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Field Sampling Procedures for Fuel and Motor Oil Quality Testing

A Handbook for Use by Fuel and Oil Quality Regulatory Officials

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NIST Handbook 158

2016 Edition

FIELD SAMPLING PROCEDURES FOR FUEL AND MOTOR OIL QUALITY TESTING

A HANDBOOK FOR USE BY FUEL AND OIL QUALITY REGULATORY OFFICIALS

Editor:
Kenneth Butcher

Linda Crown
David Sefcik
Lisa Warfield
Office of Weights and Measures
Physical Measurements Laboratory

Carol Hockert, Chief
Office of Weights and Measures
Physical Measurements Laboratory

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U.S. Department of Commerce *Penny Pritzker, Secretary*

National Institute of Standards and Technology *Willie May, Under Secretary of Commerce for Standards and Technology and Director*

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I. PURPOSE AND SCOPE

Fuel and motor oil quality programs are implemented to provide an official presence in the marketplace and to verify that sellers of engine fuels and motor oils have control systems in place which ensure the products they sell conform to the quality specifications in federal and state laws and regulations. Routine, unannounced verification of fuel and motor oil quality enables the programs to identify sellers and their suppliers who have quality control systems in place and to focus enforcement resources on those who do not. This handbook outlines how samples are to be taken, identified, protected and transported to a laboratory for testing. It also provides information on safety and sampling equipment and includes illustrations of the equipment and forms described in the text.

> ***NOTE:*** *This handbook only covers the sampling of products stored at or near atmospheric pressure. For instance, the procedures for sampling fuels stored under pressure (e.g., LPG & CNG) are not included.*

II. TERMINOLOGY

A. Chain-of-Evidence (custody)

A record keeping system documenting the history of the collection, movement, storage location(s), custody (who possessed or controlled it), and other conditions (e.g., environmental and storage conditions, if critical to protecting the product) of a sample from the time it was obtained to the time it is accepted and logged into the laboratory management system for testing. See ASTM D4840 "Standard Guide for Sample Chain-of-Custody Procedures" for more information.

B. Sample

An amount of fuel or motor oil taken from a storage tank or dispenser that is representative of a larger amount of product. A majority of the samples collected are classified as either "open," "routine," or "regular" samples which means they are periodically collected through "announced" inspection visits (that is the official identifies his or her self and notifies the seller that an inspection will be made and samples collected). A sample collected specifically in response to a complaint can be taken after announcing the purpose of the visit or as an unannounced or "undercover" investigation. References to other names for samples are mentioned in the section on sampling but those terms (i.e., nozzle sample versus bottom sample) only refer to the point of collection of the sample and should not be confused with this definition.

Complaint/Undercover Investigation Sample: The collection of a sample(s) of the product(s) in question without announcing its collection to the station operator/owner. This can be done by means of a "trap tank" in an undercover vehicle or by purchasing the product and putting it in an Underwriters Laboratory or Factory Mutual listed, approved container.

User Collected Sample: A sample that was not collected by a regulatory official following the prescribed sampling procedures. This sample can be tested but no immediate enforcement action can be taken on negative results because the sample may have been contaminated or mishandled by the user. However, the test results may indicate the need to take an official sample.

> ***NOTE:*** *Evidence is something that tends to prove or disprove the existence of an alleged fact. A sample is "evidence" (and must be treated as such) but, it is typically called a "sample." A sample that is not collected in accordance with prescribed procedures, or which has an undocumented chain of custody, will have little chance of being admitted as evidence in legal proceedings.*

> ***NOTE:*** *For evidentiary purposes the collection of samples and related activities should be noted and documented either on paper or in digital data systems (these systems are acceptable for use only if there is a real-time continuous data back-up in operation and the data is maintained on a*

remote server) and all documents should bear the seal of the state or local authority as well as the identity of the agency collecting the sample. On each official document there should be a space for the placement of an official's signature of attestation or execution along with the individual's title and date of signing. Notes about an inspection should answer the questions who, what, when, where, why and how. This documentation allows for an independent evaluation of the work conducted and will allow an official to refresh his or her memory should he or she be asked to testify about an inspection at a later time.

C. Sampled Lot

The amount of fuel or motor oil represented by a particular sample (i.e., the volume of product in the storage tank).

III. SAFETY AND ENVIRONMENT

The procedures in this handbook require the handling of harmful and flammable materials in hazardous work locations. This handbook cannot encompass all of the dangers that may be present while taking fuel and motor oil samples. Officials must identify and comply with the health and safety practices for each work location, following all notices and local requirements. Both short term and long term effects can impact health so being proactive is essential.

The safety and physical well-being of officials and other individuals at the site is the first priority. This handbook does not address all of the safety issues that need to be considered before collecting samples. It is the official's duty to obey the safety rules in effect in the work environment in which samples are collected and to seek out advice and training on good working practices. Officials must work safely so that their actions do not harm others. Collecting samples requires working in hazardous environments with dangerous materials, which means that even a minor incident could result in serious injury or death. Samples should never be transported in the passenger compartment of a vehicle. Samples must be transported in closed metal boxes designed to contain a spill when secured in the trunk of a car, pickup or van should an accident occur. Never smoke or allow open flames around a vehicle used to transport samples.

A. Awareness

The best safety tools are the senses of sight, smell, and hearing, and they should be used throughout the collection process to alert the official of potential dangers. The traits of vanity, apathy, and laziness have resulted in many injuries while common sense, patience, and safe work habits help to avoid them. Obtain and use available Personal Protective Equipment (PPE) regardless of appearance, such as safety glasses, fuel and oil resistant gloves, bright orange or yellow safety vests or respirators . The job of sampling these products increases the frequency of exposure to the inhalation of harmful fumes; and fuel splashes or spills may contaminate clothing, result in flash fires, or cause other hazards such as slippery walking and climbing surfaces. (**Note:** It is a good idea to carry a change of clothing in case clothes do get soaked with fuel or motor oil). In retail locations for example, there is the added danger of vehicular traffic and exposure to accidents caused by careless or distracted motorists or customers who may disregard safety rules and endanger others. No sample is worth an injury. Follow safety protocols and stop sampling immediately if safety cannot be controlled in the work environment. When working alone, extra precaution should be taken, such as advising the business personnel about the work that is being done and reminding them of their responsibility to ensure a safe working environment for those present on their property.

B. Safety Data Sheet (SDS)

Read the SDS for each type of fuel (e.g., gasoline, gasohol, kerosene, E-85, diesel, marine fuel, aviation fuel) or motor oil that is sampled and periodically review (e.g., every six months) updated SDSs to learn new information on the product.

NOTE: *To learn more see the American Petroleum Institute's "Safety Data Sheets: Petroleum Industry Practices" at this URL: http://www.api.org/~/media/Files/EHS/Health_Safety/SDS_Petroleum_Industry_Practices_Feb2009.pdf).*

Additional information is available from OSHA at: https://www.osha.gov/Publications/HazComm_QuickCard_SafetyData.html and information on Safety Data Sheets is available at: https://www.osha.gov/Publications/OSHA3514.html

A detailed explanation of hazardous pictograms and symbols is available from OSHA at: https://www.osha.gov/Publications/OSHA3636.pdf

C. Static Electricity

The movement or separation of materials, including liquids, generates static electricity. When these materials are different, such as when fuel moves through a nozzle or a piece of clothing is separated from a car seat as a driver leaves the seat of a car, there is often a transfer of free electrons. If either or both of the materials are poor conductors, the potential for a static discharge can build as one material becomes negative and the other positive, depending on which accumulates excess electrons. When there is no bond or ground in place to dissipate the charges, the voltage builds and the static electricity seeks an outlet. High humidity does not prevent static electricity, and lightning, the strongest example of static electricity, is common during rainstorms.

Never underestimate the danger posed by static electricity when taking samples. Even though a specific fuel and air combination must be present for a spark to cause ignition, those conditions cannot be measured with the senses. Think and act as if a very hazardous situation exists whenever carrying out the tasks described in this handbook. Study and use good grounding practices and bonding equipment, noting that nothing completely eliminates the hazard presented by the accumulation of static electricity, which can build up rapidly for a wide variety of reasons in different sources (e.g., on clothing or the flow of fuel from the nozzle into a sampling container). Before pouring fuel into another container or from a nozzle into a container, be sure they are bonded or grounded to each other. For example, place the nozzle against the opening of the container and insert it as deep as possible (use a fill tube if available) to reduce splash filling and to maintain a smooth flow so that droplets do not form. Remember to ground equipment in accordance with the instructions of the manufacturer.

Sampling procedures can introduce spark promoters into storage tanks or transport compartments so extra caution, good grounding procedures and special non-sparking equipment and tools, must be used (e.g., cords made from synthetic materials such as nylon could cause charges as it rubs against a glove or other objects). When working around rusted steel, a spark hazard can be created if equipment made of aluminum or magnesium is used.

Be aware of the notices placed on and around dispensers and ensure compliance with any warnings (e.g., such as not filling a container while it is sitting on a plastic bed liner or while it is in an enclosed space such as the trunk of a car). After getting out of a vehicle, touch a metal part of the dispenser housing to discharge any electrostatic charge before going to the dispenser island.

Do not take samples during hail and thunderstorms or when lightning is observed.

Do not take samples from a dispenser connected to a storage tank being filled by a tanker truck because the filling process generates an electrostatic charge. Wait for 30 minutes after the delivery is completed before sampling from the tank or opening its fill ports.

It is a good habit to ground the static charge on one's body by touching a metal part of the dispenser or support structure of a tank before taking a sample. On tanks and drums, touch the structure at a point at least 1 m (39 in) away from an opening.

***NOTE*:** *To learn more about static electricity as it relates to fuels, visit the Petroleum Equipment Institute's "Stop Static" URL* at http://www.pei.org/static Also view the U.S. Chemical Safety and Hazard Investigation Board's video on one static caused explosion of non-conductive liquids to understand why reviewing SDSs periodically is essential: *https://www.youtube.com/watch?v=tVZzdtnZaJk* (see also: *https://www.speedway.com/About/FuelSafety).*

D. Personal Protective Equipment

1. **Clothing:** Outer garments should be made from anti-static materials such as cotton (avoid wool and synthetics which, when moving against each other, can rapidly build up static charges). The color of the clothing should be suitable for the working environment and brightly colored or covered with a vest with light reflecting elements that conform to the Class 2 or 3 requirements in the latest edition of ANSI/ISEA 107 "High-Visibility Safety Apparel and Headwear."[1] This type of high-visibility safety apparel alerts motorists and other equipment operators to an official's presence in high traffic areas around fuel dispensers and storage tanks.

2. **Shoes:** Steel toed shoes or boots manufactured to be static dissipative and slip resistant with oil/gas resistant soles should be worn. Footwear capable of causing sparks should not be worn.

3. **Eye/Face Protection:** Safety glasses or goggles should be worn whenever samples are handled and especially during collection where splashing or spraying could occur.

4. **Skin:** Avoid skin contact with all fuels, oils and other chemicals. Hand protection should be worn whenever handling samples. Gloves should be made of Nitrile2, or coated with Neoprene or Tychem2. Materials such as Nitrile2 offer chemical resistance, are considered to be strong disposable gloves, and are generally safe for people who are allergic to latex. PVC-coated gloves are recommended for use with biodiesel.

5. **Toxic Materials:** Avoid breathing toxic vapors. When fuel, oil vapors or mists are present, wear a National Institute for Occupational Safety and Health (NIOSH) – approved organic vapor/mist respirator and maintain it in accordance with the manufacturer's instructions.

E. Other Safety and Accessory Equipment

1. **Eye Wash:** Portable eye wash station or emergency eye flush solution kit (e.g., Eyesaline[2] or equivalent).

2. **Flashlight:** Use an explosion proof flashlight, Class I Division 1 C&D, Class I Division 2 A, B, C, D, Class II Division 2 G, T3C Operating Temperature.

3. **Tools:** Set of non-sparking tools (including screwdrivers, adjustable wrenches, hammer and pry tools).

4. **Traffic Cones:** Four or more – 90 cm (36 in) fluorescent traffic cones (for blocking sampling area and tank openings).

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[1] This ANSI Standard "High-Visibility Safety Apparel and Headwear (ANSI/ISEA 107-2010) was established by American National Standards Institute (http://ansi.org/) and the International Safety Equipment Association (http://www.safetyequipment.org/). Officials and other workers are routinely exposed to the hazards of low visibility while on the job. This standard provides guidelines for the selection and use of high-visibility safety apparel such as shirts, rainwear, outerwear, safety vests and headwear to improve worker visibility during the day, in low-light conditions, and also at night.

[2] NOTICE: The mention of trade or brand names does not imply endorsement or recommendation by the U.S. Department of Commerce over similar products which provide equivalent or better protection that may be available from other manufacturers.

5. Fire Extinguishers:

a. Fire Extinguisher 5 kg (10 lb) or larger: B type extinguishers are best suited for petroleum fires but a multi-purpose fire extinguisher labeled A, B, C or any combination of those letters is recommended since any type of fire may be encountered. Assure that portable fire extinguishers with current, valid inspection dates are maintained in a fully charged and operable condition and kept in their designated places at all times except during use.

b. Foam extinguishers for samples with more than 10 % ethanol by volume: AR Foam Fire Extinguisher – 6 L (2.5 gal): When the ethanol content of fuels is E10 or higher, an Alcohol Resistant (AR) foam must be used on gasoline fires as traditional AFFF foams have minimal effect.

6. First Aid: A first aid kit that meets or exceeds American National Standard (ANSI) Z308.1-1998 "Minimum Requirements for Workplace First-aid Kits."

7. Fuel Containers: 9.4 L to 19 L (2.5 gal to 5 gal) capacity metal fuel containers. These are used to hold fuel from nozzle flushes and to obtain undercover samples, and these must conform to "7-29 - Ignitable Liquid Storage in Portable Containers" from Factory Mutual - Global Property Loss Prevention Data Sheets and Underwriters Laboratory # 30 "Standard for Metal Safety Cans." These requirements cover metal safety cans that have nominal capacities of 19 L (5 gal) or less and that are primarily intended to store and handle flammable and combustible liquids, such as gasoline, naphtha, kerosene, acetone, MEK, and similar liquids in accordance with the Flammable and Combustible Liquids Code, NFPA 30.

8. Digital Evidence Data: Digital camera that is waterproof and shock resistant with GPS and wireless functions. This is for use in collecting photographic evidence such as signs, device markings, totalizer indications and other information.

9. Spill Clean-Up Materials

a. "Fuel/Oil Spill Kit": Kit is used to contain, clean up, and dispose of spilled liquids such as water, oil, and chemicals. Spill kits typically include absorbent products (such as socks, pillows, and pads), a disposal bag, a steel self-closeable container for storage, and absorbent wipes for cleaning up spills.

b. Wiping Cloths: Lint free wiping cloths or disposable wipes for wiping down sample containers and tools. Vehicles should be equipped with a self-closing steel trash can, stored outside the driver compartment, and used to hold disposable rags and wipes.

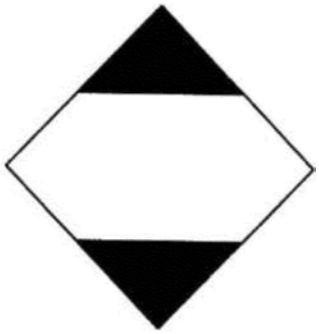
F. Vehicle and Sample Case Markings for Hazardous Materials Transportation – Alerting Emergency Responders

1. Vehicles: A vehicle used to transport limited quantities of hazardous material (less than 454 kg [1001 lb] aggregate gross weight) is not required to display hazardous material placards under U.S. Department of Transportation Hazardous Material Regulations. However, under that regulation, voluntary placarding is permitted to alert emergency responders that the vehicle's cargo compartment may contain containers of flammable or combustible liquids. This information may be valuable in case the vehicle is involved in an accident or other emergency.

For the exemption see: 49 CFR §172.504 "General Placarding Requirements."

> ***(c) Exception for less than 454 kg (1,001 pounds).*** *Except for bulk packagings and hazardous materials subject to §172.505, when hazardous materials covered by table 2 of this section are transported by highway, placards are not required on (1) A transport vehicle which contains less than 454 kg (1001 pounds) aggregate gross weight of hazardous materials covered by table 2 of paragraph (e) of this section; The exceptions provided in paragraph (c) of this section do not prohibit the display of placards in the manner prescribed in this subpart, if not otherwise prohibited (see §172.502), on transport vehicles which are not required to be placarded.*

2. Sample Cases: When "limited quantities" of flammable liquids are contained in carrying cases or shipping cartons, other exceptions and labeling requirements apply. Under this exemption, officials are permitted to transport Class 3 Flammable and Combustible Liquids without a special driver's license and shipping papers are not required. However, individual container capacity must not exceed certain limits (for Packing Group II it is 1 L (0.3 gal) and carrying cases and shipping cartons must be labeled with a "limited quantities" placard which conforms to 49 CFR 172.315 such as shown below:



For the exemption see: 49 CFR §173.150 Exceptions for (Limited Quantities) of Class 3 (Flammable and Combustible Liquids).

§173.150 Exceptions for Class 3 (flammable and combustible liquids).

(a) General. *Exceptions for hazardous materials shipments in the following paragraphs are permitted only if this section is referenced for the specific hazardous material in the §172.101 Table of this subchapter.*

(b) Limited quantities. *Limited quantities of flammable liquids (Class 3) and combustible liquids are excepted from labeling requirements, unless the material is offered for transportation or transported by aircraft, and are excepted from the specification packaging requirements of this subchapter when packaged in combination packagings according to this paragraph. A limited quantity package that conforms to the provisions of this section is not subject to the shipping paper requirements of subpart C of part 172 of this subchapter, unless the material meets the definition of a hazardous substance, hazardous waste, marine pollutant, or is offered for transportation and transported by aircraft or vessel, and is eligible for the exceptions provided in §173.156 of this part. In addition, shipments of limited quantities are not subject to subpart F (Placarding) of part 172 of this subchapter. Each package must conform to the packaging requirements of subpart B of this part and may not exceed 30 kg (66 pounds) gross weight. Except for transportation by aircraft, the following combination packagings are authorized: (1) For flammable liquids in Packing Group I, inner packagings not over 0.5 L (0.1 gallon) net capacity each, packed in a strong outer packaging; (2) For flammable liquids in Packing Group II, inner packagings not over 1.0 L (0.3 gallons) net capacity each, packed in a strong outer packaging. (3) For flammable liquids in Packing Group III and combustible liquids, inner packagings not over 5.0 L (1.3 gallons) net capacity each, packed in a strong outer packaging.*

Reference: Find the latest version of these regulations at *Code of Federal Regulations at: http://www.ecfr.gov.*

G. Safety and Health Checklist and Periodic Review

Reorder replacement supplies immediately after use so adequate supplies are available to do the job. Also, during the first week of each month, safety and health related supplies should be inventoried and inspected to ensure that they are undamaged, any expiration of use dates are current and that equipment is ready for use. By setting a specific time to do the inspection, it will become a habit. Anticipate the need for replacement supplies

so that they can be ordered to allow ample time to obtain them and have them delivered. A sample checklist for inspecting safety and health equipment is presented in Appendix A. "Safety and Health Equipment Checklist."

H. Training

Prior to performing any sampling activities, officials should attend training courses or webinars in these subjects:

1. **Fire Extinguishers:** Use of fire extinguishers in fighting fires (a live fire demonstration is recommended).

   For example see: Fire Extinguisher Training at http://emergency.yale.edu/sites/default/files/files/TMS-Fire-Extinguisher-Training.pdf

2. **U.S. Department of Labor:** Occupational Safety and Health Administration (OSHA) Training on Flammable and Combustible Materials and Emergency spill response including how to clean up small spills.

   For example see: OSHA Flammable Liquids at https://www.osha.gov/dte/library/flammable_liquids/flammable_liquids.html

   For example see: How Fire Departments Respond to Small Fuel Spills - Self Study at https://www.pca.state.mn.us/sites/default/files/c-er4-05.pdf

3. **Ladder Safety:** Sometimes climbing may be required to obtain samples, so courses on ladder safety and cargo tanker safety are recommended.

   For example see: Ladder Safety - Self Study at http://www.laddersafetytraining.org/ and Climbing on Tankers at http://www.cargotanksafety.org/wp-content/uploads/2014/03/ctrmctrailerclimbingtrainingoutline3-28-2011-110330091455-phpapp02.pdf

4. **First Aid Training:** This is required under OSHA First Aid Standard 29 CFR 1910.151 which requires that in the absence of an infirmary, clinic or hospital in close proximity to the workplace, a person or persons shall be adequately trained to render first aid. The First Aid, CPR, and AED Training must conform to OSHA First Aid Standard 29 CFR 1910.151 and should be provided by an instructor certified by the National Safety Council.

   For example, see First Aid OSHA Compliance Training at http://www.nsc.org/learn/Safety-Training/Pages/first-aid-train-your-employees.aspx

5. **Driver Training:** It is recommended that officials take an on-line or self-study Professional Truck Driver training course by the National Safety Council. The training covers defensive driving techniques to help avoid collisions, injuries and violations, and teaches personal responsibility for driving decisions.

   For example see: Professional Truck Driver Defensive Driving Course at http://www.nsc.org/learn/Safety-Training/Pages/professional-truck-driver-training.aspx

6. **Other Training Resources**: https://www.osha.gov/dte/library/index.html

7. **OSHA Laboratory Safety Guidance:** https://www.osha.gov/Publications/laboratory/OSHA3404laboratory-safety-guidance.pdf

IV. SAMPLING PROCEDURE OVERVIEW

Specific quality assurance guidelines must be established within every fuel or motor oil inspection program to facilitate the implementation of a sampling program. However, the following general quality assurance procedures apply:

A. Data

All data must be documented on standardized primary inspection reports and sample collection worksheets or entered into a digital equivalent.

B. Instruments and Sampling Equipment

All instruments and sampling equipment must be operated in accordance with the operating instructions supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

C. Sampling Procedures

Sampling procedures should be identical to those used by the Environmental Protection Agency (see 40 CFR 80.8) to collect samples of gasoline, diesel fuel, blendstocks, fuel additives, and renewable fuels for purposes of determining compliance with applicable laws and regulations.

1. **Manual Sampling:** Manual sampling of retail/wholesale fuel dispensers and storage tanks shall be performed according to the applicable procedures specified in the latest edition of ASTM International (ASTM) D4057 "Standard Practice for Manual Sampling of Petroleum and Petroleum Products."

2. **Automatic Sampling (not addressed in this handbook):** Automatic sampling of petroleum products in pipelines shall be performed according to the applicable procedures specified in the latest edition of ASTM D4177 "Standard Practice for Automatic Sampling of Petroleum and Petroleum Products."

3. **Sampling and Sample Handling for Volatility Measurement:** Samples to be analyzed for Reid Vapor Pressure (RVP) shall be collected and handled according to the applicable procedures specified in the latest edition of ASTM D5842 "Standard Practice for Sampling and Handling of Fuels for Volatility Measurement."

4. **Sample Compositing:** Composite samples shall be prepared using the applicable procedures specified in ASTM D5854 "Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products."

5. **Sampling Plans:** The collection of fuel and motor oil samples should be carried out under a directed work plan that ensures that these products are subject to periodic verification throughout the jurisdiction. Sampling is typically carried out without advance notice so there is no opportunity for the seller to alter either the product or labeling on the dispensing device. Variances from a plan are permitted (e.g., when new installations or new sellers or suppliers enter a marketplace). Increased frequency of inspections can be initiated on sellers whose products fail, but this decision should be based on the circumstances of each failure and should not be an automatic response. For example, if the cause of the failure was due to the mis-drop of a product by a new or part-time truck driver, then the likelihood of a repeat of this type of error is much less and may not merit a diversion of inspection resources. That is especially true if corrective actions and preventative measures are taken by the delivery company and seller.

V. FUEL SAMPLING

A sample is a small amount of fuel taken from a storage tank or dispenser that is representative of a larger amount of fuel. The sample will be tested to determine if the fuel quality is in compliance with fuel quality standards. Sampling can be done manually or automatically with automatic systems. This handbook only addresses manual sampling. There are many "types" of samples defined by the location in a tank from where they are collected.

A. Types of Manual Sampling

1. **Nozzle/Outlet Sampling:** Taking a sample from the outlet nozzle of a fuel dispenser or pump. This is the most common type of sample taken by officials. It is presumed to be representative of the fuel sold to consumers through all of the dispensers piped to the same storage tank.

   Tank Sampling Positions

   When there is a need to collect a sample from a storage tank, a weighted bottle is used to collect the following samples from various levels of fuel in the tank:

   Top Sample: A sample taken 152 mm (6 in) below the top level of fuel.

   Upper Sample: A sample taken from the middle of the top third level of fuel.

   Middle Sample: A sample taken from the middle level of fuel (or a level halfway between the upper and lower sampling points).

   Lower Sample: A sample taken from the middle of the bottom third level of fuel.

   Bottom Sample: A sample taken on the bottom of a tank.

2. **All-Level Sample (sometimes called a "composition sample"):** A sample taken by submerging a closed-weighted bottle sampler to a point as near as possible to a tank's outlet point. The sampler is then opened and raised at a constant rate so that it is between 70 % and 80 % full when it emerges from the top level of fuel.

3. **Average Sample:** A sample consisting of proportionate parts from all levels of the fuel (e.g., an average sample from a horizontal, cylindrical, or a spherical tank should contain more material from the middle of the tank where the diameter is greatest.)

B. Samplers

The most frequently used containers for collecting fuel samples from retail engine fuel dispensers are clear or amber glass bottles (PVC coated safety bottles that reduce spills if broken are available) or metal cans such as shown below. Typically, samples used for quality testing at the wholesale level are taken from storage tanks and tank trucks. There are also times when samples must be taken from bulk storage as part of an investigation or follow-up to a consumer complaint. The safe collection of a representative sample should be the criteria for selecting sample locations. A representative sample can be collected using techniques or equipment designed for obtaining fuels from various fuel depths. The structure and characteristics of some storage tanks present access problems with collection of samples from more than one location; therefore, the selection of sampling devices is an important consideration. Depending on the type of storage vessel, the official can choose a bacon bomb sampler, subsurface grab sampler, or a glass thief to collect the sample. Other custom-made samplers may be used depending on the specific application. Sometimes samples are taken from fuel storage tanks, tanker trucks and even barges. To collect samples from these sources, specialized fuel sampling equipment must be used. These include a weighted bottle (see Figure 1), a submerged sampler or bacon-bomb thief (see Figures 2, 3, and 5), and tank and drum thieves (see Figures 4 and 6). There are many other types of sampling equipment of many different designs so the following are only examples of a few of the different tools available to the official for use in fuel sampling. The drop line and other lines used on samplers is 100 % cotton rope with a brass end hook for attaching the rope to the sampler.

NOTE: *If a sampler is used to take the fuel sample for microbiological testing, it must be cleaned and sterilized prior to use.*

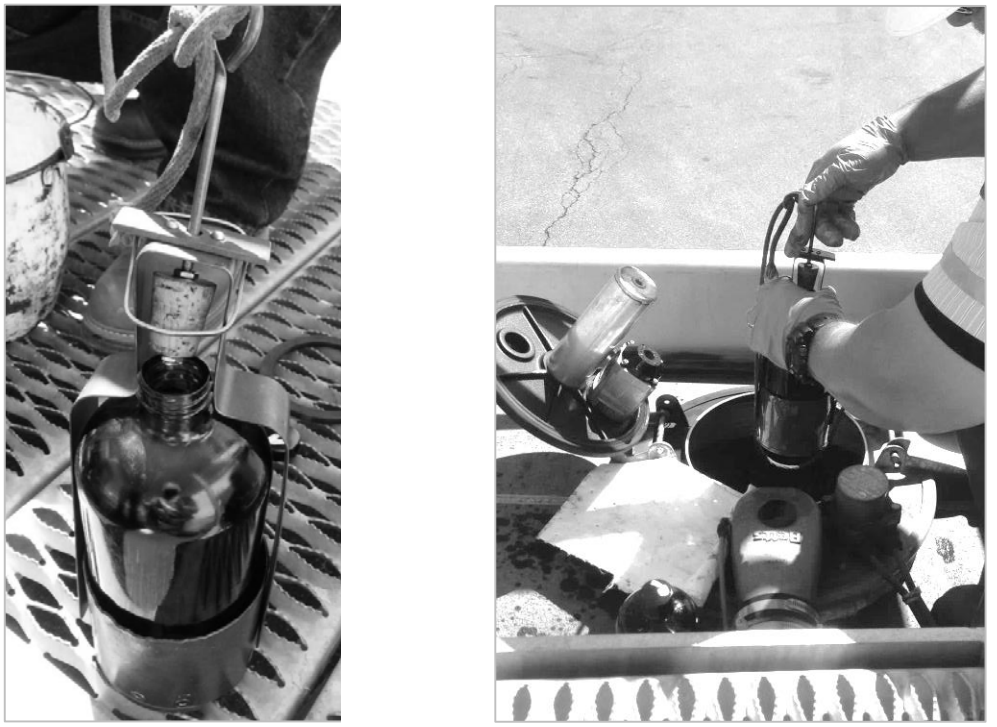


Figure 1. A Weighted Bottle for use in sampling Stationary Tanks and Tanker Trucks.
Photo courtesy of Chevron Products Company and the California Division of Measurement Standards.

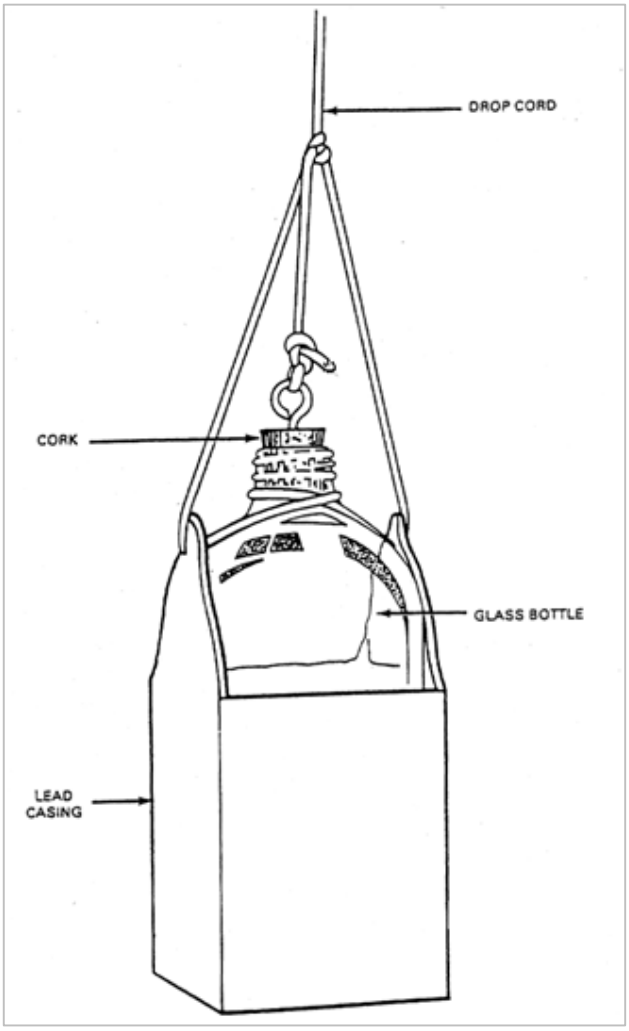


Figure 2. Weighted Sampling Bottle.

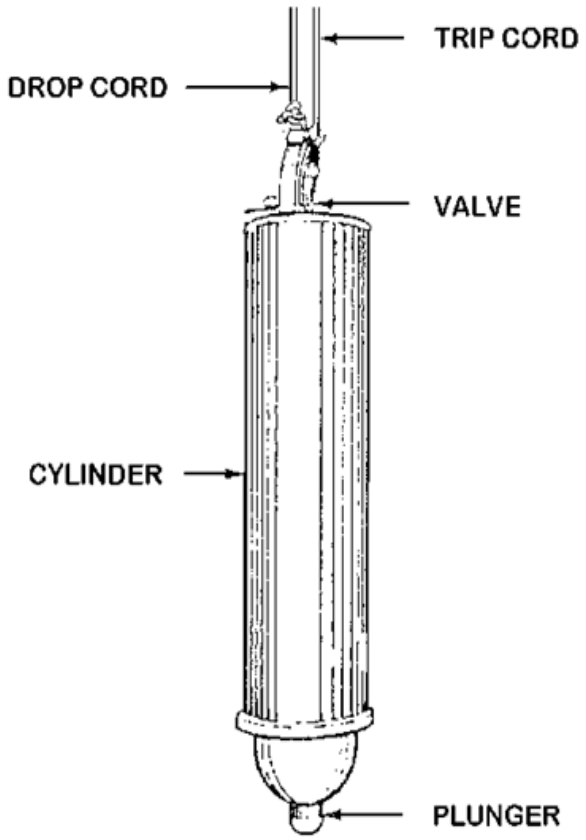


Figure 3. Bacon Bomb Thief.

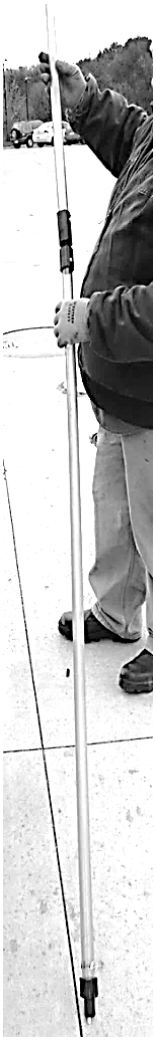


Figure 4. Tank Thief Sampler.

Photo courtesy of the Missouri Department of Agriculture.

Figure 5. Submerged Samplers (Bacon Bomb Thieves) of Different Capacities.

Photo courtsey of Koehler Instruments (2015)

Figure 6. Drum Thief.

1. **Weighted Bottle Sampler:** The weighted bottle sampler (see Figures 1 and 2) consists of a bottle permanently attached to a base. (Some of these types of samplers use a copper cylinder or beaker.) A drop cord is attached to the handle through a ring in the stopper so that a short, quick pull on the cord opens the bottle at any desired point beneath the surface of the liquid. This sampler is used to take an upper, middle, lower, or all-level sample of liquid product. It is used for sampling tanker or barge compartments, shore-tanks, tank cars, and tank trucks.

   Typical Procedures for Taking an All-Level Sample Using a Weighted Bottle Sampler:

   NOTE: *To ground a static buildup the person taking the sample should touch the tank at a point not less than 1 m (39 in) away from the sampling opening before starting the sampling process.*

   Recommended Steps: Place an appropriate disposable fuel/oil spill pad (sometimes called a "soaker pad") next to the tank sampling point.

   NOTE: *Fill the sampler with fuel and drain it completely before taking a sample.*

   a. Assemble the weighted bottle sampler and open the tank access port.

   b. If the weighted bottle sampler is to be used to obtain samples at specific depths, then estimate the depth to be sampled and mark the sampling line at the desired depth. In some cases, a storage tank gauge stick may be lowered to the bottom of the tank, removed, and then used to measure the actual depth of the fuel as indicated on the stick. Using the sample line, slowly lower the sampler until the desired level is reached.

   c. When the sampler is at the required depth, pull out the bottle stopper with a sharp jerk of the sampler line and allow the bottle to fill completely (usually evidenced by the cessation of air bubbles).

d. Retrieve the sampler by the sample line. Position it over the fuel/oil spill pad and wipe off the exterior of the sampler body with a disposable rag.

e. Position the sampler over the sample container and release its contents by pulling up on the plunger line. Fill the sample container to 80 % of capacity.

f. Cap the sample container tightly, and (if used in your jurisdiction, attach a security seal) place it in transport carrier.

g. Properly dispose of any excess fuel in the sampling device; then clean, dry, and store it.

h. Reseal the tank access port and properly dispose of any contaminated soaker pads or rags.

2. Submerged Samplers (Bacon-Bomb-Thief) (Figures 3 and 5**):** These samplers are typically used to take bottom samples but can be modified to take samples at different levels. They consist of a nickel-plated brass cylinder tapered at both ends and fitted with an internal, plunger-type valve. The valve opens automatically when the sampler strikes the bottom of a storage tank and allows the fuel to enter the container and closes when lifted. A drop cord is attached to a ring at the top of the sampler.

Typical Procedures for Use of a Submerged Sampler:

NOTE: *To ground a static buildup, the person taking the sample should touch the tank at a point at least 1 m (39 in) away from the sampling opening before starting the sampling process.*

Recommended steps: place an appropriate disposable fuel/oil spill pad (sometimes called a "soaker pad") next to the tank sampling point.

NOTE: *Fill the sampler with fuel and then rinse and drain it before taking a sample.*

a. Attach the sample line and the plunger line to the sampler.

b. Estimate the depth to be sampled and then mark the sampling line with the desired depth. In most cases, a storage tank gauge stick may be lowered to the bottom of the tank, removed, and then used to measure the actual depth of the fuel as indicated on the stick.

c. Open the tank access port. Using the sample line, slowly lower the sampler until the desired level is reached.

d. Pull up on the plunger line and allow the sampler to fill before releasing the plunger line to close the seal.

e. Retrieve the sampler by the sample line being careful not to pull up on the plunger line and thereby prevent accidental opening of the bottom valve.

f. Position it over the fuel/oil spill pad and wipe off the exterior of the sampler body with a disposable rag.

g. Position the sampler over the sample container and release its contents by pulling up on the plunger line. Fill the sample container to 80 % of capacity.

h. Cap the sample container tightly and, (if used in your jurisdiction, attach a security seal) place in transport carrier.

i. Properly dispose of any excess fuel in the sampling device and then clean, dry, and store it.

j. Reseal the tank access port and properly dispose of any contaminated soaker pads or rags.

3. **Tank or Drum Thief Sampler (Plastic Cylinder):** Typically these are plastic cylinder (tube type) samplers which consist of a multi-piece, plastic tube, 1 m (39 in) to 5 m (195 in) long and 38.1 mm (1½ in) at maximum diameter. The tubes are typically fitted with two finger rings at the upper end and three supporting legs at the bottom. Both ends are tapered with openings. The top opening of the sampler is closed with a stopper (or gloved thumb) or valve until the sampler is submerged in the liquid. Then the stopper is removed from the opening or the valve is opened, allowing the fuel to fill the sampler. It is used in tanks drums, barrels, or cans.

   Typical Procedures for Use:

   NOTE: *To ground a static buildup, the person taking the sample should touch the tank at a point at least 1 m (39 in) away from the sampling opening before starting the sampling process.*

   NOTE: *Fill the sampler with fuel and then rinse and drain it before taking a sample.*

   a. Remove cover from sample container and place it on a solid level surface at a conveniently located height so that it is easily accessible when holding a filled thief tube (typically a clean, dry jar with a large opening is use to collect this fuel sample so that the tube thief can be easily inserted.)

   b. Open the tank access port. Slowly insert thief tube into storage tank. Hold it firmly with a wiping cloth while sampling and use the cloth to dry the tube as you remove it from the tank. Keep the cloth in contact with the tube throughout the process to reduce the buildup of static electricity.

   c. Open the tube or valve and allow the fuel in the storage tank to reach an equal level in the tube. Once the tube is filled close the tube or valve firmly.

   d. Remove the thief tube from the storage tank slowly to confirm that there is no fuel leaking and then insert the tube into the receiving jar. Wipe the tube dry.

   e. Release the fuel into the sampling container until it is filled to 80 % of capacity.

   f. Close the tube or valve firmly and remove the sampler from the sample container. Close the sample container. Dispose of any excess fuel in the tube and then clean, dry, and secure the sampler.

   g. Reseal the tank access port and properly dispose of any contaminated soaker pads or rags.

C. Fuel Sample Containers

Types of sample containers may include clear or amber colored borosilicate glass bottles (laboratory grade) or metal cans. (**Note:** Shatter resistant glass bottles are available from a variety of vendors.) Only cans with seams soldered on the exterior surface may be used for fuel samples. (If they are not properly soldered, minute traces of flux may contaminate the sample and interfere with tests for dielectric strength, resistance to oxidation, and sludge formation.) There are several reasons that clear bottles may be preferred. Glass prevents permeation and allows a visual inspection of the sample for cleanliness and to see if there is free water or solid impurities present. However, samples of gasoline, jet fuel, and kerosene must be protected from direct sunlight so amber bottles or cans are recommended for those fuels. Clear glass bottles covered with paper or foil may also be used, and immediately placing a clear bottle in a transport box (described elsewhere in this handbook) also provides protection. Screw caps made of either plastic or metal may be used; the caps should provide a vapor tight closure seal. The screw caps must be protected with liners made of metal foil, Teflon, polyethylene, or other material that will not be destroyed by or affect the sample product. Plain cork stoppers and lids with cardboard inner-liners are not acceptable. If samples are shipped, see the U.S. Department of Transportation requirements in §49 Code of Federal Regulations. Containers may be reused indefinitely but must be cleaned and resealed to reduce the possibility of contamination. See Table 1. Suggested Container Types and Minimum Sample Sizes and Figures 7 through 12 for examples of the containers typically in use and minimum sample sizes. For a more detailed statement on specifications for sampling containers see ASTM D5854 “Standard Practice for the Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products.”

Table 1.
Suggested Container Types and Minimum Sample Sizes for Fuel

	Product	Container Material				Minimum Sample Size
		Glass	Aluminum	Metal	FHDPB "Plastic"	
1.	**Gasoline –** General[4]	**X**	**X**	**X**	NO	2 L
	Alcohol/Ether	**X**	**X**	**X**	NO	2 L
	Vapor Pressure	**X**	**X**	**X**	NO	1 L
	Trace Lead	**X**	**X**	**X**	NO	1 L
2.	**Diesel Fuel –** General	**X**	**X**	**X**	NO	2 L
3.	**Kerosene –** General	**X**	**X**	**X**	NO	2 L
4	**Fuel Oil –** General	**X**	**X**	**X**	NO	2 L
5.	**Aviation Gas –** General[2,3]	**X**	**X**	**X**	NO	2 L
6.	**Aviation Turbine Fuel –** General[2, 3]	**X**	**X**	**X**	NO	2 L
7.	**Biodiesel –** General	**X**	**X**	**X**	NO	1 L
8.	**E85 –** General	**X**	**X**	**X**	NO	1 L
9.	**Hydrogen –** General	**X**	**X**	**X**	NO	1 L
10.	**Methanol –** General	**NO**	**NO**	**X**[1]	NO	1 L

NOTE 1: *Methanol (also known as methyl or wood alcohol) is used as a fuel primarily in race cars. It is also available in gasoline-methanol blends that range from 10 % to 30%. If samples are taken of these fuels do not use aluminum containers because there is a potential for corrosion to occur. It is recommended that containers constructed of 316L series stainless steel be used to hold samples of this fuel or blends containing methanol. See the "Methanol Safe Handling Manual" at Methanol Institute (*www.methanol.org*) for specific guidance on handling this product.*

NOTE 2: *See ASTM D4306 "Standard Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination" for more guidance on containers and their preparation prior to placing fuel in them. Generally, borosilicate glass bottles are adequate if wrapped in aluminum foil or stored in a sealed sample box to protect the fuel from light.*

NOTE 3: *When collecting samples of aviation gasoline and aviation turbine fuel for thermal stability, water separation, trace metal and other tests refer to ASTM 4306 for special container requirements and guidance on cleaning, preparation and handling procedures. The sample must be tested within 24 hours of taking.*

NOTE 4: *According to Section 6. Interferences in ASTM D2699 "Standard Test Method for Research Octane Number of Spark-Ignition Engine Fuel" and ASTM D2700 "Standard Test Method for Motor Octane Number of Spark-Ignition Engine Fuel" exposing fuels to UV wavelengths shorter than 550 nm for a short period of time may significantly affect octane number ratings. For this reason, fuel samples must be protected from damaging light. Collect and store fuels to be tested for research or motor octane in an opaque container, such as a dark brown glass bottle or metal can to minimize exposure to UV emissions from sources such as sunlight or fluorescent lamps.*

Figure 7. Clear Bottles.

Figure 8. Can with Provision for Security Seal.

Figure 9. Amber Brown Bottle with Label.

Photo courtesy of the State of Colorado, Div. of Oil and Public Safety.

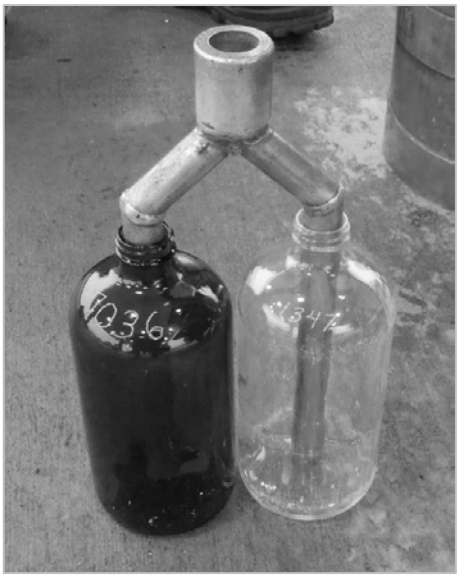


Figure 10. Bottles with Etched Identity Numbers.

Photo courtesy of the Missouri Department of Agriculture.

Figure 11. One Quart – Metal Container with Label.

Figure 12. One Liter - Stainless Round Container with Wire Security Seal Loops.

D. Washing and Drying Sample Containers (one example)

After each use, the sample container should be cleaned using the following procedure or one that provides equivalent or better results:

1. Rinse with a solvent. Discard solvent in accordance with good environmental practice.
2. Wash with a strong soap solution.
3. Rinse with distilled water.
4. Dry in a dust-free cabinet at a temperature of at least 40 °C (104 °F) or warmer.
5. Close container immediately after it is dry.
6. Store in a location specifically designated for clean-ready to use, sample containers.

NOTE: Samples Containers for Microbiological Testing: *A sterilized glass or polypropylene bottle must be used to hold the sample. If a sampler is used to take the fuel sample, it too must be cleaned and sterilized before use. Sterilization can be accomplished by placing the bottle (and cap if heat resistant) in an oven at 160 °C (320 °F) for one hour. Alternatively, an autoclave may be used as long as the bottle and cap are dried prior to use. Microbiological sampling requires procedures not covered in this handbook. Refer to ASTM D7464 - 14 "Standard Practice for Manual Sampling of Liquid Fuels, Associated Materials and Fuel System Components for Microbiological Testing" for guidance on sampling methods and handling procedures.*

NOTE: Sample Containers for Trace Analysis*: Use procedures that ensure sampling equipment and containers are made with materials known not to interfere with the analysis. It is also important to ensure that every component of the sampling process is clean and dry so that the fuel sample is not contaminated or tainted.*

NOTE: *To avoid potential rust contamination, metal containers may be cleaned using Varsol or acetone.*

E. Capacities

The capacity of the most common sample bottles and containers are typically 937 mL (1 QT) and they have sealing caps compatible with fuel. Bottles and sealing caps must be clean and dry prior to use.

F. Identifying Samples for Traceability

The information shown in Table 2 illustrates the type of information typically collected on a fuel sample. In many jurisdictions, the sample container is permanently marked with a unique identifying number and no label is applied. In other jurisdictions, a label is applied to the container which bears a unique identifier number. In most jurisdictions, a Fuel Sample Data Sheet (FSDA) is included with the sample in the shipping case. Some information may be stored in a database while other data is entered on a data sheet.

Table 2.
Examples of Entries on a Fuel Sample Data Sheet

	Item	Entry
1.	Sample number/unique container identity	Enter the sample container's unique identifier number. Each sample must have a unique identifier such as a number or alpha numeric code so its handling can be traceable, and so that all collection reports and laboratory tests are linked to the original sample.
2.	Product identification	Obtained from device product label, tank marking, or bill of lading.
3.	Ethanol content	Indicate if device label or signage reads (e.g., "up to 10 %" or "contains 10 %" or other claim).
4.	Sampling location identity	Enter business name, identifier number (this may be assigned by the fuel regulatory agency), address of sample location, business mail address, agent name, telephone, fax, and e-mail. This information may be used to immediately notify the seller to remove the product from sale should the sample fail.
5.	Special test to be conducted on sample	This item is entered if there is a reason to call for a specific test to be conducted on a sample. This may be used in cases where the testing laboratory does not routinely conduct the requested test on all samples (e.g., in case of a consumer complaint).
6.	Sampled lot	Amount of fuel that the sample represents. Total liters or gallons in the source fuel storage tank represented by the sample.
7.	Supplier(s) of fuel	Enter the name of the supplier or suppliers of the fuel in the source fuel storage tank.
8.	Date of last fuel delivery to storage tank.	Enter the day of the latest delivery of the fuel into the storage tank from which the sample was taken.
9.	Sample Taken by	Name (or identifier number) of the official who took the fuel sample.
10.	Source of sample	Identify the specific source of the sample (e.g., dispenser or storage tank identity, number or location, or license or vehicle number of tank truck and compartment number).

Table 2.
Examples of Entries on a Fuel Sample Data Sheet

	Item	Entry
11.	Date/Time sample collected	Enter the time of day, day, month and year indicating when the sample was collected.
12.	Sampling Equipment Used	Enter weighted bottle or other sampling tool, if applicable.
13.	Type of Sample (when taken with a Sampler)	Enter outlet sample, or upper, middle, lower, bottom or all level sample depending on the collection method used.
14.	Notes/Safety Warning Label	Enter weather conditions and any remarks necessary to accomplish the analysis of the sample. Provide Required Safety Warnings. 
15.	Security Seal(s)	Enter the identification number of any security seal applied to a sample container or transport case.

G. Sample Transport Cases

Most jurisdictions place fuel samples in sealable insulated containers immediately after they are taken. These cases (see examples in Figure 13) hold the fuel sample safely for transport while protecting them from sunlight and heat. A sample case must bear a label indicating that it contains gasoline or oil samples to alert anyone who handles it that it contains flammable liquids. (See also Section I., F. Vehicle and Sample Case Markings for Hazardous Materials Transportation – Alerting Emergency Responders, Item 3. Sample Cases.)

Figure 13a. Sample Box.

Photo courtesy of the North Carolina Department of Agriculture and Consumer Services.

Figure 13b. Sample Box Showing Insulation.

Photo courtesy of the Missouri Department of Agriculture.

Figure 13c. Sample Box showing Security Seal in Place

Photo courtesy of the Missouri Department of Agriculture.

Figure 13d. Sample Box containing Collection Reports as received at the Fuel Laboratory.

Photo courtesy of the Georgia Department of Agriculture.

1. Procedure for Use of Transport Boxes:

Once samples have been collected:

a. Recheck that the sample container is not overfilled and confirm tightness of the cap/seal on the container and check for leakage.

b. Ensure a unique sample identification number is on the can. Place sample container in the transport box.

c. Ensure that the custody record for each transport box is complete, placed in a plastic protective cover, and placed in the container or affixed to the inside lid.

d. Secure and custody seal the lid of the transport box and record the security seal number on the primary inspection report.

I. Security Seals for Containers and Boxes

A container holding a fuel sample should be sealed as part of the chain of custody system but this sealing is not mandatory if other safeguards are in place. For example, if the fuel is held under the secure control and possession of the fuel official who collected the sample from time it was collected until it is delivered to the fuel laboratory, sealing is unnecessary. Another exception to sealing is permitted if the container is placed in a sealed sample transport box for storage and transportation to the fuel laboratory.

J. Recommended Sampling Equipment - Nozzle Extender

It is recommended that all fuel samples taken from a dispenser nozzle be collected using a nozzle extender. These tubes are typically constructed of Schedule 80 non-ferrous metal. They can be constructed of a single tube (See Figure 14.) or made for bi-furcated filling (See Figure 15.). See ASTM D5842 for detailed instruction on fabricating these extenders.

14. Single Nozzle Extender.

15. Dual Nozzle Extender.

Photo courtesy of the Missouri Department of Agriculture.

VI. SAMPLING PROCEDURE FOR TAKING FUEL SAMPLES AT RETAIL FUELING LOCATIONS

A. Preparation

1. **Conduct:** Officials must conduct themselves in a professional manner at all times when taking samples. This includes being aware of what is going on around them so that a safe working environment prevails. Officials should park vehicles in a suitable location until management of the sampling location have been notified of the identity, authority, and nature of the visit. When sampling at retail locations, it is often necessary to have the fuel dispensers authorized for operation so that samples can be taken. Officials must establish contact with the authorized management representative and explain how samples will be taken to ensure that the console operator(s) understands what is expected in assisting the official. It is management's right to observe sampling procedures and be present during the sample collection process if they choose to do so. This will allow the person to confirm the source of the fuel and identity of the container and enable them to satisfy themselves that the sample container was properly sealed and purged fuel was returned to the proper storage.

2. **Business Identity:** Obtain the business ownership and other identity information.

3. **Storage Tank:** To ensure that purged fuel is returned to the correct storage tank, verify that the markings on the storage tank are understood, and that they match the fuel identity chart. If there is any doubt about the proper storage tank, the official should ask the location manager to indicate the appropriate tank access point.

   NOTE: *For reference see NIST Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices," Section 3.30. Liquid-Measuring Devices Code, U.R.2.5. Product Storage Identification. (See also NIST Handbook 130, Uniform Engine Fuels and Automotive Lubricants Regulation, Section 4.4. Product Storage Identification.):*

Source: NIST Handbook 44 – Section 3.30.

UR.2.5. Product Storage Identification.

(a) The fill connection for any petroleum product storage tank or vessel supplying motor-fuel devices shall be permanently, plainly, and visibly marked as to product contained.

(b) When the fill connection device is marked by means of a color code, the color code key shall be conspicuously displayed at the place of business.

4. **Avoid Disrupting Normal Business Operations:** The official should select a dispenser lane for sampling and either block the lane around the dispenser with safety cones or park their vehicle in the lane. The vehicle should be positioned to allow ample access to the dispenser. The official should turn off lights, radios and the vehicle engine and set its parking brake. A walk-around inspection should be conducted to ensure there is easy access to sampling equipment and a fire extinguisher. At the end of the sampling and before the vehicle is moved another walk-around inspection should be made to ensure that all equipment has been collected and all samples and the dispenser are secured (e.g., that the dispenser housing is reclosed if it was opened for inspection.)

5. **Payment for Samples**: In most jurisdictions, the official is obligated to pay the retail value of the product if a fuel sample is taken from a place of business where it can be sold legally unless the sample is being collected pursuant to a search warrant, or the fuel's owner surrenders the sample at no cost.

A sample of a payment receipt is shown below:

PAYMENT RECEIPT

Agency Responsible for Engine Fuel Quality

Address,
City, State, Zip

Telephone, E-mail, URL

Seller's Name:	**Address:**	**Date:**

Received $_____as payment for the fuel or oil samples described below taken for inspection purposes as provided for by Chapter xxxxx of the Code of the State of _____.

_____
Signature of Business Representative

Sample Taken:	**Official:**

6. **Documentation:** Throughout an official visit, it is important that information about device labeling and signage related to the fuel be recorded to document the product identity and other claims made by the seller. The official should make a brief record of actions taken and his or her observations as well as details of any relevant information provided by the seller or the seller's representative. Taking notes, photographs, and keeping logs provide permanent records of a fuel sampling activity and facilitate enforcement.

B. Sample and Containers

1. **Sample Size:** A fuel sample of at least 1 L (1 qt) should be taken. If a vapor pressure test is to be performed, an additional fuel sample of the same volume should be taken. As a general rule, a sufficient amount of product should be collected to allow for the initial test, a repeat test, and retention of some product for evidence in case of legal action. For reasons of due process, irreplaceable evidence, whether favorable or unfavorable to a regulated business, should not be discarded prior to the conclusion of legal proceedings, including the time allowed for the filing of appeals.

2. **Sample Container Fill Levels:** To allow for thermal expansion, sample containers should not be filled to more than 80 % of their capacity. Samples taken for vapor pressure testing **MUST** be filled between the 70 % to 80 % level. The official should always close sample containers tightly immediately after filling and check for leaks by tilting the container up and holding it in the inverted position for 10 seconds. The most widely used method for the collection of fuel samples is to fill a clean sample bottle with fuel from a dispenser nozzle/outlet. This eliminates the use of other sampling equipment and reduces the risk of contamination. The sample container should be of the type best suited to the product and to the purpose of the test. It must be visually inspected immediately prior to use to ensure it is clean, dry, and lint-free. Only use clean and dry sampling equipment and containers to prevent contamination of the fuel sample.

Table 3.
Sample Size – Container Fill Levels Based on Dispenser Readings

Sample Container Capacity	**70 % Capacity**	**80 % Capacity**
1 Fl Qt*	**Dispenser Readings from Zero (0)**	
0.25 gal	0.175 gal	0.200 gal
0.946 L*	0.662 L	0.756 L
Sample Container Capacity 1 L	0.700 L	0.800 L

*These values are provided for situations where a one fluid quart container is used to take a sample from a retail dispenser which delivers in liters.

3. **Recommended Sampling Practice:** It is recommended that the sample container be placed on the island next to the dispenser (or on a grounded cart such as the one pictured below) to avoid the possibility that the container will be dropped or that a spill might result in the official's clothes being soaked with fuel. Submerged filling of an open container is critical to ensuring safety and to reduce the loss of light ends [3] The official should use a cotton rag to wipe and clean the parts of the nozzle and extension piece that come into contact with the sample container and fuel sample. Use of an extension tube constructed of conductive metal (e.g., copper) that reaches to the bottom of the sample container to ensure submerged filling of the container (see Figure 16) is recommended for taking all samples. The official should place the metal nozzle spout in contact with the extension piece or container to prevent build up and discharge of static electricity and then manually control the nozzle and fill the container slowly to decrease the build-up of static electricity. It is recommended that the sample container be kept at least 1 m (3 ft) away from any vehicle during filling to prevent ignition of fumes by hot engines or catalytic converters during filling.

[3]The term "light ends" means hydrocarbons from crude distillation that are low density (lighter weight than gasoline) and have low boiling temperatures. Butanes are the most common light end hydrocarbons used in gasoline.

Figure 16. Sample Bottles Empty and Filled with Bifurcated Tube.

Photos Courtesy of Missouri Department of Agriculture

*17. Fuel Sampling Cart with Transport Case and Safety Gasoline Can to hold fuel from nozzle-hose flushes.**

*18. Fuel Sampling Cart with Sample Container bonded to cart and ground.**

**This cart is used by the State of North Carolina. Photos courtesy of the North Carolina Department of Agriculture and Consumer Services*

C. Sampling

1. **Sample Taken from a Measuring Device that Dispenses a Single Product:** No flushing is required for this nozzle-hose combination. The official should:

   a. Place the sample container on the concrete drive-way, a grounded cart, or on the island next to the dispenser so it is grounded or bonded.

   b. Use a cotton rag to wipe the parts of the nozzle and extension tube that come into contact with the sample container and fuel sample.

   c. Authorize the dispenser and place the nozzle/outlet and extension tube in the sample container and fill it slowly to reduce foaming and light end loss and so that air leaves the container without splashing fuel droplets. Continue until it is filled to the specified volume (or the dispenser indicates the quantity specified for the sample). See Table above for dispenser readings when the delivery begins at 0.000.

   d. Close the sample container and mark as required.

2. **Sample Taken from a Multi-Product or Blended Product Dispenser (See Section 3. for recommended procedures for use in taking an E15 sample.):**

   Background: *In 2000, the National Conference on Weights and Measures (NCWM) Laws and Regulations (L&R) Committee issued a guideline recommending that the minimum flush quantity to be at least 1.1 L (0.3 gal).*[4] *Since that time, data from a number of states indicates that this amount (1.1 L) is not sufficient. NIST recommends that a minimum flush quantity of 1.8 L (0.5 gal) be used for most installations unless the installation indicates that a larger purge is justified. The fuel used for flushing the nozzle of the dispensers should be collected in an approved container and then be returned to the storage tank containing the lowest octane fuel but do not return flex-fuel blends of ethanol above 10 % to the source storage tank.*[5] *Provision must be made by the seller for disposing of blended products which cannot be returned to storage tanks. The amount of fuel flushed from each dispenser must be recorded on the primary inspection report and a copy presented to the seller.*

   The official should:

   a. Select the lowest grade. Authorize the dispenser and run 1.8 L (0.5 gal) slowly into an approved container (e.g., a 19 L [5 gal] safety can or test measure).

   NOTE: *When a sample is taken from a measuring device that is capable of blending different grades of fuel for delivery through a single nozzle, the official must flush the hose and nozzle prior to taking a sample. NIST recommends that a minimum flush quantity of 1.8 L (0.5 gal) be taken from a typical dispenser installation equipped with a standard length hose.*

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[4]Based on data from several programs, when a 1.1 L flush is used, many samples failed because the amount of fuel retained in dispensers varies depending on the installation. In some instances, the use of a 1 gal flush may be required to eliminate the possibility that hose and nozzle contamination can cause a sample to fail or that a failure can be called into question. By increasing the flush quantity to a minimum of 1.8 L (0.5 gal) programs were successful in addressing issues where installations requiring additional piping would fail due to inadequate purge of 1.1 L (0.3 gal) value. Based on this information, NIST recommends a minimum flush quantity of 1.8 L (0.5 gal) be used for most installations unless the installation indicates that a larger purge is justified.

[5]From Draft "Blending and Dispensing Flex Fuels" by the Colorado Department of Labor and Employment – Division of Oil and Public Safety at: https://www.colorado.gov/pacific/sites/default/files/Guidance%20-%20Blending%20And%20Dispensing%20Flex%20Fuels.pdf. Accessed 8/12/2015. See also "Missouri Guidelines for Blending Flex Fuels Pilot Program" at http://www.blenderpumps.org/factors-to-consider/state-guidelines-a-programs/103-guidelines-for-blending-flex-fuels-pilot-program.html. Accessed 8/12/15.

b. Use a cotton rag to wipe the parts of the nozzle and extension tube that come into contact with the container and fuel sample. (See Table 3. Sample Size – Container Fill Levels Based on Dispenser Readings when the delivery begins at zero [0]).

c. Place the nozzle/outlet and extension tube in the sample container and fill it slowly to reduce foaming and light end loss and so that air leaves the container without splashing fuel droplets. Continue until it is filled to the specified volume (or the dispenser indicates the quantity specified for the sample).

d. Seal the sample container and mark as required. The exterior of the sample container must be wiped to ensure it is clean and dry prior to placement in a sample transport case.

e. Reset and reauthorize the dispenser, select the next grade, flush the nozzle and hose and fill the sample container as described above. Continue this process until samples of all grades have been taken.

f. Return purged fuel to proper storage and record quantities on inspection report. Do not return flex-fuel blends of ethanol above 10 % to the source storage tank. Provision must be made by the seller for disposing of blended products which cannot be returned to storage tanks.

NOTE: *Where mid-grade flex fuels are blended using Multiple Product Dispensers (MPD), adjustments MUST be made to the blend ratio of each dispenser at different times throughout the year to ensure that the blend contains the required amount of ethanol. The time at which these changes are made is dependent on the geographic location of the dispenser. The blend ratio required to achieve the correct blend depends on the amount of ethanol contained in the unleaded gasoline and E85. The amount of ethanol contained in these components will vary with the provider. Each grade of mid-grade flex fuel dispensed through blending dispensers must be independently tested for ethanol content at the time the dispenser (or group of dispensers) is installed at a facility, and prior to use.*

3. Recommended Sampling Procedures for Taking an E15 Sample from a Multiple Product Dispenser (MPD).

Background*: Multiple Product Dispensers (MPDs) or blender pumps are designed to deliver a single grade of product or to combine two grades at the dispenser in predetermined ratios by drawing fuel from different storage tanks and using sensors and flow rate controllers that ensure the targeted blend is dispensed. These pumps have been used for many years to create mid-octane fuels by blending the low and high octane fuels at the dispenser. The typical MPD uses a feedback system to adjust the blend delivered at the nozzle. To do that, two grades of fuel from two different inlets are fed through individual meters with their quantities controlled by a variable flow valve located after each meter. The dispenser senses the amount of product going through each meter and adjusts the opening of each valve to conform to the ratio for the selected product. At the beginning of the transaction and during re-starts (i.e., the blend ratio mechanism is reset every time the user closes and reopens the nozzle and when the nozzle's automatic shutoff kicks in and the nozzle is then restarted), the dispenser makes adjustments to attain the correct blend ratio as it relates to the entire transaction and to deliveries made at normal speed. It is important to recognize that the fuel blend is also affected by both the flow rate of the dispenser and system pressure, which vary depending on the number of dispensers on the system drawing from the different fuel storage tanks. The blend ratios will be different when using a MPD to produce E15 and mid-level ethanol blends (Exx). Because the normal fuel sampling process involves taking a small quantity of fuel at a slow flow rate (and that may involve re-starts), it is likely that the fuel blend in these samples are not representative of the fuel delivered in a typical customer transaction. The Environmental Protection Agency (EPA) has recognized that this operational characteristic of MPDs for blending E15 may result in the inadvertent mis-fueling of E15 in vehicles, engines, and equipment not covered under the EPA's E15 waiver to the Clean Air Act. To help ensure that customers do not inadvertently mis-fuel vehicles, engines, and equipment not covered underE15 waiver, the EPA requires retailers to dispense E15 at a MPD only through EPA-approved MPD configurations. (See pages 43 and 45 in the "E-15 Retailer Handbook" by the Renewable Fuels Association at http://ethanolrfa.3cdn.net/643f311e9180a7b1a8_wwm6iuulj.pdf.)*

For these reasons, it is recommended that a fuel quality sample (e.g., 1 L) be taken from a larger sample of between 7.5 L (2-Gal) and 9.4 L (2.5- Gal) or more. The sample should be collected in a clean container (e.g., a 9.4 L (2.5- Gal) or 19 L (5-Gal) safety can under a continuous flow delivered at or near the full-flow rate of the device because this allows the dispenser adequate time to account for system variations in making its adjustments to the blend ratio. If the flow is interrupted prior to collecting at least 7.5 L (2–gal) the product must not be used in a fuel sample. By following the recommended procedures to collect samples for fuel quality determinations, an official should obtain an accurate representation of the fuel that the dispenser has delivered.

Important: For samples to be tested for conformance to volatility standards during the VOC season (June 1- Sept 15) additional steps and procedures will need to be followed. See NOTICES section for appropriate ASTM International Standards.

E15 Sampling Procedure

There are several methods that can be used to obtain a sample of the product that is representative of the fuel going into the customer's tank in a typical delivery. Here are three suggestions based on whether the official is simply taking a fuel sample or taking a fuel sample in conjunction with testing the dispenser for accuracy according to NIST Handbook 44.

There are three acceptable Methods for procuring samples for quality testing.

Method #1 (Taking a Fuel Sample)

1. Flush the dispenser with a minimum of 1.8 L (0.5-Gal) using E15 (or with the blend being tested) into a separate container using a continuous flow at or near the full-flow rate of the device and dispose of the flushed fuel.

2. Place the nozzle into the can against the opening at a level to avoid overfilling but positioned to reduce the possibility of prematurely activating the automatic shut-off mechanism. If practical, maintain a continuous flow by avoiding manual restarts of the nozzle. Start a new transaction with the E15 setting (or whatever blend is under test), dispense at least 7.5 L (2-Gal) into a clean 9.4 L (2.5-Gal) or larger safety can using a continuous flow at or near the full-flow rate of the dispenser. If the flow is stopped for any reason prior to the collection of 7.5 L (2-Gal) dispose of the fuel and repeat this step.

3. Take the sample from the fuel in the container.

Method #2 – (Taking a Fuel Sample)

1. Flush the dispenser with a minimum of 7.5 L (2-Gal) with continuous flow at or near the full-flow rate of the device using E15 (or whatever blend is being tested). If there is a flow interruption prior to delivering 2-Gallons do not restart the flow, dispose of the fuel. Repeat this step until more than 7.5 L (2-Gal) is delivered without interruption. Proceed to next step.

2. Pull a sample from what is left in the hose (residual) into an appropriate clean sampling container. The sample should not exceed 0.49 L (0.13-Gal).

3. Dispose of the flushed fuel.

Method #3 (Taking a Fuel Sample in conjunction with a device accuracy test)

1. Flush the dispenser with a minimum of 1.8 L (0.5-Gal) using E15 (or whatever blend is being tested) into a separate container using a continuous flow at or near the full-flow rate of the device. Dispose of the flushed fuel.

2. Place the nozzle in the test measure and against the opening at a level to avoid overfilling the test measure and but positioned to reduce the possibility of prematurely activating the automatic shut-off mechanism. Conduct a device accuracy test in the E15 setting (or whatever blend is being tested), and

dispense 19 L (5-Gal) into a test measure to check the accuracy of the dispenser. Operate the nozzle at or near the full-flow rate of the device and, if practical, maintain a continuous flow by avoiding manual restarts of the nozzle.

3. After the accuracy test is completed, take the fuel sample directly from the test measure by filling the sample container using a clean dry funnel.

NOTICE: It is recommended that the following ASTM International Standards be utilized to procure fuel quality samples and to determine the ethanol content of E15 (or whatever blend is being tested) samples.

- ASTM D5599 - 15 "Standard Test Method for Determination of Oxygenates in Gasoline by Gas Chromatography and Oxygen Selective Flame Ionization Detection"
- ASTM D5501-12$^{\varepsilon 1}$ "Standard Test Method for Determination of Ethanol and Methanol Content in Fuels Containing Greater than 20% Ethanol by Gas Chromatography"
- ASTM – D4057 - 12 "Standard Practice for Manual Sampling of Petroleum and Petroleum Products"
- ASTM - D5842 - 14 "Standard Practice for Sampling and Handling of Fuels for Volatility Measurement"

$^{\varepsilon 1}$ Note – Editorial corrections were made to 7.4.3. and 7.5. in July 2013

4. NIST Handbook 44, Section 3.30. Liquid Measuring Devices, User Requirements (UR).

NOTE: Alternative Flush Quantities: *The recommended minimum flush amount is based on the internal volume of a 3 m (10 ft) hose. In NIST Handbook 44, "Specifications Tolerances and other Technical Requirements for Commercial Weighing and Measuring Devices," Section 3.30. Liquid Measuring Device Code, U.R.1.1. User Requirement (shown below) permits discharge hose lengths up to 5.5 m (18 ft) on most retail fuel dispensers, but dispensers at marinas are permitted to extend to 15 m (50 ft).*

UR.1.1. Discharge Hose.

UR.1.1.1. Length. *– The length of the discharge hose on a retail motor-fuel device:*

(a) shall be measured from its housing or outlet of the discharge line to the inlet of the discharge nozzle;

(b) shall be measured with the hose fully extended if it is coiled or otherwise retained or connected inside a housing; and

(c) shall not exceed 5.5 m (18 ft) unless it can be demonstrated that a longer hose is essential to permit deliveries to be made to receiving vehicles or vessels.

An unnecessarily remote location of a device shall not be accepted as justification for an abnormally long hose.

UR.1.1.2. Marinas and Airports.

UR.1.1.2.1. Length. *– The length of the discharge hose shall be as short as practicable, and shall not exceed 15 m (50 ft) unless it can be demonstrated that a longer hose is essential.*

The following Table 5. provides the approximate volume contained in various internal diameters of fuel hoses with the length of 3 m (10 ft). The recommended purge is adequate for the most commonly used hose with an internal diameter up to 22.2 mm ($^{7}/_{8}$ in) hose diameter. If an official encounters hoses with larger internal diameters or lengths of greater than 3 m (10 ft) the flush amount can be adjusted to fully

purge the hose and reduce the chance for contamination. If 3 m (10 ft) lengths of the larger interior diameters hoses are found, increase the flush to the quantities stated in Column 2. If longer lengths of any of the discharge hoses are found, the official should measure its length and multiply that value by the volume contained in 304 mm (1 ft) by the volume in Column 3. For example, if a blending dispenser with a 18 ft discharge hose with an interior diameter of $^{7}/_{8}$ in is found, multiply 18 × 0.030 gal = flush volume of 0.540 gal.

Table 5.
Approximate Volume Contained in Various Internal Diameters of Fuel Hoses
(based on the hose length of 3 m [10 ft])

Column 1. Discharge Hose Interior Diameter	**Column 2. Approximate Volume in 3 m (10 ft)**	**Column 3. Approximate Volume in 304 mm (1 ft)**
12.7 mm ($^{1}/_{2}$ in)	0.370 L (0.10 gal)	0.037 L (0.010 gal)
15.9 mm ($^{5}/_{8}$ in)	0.600 L (0.16 gal)	0.056 L (0.015 gal)
19.1 mm ($^{3}/_{4}$ in)	0.870 L (0.23 gal)	0.075 L (0.020 gal)
22.2 mm ($^{7}/_{8}$ in)	1.170 L (0.31 gal)	0.113 L (0.030 gal)
25.4 mm (1 in)	1.552 L (0.41 gal)	0.151 L (0.040 gal)
31.8 mm ($1^{1}/_{4}$ in)	2.422 L (0.64 gal)	0.227 L (0.060 gal)

NOTE: *Except for the ethanol blends noted above, return the accumulated flush fuel for all of the sampled blends to the lowest grade storage tank.*

NOTE: *If a weights and measures official is testing dispensers for compliance with NIST Handbook 44 using a 19 L (5 gal) test measure, the flush procedure can be skipped and the fuel sample taken after the official has filled the measure and determined the device error.*

NOTE: *Officials should verify and document the dispenser's programed blend ratio if they have the appropriate access equipment and training from the device manufacturer. This is a good practice to carry out on new installations and devices where there is a suspected problem with fuel grades. Instructions for accessing the blend ratio of a device are included in the Certificate of Conformance for a blending device from the NCWM. The NCWM Certificate of Conformance Search Engine is located at this URL: http://www.ncwm.net/ntep/cert_search.*

5. Taking a Sample of Fuel for Volatility Measurement

The vapor pressure of a fuel is affected by evaporation and composition so special handling and filling equipment is required. This nozzle sampling procedure is based on ASTM D5842 "Standard Practice for Sampling and Handling of Fuels for Volatility Measurement."

a. If the sample is taken from a blending dispenser, flush the nozzle with 1 L (0.3 gal) of the grade of product being sampled. This step is taken to ensure the hose and nozzle is not contaminated with a blend of fuel different from that intended to be tested.

The official should then:

b. Rinse the sample container (and sampling device if used) with fuel and allow it to drain before filling. This step is taken to ensure the container is not contaminated and it cools the container which may help to reduce evaporation.

c. Use a nozzle extender to fill the sample container slowly to 70 % to 80 % of its capacity. The slow filling time and nozzle extension are used to reduce evaporation.

d. Immediately seal the sample container and check it for leaks. If a leak is found discard the sample and container and take another sample using a new container. It is recommended that a sealing tape be wrapped around the container lid to further reduce the chance of evaporation (See Figure 4 below for an example of bottles sealed in this manner).

***NOTE*:** *When glass bottles are used in collecting samples for vapor pressure testing, it is recommended that container sealing tape be used to seal the lower edge of the cap to the neck of the bottle to prevent evaporation. (This is usually a stretchable tape that reduces the chance for gas exchange and prevents the entry of contaminants. These tapes remain flexible in most temperatures and they are waterproof and resistant to most chemicals.) If the containers are properly sealed and leak free, they can also be inverted during shipment to prevent evaporation.*

Figure 19. Sealing Tape Applied to Amber Sample Bottles

Photos courtesy of the Missouri Department of Agriculture.

D. Protecting Fuel Samples

Extreme care and good judgment are necessary to ensure the samples obtained are representative of the product being sold, assuring the test results are the same as if the sample had been tested immediately after it was taken. Samples should be kept cool or be cooled and protected from sunlight in order to minimize any potential reaction due to the light sensitivity of the sample. Samples of gasoline and JP-4 (which is not widely used) should be kept cool to prevent "light ends" from evaporating. Also, samples of fuels with lead additives must be protected from sunlight. It is necessary to protect all volatile samples of petroleum products from evaporation. In every situation the product sampled should be put directly into a sample container as soon as it is obtained. This must be done with vapor pressure samples. When it is necessary to obtain product with a sampling apparatus (or it is an undercover purchase in a consumer type gas can), or from an underground storage tank, transfer the product to a sample container immediately. If applicable, keep the containers and samplers closed except when material is being transferred. Never completely fill any container; allow adequate room for expansion by filling them to no more than 80 % capacity. To prevent the loss of liquid and vapors during transport, screw the caps of containers down tightly and check for leakage (check for leakage by tilting the container on its side and looking for fuel leaks around the cap or air bubbles entering the fuel).

NOTE: *Control temperature conditions. According to ASTM D4814 fuels should not be cooled below their dispensed temperatures or 15 °C (59 °F) because cooling of gasoline-oxygenate fuels can produce changes in appearance (e.g., hazing) that are not reversed on rewarming.*

E. Visual Inspection – (Per ASTM D6751 and ASTM D4814-16a - 6. Workmanship)

Immediately examine the fuel sample to determine if it is clear and bright at the ambient temperature, at the fuel temperature at the point of custody transfer, or at a lower temperature agreed upon by the purchaser and seller. The fuel must be visually free of undissolved water, sediment, or suspended matter. If the fuel does not pass this visual inspection, a stop-sale order should be issued immediately.

Label and seal the containers immediately after the sample is obtained and place in a secure sample transport box for transportation to the fuel laboratory for testing. The official should RECHECK that every sample is accurately identified and documents are completed. If the lab receives a sample with missing or incomplete labels or documents, it will be rejected and disposed of without testing.

Figure 20. Visual Inspection of Samples.

PASS

FAIL

Clean, Bright Sample Passes **Sample with Water Fails**

PASS

FAIL

FAIL

PASS

F. Transporting Samples to Laboratory

There are several approaches used to transport fuel and oil samples to a fuel laboratory. All are acceptable as long as the integrity of the chain-of-custody is documented.

1. **Direct Delivery:** The official who collects the sample transports it directly to the laboratory and presents it for testing.

2. **Public Carrier Delivery:** The official who collects the sample packs it in appropriate shipping cartons, labels them and delivers them to a public carrier who then transports the sample to the fuel laboratory for testing (or to a delivery point where a representative from the laboratory picks up the samples).

3. **Laboratory Courier:** The officials who collect samples deliver them to a central consolidation point where a courier collects the samples and transports them to the fuel laboratory. These couriers are almost always employees of the fuel laboratory.

The collection of fuel samples requires that the fuel official receives a continuous supply of fresh sample containers, so it is important to set up a cost effective system that simplifies the transportation of fuel samples to the laboratory while at the same time ensures that it resupplies the field official.

G. Chain of Evidence (Custody) and Transfer

A chain of evidence (custody) is a record of each person who has come into possession of the fuel sample from the time it is taken until the time the test results on the sample are presented as evidence in an administrative or judicial proceeding. A sample is in custody if it is in the official's possession or if it is under his or her control, or the control of another authorized person while stored in a secure location. A chain of evidence is the only means to prove that the sample presented in the proceeding is the one obtained at the location in question.

A record must be maintained which lists all those persons coming in possession of the evidence. This is particularly true when an analysis of fuel samples is to be made. It must be proven that there was no tampering with, alteration, or substitution of the sample between the time it was collected and the time of analysis by the fuel laboratory. The burden of proof is on the party offering the sample into evidence.

Fuel samples must be passed from the field person who obtained them to the laboratory personnel through a controlled process. When this takes place, the record must indicate to whom and when the sample was released. In other words, the chain of custody must be maintained. This means that the transfer of the sample must be documented each time, and that the record must remain with the sample. If this proof is not available, the sample and its analysis may be excluded from evidence.

Although an accurate and complete record is maintained of the chain of custody, it is still advisable that the samples go through as few people as possible. The fewer involved, the less chance there is the sample may be tampered with, altered, or lost. Also, should a case end up in court or administrative hearing, fewer witnesses will be needed to be called to establish the fact that the sample analyzed is the same fuel sample collected at the location. See ASTM D4840 "Standard Guide for Sample Chain-of-Custody Procedures" for more information. A sample of a Chain-of-Custody document is presented in Appendix C.

H. Timeliness of Samples

Due to the velocity at which fuel is sold from a seller's tanks, a sample that is not analyzed and the results provided within 24 hours to 48 hours of its collection is of little value in stopping the sale of nonconforming fuel.

I. Respond to Test Results – Time is of the Essence.

If a sample fails any laboratory test, immediate action must be taken to ensure the product is removed from sale. Follow-up oversight must verify that the seller has taken the appropriate corrective actions including determining and documenting the cause of the failure so it can be included in a program assessment to identify possibilities for changes in quality standards or handling and storage procedures. Timely testing of all samples

is a critical factor because, after subsequent deliveries occur, the sample is no longer representative of the product in the storage tank.

1. **If the Sample Passes:** No enforcement action is taken. The test reports are stored according to the record keeping requirements of the enforcement agency and the results are added to the compliance history of the seller and cross-referenced to the supplier. All test results are also incorporated into a summary of test results which can be analyzed and presented in (annual) reports detailing the benefits of fuel quality testing.

2. **If the Sample Fails:**

   a. Recommended Engine Fuel Off-Sale Guidance: Upon notification from the laboratory that a product sample did not meet specifications, the official should go to the location where the sample was obtained and contact the manager. It is also appropriate to issue an initial notification of an off-sale order by e-mail or by telephone to the location manager and, if appropriate, the corporate office if the retailer is a chain store outlet. E-mail notifications of test failures to the seller are the fastest way to prevent the sale of out of specification product and initiating corrective actions.

   b. Report the test results for the sample, what the specifications for that product are, and what action is going to be taken. Refer questions about the test results to the management of the fuel program. Do not recommend how to correct or bring the failed fuel into compliance because the agency may be held liable should advice be found to be improper.

   The official should:

   (1) If applicable, read and record the pump totalizers and determine the amount of product in the storage tank from which the sample was originally taken.

   (2) If additional product has been added to the storage tank since the original sample was taken, resample the product, label and seal it and then send it to the laboratory for testing (or if applicable retest on-site).

   (3) If additional product has not been added to the storage tank since the sample was collected, label and seal the storage tank fill pipe(s) and/or dispenser(s) in accordance with agency policy.

   (4) Explain the agency's policy on the disposition of off-sale product (e.g., off-sale fuel cannot be sold and must be corrected or disposed of within 10 days of off-sale action). Leave a written copy of any instructions with the manager.

   (5) If the agency requires the official to be present when the off-sale product is to be removed from the tanks, the official should advise the seller to contact his or her office to make an appointment. When fuel storage tank(s) are to be pumped out, the official should check the tags and seals applied when the product was ordered off sale to see that they are intact. If they are not secure, the official should document his or her findings and take action according to agency policy or notify management. Also, the official should check the totalizer readings and measure the amount of product in the tank to determine if any has been removed. Break the seals and allow the product to be pumped out of the storage tank. Have the lines and filters flushed with sufficient compliant product to assure all off-specification product is removed before releasing the dispensers for use. It is sound procedure to obtain a sample of replacement product from the delivery truck and of the new product through the dispenser after it has been emptied into the storage tank so they can be tested to ensure the problem has been corrected.

   (6) Verify Product Disposition: The official should require the seller to provide a written explanation of how the off-sale product was disposed of. Some questions that may be asked are: How was sale of volatile product prevented? Was the product disposed of or returned to supplier? What documents or processes confirm the disposition? Was the process completed within 30 days of notice?

NOTE: Examples of a Notice of Violation and a Stop Sale Order are provided in Appendix C.

VII. TESTING FOR WATER IN A FUEL STORAGE TANK

A. Storage Tanks

According to the Steel Tank Institute, the installation of storage tanks and lax maintenance procedures used for water monitoring and removal can lead to a number of problems, from degradation of fuel quality and subsequent vehicle performance to damage of the storage system. This concern pertains to all storage systems, both underground and aboveground, regardless of the material used for their construction and irrespective of the fuel stored in the tank. According to Clean-Diesel Org (see http://www.clean-diesel.org/), not only is water a problem in itself, but it also creates the environment for biological growth within the fuel. Studies have revealed that less than 6.35 mm (0.25 in) of water is more than sufficient to promote microbial growth. Microorganisms live at the level of the fuel-water interface and feed on the fuel. The presence of microorganisms can lead to filter plugging, pump and injector problems, deactivation of the water monitor, and buildup within the tank, which is costly to remove.

It is recommended that a manual inspection for water be made on each storage tank at a location, and that every jurisdiction enforce the maximum water limits specified in their jurisdiction's laws or regulations such as those specified in NIST Handbook 130, Uniform Engine Fuels and Automotive Lubricants Regulation, Section 4. "Retail Storage Tanks and Dispenser Filters." While most modern storage tank monitoring systems have water monitoring features, those may not be accurate, so a manual measurement using a gauge stick with water finding paste and calibration chart are recommended. Officials should inspect each automatic system for the level of water in each storage tank and document the results on the inspection reports, and compare the automatic indication with the manual readings to indicate any significant differences that exist. Officials should take action based on the level determined using the stick and water paste that exceed the specified limits (i.e., order the water removed by a specified deadline and require seller to report completion of the removal). Whatever measuring device the official uses must be capable of measuring the fuel level over the full range of the tank's height to the nearest 3 mm ($^1/_8$ in). If the storage system does not have an automatic monitoring system, it is recommended that the official conduct a manual inspection for water in each storage tank at each sample location and enforce the maximum water limits specified in their jurisdiction's laws or regulations such as those specified in NIST Handbook 130, Uniform Engine Fuels and Automotive Lubricants Regulation, Section 4. "Retail Storage Tanks and Dispenser Filters."

Section 4. Retail Storage Tanks

4.1. Water in Gasoline-Alcohol Blends, Biodiesel Blends, Ethanol Flex Fuel, Aviation Gasoline, and Aviation Turbine Fuel. *–No water phase greater than 6 mm (¼ in) as determined by an appropriate detection paste or other acceptable means, is allowed to accumulate in any tank utilized in the storage of gasoline-alcohol blend, biodiesel, biodiesel blends, ethanol flex fuel, aviation gasoline, and aviation turbine fuel.*

4.2. Water in Gasoline, Diesel, Gasoline-Ether, and Other Fuels. *–Water shall not exceed 25 mm (1 in) in depth when measured with water indicating paste or other acceptable means in any tank utilized in the storage of diesel, gasoline, gasoline-ether blends, and kerosene sold at retail except as required in Section 4.1. Water in Gasoline-Alcohol Blends, Biodiesel Blends, Ethanol Flex Fuel, Aviation Gasoline, and Aviation Turbine Fuel.*

1. **Equipment:** The Environmental Protection Agency specifies the following requirement for gauge sticks and other water measuring systems:

2. **Gauge Stick or Other Gauges:** The gauge stick used to measure the depth of liquid in an underground tank must be clearly labeled in 3 mm ($^1/_8$ in) graduations starting with zero at the bottom end. Inspect the stick to ensure the end has not been worn or cut off and that the stick is not warped. The stick should be

made of non-sparking material, such as wood, and varnished to minimize the creeping of fuel above the actual fuel level in the tank. Whatever measuring device the official uses must be capable of measuring the fuel level over the full range of the tank's height to the nearest 3 mm ($^1/_8$ in).

3. **Water Finding Paste:** The best way to measure water is to use water-finding paste that is applied to the bottom of a gauge stick (when testing fuel that contains ethanol, use a water paste that is formulated for use with blend gasolines). Follow the paste manufacturer's directions for using the water paste, especially the amount of time the stick needs to be immersed in the fuel and what color change indicates the presence of water.

NOTE: *It is a good idea to take a photograph of the stick after applying the paste and another photo with the stick and a measuring tape laid next to it to indicate the water level if excessive water is found.*

NOTE: *Read the paste manufacturer's Safety Data Sheet for warnings and storage requirements, and follow the exposure controls and personal protection equipment requirements.*

4. **Procedure:** The manual way of measuring the amount of water in an underground tank is with a wooden gauge stick. To take a reading, apply a thin film of the water finding paste on one side of the stick and its bottom and spread it uniformly over the surface to a height of 100 mm (4 in). Lower the stick gently to the bottom of the tank and let it sit for 5 seconds to 10 seconds (or follow the paste manufacturer's instructions if they differ from this recommendation) and then raise it quickly. Locate the paste and determine if there is any change in the color of the paste which would indicate that water is present. Record the number of millimeters (inches) of water indicated to the nearest 3 mm ($^1/_8$ in).

   For manual gauging, if there is no separate gauge opening, the tank-fill drop tubes must have no obstruction at the end of the tube which will interfere with gauging of water. Be aware of drop tubes with "floating striker plates" – these devices won't show the lowest 19 mm (0.75 in) of the tank.

5. Ac**tion:** If the permitted water limit is exceeded, issue an order that the seller have the water removed.

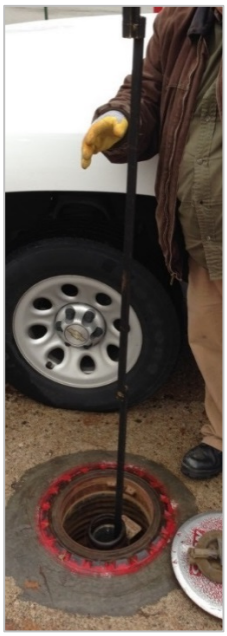


Figure 21. Testing for Water.

Figure 22. Stick with Paste – No Water Indicated.

Figure 23. Sticks with Red Coloring that Shows Water Levels in Different Storage Tanks.

VIII. LABELING ENFORCEMENT CHECKLIST AND SAMPLING PROCEDURE OUTLINE FOR TAKING SAMPLES OF MOTOR OIL AT SERVICE LOCATIONS

A. Preparation

1. **Contact:** Officials should park their vehicle in a suitable location until they have notified the management of the business where sampling will occur of their identity, authority, and nature of the visit. When sampling at retail locations, is it often necessary to have the oil dispensers unlocked or air compressors started so samples can be taken. Officials must establish contact with the authorized management representative and explain how samples will be taken and ensure that employees understand

what is expected of them in assisting the official. It is management's right to observe sampling procedures and to be present during the sample collection process if they choose to do so. This will allow the person to confirm the source of the oil and identity of the container and enable them to satisfy themselves that the sample container was properly sealed and purged product was returned to the proper storage.

2. **Business Information:** Obtain the business ownership and other identity information.

3. **Labeling:** Ensure that the label on any vehicle engine (motor) oil container, receptacle, dispenser, or storage tank is properly labeled. In addition, if remote tank filling ports are used, it is recommended that they be properly marked and secured. If there is any doubt, the official should ask the manager to indicate the location of the appropriate storage tank for each grade or brand of oil.

B. Labeling and Documentation

If the official's state adopts the Uniform Method of Sale of Commodity Regulation in NIST Handbook 130, carry out an inspection according to Section 2.33 "Labeling of Vehicle Engine (Motor) Oil."

2.33. Oil.

2.33.1. Labeling of Vehicle Engine (Motor) Oil. *– Vehicle engine (motor) oil shall be labeled.*

2.33.1.1. Viscosity. – *The label on any vehicle engine (motor) oil container, receptacle, dispenser, or storage tank, and any invoice or receipt from service on an engine that includes the installation of vehicle engine (motor) oil dispensed from a receptacle, dispenser, or storage tank, shall contain the viscosity grade classification preceded by the letters "SAE" in accordance with SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification."*

NOTE: *If an invoice or receipt from service on an engine has limited room for identifying the viscosity, brand, and service category, then abbreviated versions of each may be used on the invoice or receipt and the letters "SAE" may be omitted from the viscosity classification.*

2.33.1.1. Viscosity – Are the following labeled with the viscosity grade classification preceded by the letters "SAE" in accordance with SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification?"		**Yes**	**No**	**Comments**
a.	Containers			
b.	Receptacles			
c.	Dispensers			
d.	Storage Tanks			
e.	Invoice or Receipts			

2.33.1.2. Brand. – *The label on any vehicle engine (motor) oil container and the invoice or receipt from service on an engine that includes the installation of bulk vehicle engine (motor) oil dispensed from a receptacle, dispenser, or storage tank shall contain the name, brand, trademark, or trade name of the vehicle engine (motor) oil.*

2.33.1.2. Brand. – Are the following labeled with the name, brand, trademark, or trade name of the vehicle engine (motor) oil?		**Yes**	**No**	**Comments**
a.	Containers			
b.	Receptacles			
c.	Dispensers			
d.	Storage Tanks			
e.	Invoice or Receipts			

2.33.1.3. Engine Service Category. – *The label on any vehicle engine (motor) oil container, receptacle, dispenser, or storage tank and the invoice or receipt from service on an engine that includes the installation of bulk vehicle engine (motor) oil dispensed from a receptacle, dispenser, or storage tank shall contain the engine service category, or categories, displayed in letters not less than 3.18 mm (1/8 in) in height, as defined by the latest version of SAE J183, "Engine Oil Performance and Engine Service Classification (Other than "Energy Conserving")," API Publication 1509, "Engine Oil Licensing and Certification System," European Automobile Manufacturers Association (ACEA), "European Oil Sequences," or other Vehicle or Engine Manufacturer standards as approved in Section 2.33.1.3.1. "Vehicle or Engine Manufacturer Standard."*

2.33.1.3. Engine Service Category. – Are the following labeled with the engine service category, or categories?		**Yes**	**No**	**Comments**
a.	Containers			
	Height of the letters at least 3.18 mm (1/8 in)?			
b.	Receptacles			
	Height of the letters at least 3.18 mm (1/8 in)?			
c.	Dispensers			
	Height of the letters at least 3.18 mm (1/8 in)?			
d.	Storage Tanks			
	Height of the letters at least 3.18 mm (1/8 in)?			
e.	Invoice or Receipts			
	Height of the letters at least 3.18 mm (1/8 in)?			

2.33.1.3.1. Vehicle or Engine Manufacturer Standard. – *The label on any vehicle engine (motor) oil container, receptacle, dispenser, or storage tank and the invoice or receipt from service on an engine that includes the installation of vehicle engine (motor) oil dispensed from a receptacle, dispenser, or storage tank shall identify the specific vehicle or engine manufacturer standard, or standards, met in letters not less than 3.18 mm (1/8 in) in height. If the vehicle (motor) oil only meets a vehicle or engine manufacturer standard, the label must clearly identify that the oil is only intended for use where specifically recommended by the vehicle or engine manufacturer.*

2.33.1.3.1. Vehicle or Engine Manufacturer Standard. – Are the following labeled with the specific vehicle or engine manufacturer standard, or standards the oil meets? **NOTE**: If the oil only meets a vehicle or engine manufacturer standard, the label must clearly identify that the oil is only intended for use where specifically recommended by the vehicle or engine manufacturer.		**Yes**	**No**	**Comments**
a.	Containers			
	Height of the letters at least 3.18 mm (1/8 in)?			
b.	Receptacles			
	Height of the letters at least 3.18 mm (1/8 in)?			
c.	Dispensers			
	Height of the letters at least 3.18 mm (1/8 in)?			
d.	Storage Tanks			
	Height of the letters at least 3.18 mm (1/8 in)?			
e.	Invoice or Receipts			
	Height of the letters at least 3.18 mm (1/8 in)?			

2.33.1.3.2. Inactive or Obsolete Service Categories. – *The label on any vehicle engine (motor) oil container, receptacle, dispenser, or storage tank and the invoice or receipt from service on an engine that includes the installation of bulk vehicle engine (motor) oil dispensed from a receptacle, dispenser, or storage tank shall bear a plainly visible cautionary statement in compliance with the latest version of SAE J183, Appendix A, whenever the vehicle engine (motor) oil in the container or in bulk does not meet an active API service category as defined by the latest version of SAE J183, "Engine Oil Performance and Engine Service Classification (Other than "Energy Conserving")." If a vehicle engine (motor) oil is identified as only meeting a vehicle or engine manufacturer standard, the labeling requirements in Section 2.33.1.3.1. Vehicle or Engine Manufacturer Standard applies.*

2.33.1.3.2. Inactive or Obsolete Service Categories. – Do the following bear a cautionary statement in compliance with the latest version of SAE J183, Appendix A, whenever the vehicle engine (motor) oil in the container or in bulk does not meet an active API service category as defined by the latest version of SAE J183, "Engine Oil Performance and Engine Service Classification (Other than "Energy Conserving")." If a vehicle engine (motor) oil is identified as only meeting a vehicle or engine manufacturer standard, the labeling requirements in Section 2.33.1.3.1. Vehicle or Engine Manufacturer Standard applies.		**Yes**	**No**	**Comments**
a.	Containers			
	Is the cautionary statement plainly visible?			
b.	Receptacles			
	Is the cautionary statement plainly visible?			
c.	Dispensers			
	Is the cautionary statement plainly visible?			
d.	Storage Tanks			
	Is the cautionary statement plainly visible?			
e.	Invoice or Receipts			
	Is the cautionary statement plainly visible?			

2.33.1.4. Tank Trucks or Rail Cars. – *Tank trucks, rail cars, and other types of delivery trucks that are used to deliver bulk vehicle engine (motor) oil are not required to display the SAE viscosity grade and service category or categories on such tank trucks, rail cars, and other types of delivery trucks.*

2.33.1.5. Documentation. – *When the engine (motor) oil is sold in bulk, an invoice, bill of lading, shipping paper, or other documentation must accompany each delivery. This document must identify the quantity of bulk engine (motor) oil delivered as defined in Sections 2.33.1.1. Viscosity; 2.33.1.2. Brand; 2.33.1.3. Engine Service Category; the name and address of the seller and buyer; and the date and time of the sale. For inactive or obsolete service categories, the documentation shall also bear a plainly visible cautionary statement as required in Section 2.33.1.3.2. Inactive or Obsolete Service Categories. Documentation must be retained at the retail establishment for a period of not less than one year.*

2.33.1.5. Documentation Requirements		**Yes**	**No**	**Comments**
a.	**Invoice**			
i.	Does the seller provide an invoice?			
ii.	Is the date and time of sale included?			
iv.	Is the seller name and address included?			
v.	Is the buyer name and address included?			
vi.	Does it identify the quantity of bulk oil delivered?			
vii.	2.33.1.1. Viscosity. – Does it include the viscosity grade classification preceded by the letters "SAE" in accordance with SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification"?			

2.33.1.5. Documentation Requirements		**Yes**	**No**	**Comments**
viii.	2.33.1.2. Brand. – Does it include the name, brand, trademark, or trade name of the vehicle engine (motor) oil?			
ix.	2.33.1.3. Engine Service Category. – Does it include engine service category, or categories?			
x.	2.33.1.3.2. Inactive or Obsolete Service Categories. – If applicable, includes a cautionary statement in compliance with the latest version of SAE J183, Appendix A.			
xi.	Is the document retained at retail business for at least one year?			
b.	**Bill of Lading**			
i.	Does the seller provide a Bill of Lading?			
ii.	Is the date and time of sale included?			
iv.	Is the seller name and address included?			
v.	Is the buyer name and address included?			
vi.	Does it identify the quantity of bulk oil delivered?			
vii.	2.33.1.1. Viscosity. – Does it include the viscosity grade classification preceded by the letters "SAE" in accordance with SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification"?			
viii.	2.33.1.2. Brand. – Does it include the name, brand, trademark, or trade name of the vehicle engine (motor) oil?			
ix.	2.33.1.3. Engine Service Category. – Does it include the engine service category, or categories?			
x.	2.33.1.3.2. Inactive or Obsolete Service Categories. – If applicable, includes a cautionary statement in compliance with the latest version of SAE J183, Appendix A.			
xi.	Is the document retained at retail business for at least one year?			
c.	**Shipping paper or other documentation.**			
i.	Does the seller provide other shipping paper?			
ii.	Is the date and time of sale included?			
iv.	Is the seller name and address included?			
v.	Is the buyer name and address included?			
vi.	Does it identify the quantity of bulk oil delivered?			
vii.	2.33.1.1. Viscosity. – Does it include the viscosity grade classification preceded by the letters "SAE" in accordance with SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification"?			
viii.	2.33.1.2. Brand. – Does it include the name, brand, trademark, or trade name of the vehicle engine (motor) oil?			
ix.	2.33.1.3. Engine Service Category. – Does it include the engine service category, or categories?			
x.	2.33.1.3.2. Inactive or Obsolete Service Categories. – If applicable, includes a cautionary statement in compliance with the latest version of SAE J183, Appendix A.			

2.33.1.5. Documentation Requirements		**Yes**	**No**	**Comments**
xi.	Is the document retained at retail business for at least 1 year?			
xii.	Does the seller provide an invoice?			

3.13.2. Labeling of Recreational Motor Oil.

3.13.2.1. Viscosity. *– The label on each container of recreational motor oil shall contain the viscosity grade classification preceded by the letters "SAE" in accordance with the SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification."*

3.13.2.2. Intended Use. *– The label on each container of recreational motor oil shall contain a statement of its intended use in accordance with the latest version of SAE J300, "Engine Oil Viscosity Classification."*

3.13.2. Labeling of Recreational Motor Oil. **3.13.2.1. Viscosity.** –The label on each container of recreational motor oil shall contain the viscosity grade classification preceded by the letters "SAE" in accordance with the SAE International's latest version of SAE J300, "Engine Oil Viscosity Classification."		**Yes**	**No**	**Comments**
a.	Containers: Is the viscosity grade classification provided and is it preceded by the letters "SAE."			

3.13.2. Labeling of Recreational Motor Oil. **3.13.2.2. Intended Use.** – The label on each container of recreational motor oil shall contain a statement of its intended use in accordance with the latest version of SAE J300, "Engine Oil Viscosity Classification."		**Yes**	**No**	**Comments**
a.	Containers: Does the label contain a statement of its intended use?			

C. Payment for Samples

In most jurisdictions, the official is obligated to pay the retail value of the product if a fuel sample is taken from a place of business where it can be sold legally unless the sample is being collected pursuant to a search warrant, or the fuel's owner surrenders the sample at no cost.

PAYMENT RECEIPT **Agency Responsible for Engine Fuel Quality** **Address,** **City, State, Zip** **Telephone, E-mail, URL**		
Seller's Name:	**Address:**	**Date:**
Received $_____as payment for the fuel or oil samples described below taken for inspection purposes as provided for by Chapter xx-xx of the Code of the State of _____. _____ **Signature of Business Representative**		
Sample Taken:	**Official:**	

D. Taking Oil Samples

1. **Packaged Engine (Motor) Oil:** Motor oil is typically packaged in 946 mL (1 qt) and larger containers. Sample packages are usually taken at retail locations from a lot of containers offered for sale on the shelf. To obtain a sample of packaged motor oil, select one package from the lot and either purchase it or provide the seller with an evidence receipt. Apply a sample identity label (do not cover label information) to the package and document the business location, date, time of purchase, identity, and other information about the sample on an official report form, and document the chain-of-custody. Secure, protect, and ship or transfer to the quality laboratory.

2. **Nozzle Samples.**

   a. **Sample Container and Sample Size:** Use a clean sample container that has a secure cap. See the following table.

Suggested Container Types and Minimum Sample Sizes for Motor Oil

Product	Container Material				Minimum Sample Size
	Glass	Aluminum	Metal	FHDPB "Plastic"[1]	
Engine (motor) Oil – General	**YES**	**YES**	**YES**	**YES**	1 L

NOTE 1: *Fluorinated High-Density Polyethylene Bottles (FHDPB) are available in wide mouth sizes and are fluorinated inside and outside for improved barrier properties and reduced solvent absorption and penetration. Fluorination enhances long-term container performance and prevents or reduces permeation loss. Useful with most aggressive organic solvents, they are durable and puncture-resistant.*

b. Sample Collection

c. Identifying Samples for Traceability: The following information illustrates the type of information typically collected for an oil sample. It is acceptable to either permanently mark the sample container with a unique identifying number or to apply a label to the container with a unique number. An Oil Sample Data Sheet should be prepared and included with the sample in a shipping container or sample case. This information can also be collected directly in a database or entered on a data sheet. Regardless of the system used, the following is a compilation of the information usually collected for an oil sample.

Examples of Entries on an Oil Sample Data Sheet		
	Item	**Entry**
1.	Sample number/unique container identity	Enter the sample container's unique identifier number. Each sample must have a unique identifier such as a number or alpha numeric code so that its handling can be traceable and so that all collection reports and laboratory tests are linked to the original sample.
2.	Product Identification – Viscosity grade, Service Category	} Obtained from device label, tank marking, or bill of lading.
3.	Brand	
4.	Sampling location identity	Enter business name, identifier number (this may be assigned by the fuel regulatory agency), address of sample location, business mail address, agent name, telephone, fax, and email. This information may be used to immediately notify the seller to remove the oil from sale if the sample fails.
5.	Sampled lot	Amount of oil that the sample represents. Total liters or gallons in the source oil storage tank represented by the sample.
6.	Supplier(s) of oil	Enter the name of the supplier or suppliers of the oil in the source storage tank.
7.	Date of last oil delivery to storage tank.	Enter the day of the latest delivery of the oil into the storage tank from which the sample was taken.
8.	Sample Taken by	Name (or identifier number) of the official who took the sample.
9.	Source of sample	Identify the specific source of the sample (e.g., dispenser number, storage tank number or location, or license number of tank truck and compartment number).
10.	Date/Time sample collected	Enter the time of day, day, month and year indicating when the sample was collected.
11.	Sample Type	Nozzle or other collection method
12.	Notes/Safety Notice 	Enter weather conditions and any remarks necessary to accomplish the analysis of the sample. Safety warning label.
13.	Security Seal(s)	Enter the identification number of any security seal applied to a sample container or transport case.

Figure 24. Brand and Viscosity on a Dispenser.

Figure 25. Taking Oil Samples – Metal Cans.

Photo courtesy of North Carolina Department of Agriculture and Consumer Services.

d. Sampling

(1) Sample Taken from a Measuring Device that Dispenses a Single Product: Typically no flushing is required for these single product nozzle-hose combinations if they are protected from contamination. If the official is taking a sample from an oil dispenser covered with an accumulation of dirt and oil, take care to clean the nozzle to ensure that dirt and debris are not introduced to the container. It may be necessary to first run enough oil into another container to ensure the nozzle is dispensing uncontaminated oil.

When bulk storage is used, one aspect to look at is the accuracy and clarity of the markings of storage tanks and remote fill openings to avoid the possibility of cross-mixing or contamination. Storage conditions affect the shelf-life of most lubricants so officials should determine if the seller is aware of the manufacturer's recommendations. If no shelf-life guidance is provided and the lubricant is greater than two-years old, the seller should contact the manufacturer for guidance about the suitability of the oil for use. Most oils are not affected by normal storage temperatures but sometimes storage tanks can be located too near heat sources, which may create situations that cause oil additives to oxidize prematurely.

- Operate oil meters/fillers manually and do not use automatic pre-set delivery features when collecting oil samples.

- If the oil meter/filler control is equipped with a totalizing device, the official should record the product identity and the before and after readings on the sample collection report.

⚠ CAUTION

SKIN INJECTION HAZARD: Some oil delivery systems operate under high-pressure. Fluids spraying from dispenser valves, hose leaks, or ruptured components may send out spray that may pierce skin and cause serious injuries and long term health consequences (e.g., oil, chemicals and dirt can be injected under the skin). The official should wear personal protective equipment and, should an injury occur, he or she should seek immediate medical attention. The official should never point a dispenser valve at anyone or at any part of his or her body or put a hand over the end of a nozzle while opening or operating the flow valve regardless of its operating pressure.

i. The official may hold the sample container or place it on a solid level surface adjacent to the dispenser.

The official should then:

ii. Use a cotton rag to wipe and clean the parts of the nozzle that comes into contact with the sample container and oil sample.

iii. Ensure the dispenser is operational (e.g., air supply is turned on) and, if required, have the dispenser authorized.

iv. Place the nozzle/outlet in the sample container and fill it slowly. Continue until it is filled to the specified volume (or the dispenser indicates the quantity specified for the sample).

v. Seal the sample container and mark as required.

vi. Record the sample information on an official report and document the details needed to start the chain of custody process.

vii. Issue a Notice of Violation for any labeling violations found during the inspection. An example of a Notice of Violation is provided in Appendix C.

e. Protecting and Transporting the Sample

(1) Protecting Samples: The samples should be kept cool and be protected from ultraviolet light to prevent deterioration and mishandling. A shipping carton or hard-shell sample transport case similar to those used to protect fuel samples may be used.

(2) Transporting Samples: Transport the sample and related documentation to the quality laboratory in a timely manner in accordance with agency procedures. This is important because, after subsequent deliveries occur, the sample is no longer representative.

f. Documentation – Collecting Information: Throughout a visit, it is important that officials collect information about device labeling and other signage to document the identity and other claims made by a seller about the oil being sampled. It is good to record a brief description of actions and observations as well as recording any relevant information provided by the seller. Taking notes, photographs and keeping logs, provide permanent records of a sampling activity and facilitate enforcement.

g. Follow through actions: See **IX**. "**Respond to Test"** In the fuel sampling outline for guidance on how to respond to test results and initiating stop sale actions.

APPENDIX A. – MONTHLY SAFETY AND HEALTH EQUIPMENT CHECKLIST

Safety and Health Equipment Checklist

Notice: Reorder replacements immediately after they are used or damaged.

Date:		**Official:**		
	Item:	**Inspected** ✔	**Replace** ✖	**Comment:** • Condition? • What type or brand is needed and how many?
1.	Safety Clothing/Vest			
2.	Steel-Toed Shoes or Boots			
3.	Eye/Face Protection			
4.	Gloves			
5.	Respirator/Filters, Dust Mask			
6.	Eye-Wash Kit and Solution			
7.	Safety Flashlight/Batteries			
8.	Safety/Non-sparking Tools			
9.	Traffic Cones			
10.	Fire Extinguisher (recharge or replace immediately after use)			Expiration Date:
11.	First-Aid Kit			
12.	Safety Fuel Storage Can			
13.	Digital Camera (data card/battery)			
14.	Oil Spill Kit – (absorbent , wipes)			
15.	Lint Free Wiping Cloths			
16.	Vehicle Emergency Triangles			
17.	Rain Suit/Weather Clothing			
18.	Hardhat			
19.				
20.				
21.				
22.				
23.				

Safety and Health Equipment Checklist

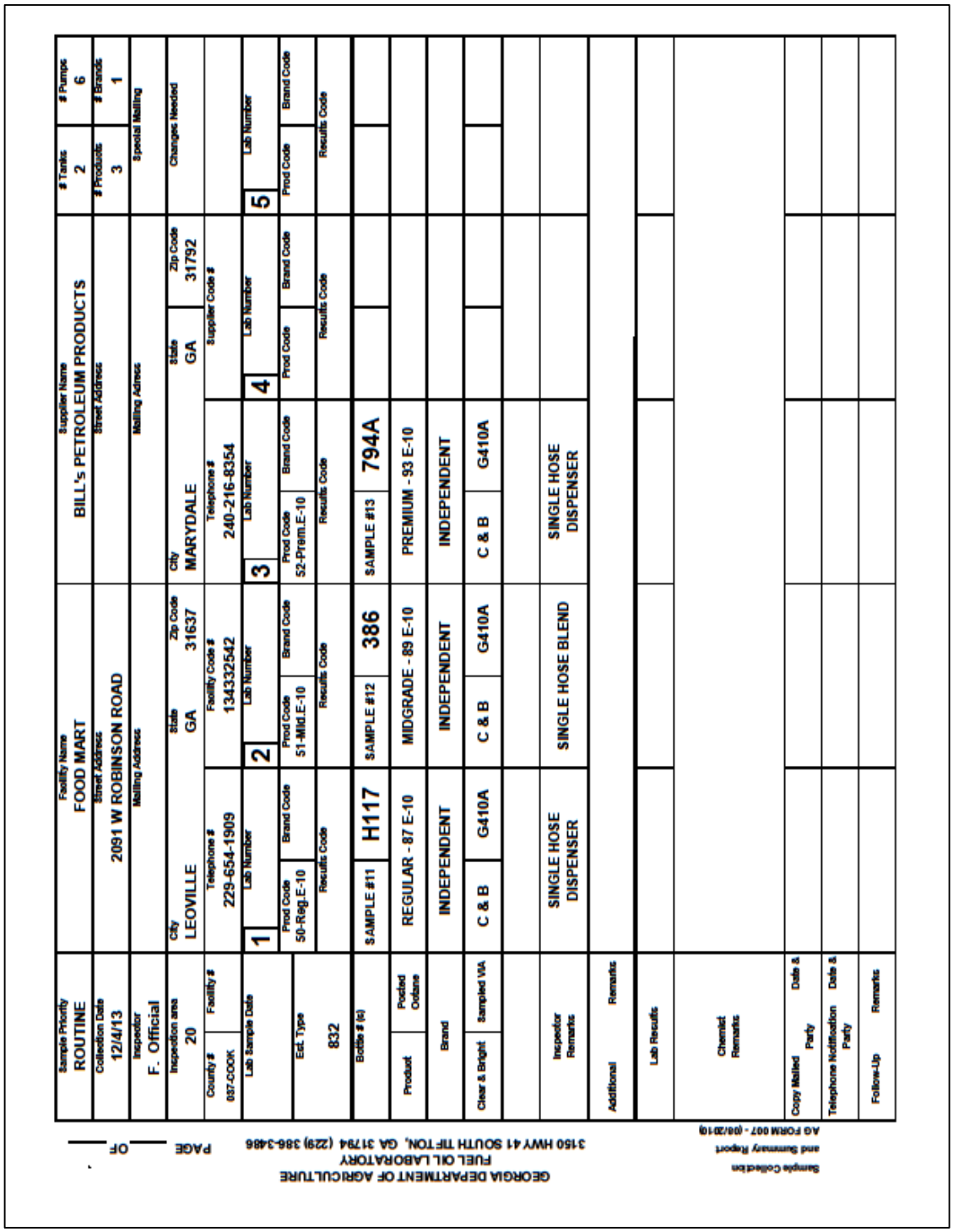
Notice: Reorder replacements immediately after they are used or damaged.

24.	Other Equipment Needed:			
25.	Other Supplies Needed:			

Questions:

- Does the equipment fit properly and is it clean, sanitary and serviceable?
- Are there rips, tears, or cuts that reduce usability of the item?
- Does it require regular replacement or recharging? Is it stored properly and is it easily accessible?
- Have you been trained in proper use?
- Have you read the Safety Data Sheets (SDSs) for fuel products within the last 180 days?

APPENDIX B. – EXAMPLES OF FUEL SAMPLING AND CHAIN-OF-CUSTODY REPORTS



GEORGIA DEPARTMENT OF AGRICULTURE
FUEL OIL LABORATORY
3150 HWY 41 SOUTH TIFTON, GA 31794 (229) 386-3486

PAGE ___ OF ___

Sample Priority: ROUTINE
Collection Date: 12/4/13
Inspector: F. Official
Inspection area: 20
County #: 037-COOK
Facility #:
Lab Sample Date:
Est. Type: 832
Bottle # (s):
Product:
Pooled Octane:
Brand:
Clear & Bright:
Sampled Via:
Inspector Remarks:
Additional Remarks:
Lab Results:
Chemist Remarks:
Copy Mailed Party: Date &
Telephone Notification Party: Date &
Follow-Up: Remarks:

Facility Name: FOOD MART
Street Address: 2091 W ROBINSON ROAD
Mailing Address:
City: LEOVILLE
State: GA
Zip Code: 31637
Telephone #: 229-654-1909
Facility Code #: 134332542

	1	2	3	4	5
Lab Number					
Prod Code	50-Reg.E-10	51-Mid.E-10	52-Prem.E-10		
Brand Code					
Results Code					
SAMPLE #	#11	#12	#13		
	H117	386	794A		
	REGULAR - 87 E-10	MIDGRADE - 89 E-10	PREMIUM - 93 E-10		
	INDEPENDENT	INDEPENDENT	INDEPENDENT		
	C & B	C & B	C & B		
	G410A	G410A	G410A		
	SINGLE HOSE DISPENSER	SINGLE HOSE BLEND	SINGLE HOSE DISPENSER		

Supplier Name: BILL's PETROLEUM PRODUCTS
Street Address:
Mailing Address:
City: MARYDALE
State: GA
Zip Code: 31792
Telephone #: 240-216-8354
Supplier Code #:

	4	5
Lab Number		
Prod Code		
Brand Code		
Results Code		

Tanks: 2
Products: 3
Special Mailing
Changes Needed
Pumps: 6
Brands: 1

	5
Lab Number	
Prod Code	
Brand Code	
Results Code	

Sample Collection and Summary Report
AG FORM 007 - (08/30-10)

COLORADO DEPARTMENT OF LABOR AND EMPLOYMENT
DIVISION OF OIL AND PUBLIC SAFETY
CHAIN OF CUSTODY (COC)

Facility ID: _____
Tank ID: _____

Site Name: _____ **Inspector:** _____

Site Address: _____ **Phone Number:** (___) ___-____

_____ **Priority:** **Normal** **Rush**

Contact: _____ **(CIRCLE PRIORITY RATING)**

Telephone #

FOR LAB USE ONLY

Sample Containers Damaged:
Y___ N___

Sample container filled Appropriately: Y___ N___

ORI – OGL
OCP – OTA
Routine Retail
Routine Bulk
Non Retail
Refinery
Pipeline
CDPHE
(Circle Sample Type & Loc.)

Sample Number:	Date Collected and Time	Pump Number	% Mix on Label ETOH - MTBE	Sample Matrix: Product: Unleaded	Unleaded+	Premium	Diesel	Bio-Diesel	E-85	Kerosene	Other (specify)	Environmental: Soil	Water	Other (specify)	Oxy Fuel	Analysis Requested: 8260	8015	8270	Other (specify)	Comments: (include posted Octane #)
Relinquished by:							Date and time:							Received by:					Date and Time:	
Relinquished by:							Date and time:							Received by:					Date and Time:	

Page ____ of ____

MISSOURI DEPARTMENT OF AGRICULTURE
DIVISION OF WEIGHTS AND MEASURES
MOTOR FUEL QUALITY INSPECTION
TELEPHONE (573) 751-2922 FAX: (573) 751-8307

**

TYPE OF INSPECTION
☐ ROUTINE
☐ FOLLOW UP
☐ COMPLAINT
☐ OFFICE REQUEST
☐ OTHER

FACILITY TYPE:
☐ Service Station ☐ Marina
☐ Key/Card Attended ☐ Airport
☐ Key/Card Unattended ☐ Other
☐ Bulk Plant

FOR OFFICE USE ONLY
DATE RECEIVED
SEALS INTACT
RECEIVED BY

ID NO.	STATUS	SALES TAX NO.	DNR UST NO.	LATITUDE	LONGITUDE	NOTES
BUSINESS NAME			BUSINESS CONTACT		TITLE	SUPPLIER
ADDRESS			BUSINESS NAME			CITY / TELEPHONE
CITY / STATE / ZIP CODE			ADDRESS			SUPPLIER
COUNTY			CITY		STATE / ZIP CODE	CITY / TELEPHONE
TELEPHONE / FAX			TELEPHONE	FAX		BRAND
EMAIL			EMAIL			WEATHER CONDITIONS

LAB NUMBER	CONTAINER NUMBERS	PROD. CODE	NAME OF ADV. PRODUCT	FILTERS NO.	FILTERS SIZE	ALC/BIO LABELING NO	ALC/BIO LABELING ETH	ALC/BIO LABELING BIO	POSTED OCTANE	TANK OR PUMP NO.	GALLONS ON HAND	WATER/STORAGE AST	WATER/STORAGE UST	LAST DELIVERY	PRICE PER GALLON	QTY. PURGED GAL.	QTY. PURGED $	SAMPLE QTY. TAKEN	SAMPLE QTY. $

REMARKS

☐ STOP SALE
☐ NOTICE OF VIOLATION

LAB NOTES

INSPECTOR SIGNATURE | INSPECTION DATE | TIME | REPORT RECEIPT ACKNOWLEDGMENT

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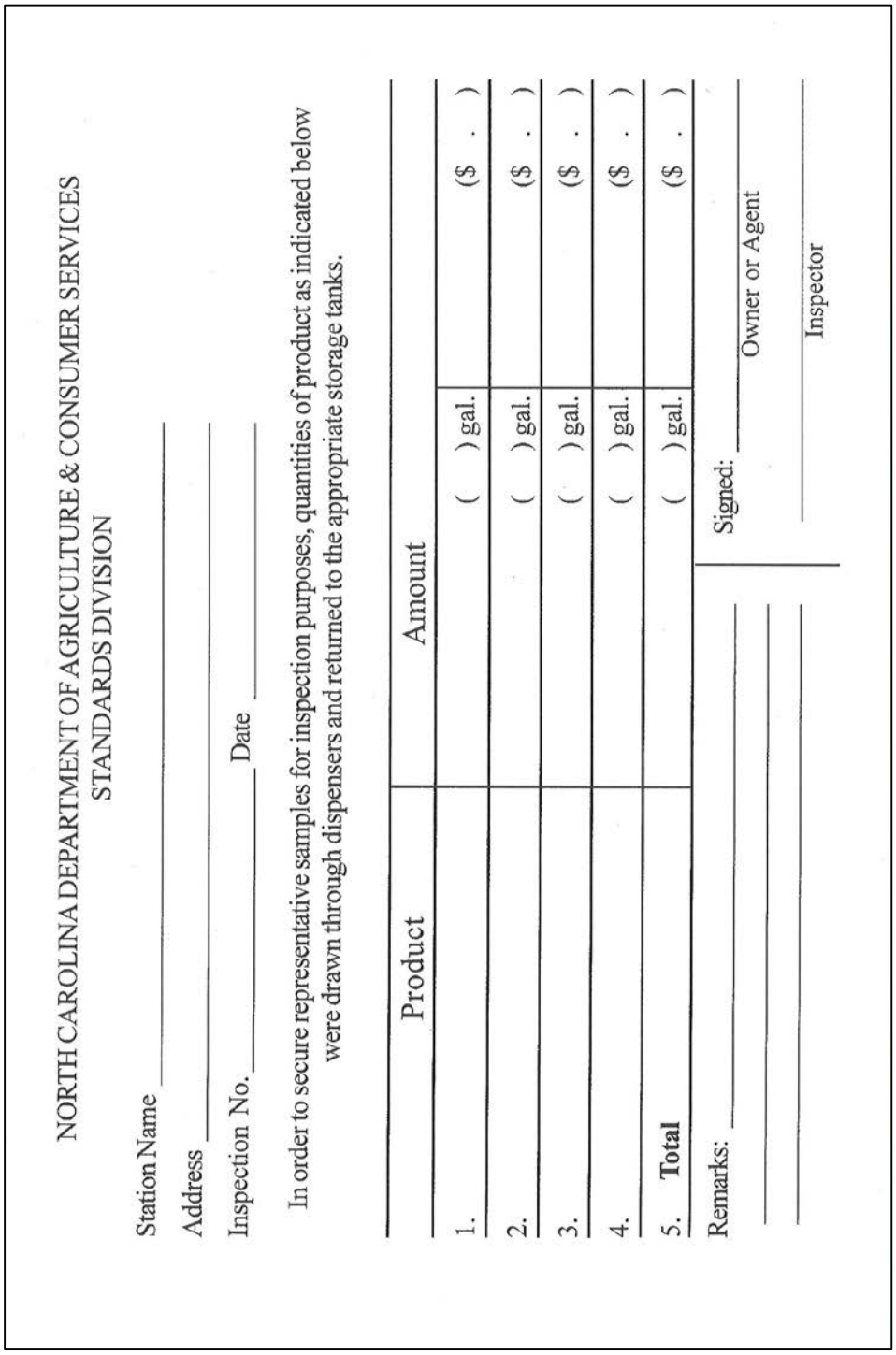
APPENDIX C. - EXAMPLES OF NOTICE OF VIOLATION AND STOP SALE REPORTS



NORTH CAROLINA DEPARTMENT OF AGRICULTURE & CONSUMER SERVICES
STANDARDS DIVISION

Station Name _____

Address _____

Inspection No. _____ Date _____

In order to secure representative samples for inspection purposes, quantities of product as indicated below were drawn through dispensers and returned to the appropriate storage tanks.

Product	Amount	
1. _____	( ) gal.	($.)
2. _____	( ) gal.	($.)
3. _____	( ) gal.	($.)
4. _____	( ) gal.	($.)
5. **Total**	( ) gal.	($.)

Remarks: _____

Signed: _____ Owner or Agent

_____

_____ Inspector

STATE OF MISSOURI
DEPARTMENT OF AGRICULTURE
FUEL QUALITY PROGRAM

NOTICE OF VIOLATION

INSTRUCTIONS:

1) CORRECT INDICATED PROBLEM

2) SIGN REPORT BELOW

3) MAIL REPORT TO:
MO DEPARTMENT OF AGRICULTURE
FUEL QUALITY PROGRAM
P.O. BOX 630
JEFFERSON CITY, MO 65102

4) QUESTIONS?
CALL: 573-751-2922

STATION NAME	COUNTY	I.D. NUMBER

ADDRESS, CITY, STATE, ZIP

The following fuel quality and labeling violations were found. Missouri state law sections 414.012 and 414.152 RSMo. Code of State Regulations, 2 CSR 90-30.040 through 90-30.110.

☐ 1. Products containing ethanol must have a suitable filter of 10 microns or less installed in the meter inlet or discharging line and immediately adjacent to the meter.

☐ 2. Dispenser(s) shall identify name of product being sold. (Dispenser No. _____)

☐ 3. Dispenser(s) shall identify octane rating of product in accordance with FTC Automotive Fuel Ratings, Certification and Posting Rule. (Dispenser No._____)

☐ 4. Dispenser(s) shall display grade of product being sold. (Dispenser No. _____)
- ☐ Aviation gasoline, grade 80, grade 100, or grade 100LL. ☐ Aviation turbine fuel, Jet A, Jet A-1, or Jet B.
- ☐ Diesel fuel, No. 1-D or No. 2-D.
- ☐ Kerosene, No. 1-K, or No. 2-K. Grade No. 2-K requires a warning label stating "WARNING - NOT SUITABLE FOR USE IN UNVENTED HEATERS REQUIRING NO. 1-K" in letters 1/2" high and 1/16" stroke.

☐ 5. Water in storage tank shall not exceed (1") one inch. The _____ inches in _____ storage shall be removed within 48 hours.

☐ 6. All storage tanks shall be clearly posted with the name of the product they contain.

☐ 7. All fill connections shall be identified by the product for which they contain.

☐ 8. Blending dispenser(s) do not comply with the Federal Trade Commission's Octane Posting Rule. These dispensers blend _____ octane premium with 87 octane regular unleaded to obtain a midgrade product(s). Blenders must be set at no less than _____ % premium, and no more than _____ % regular unleaded to obtain an _____ octane blend. The blend ratios on all dispensers must be changed immediately to comply with state and federal law.

☐ 9. Blend valves shall be sealed & tagged with percentage of each blended product.

☐ 10. Spill basins shall have:
- ☐ proper fitting & sealing caps ☐ broken caps replaced ☐ seals replaced
- ☐ debris removed from spill basins ☐ functional drains ☐ water removed from spill basins

☐ 11. All totalizers shall be functional. (Dispenser No._____)

☐ 12. Diesel nozzle spout end should be 0.930 inch or larger in diameter.

☐ 13. _____

☐ 14. _____

☐ 15. _____

☐ 16. _____

☐ 17. _____

☐ 18. _____

Corrections to be completed on or before, or as otherwise noted. MAIL FORM TO ADDRESS ABOVE. ▶ DATE

INSPECTOR	INSPECTION DATE	RECIPIENT'S SIGNATURE

I hereby declare all fuel quality and labeling violations have been corrected to comply with Missouri state laws.

SIGNATURE (OWNER, STORE MGR, CERTIFIED REPAIRMAN, ETC.)	DATE OF CORRECTION

PRINT NAME AND TITLE

SUBMITTING FALSE OR MISLEADING INFORMATION IS A VIOLATION OF MISSOURI STATE LAW SECTION 575.060 RSMo.

MO 350-1075N (12-04) **DISTRIBUTION: WHITE** - OFFICE **CANARY** - INSPECTED PREMISES

MISSOURI DEPARTMENT OF AGRICULTURE
DIVISION OF WEIGHTS AND MEASURES
TELEPHONE: (573) 751-2922 FAX: (573) 751-8307

STOP SALE NOTICE

STATION NAME		ID NUMBER	DATE	TIME
ADDRESS		CITY		
STATE	ZIP	COUNTY	TELEPHONE NUMBER	

You are hereby notified to immediately stop the sale of the product(s) listed below.

PRODUCT AND GRADE	PUMP, TANK NUMBER OR OTHER I.D.	TOTALIZER READINGS	QUANTITY	WIRE SEALED

REASON FOR STOP SALE

INSTRUCTIONS

SIGNATURE OF INSPECTOR	RECEIPT OF NOTICE ACKNOWLEDGED BY OWNER OR OPERATOR

WARNING: Disposal or removal of any rejected product contrary to law is prohibited. RMSo 414.141

MO 350-0968N (10-04)

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