SEEMINGLY INSIGNIFICANT HYDROCARBON MEASUREMENT INACCURACIES ACCOUNT FOR SIGNIFICANT REVENUE LOSSES

Christopher Tucker
Oil Movement Consultants, Inc.

Inaccuracies in hydrocarbon measurements can cause significant revenue losses for a company.

This paper will discuss the problems associated with hydrocarbon measurements and the preventive measures a company can take to correct the inaccuracies.

Historically, exploration and production companies have adopted a casual attitude to the necessity of accurate hydrocarbon measurements. All too often this author has heard, "Our measurements are pretty close; anyway what's a few barrels between friends".

These types of attitudes can cause significant revenue losses for a company as the examples below demonstrate.

Information

a =	Daily Oil Production:	20,000 barrels per day.
b =	Crude Oil Price:	$20.00 per barrel.
c =	Average Barrels per Sale:	175 barrels (1 truck).
d =	Overall Average Loss Due To Measurement Inaccuracies:	1 percent or 1.75 barrels per each sale.

1) How much revenue is the company losing each day due to inaccurate measurements?

Formula: a x d x b = Daily Revenue Loss

20,000 x 0.01 x 20.00 = $4000.00 lost each day.

2) How much revenue is the company losing each year due to inaccurate measurements?

Formula: a x d x b = Yearly Revenue Loss

20,000 x 0.01 x 20.00 x 365 = $1,460,000.00 lost each year.

3) How many barrels of oil is the company losing each year (or each day) due to inaccurate measurements?

Formula: a x d x 365 = Number of Barrels Lost Each Year.

Year: 20,000 x 0.01 x 365 = 73,000 bbls. lost each year.

Day: 20,000 x 0.01 = 200 barrels lost each day.

4) How many truckloads (average truckload 175 barrels) is the company losing each year (or each day)?

Year: 73,000 bbls / 175 = 417.14 truckloads lost each year.

Day: 200 bbls. / 175 = 1.14 truckloads lost each day.

As you can see the "anyway what's a few barrels between friends" attitude can quite easily deprive a company of significant revenues. It does not matter whether the volume losses are intentional or unintentional the end result is:

LOST REVENUE!

While it is virtually impossible to obtain exact measurements. If the proper type of equipment being used is approved by API/ASTM, is in good working condition, the personnel properly trained and the API/ASTM guidelines are followed, then accurate measurements can be obtained. The following are general guidelines and hints to obtain accurate measurements.

Author's Note: The appropriate API/ASTM guidelines should be consulted for specific procedures.

General Guidelines and Hints To Ensure Accurate Measurements

1. Gauging: To obtain accurate measurements when gauging hydrocarbons, great care should be taken to ensure:

a) The gauge line and gauge bob are approved by API/ASTM and is good working order.

b) All parties take the measurements at the same point on the gauge hatch.

c) The gauge height of the gauge hatch is verified each time a measurement is taken to ensure that the gauge bob has reached the bottom of the tank (or strike plate).

d) The gauge bob does not tilt or lean when it strikes the bottom of the tank (or strike plate).

e) A minimum of two identical oil level gauges are obtained before continuing.

2. Temperatures: To obtain accurate temperatures of the hydrocarbons, great care should be taken to ensure:

a) The cup case thermometer is approved by API/ASTM and in good working order.

b) The thermometer is given sufficient time to adjust to the temperature of the oil.

c) The temperature are taken in all necessary levels to obtain accurate overall average.

Hint: Take the temperature at the required level for 3 minutes, read the thermometer, dump the oil out of the cup case, return the thermometer to the same level for two minutes. If the temperature is the same as before proceed to the next level. If the second temperature is not the same as the first, repeat the procedure.

Hint: Upper level, middle level, lower level = calculated average.

Hint: As rule of thumb 12 degrees of temperature difference is approximately equivalent to 1 inch of oil.

3) Samples: To obtain accurate samples of the hydrocarbons:

a) The sampling device should be approved by API/ASTM.

b) The sampling device and the retaining cans or bottles must be clean and free of foreign matter.

c) Take the necessary representative samples of the hydrocarbons.

Hint: Upper sample, middle sample, lower sample.

Hint: The hydrocarbons should NEVER be sampled below the load line for the purposes of running the sediment and water test.

Hint: The representative samples should be taken BEFORE the tank bottoms or free water is checked to ensure the samples are not contaminated.

4) Free Water or Tank Bottoms: To obtain accurate measurements of the free water or tank bottoms ensure:

a) The measuring device is approved by API/ASTM and in good working order.

b) If a Tulsa Type Oil Thief is used, the thief should be clean and free of foreign matter.

Hint: The free water or tank bottoms should be checked AFTER the representative samples have been taken in order not to contaminate the samples.

Hint: If water indicating paste is used, recorded the solid reading and the spotted reading.

5) Sediment & Water Test: To obtain accurate sediment and water readings ensure:

a) The centrifuge, centrifuge tubes and solvents should be approved by API/ASTM.

b) The centrifuge tubes should be clean, dry and free of foreign matter.

c) The proper API/ASTM sediment and water test is followed.

Hint: Ensure the solvents are free of condensation and foreign matter.

Hint: Ensure the hydrocarbons is heated to the proper temperature before and after the test.

Hint: Ensure paraffin IS NOT read as sediment and water.

6) API Gravity Test: To obtain an accurate API gravity readings ensure:

a) The hydrometer is approved by API/ASTM.

b) The hydrometer is clean and dry.

c) The thermometer (if any) does not have any splits in the mercury.

d) The proper API/ASTM gravity test is followed.

Hint: Run the API gravity test until you obtain at least two identical corrected readings.

While it is obvious that obtaining accurate measurements takes an attention to details, the procedures are not overwhelming to the average person.

It has been this author's experience that with just eight hours of comprehensive measurement classes by a qualified instructor most people will not only learn the basics of hydrocarbon measurements but are able to effectively represent their company in the field.

Of course with more training and experience the same personnel become more effective resulting in more accurate measurements.

The following are some of the preventive measures which can be taken to maximize measurement accuracies.

1. Training: All too often the only training an employee receives in how to measure hydrocarbons is the on the job training. Without a doubt the employee needs the hands on experience but the employee is usually trained by a senior employee who has to train this person and is also responsible for his normal job duties. Many times the training is rudimentary at best.

A comprehensive training program should be implemented following API/ASTM guidelines and the company's measurement policy.

2. Attitude: If the management of the company does not stress the importance of accurate measurements then the field personnel will not be as concerned as they should be.

   Management should make sure the employees understand the importance of accurate measurements and support the employees in all phases of obtaining accuracy.

3. Company Policy: Many companies do not have a defined policy concerning hydrocarbon measurements or do not enforce the measurement policy that they do have.

   A company should issue or reissue a concise measurement policy which contains the requirements each employee is expected to meet. Once the policy is issued then measures should be taken to ensure that the policy is being followed.

3. Equipment: It is virtually impossible for the employee to be effective and accurate if he does not have the proper equipment. The minimum equipment needed to gauge crude oil accurately is as follows:

   a) Gauge Line: An API/ASTM approved gauge free of kinks, not worn at the swivel, free of excessive wear and in good working order.

   b) Gauge Bob: An API/ASTM approved gauge bob not flattened on the tip, not worn at the swivel attachment, and in good working order.

   c) Thermometer: An API/ASTM approved cup case or wood back thermometer free of splits in the mercury, checked for accuracy and in good working order.

   d) Tulsa Type Oil Thief: An API/ASTM approved oil thief used for catching samples and checking the free water in the production tanks. The oil thief should not leak, be able to trip at any level, be able to trip upon striking the floor of the production tank and be in good working order.

e) Gauge Paste: An API/ASTM approved gauge paste as needed when the product is too light to make a clear mark on the gauge tape.

f) Water Paste: An API/ASTM approved water indicating paste to be used to double check the Tulsa Oil Thief and also doubles as a backup in case the Tulsa Oil Thief breaks while in use in the field.

g) Hydrometer: An API/ASTM approved hydrometer suitable for the gravity of the oils which are being measured. The hydrometer should be free of cracks, splits in the thermometer mercury (if it has a thermometer) and in good working order.

h) Centrifuge: An API/ASTM approved centrifuge with the capability of turning at the necessary revolutions for the necessary API/ASTM sediment and water test. Note: Hand cranked centrifuges are not approved by API/ASTM.

i) Centrifuge Tubes: An API/ASTM approved centrifuge clean and free of any oils, dust and water. Note: 12.5 ml tubes are no longer approved by API/ASTM.

j) Solvent: An API/ASTM approved solvent as required for running the sediment and water test.

k) Safety Glasses: OSHA approved safety glasses or goggles to be worn as needed during the measurement or testing procedures.

l) Rubber Gloves: OSHA approved rubber gloves to be worn during the measurement or testing procedures.

m) Tank Tables: An independent tank table or strapping for each production tank in use should be provided to the pertinent employee for use in calculating the volumes.

n) API 5A & 6A Correction Tables: Current API 5A & 6A correction tables should be issued to each pertinent employee for use in correcting the observed API gravity and obtaining a volume correction factor.

4. Company Run Tickets: If the company has its own run tickets which are completely filled by the field personnel then there is a record of any measurement

differences. This would enable the company to make claims for any shortages, distinguish any patterns of inaccuracies and serve as proof that the company has taken reasonable precautions to protect its investors, royalty owners and all governmental agencies which receive taxes on this revenue.

Conclusion

While an effective loss prevention program can cost a company money and time, the potenetial returns are well woth the effort.

The importance of accurate measurements can not be over stressed because the sale of hydrocarbons is how a company recoups the monies it has invested, hopefully making a profit.

That is why we explore and produce hydrocarbons, isn't it?

Author's Note: The author in no way intended to misrepresent or rewrite the API/ASTM guidelines, if in fact that has happened. For specific procedures please consult the current API/ASTM procedures.

All material contained within this paper is meant to be generic and does not specifically address any one company, individual or circumstances.