

Fuel Quality Considerations: Routine, Complaint and Investigation

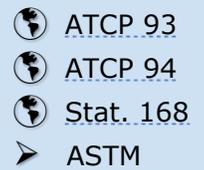
Last Revision: February 17, 2018

[Flow Charts](#)

[Back to Table of Contents](#)

Question/Issue

What must the inspector do when field screening fuel?



Fuel quality screening in the field is an important function of Weights and Measures Petroleum Inspectors. This document is intended to give the inspector guidance on sampling practices, inspection responsibilities, and investigative procedures for field fuel quality screening. The first part of the document is intended as a guide. The second part of the document is flow charts to simplify sometimes complex field investigations.

Procedure

Checking for water with a tank stick and water finding paste

Gasoline with ethanol

Check the tank for water using tank stick and water finding paste. Use the appropriate paste for gasoline with ethanol, Gasoila or Kolor Kut. Sargel is appropriate for a pure gasoline (conventional) product. Allow the paste to remain in product for one minute to see a color change.

Gasoila may change color in the presence of alcohol in fuel from brown to dark green. Gasoila will change color to yellow in the presence of water or phase separated product. When the product evaporates from the used tank stick, the remaining paste will return back to its original brown color. The reading of the tank stick and determination of what it is showing, alcohol in product (green) or phase separated product (yellow), is time sensitive before the paste returns to its brown color. Gasoila can be reused on the tank stick by allowing the product to evaporate and the paste to turn back to brown in color. Other types of paste like Sargel are one use only. Once Sargel has turned red showing the presence of water it remains red and will not return to its original white color. Gasoila is used on gasoline products to detect water or phase separated product.

Kolor Kut is normally brown in color, will turn reddish/purple when in contact with water, and will turn a brownish gold when in contact with a gasoline/ethanol blend greater than 2%. The paste will turn banana yellow when in contact with straight ethanol as a result of a phase separation. The purple will not be as distinct when used in conventional gasoline, but water will turn Kolor Kut purple. Kolor Kut can be used on Gas or Oil tanks to detect water.

Conventional Gasoline

Check the tank for water using tank stick and water finding paste. Appropriate pastes are Gasoila, Kolor Kut or Sargel. Allow the paste to remain in product for one minute to see color change. Tanks with conventional gasoline can have up to 2 inches of water at bottom of tank before the risk of pumping bad product to the consumer.

Sargel will change color from white to red or pink when in contact with water or phase separated product. Sargel will not always turn color with phase separated product depending on temperature and other conditions. Sargel should be used in conventional gasoline or oil tanks to detect water.

Oils (Diesel, K1, and Dyed Diesel)

Check tank for water using tank stick and water finding paste. An appropriate paste is Sargel. Allow paste to remain in product for one minute to see color change. Tanks with Oil can have up to 2 inches of water at bottom of tank before the risk of pumping bad product to the consumer.

Ethanol Product Considerations

Water in gasoline containing ethanol can be difficult to determine and resolve. Water and alcohol bond together chemically. A tank system can have one gallon of water pull the ethanol in the product out, and drop it to the bottom of the tank. Instead of one gallon of water at bottom of the tank, you will see 50 gallons of water and ethanol at the bottom of tank. When water and ethanol bond together and drop to bottom of the tank this is called "Phase Separation". Phase separated product cannot have the "water" pumped off the bottom and the remaining product used. All the product must be pumped out of tank and replaced with fresh product. The gasoline above the phase separated product may or may not be cloudy with 1% to 4% ethanol concentration remaining in the product and is not suitable for sale. Pumping the tank and disposal of the product is the only option. Pumping and placing the product in a different tank, treating with chemicals or treating with a filter system are not acceptable solutions.

Degrees of water in ethanol systems

Small amounts of water in a tank system will produce cloudy product due to the water being absorbed by the ethanol and held in suspension. Vehicles may or may not run on cloudy product. The ATG will show no water in the tank, but cloudy product is always rejected. Medium amounts of water in a tank will have the alcohol absorb water until it reaches a saturation point. The water and ethanol will drop to the bottom of the tank as phase separation. Most times, an ATG will not show that there is water in the tank even though a phase separation has occurred. This product is always rejected. Large amounts of water in ethanol will cause a phase separation and will have free water at the bottom of tank. The ATG will show a few inches of water and there will be more phase separated product above the water. This product is always rejected.

Suspected water in product all grades and types of product

Check the automatic tank gauge for water levels in the tanks. It is possible to have water and phase separated product in tanks and have the ATG report no water. A sample may be cloudy showing water in suspension within the product, vehicles will run poorly or not run at all and the ATG will show 0 inches water. Tank monitors, depending on the manufacturer, may not alarm until it is too late. The site will not know there is water in the tank. An example would be Gilbarco Veeder-Root ATGs: The lowest the alarm for water can be set is 0.78 inches. Check tank top sumps, spill buckets, vapor recovery ports and ATG probe wires for water entry points. Visually inspect the tank vents for damage, a cracked or broken vent line is often the water entry point.

Fuel Quality Samples

The legal sample is the sample taken out of the nozzle after a two (2) gallon flush by the state inspector. Before a sample is put into a sample can, confirm that the can is clean. The product being sampled may be used to flush the can if the can is suspected of being dirty. For fuel laboratory samples with 10% or less ethanol content, samples must be collected using a nozzle

extender. Some of the tests performed at the fuel quality laboratory are very sensitive to the evaporation of gasoline (RVP {DVPE} and distillation). The nozzle extender reduces evaporation. Samples screened in the field and returned to storage do not require use of the nozzle extender. The nozzle extender is inserted into the sample can; it extends to the bottom of the 1-quart sample can and bottom fills the can. By using a nozzle extender for all gasoline samples collected, the extender will mitigate light ends from evaporating off, in turn, giving a more accurate test result for RVP (DVPE) and distillation. The sample can should be immediately capped after collection of a sample.

A useful sample is the sample taken from the tank or tanks using a clear plastic bailer so that the water, phase separation, and cloudy product can be observed. It is not uncommon to see two or more layers in the bailer. The most useful sample is the sample taken with a clear bailer in a tank with the drop tube removed so the true layers of the product can be observed. It is also possible to get a good sample from the ATG probe riser pipe. Inspectors should not remove drop tubes or ATG probes from tank risers. A petroleum contractor should remove the equipment and replace when finished sampling. Many sites have more than one tank of the same product, the nozzle sample could be from one or the other tank or both or whatever one has most product. Sampling all tanks with a bailer will eliminate the question/issue of which tank the sample is from.

Field testing of suspected contaminated ethanol product

An alcohol extraction should be performed on the suspected contaminated product, any results lower than 10% show that a phase separation has occurred. If sampled early, and the sample is from the water and ethanol portion of the tank, the water extraction will show large amounts of alcohol in the system. This is because there is so much water in the sample that the extraction test reports like it is an E85 fuel. Many times vehicles will get water in the tank and the repair shop will test the gas by a test similar to a water extraction test. They will mistake the results for E85 fuel. If the sample comes back with low alcohol content, the sample is from what remains of the gasoline on top of the phase separated product. This leftover gas might even be clear but the alcohol will range from 0% to 6%. Anything but 10% (or 15% for E15) shows something happened to that product.

Water in Gasoline (No Ethanol)

Water in gasoline without ethanol is far easier to deal with than water in ethanol products. Water contaminated conventional gasoline will have the water drop to the bottom of tank without damaging the gasoline. As long as the water level stays below the submersible pump pickup level the tank system can deliver product without harm. When the water level rises above 2 inches the system is at risk of the submersible pump picking up the water and delivering contaminated product. Water found in these tanks can be pumped out and disposed of.

Water in Oils (Diesel, Dyed Diesel, and Kerosene)

Water in oils will behave similar to water in conventional gasoline. The water will drop to the bottom of the tank and as long as the water level stays below the submersible pump pickup level the tank system can deliver product without harm. When the water level rises above 2 inches the system is at risk of the submersible pump picking up the water and delivering contaminated product. Water found in these tanks can be pumped out and disposed of.

Other contaminant issues

Gasoline in Oils

When gasoline has contaminated an oil such as a mis-delivery at the station, the product will be called “hot”. Hot product will have a flashpoint that is less than 100°F as tested on an ASTM approved flash tester. Hot product can stall and damage diesel vehicles if the flash point is below 100°F. In Fuel Oil or Kerosene a gasoline contamination issue is much more serious, because a furnace, lamp, or stove could explode when attempting to light! As little as 1% gas in oil can make the flashpoint drop to less than 100°F and therefore be rejected product (e.g. 10 gallons of gas in 1000 gallons of oil). The visual appearance of the contaminated product will not change drastically from the oil it started as. The product may smell like gasoline or may not. The vapor tester used for field screening will show if there is as little as 0.5% flammables in the oil. A sample fails field screening by LEL meter at 10% of the lower explosive limit. The specific policy and procedure for LEL screening and failures includes recommendation of stopping sale and rush samples shipped to the lab for confirmation. Samples submitted to the lab will have an ASTM flash test that will show in degrees Fahrenheit the flash of the product and determine if the product can be sold. Gas in Oil will require passing lab tests (Flash and Distillation) before the product can be released for sale after the tanks have been pumped and product replaced. If the gasoline contains ethanol, the “hot” product cannot be blended off and must be disposed of.

Oils in Gas

When oil has contaminated gasoline the vehicles will run poorly at approximately 1% oil in gas or may not run at all. The product will not look visually different even with 10% or 20% oil in gas. There is no field test that will show oil in gas contamination as it will not be cloudy or change color. To test for oil in gas, a product distillation must be performed in the lab. The distillation for gasoline at the final boiling point (FBP) needs to be below 437°F max per ASTM standards. If it takes a temperature greater than 437°F to reach the FBP of the gasoline it shows that there is something heavier than gasoline in the product. Oil in Gas will require passing lab tests (Distillation) before the product can be released for sale after the tanks have been pumped and the product replaced.

#1 Oil in place of Kerosene

Kerosene can be hard to find wholesale from the terminals, so many stations and bulk plants will substitute #1 Oil for Kerosene. #1 Oil is close in specs to Kerosene but it does not pass the “Smoke Test” that Kerosene passes. For this reason, #1 oil is not allowed to be substituted for K1 at retail locations. Delivery tickets should indicate if the product is K1 or if the product is #1 Oil and fuel can be rejected based on this information. When found at a retail dispenser, a Kerosene sample is always sent to the lab for testing.

Certifying product for sale after replacement

After the bad product has been removed, replaced with fresh product and lines flushed, samples will need to be taken to ensure the new product meets standards. A good practice is to have the pipe lines blown back to the tank before the tank is pumped out. It will save time when flushing fresh product and reduce the number of wasted gallons that will have to be disposed of.

Before flushing and sampling it works best to remove the old filters and replace with a filter cap that bypasses the filter. If no cap is available, leave the old filter in place and flush the product lines. After the product is flushed and samples show no issues the new filters can be installed. The product should be checked during the flushing of lines to determine how much product to flush. Start with the farthest dispenser from the tank and pump the fresh product from the nozzle

into the disposal truck (some contractors will use drums or a tank wagon) checking the product every few gallons. The amount of product needed to flush the bad product out of the system will vary. It could be as little as twenty gallons per nozzle or it could be hundreds of gallons.

Water in Gas certifying considerations

If the contaminant is water, the dispenser shall be flushed until the product is clear. After the product is clear, the sample should have a water extraction test completed, to make sure the alcohol content is correct. If the new product is an Ethanol product and the extraction test shows low ethanol content, the lines need to be flushed more. Repeat on all nozzles and submit one sample from tank and one from farthest nozzle to lab. If samples from all nozzles and tanks are clear and bright, and the alcohol content is correct, the product can be sold.

Water in Oil certifying considerations

If the contaminant is water, the dispenser can be flushed until the product is no longer cloudy. Repeat on all nozzles and submit one sample from tank and one from farthest nozzle to lab. If samples from all nozzles and tanks are clear and bright, the product can be sold.

Gas in Oil certifying considerations

Collect a sample after a service company has flushed the line. Allow the service company to determine how much product must be flushed. Test with a vapor meter (LEL). If the sample alarms, perform an LEL test on the tank sample before any additionally flushing is completed. Repeat on every nozzle until the oil passes a vapor test. Submit one sample from tank and one from farthest nozzle to lab. If all nozzles pass the vapor test and are clear and bright, the product can be sold.

Oil in Gas certifying considerations

Flush product until a color change is observed. Repeat on all nozzles and submit one sample from tank and one from farthest nozzle to lab. There is no field test for Final Boiling Point (FBP) so the samples will need to be submitted to the lab. Confirmation from the lab of a passing product must be obtained before sales can resume.

Gasoline Not Meeting Octane Requirements

Gasoline can fail the Octane posted requirements and then become rejected product. Octane failures often result from the incorrect blending of regular and premium to get midgrade. Other examples include mis-delivery of lower octane product into higher octane tanks, whether in error or purposely, or incorrect octane labels when switching between ethanol and no ethanol containing products (ex. 93E to 91). In areas that allow conventional gasoline it is common for stations to switch between no ethanol and 10% ethanol. Sites that sell premium gas with no ethanol will need to change the octane labels from 93 octane to 91 octane and will also need to adjust blend ratios if they are blending midgrade. There is no field test for octane content but delivery tickets will show what product was delivered to the site. For conventional gasoline areas, when performing a water extraction test on a conventional gasoline and the water level increased above 10mL, a sample should be sent to the lab and further investigation started. Suspected octane issues will require samples being sent to the lab for octane screening (FTIR) and extra samples collected for possible octane motor testing at Intertek.

For confirmed octane failures, the product can be relabeled as the correct octane as long the product meets all other specifications. An investigation should be conducted to determine how much product was sold that did not meet octane specifications. Inspectors should collect delivery manifests, inventory records, and any other pertinent information (interviews of employees,

contracts with delivery companies, photos of fill points and dispensers, service company reports, ATG reports, etc.) to aid in the investigation. Inspectors may need to gather information from the terminal if the investigation at a specific site does not produce clear answers or failures across multiple stations are found. Inspectors should consult with supervisors and the lab for procedures as it will vary with site and circumstance.

Complaints and Investigations

Investigating complaints for contaminated fuel can be complex. Timeliness is critical to preventing consumer harm. Inspectors should contact the complainant to find out if the vehicle has been taken to a shop and what work was performed on the vehicle. Complaints involving suspected contaminated fuel require fuel quality screening and laboratory testing. Only samples from the suspected site's storage tank will be tested for fuel quality. Fuel samples collected from vehicle tanks will not be tested as the tank may contain product from multiple stations and there is no chain of custody. If the product is found to be contaminated or off-specification, the tank should be red-tagged and procedures for disposing of the product followed. Complainants need to be made whole by the site or site's insurance carrier if the complaint is found to be substantiated.

For octane violations or other laboratory failures, inspectors should consider the nature of the complaint or investigation on determining how far back a records requests should go and where those requests should go to. Requests for manifests for the last few months on low throughput tank at a marina may be more appropriate than on a high volume station. If a supplier is delivering an off-spec product at one location, a request for other sites where they are delivering that same product may be required. If a site changed octane on its premium, questions to consider would be when that change occurred and how many sales were affected. Determining the best course of action may require contacting a field supervisor, but requesting the last few delivery manifests and inventory records are a good starting point to determine if more action is required.

Flow Charts

The following flow charts are simplified versions of various policies and procedures taught to field inspectors. They are intended as a quick guide for in the field and are not all encompassing.

