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CRUDE BY RAIL QUALITY ISSUES

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Purpose

Discuss the stumbling blocks to quickly implementing a quality program for crude arriving by railcar

This will include a review of

- ⦿ The importance of a Crude Quality program
- ⦿ The challenges to determining good crude quality parameters
- ⦿ The challenges to implementing crude quality testing

Presentation Contents

- Handling Safety
 - Economics/Plant Reliability
 - Railcar Transportation
 - Sampling Program
- Will see these areas liberally interspersed through the presentation

Questions

- My question: Rail cars are the same as historically shipping, i.e. crude in barrels. Why do we care now about quality? What/s different?

Why Crude Quality Is An Important Topic: Handling Safely

- ① Used to ensure the safety of personnel and environment
 - Reduce/eliminate effects of H₂S and other hazardous substances imbedded in crude
- ① Used to help in eliminating transportation impact
 - Do not fully understand impact of co-mingling in rail cars (i.e. wax, asphaltenes)
 - Inability to keep crude mixed and warm; requires thorough understanding of impact on offloading

Why Crude Quality Is An Important Topic: Economics/Reliability

- ⦿ Used to determine most economic crude purchases
- ⦿ Used for planning and scheduling models, yield forecasting and financial forecasting
- ⦿ Used in determining net volume for mass balance
 - Water and sediment adjustments
- ⦿ May be used for quality related contract adjustments
 - Am I getting what I am paying for?
- ⦿ Used to ensure the continued reliability of the refinery
 - MOC process for new crudes
 - Reduce increased cost effects of incompatibility, impurities, contaminants, waste

Challenges to Determining Quality

Crude

- Number of source streams and types available increasing
- Not all crude streams/types are the same, even from same region (MSW) – See following picture slides

Sampling

- Not all samples collection methods or container types are the same.
- Not all test methods are the same.

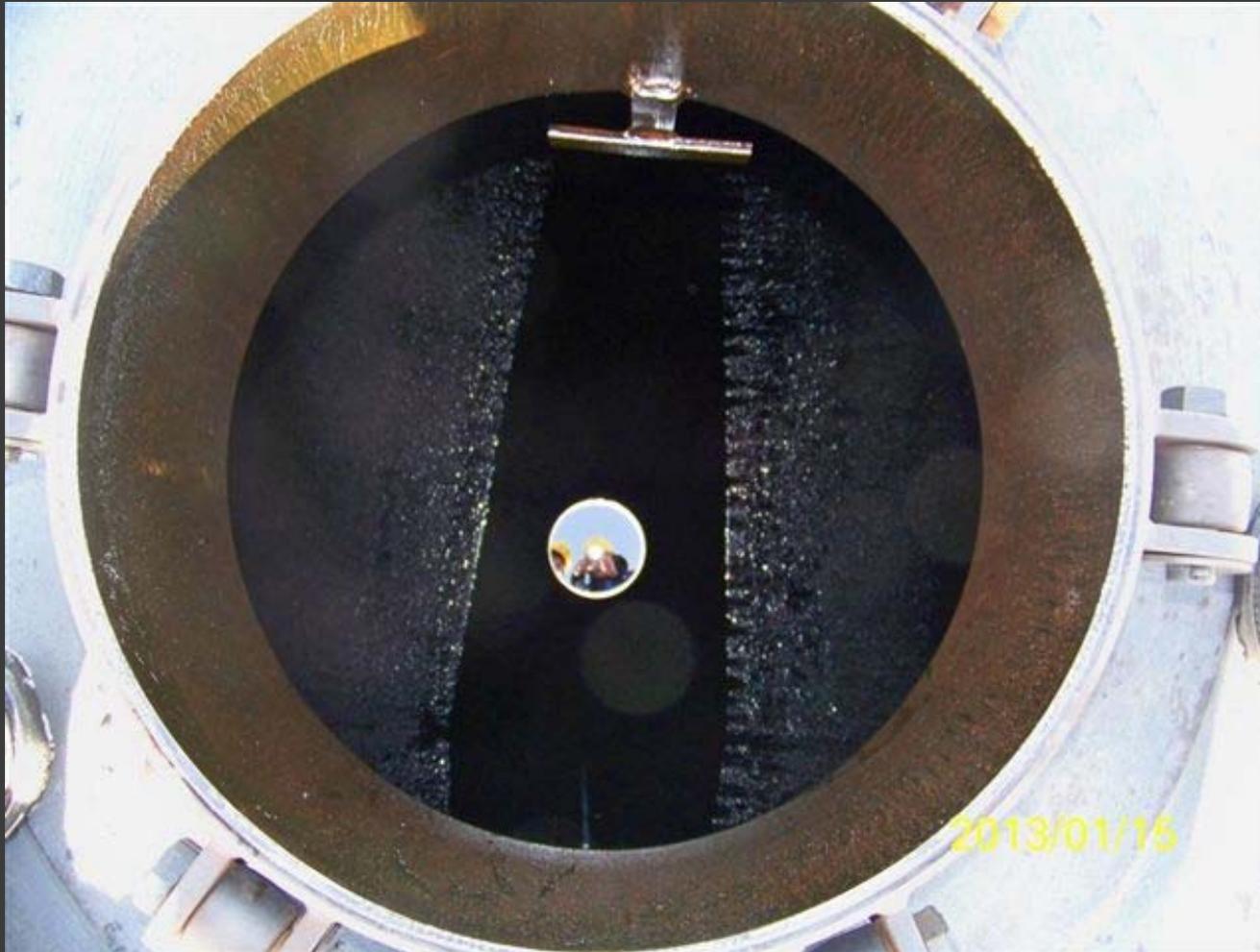
Transportation

- Only minimal data available; challenges not always the same as pipeline.

Waxy Light Crude – Same Type



Non-waxy Light Crude – Same Type



Challenges to Determining Quality Parameters

- ⦿ Co-mingling in rail cars
 - some residuals in rail cars are not crude (agglomeration of asphaltenes/waxes?) – See picture
 - One car can have three crude types
 - Loading heavies into GP in summer; some light into C&I cars
- ⦿ Contaminants in rail cars
 - Additives – impact on test results fully known?
 - Scavengers (for H₂S)
 - Pour Point Suppressants – lower pour point
- ⦿ Sample collection
 - Variable (technique, volumes and labeling)
 - Needs to be standard for important variables such as RVP
- ⦿ Some data hard to obtain - All current tests not available for all crudes
 - Cloud point – wax determination
 - Pour point below 0°C

Sludge



Challenges of rail car crude handling to Quality

○ Residuals

- unknown substances in rail car heels
- flushing residual to wrong tankage when changing rail car service

○ Stratification in rail cars

- not good for S&W tests
- may have impact on API test

○ Contaminants

- Cars viewed as trash receptacles; see picture
- H₂S Requires scavenger
 - Mixing time/requirements not fully understood
 - Industry moving to not loading if high (levels >5ppm)

Garbage in crude oil



Sampling Program

- ① What can be done to overcome challenges?
 - Current and Planned Future Practice
 - Challenges to new practice

Railcars and Sampling

Current practice

- Sample at delivery point only of either single rail cars, multiple rail with common product or blended offloads.
- Source sampling program is almost non-existent.
 - Only do when issues arise or concerns have been raised.
 - Rely primarily on established and sometimes outdated assays to make purchase decisions
- Operations personnel collect samples.
- Lab analysis work is by third parties
- Reactive in dealing with crude issues in rail transportation
- Use multiple transloaders, some in remote locations. No real oversight because of distance/personnel needed. List changes monthly.
- Product is co-mingled crude in rail cars and co-mingle crude at offload.

Delivery point sampling: Disadvantages

- Samples are not from a homogeneous mixture
 - Rails cars after 5-7 days delivery time have begun layering; water and sediment on bottom; light products on top.
- Sample collection points, timing or methods are not consistent, skewing results.
- Sediment and water already offloaded before the sample is obtained.
- Too late in process to address any safety issues.
 - By the time the sample is obtained all the tanks car have been opened and crude delivery to tanks has begun
 - Sample analysis not completed until after the cars have left the site.

Potential Future Practice

- ⦿ Stop sampling of rail cars at delivery point unless some issue/concern calls for it
- ⦿ Sample all unit trains/manifests at load points (representative sampling and % of cars)
- ⦿ Possibly stopping co-mingling crude in rail cars
- ⦿ Partner with Mid Continent lab to provide sample gathering, analysis and data management services
- ⦿ Three tiers of samples for three API ranges
 - Parameters for Continuous monitoring
 - Expanded parameters for limited analysis
 - Limited Crude Assay for Traders/MOC developers
 - (Potential 4th) Full plant assay

Load point sampling: Advantages

- Identify issues related to safety of personnel or specification while the rail car is in transit (before delivery). This will give time to plan action from the data.
- May be able to tie quality issue to a specific load/source. Offloading multiple crudes at one time will have no data impact.
- Sampling the rail car will provide better inputs to refinery mass balance.

Load point sampling: Issues to overcome

- Transloading locations and load times not stable; must have excellent communications between traders and lab
- Adverse weather may impact ability for techs to get to site and obtain sample; must plan for obtaining backup data
- Transloaders need to allow testing lab to collect samples

Review

- ⦿ There are good reasons for determining the quality of the crude being purchased
- ⦿ There are challenges to rail and the current quality sampling process/practices
- ⦿ These challenges, with new ones, can be overcome

Questions?

- My question: Same as historically shipping, i.e. crude in barrels. Why do we care now about quality? What/s different?
- I hope I have answered or begun to answer it.
- Other questions?





