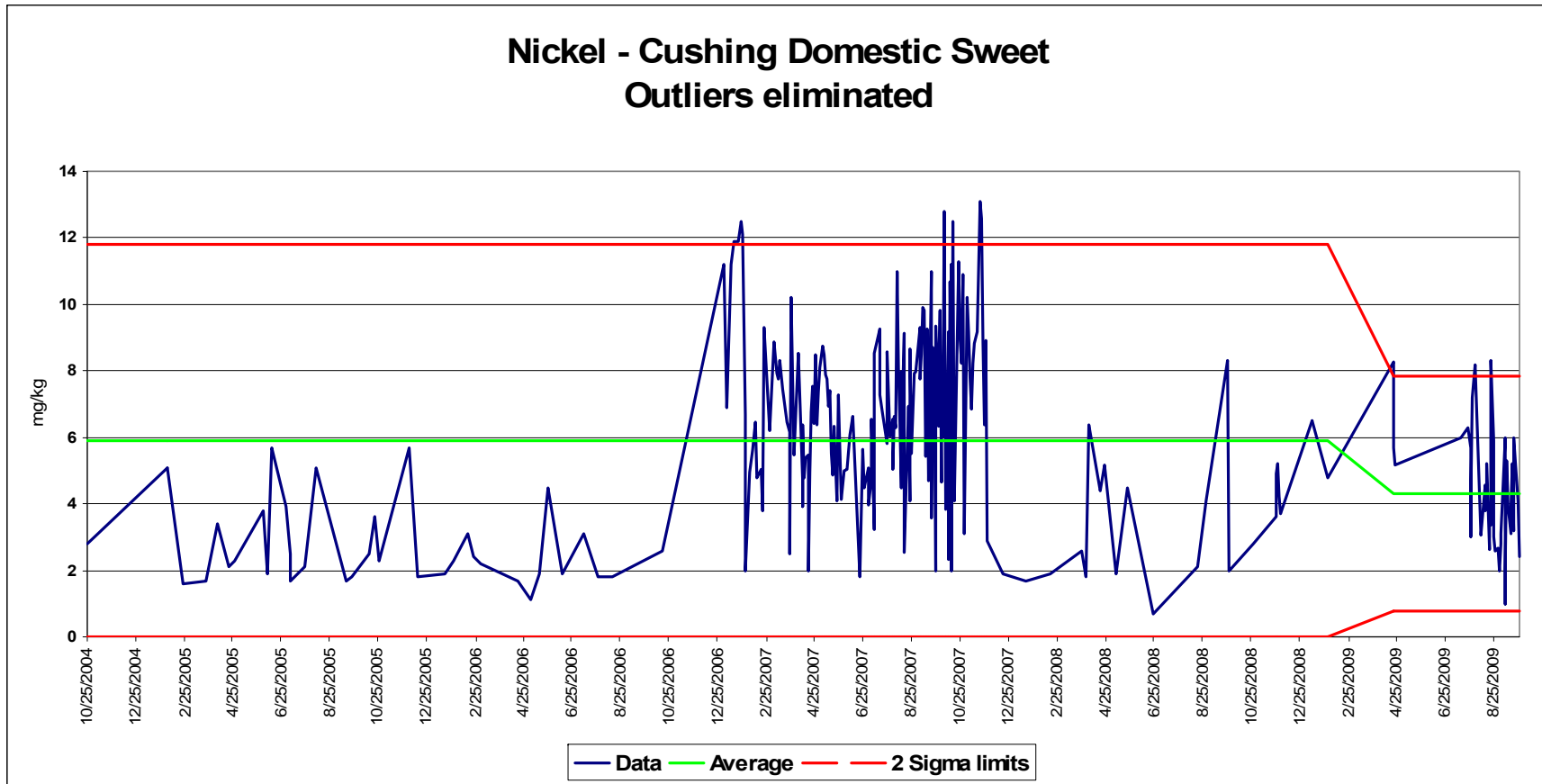
Preliminary TAN Data



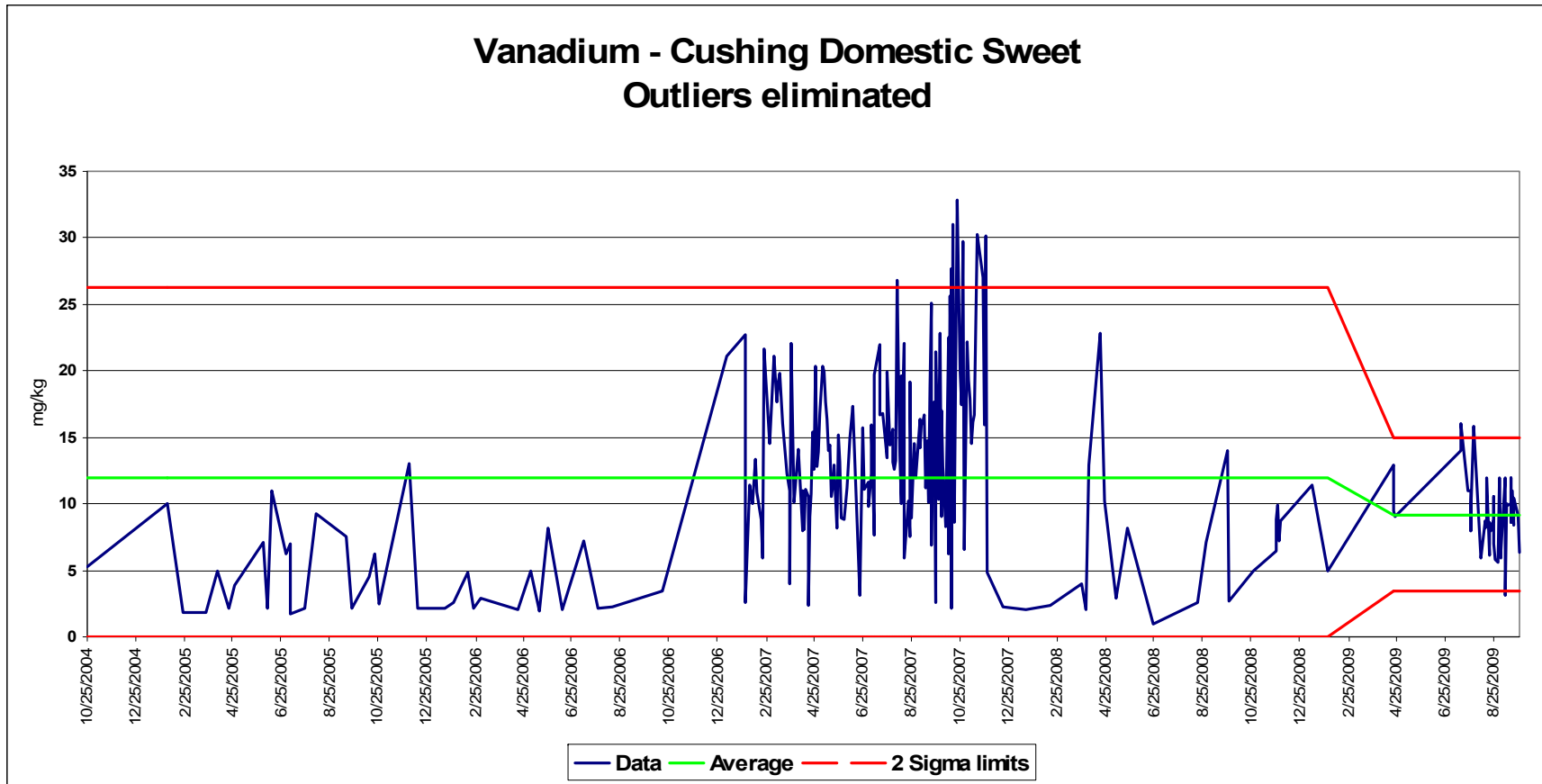
Preliminary MCRT Data



Preliminary Nickel Data



Preliminary Vanadium Data



Simulated Distillation (1)

- Reported total recovery data has varied from 92 to 100% recovery
- Reported 1020°F recovery has varied from 78.8 to 91.9% recovery
- Reported 20% recovery temperatures have varied from 206 to 286°F
- Reported 50% recovery temperatures have varied from 494 to 599°F

Simulated Distillation (2)

- Preliminary data indicates possible between laboratory biases
 - Always ~100% recovery
 - Never 100% recovery
- Complete review of data will follow when all labs are equally represented

Where do we go from here

- Continue to compile data
- Compare data from different sources
- Compare data from different labs
- Agree on control limits for the various components

Early Thoughts - Not Conclusions

- The results obtained to date are encouraging!
- Better definition of the sampling and analytical testing requirements has resulted in better precision.
- Our data, from multiple terminals at Cushing, over several months, will provide a basis for the development of meaningful specifications for WTI/Domestic Sweet.



What Next?

Future Plans - Development of Specifications

- Complete current testing survey. This should be finished by the end of the year. Clifford Mills will evaluate and distribute data without sample submitters or laboratories.
- Review this data, the CO0903 crosscheck data, previous COQG results and own individual in-house information.
- Agree on specifications for Domestic Sweet
 - API >37 and <42
 - Sulfur <0.42 weight percent
 - Nickel and Vanadium (ppm)
 - MCRT
 - TAN
 - 20%, 50% and recovery @1020F by HTSD

Future Plans - Implementation

- COQA representatives should contact their individual anti-trust attorneys and be sure legal is aware of COQA's efforts and to provide appropriate counsel.
- By January 1, be prepared to discuss how best to implement the specifications.

Final Thoughts

- NYMEX currently has published WTI specifications for: API Gravity, Sulfur, Viscosity, RVP, Basic Sediment, and Pour Point. There are no requirements on how these properties should be monitored.
- Current LLS specifications include: API, Sulfur, MCRT, Light Ends, HTSD, Metals and TAN. The Capline owners and operator have determined the monitoring and enforcement programs.
- Our current efforts to develop and implement more meaningful WTI/Domestic Sweet specs are an extension of programs that have run successfully for years!

