

CHAPTER 3

PETROLEUM QUALITY

Section I. Petroleum Inspection Procedures

GENERAL

Providing quality fuel requires inspection at the point of purchase, monitoring quality during storage, and ensuring quality while distributing fuel to users. A series of inspection procedures, laboratories, and testing kits are an integral part of Army doctrine and force structure. These procedures ensure that the petroleum products used by the US Army are of the highest quality, meet the required performance standards, and can be used for their intended purpose. Inspecting and testing are necessary to ensure that only acceptable products are offered to the government by the contractor. Laboratory technicians must be aware of the need for painstaking and conscientious work to preserve life and property. These petroleum inspection procedures are divided into three distinct areas: quality control, quality assurance, and quality surveillance.

QUALITY CONTROL

QC is the inspection procedure performed by refinery personnel to monitor the production of a particular petroleum product. QC, as distinguished from QS, involves the manufacturer's inspection of the handling, step-by-step processing, and finishing of materials. It also involves the final inspection and testing of end products to ensure that contract materials are acceptable. As the US government does not currently operate any refineries, an in-

depth discussion of QC procedures is not included in this FM.

QUALITY ASSURANCE

Military petroleum products are usually procured under federal or military specifications. QA is a contract administration function performed by the Government in determining whether contractors fulfill contract requirements and specifications of petroleum products and related services. QA ends and QS begins when the QAR accepts the product. Acceptance of the product represents the transfer of ownership from contractor to Government.

QUALITY SURVEILLANCE

QS includes all the measures used to determine and maintain the quality of government-owned petroleum products to the degree necessary to ensure that such products are suitable for their intended use. The purpose of QS is to ensure that products meet quality standards after acceptance from the contractor and still meet quality standards after transfer between government agencies or issue to users. QS is complete when the product is consumed or transferred to another agency or service. Until transfer or consumption, it is the responsibility of the owning service or agency to ensure product quality.

Section II. Quality Assurance

QUALITY ASSURANCE PROGRAM ADMINISTRATORS

The QA program ensures that the military services obtain products that conform to government specifications. The agencies and personnel responsible for QA are described below.

DLA. The DLA administers the QA program. In CONUS, the DLA delegates procurement inspection and acceptance responsibilities to the DCMC. OCONUS activities are delegated to the DCMCI. The DCMC subdivides procurement responsibilities into DFRs to aid in administration. AR 715-27 and DOD Manual 4140.25-M describe the policies and procedures used by Army activities and personnel for procurement inspection worldwide.

Contractor. The contractor is responsible for controlling the quality of his products during manufacture and storage so he can provide the government only those products that meet specifications IAW DLAM 4155.1 (AR 715-27). He must maintain an effective QC program, that covers testing, sampling, blending, packaging, sealing, marking, and loading of petroleum products. The contractor must perform all inspection tests on finished products required by the contract and specifications and maintain a satisfactory system of records and reports.

QAR. Government personnel responsible for administering QA at the contractor sites are known as QARs. QAR responsibilities are described below.

- Administer an IQUE of the contractor facilities to ensure that the contractor has in effect a QC system.
- Determine minimum verification testing acceptable for quality products.
- Verify that required tests are performed for compliance with specifications.

- Obtain quality data from the contractor to determine products as acceptable.

QAR RESPONSIBILITIES

The QAR's functional responsibility is fulfilled when the product is accepted and ownership transfers to the government. At this time, QS begins. The QAR is usually assigned responsibility for product inspection at the field inspection office in which the product is manufactured or procured. However, if requested, the QAR may provide assistance to areas outside of their jurisdiction. In some cases, it may be to the government's advantage to have the inspection performed by an activity other than the assigned one. In this case, requesting personnel should submit rationale for reassignment action to the appropriate DCMCI agency.

QUALITY ASSURANCE INSPECTIONS AND ACCEPTANCE

Standards and methods used in performing procurement QA inspection on petroleum items are developed, established, and distributed by the DCMCI. The procurement QA inspection ensures that the military services obtain products that conform to government specifications. QA inspections for acceptance can be performed at the FOB origin or FOB destination.

FOB Origin. When specified as a FOB origin contract, QA inspection is performed at the FOB origin. The product should receive a type A test IAW AR 715-27 and MIL-HDBK-200. If the product is in compliance with all the terms of the contract, it is accepted by the government representative. When products are accepted at origin or any point other than destination, they are not reinspected at their destination for QA compliance. When the product reaches its destination, receiving locations may perform general examinations to determine that the supplies are in conformity with

the contract. They should check the type and kind of product, whether or not it is contaminated, or the volumes are correct. If the product appears to be other than that ordered, or if samples fail to meet requirements, further testing is performed and the receiving activity will contact the DCMCI to request inspection assistance and guidance.

FOB Destination. When specified as a FOB destination contract, QA inspection is performed at the FOB destination to determine compliance with the contract. Title passes to the government at the receiving activity when the product is accepted. Acceptance is based on a determination of quantity and verification of enough quality characteristics, as prescribed by MIL-HDBK-200

QUALITY ASSURANCE INSPECTION OF CONTRACTOR FACILITIES

An important aspect of QA is the inspection of contractor facilities and equipment used to manufacture and transport petroleum products.

Policy. It is DLA policy to accept only those supplies and services that fully conform, in all respects, to the contract requirements. The offer of nonconforming supplies or services to the government for acceptance should be the exception, and contractors should be discouraged from submitting requests for waivers. When a waiver request occurs, the QAR will initially review and evaluate it and forward it to the field administration office. The field administration office will then contact the appropriate office given in DLAM 4155.1 (AR 715-27). When an exception to a specification is included in the original contract or incorporated as a change, that exception will be clearly indicated on DD Form 250 series document, (Material Inspection and Receiving Reports).

Preaward Survey. The QAR may make a preaward survey of the contractor's facilities or may assist in making the survey. The purpose of the survey is to ensure that the contractor has the

necessary facilities and the uncommitted capability to produce materials of the quality and in the quantities needed to fulfill the government contract. The contractor will be expected to include a quality program to ensure products are of acceptable standards. If inadequacies are evident during surveillance of contractor facilities, the inspector will record those instances of noncompliance and request corrective actions IAW DLAM 8200.2.

QUALITY ASSURANCE INSPECTIONS OF STORAGE AND TRANSFER FACILITIES

The QAR ensures that refining or terminal tanks used to store contractor-furnished or government-owned products are adequate. Consideration is given to the following:

- The amount and extent of corrosion and other contaminants present in the facilities..
- Provisions for control of water bottoms.
- Location and arrangement of suction lines and water drawoffs.
- Provisions for QC of government-owned products.
- Availability of tank calibration tables.

Transfer Lines. The QAR verifies that acceptable products designated for shipment or transfer are moved through completely segregated systems. If this is not possible, the system must be properly protected by blind or blank flanges; or open bleeder valves between double line valves in transfer lines and manifolds. Common transfer lines (non-segregated) should be displaced with the product being shipped or transferred.

Government Furnished Equipment. If the government furnishes transportation equipment, the title for the product passes to the government when the product passes through the loading orifice of the equipment. Therefore, the contractor is not responsible if the product is contaminated by unsuitable transportation equipment unless the extent of the contamination clearly indicates that contractor personnel failed to inspect the interior

of the equipment. See QA inspection of tankers and barges for inspection procedures.

Commercial Pipelines. Contractor-owned products for government use may be moved in commercial pipelines. When using this arrangement, the supply contract states that the product will be inspected at origin and accepted at destination. The product may also be tested at destination if it can be received in terminal tankage before delivery to the government.

QUALITY ASSURANCE INSPECTIONS OF TANKERS AND BARGES

The QAR must personally inspect the tanker or barge before it is loaded to make sure it is in an acceptable condition to receive cargo. The contractor is not responsible for the product once it has passed the outboard hose connections of the vessel. When a tanker or barge is scheduled for a multiple port loading, the QAR at the first loading port inspects all cargo tanks, if possible. For the tanker or barge to pass the inspection, all the cargo tanks must be approved for loading. Representatives at subsequent loading points are advised of the results of the inspection at the first loading port. Tanks not inspected at the first loading port should be inspected at a subsequent port and accepted or rejected. Tanks previously inspected and accepted, but not loaded, may be rejected at a subsequent port if the conditions appear to warrant this action. Regardless of pressure or protests, representatives must not expedite vessel movements at the expense of quality or quantity determinations. The following actions are required during inspections of tankers and barges..

- The QAR may require that samples of rust be taken from selected cargo tanks and tested with the product being loaded, or a similar solvent. This test is performed to determine the effect upon the corrosiveness and gum characteristics. The rust is pulverized and added to a sample of the product to be loaded, or a similar solvent, in proportions of 1 gram of rust per 100 milliliters of the liquid. After the mixture has been shaken vigor-

ously for at least 1 minute, it is filtered free of rust and examined for color, corrosion, and residue, as required by the product specifications.

- Loading plans are reviewed to ensure they are workable. Consideration must be given to bulkheads, lines, tank capacities, ship's trim, and other factors. If cargoes are split, the QAR makes sure the vessel is structurally suitable for handling two or more grades of product simultaneously without contamination. The representative also ensures that the bulkheads are secure and that the vessel has double valve separation or line blanks.

QUALITY ASSURANCE INSPECTIONS OF TANK CARS AND TANK VEHICLES

The QAR ensures that the contractor performs specific inspections of tank cars and tank vehicles. The contractor must inspect all tank cars and tank vehicles before loading to ensure they are suitable to receive and transport the product. Any tank car or tank vehicle that is not acceptable for loading is rejected. Any tank car or tank truck, received by the contractor from a military activity, which contains a product in excess of 200 gallons, will be reported by the QAR to the responsible supply officer. The following actions are required during inspections of tank cars and tank vehicles.

- The contractor must sample and test any residue remaining in the conveyance from a previous haul to determine whether a new product can be loaded on top of the residue. If the residue cannot be identified, the conveyance is rejected. The incompatible residue must be drained and the conveyance flushed or cleaned as needed.

- The contractor must maintain filtering devices in tank cars, tank vehicles, and small container filling lines. He must make periodic inspections of this equipment, keep records of the inspections, and make needed repairs or replacements to the equipment, when necessary.

- The contractor must check loaded conveyances for water and sediment. Any free water must be removed before shipment, except for jet fuels and lubricating oils, in which case the conveyance will be rejected.

- The contractor must ensure the product in the discharge manifold of a loaded tank vehicle is the same grade and color as that loaded.
- The contractor must perform applicable tests on representative samples taken from each loaded conveyance to ensure the product has not been adversely affected.
- The contractor is responsible for maintaining records of test results and retaining samples.
- The contractor must seal the domes of the tank cars and all openings of the tank vehicles, with numbered seals, after the conveyance has been loaded.

QUALITY ASSURANCE MEASUREMENTS AND DOCUMENTATION

The QAR ensures that the contractor performs all quantity measurements according to the ASTM methods listed in the contract. Volume correction to gallons at 60F is required for:

- All product volume measured in storage tanks, prior to receipt.
- Residual fuels and lubricating oils measured in tank trucks. Residual fuels for this purpose are products with a viscosity equal to or greater than a regular (not light) No. 4 fuel oil (ASTM D 396).
- All other volumes of fuel and fuel oil deliveries that equal or exceed 3,500 gallons, unless not required per contract provision.

Products Shipped By Tanker or Barge. The quantities of products shipped from or received by a tanker or barge, for FOB origin, shall be determined (at contractor's option) by shore tank or shipping tank measurements or calibrated meters. A government representative may be present to witness measurement. For FOB destination, quantities shall be determined (at Government's option) on basis of receiving (shore) tank measurements or calibrated meter if the facility is so equipped. A

contractor representative may be present to witness the delivery measurement.

Products Shipped By Tank Car. Quantities shipped by tank car are determined from rated shell capacity or net weight of contents; quantities shipped by tank vehicle are determined from vehicle shell calibration tables, net weight of contents, or calibrated meters.

Product Shipped by Pipeline. Quantities moved by pipeline are determined by use of calibrated meters or by tank gages at the point of origin, unless otherwise provided by contract.

Products in Contractor Terminals. Quantities of government-owned products in contractor terminals are inventoried and reported as required by contract. Quantities of government-owned products in commercial pipelines are reported separately. Inventories are witnessed and certified by the QAR.

Losses. The QAR assists departmental activities in investigating the loss of government-owned products. Losses connected with shipping are reported on SF 361 (Discrepancy in Shipment Report). Losses connected with government-owned products in the custody of contractors or in the custody of the government are reported on DA Form 4697 (Department of the Army Report Survey).

Inspection Documentation. The QAR ensures that the contractor has prepared the required inspection documents before the QAR completes it. These documents include DD Form 250 (Material Inspection and Receiving Report) and DD Form 250-1 (Tanker/Barge Material Inspection and Receiving Report). DD Form 250 is used to document receipts of contractor shipments of DLA-owned bulk fuel, by over-land transport or pipeline to DFSPs. DD Form 250-1 is used to document shipments and receipts of bulk fuel

transported by ocean tankers and barges. Samples

of these forms are included in Chapter 10.

Section III. Quality Surveillance

QUALITY SURVEILLANCE PROGRAM ADMINISTRATORS

QS begins when petroleum products are accepted by the government. It applies to all petroleum-related products, and is the responsibility of all personnel who handle them. Testing products in the supply system is necessary to confirm that petroleum products are satisfactory for their intended use. The Quality Surveillance Handbook for Fuels, Lubricants, and Related Products (MIL-HDBK-200) sets forth procedures and requirements used by the military departments and the DLA. Agencies and personnel responsible for QS programs and procedures are described below.

- The USAPC, New Cumberland Army Depot, New Cumberland, PA, is responsible for developing, coordinating, and monitoring CONUS QS programs as described in AR 710-2. This activity is under the staff supervision of the AMC and the operational control of the TROSCOM. Besides the USAPC laboratories, other laboratories that have a limited quality surveillance capability are located at Fort Hood, Tx; Fort Lee, VA; Fort Campbell, KY; Fort Bragg, NC; Fort Stewart and Fort Benning, GA; and Fort Rucker, AL. Upon request, USAPC will provide assistance to overseas commanders in coordinating QS and technical assistance programs

- In the theater, the JPO is responsible for ensuring that an adequate QS program is maintained within major commands. In a large theater, there may be requirements for a SAPO or offices to assist the JPO in monitoring the petroleum system in the areas of responsibility. Overseas laboratory facilities will be provided and maintained for

testing fuels and lubricants per joint regulation AR 700-36 (AFR 74-16, NASUPINST 4730.1D, MCO P4760.1A, DLAR 4155.29).

- Ultimately, QS is the responsibility of every agency in the supply system that transports, stores, distributes, or issues petroleum products. Owning agencies are responsible for establishing and maintaining a QS program as prescribed by MIL-HDBK-200. The organization's commander must ensure that facilities are available and adequate to test the various petroleum products. He is also responsible for informing the JPO or SAPO, DFR, or DFSC when any petroleum product, except pipeline interface product, does not meet deterioration limits.

PETROLEUM QUALITY SURVEILLANCE AND TECHNICAL ASSISTANCE PROGRAM

The Petroleum Quality Surveillance and Technical Assistance Program consists of multiple programs designed to assist commanders in the receipt, storage, and issue of quality petroleum products. CONUS commanders will provide necessary information, equipment, and personnel available within their resources to assist the coordinating USAPC in accomplishing the requirements of these programs. The total program consists of the following elements listed below.

- Quality Surveillance Program.
- Petroleum Technical Assistance Program.
- Operational Surveillance Program.
- Air Pollution Abatement Program.
- Petroleum Laboratory Certification.
- Engineering Technical Review Program.

- Underground Storage Tank Program.

Quality Surveillance Program. The Quality Surveillance Program is conducted to ensure the quality of petroleum products supplied from commercial sources directly to US Army, ARNG, and USAR units, and maintain the quality of Army-owned petroleum. It will be conducted on all bulk petroleum, and packaged products at the frequencies established in MIL-HDBK-200. It can be conducted more frequently, if desired, for closer surveillance or when directed by USAPC. It will be established worldwide for both bulk and packaged products. Samples are taken from delivery conveyances, and commercial product sources, IAW DA PAM 710-2-1, for each contract, (including local purchases) totaling more than 10,000 gallons annually.

- In CONUS, USAPC will establish a CONUS sampling schedule. Although the USAPC is not responsible for QA, petroleum products are tested upon receipt from the contractor to establish a base line for future testing. Upon request, the USAPC will provide to the submitting activity detailed sampling instruction, advise the submitting activity of the test results, and determine if additional QS samples need testing.

- In OCONUS, commanders will establish a sampling schedule at the frequencies established in MIL-HDBK-200 or more frequently, if desired, under the guidance of the JPO.

Petroleum Technical Assistance Program. The petroleum technical assistance program is conducted in conjunction with MACOMs and administered by the USAPC to provide technical assistance to commanders in solving petroleum problems. Commanders may request help from a technical assistance team to resolve problems on receiving, storage, handling, usage, QS, supply, and distribution of petroleum products. Commanders may also obtain assistance with the design, construction, maintenance, and repair of petroleum facilities and dispensing equipment. The Technical Assistance Program is conducted in CONUS by USAPC. Upon request, USAPC will provide assistance to overseas commands.

Operational Surveillance Program. The operational surveillance program is designed to provide essential QS services to commanders of US Army and National Guard installations as well as Army Reserve units. It ensures delivery of acceptable products for use in military equipment by applying proper handling and control measures. It enables the collection and reuse of products to the maximum extent possible.

Air Pollution Abatement Program. The APAP provides a testing service to CONUS commanders for compliance with air pollution abatement standards established by law and implemented by AR 200-1.

Petroleum Laboratory Certification. All TDA and TOE petroleum testing laboratories must be certified. Certification will include a review of facilities, equipment, methods, and personnel qualifications. The USAPC is responsible for certifying all CONUS-based labs and for providing the personnel necessary to certify OCONUS laboratory facilities. Laboratories shall not perform testing for the purposes of determining suitability or disposition of petroleum products unless they are certified.

Engineer Technical Review Program. Plans for new construction, modifications, or upgrading of petroleum facilities are submitted to the USAPC for review or technical assistance. All facilities must meet all the requirements of applicable regulations and safety considerations.

Underground Storage Tank Program. This program establishes underground storage tank standards as required by law. The UST program applies to all CONUS Army and ARNG installations and USAR units that operate underground storage tanks. OCONUS units must comply with substantive requirements of federal regulations for USTs, plus the more stringent of Army or host nation requirements.

CORRELATION PROGRAMS

In addition to the Quality Surveillance and Technical Assistance Program, correlation programs exist to provide efficiency checks on certified laboratory facilities. Samples from the same cut of fuel are sent to all laboratories for testing. The results obtained from each laboratory are tabulated. Individual laboratory test results that deviate from the majority can be an indicator that the testing facility and/or equipment is substandard or personnel are not adequately trained. Results are reported to the laboratory with guidance for corrective action. Specific guidance on the correlation program is found in the appropriate command's instructions that cover POL. The USAPC administers the CONUS correlation programs. Theater-wide correlation programs are usually administered by the JPO.

QUALITY SURVEILLANCE DURING STORAGE, LOADING AND UNLOADING OPERATIONS

The petroleum laboratory technician, assigned to a base, mobile, or airmobile laboratory, provides laboratory testing support to surrounding units by performing prescribed tests on petroleum samples submitted IAW MIL-HDBK-200. He also provides laboratory testing on any samples submitted of questionable quality. The test results are documented and provided to the supported units with recommendations, when necessary. They perform the technical evaluation necessary for QS. The majority of information contained in this FM addresses the duties and responsibilities associated with the operation and maintenance of a base, mobile or airmobile laboratory. However, the QAR implements QS in petroleum storage and distribution operations. Minimum procedures required for proper quality surveillance of storage operations are discussed below

QUALITY SURVEILLANCE DURING STORAGE OPERATIONS

QS of storage operations requires the following procedures

- Store only one kind of fuel in a tank to maintain fuel quality. If it is necessary to store another type of fuel in a tank, the tank must be cleaned before pumping in the new fuel.
- Inspect storage tanks IAW MIL-STD-457. Establish a card file to record the inspection results and establish tank cleaning schedules.
- Segregate products and grades in separate systems when possible and identify lines and facilities as prescribed in CFR, Title 29-Labor. Protect the product by using blind or blank flanges or open bleeder valves between double line valves, or by removing a section of pipe. Segregation by a single valve is not sufficient.
- Consolidate on-specification stocks. This will keep storage tanks filled for shipments or issues and keep other tanks empty for receipt of new products. It will also reduce breathing and evaporation losses, reduce the number of tank switches in batching operations, and allow necessary time

for settling and testing of new stocks before using.

- Receive on-specification products into partly filled tanks if necessary, but do not add new stocks of doubtful quality. Be sure that the fresh product received into a partly filled tank is the same product and of equal or better quality than the old product.
- Refer to MIL-HDBK-200 for the minimum settling time requirements for petroleum products before using.
- Bulk fuel tanks should be drained of water after each product receipt and at a minimum of weekly, thereafter. Do not maintain water bottoms unless specifically authorized by the appropriate technical authority.
- Sample and test dormant stocks as prescribed in quality surveillance tables in MIL-HDBK-200.
- In instances where water bottoms cannot be completely removed, the water layer should be checked monthly. Check for the presence of hydrogen sulfide that sometimes forms as a result of bacterial action in sulfates present in the water. Hydrogen sulfide is corrosive and will cause the product to fail the copper corrosion requirement of the specification.

- Water checks should be made daily in issue tanks and weekly in static tanks or each time a tank is gaged. If water is found, it should be drained as soon as possible.

QUALITY SURVEILLANCE DURING TANKER AND BARGE LOADING OPERATIONS

A barge is any vessel with less than a 30,000 barrel capacity. A tanker is any vessel with over a 30,000 barrel capacity. Minimum procedures required for proper QS in tanker and barge loading operations are as follows.

- Tankers and barges should be used for one-product service when possible. Otherwise, a tanker or barge should be used for clean products or for black products only.
- Any vessel with greater than a 30,000 gallon capacity, is inspected by tank entry and prepared IAW AR 715-27, Table II (Guide for Preparation of Cargo Tanks).
- By referring to the ship's log, the government representative must verify that minimum procedures listed in DLAM 4155.1 (AR 715-27) were followed to prepare cargo tanks for change of product.
- The government representative reviews the cargo layout plan. He verifies that split cargoes are properly separated to prevent intermingling.
- Cargo tanks that have been ballasted with salt water must be stripped and wiped dry before loading. Any water in the tank or lines needs to be removed.
- The quality of the product in shore tanks and all lines used in loading must meet specifications. Approximately 2,000 to 5,000 barrels or at least line fill, should be pumped into one center cargo tank in the vessel. The ship's officer should then switch the loading to another tank and continue loading. A sample should be drawn from the first tank and tests performed to determine if the quality of the product being loaded is satisfactory. Further sampling and testing are conducted at the discretion of the representative. If at any time there is an indication of contamination, the loading

operation is stopped until the cause and extent of the contamination is determined.

QUALITY SURVEILLANCE DURING JET FUEL OR KEROSENE LOADING OPERATIONS

When jet fuel or kerosene is loaded, minimum QS procedures are enforced. They are described below.

- Before loading, all lines are dropped and water removed from the cargo tanks.
- Initial loading will be at a rate not more than 3 feet per second (about 1,500 barrels per hour through a 1/2-inch line) through loading lines into the cargo tanks until the discharge outlet has been covered by at least three feet of the product. Thereafter, the normal loading rate is resumed. The loading rate will not exceed the sum of the allowable rates for the individual tanks being filled. If turbulence or splashing occurs in a cargo tank after the discharge outlet is covered by the specified 3 feet of product, the reduced loading rate should be applied until the turbulence ceases.
- When a cargo tank is filled, ullages, water soundings, temperatures, and samples should not be taken until 30 minutes after flow has ceased to allow static charge to dissipate. Quality spot checks can be made 30 minutes after cessation of flow. Whether the tank is being completely filled or just partially filled the same waiting restrictions apply before sampling is permitted.
- If strapping tables are available, on-board quantities are estimated for comparison with quantities delivered from shore tanks. The representative enters quantities shipped on DD Form 250-1 and testifies as to quality of product loaded. If ship and shore corrected quantity figures differ by more than ± 0.5 percent, investigate the difference by regaging, checking seals, or other actions. Enter results of investigation on DD Form 250-1 in the REMARKS block. The ± 0.5 percent figure must be tempered with the known loading history of the ship.

QUALITY SURVEILLANCE DURING TANKER AND BARGE UNLOADING OPERATIONS

The following QS procedures are recommended when unloading tankers and barges.

- All level samples are taken from cargo tanks, and the receiving checks are performed as prescribed by the QS table in MIL-HDBK-200 before discharging begins. Verify all seals shown on the document. If the API gravity of any tank differs by ± 0.5 percent API from the loading API gravity, isolate that tank until its quality is verified. Other prescribed tests are performed on composite samples. However, discharging operations should not be delayed further if the receiving checks are favorable.

- Ullages, water soundings, and temperatures of cargo tanks are taken. If strapping tables are available, quantities on board are compared with quantities obtained at the loading point. Any deficiencies in the quantity or quality of the product at the loading point are noted.

- Gages, water measurements, and temperatures of shore tanks are taken before and after discharging. Final gages must be done as soon as possible but cannot be started until tanks have settled for 30 minutes to dissipate static electricity. After the initial 30 minute wait, gages can be repeated at 15 minute intervals until the two are constant. Final quantity figures are entered on DD Form 250-1 before vessel departure.

- Checks must be made to verify that shore and pier lines are empty or full before and after discharge.

- Cargo tanks are inspected after discharging. If strapping tables are available, quantities discharged and those remaining are compared with quantities delivered to shore tanks.

- Shore tanks are sampled and post discharge tests are performed after settling a minimum of 2 hours or 1 hour per foot in depth, if time permits.

- Any product received that does not conform to established use limits is reported to the JPO.

QUALITY SURVEILLANCE DURING
TANK CAR AND TANK VEHICLE
LOADING AND UNLOADING
OPERATIONS

Minimum procedures required for proper QS in tank car and tank vehicle loading and unloading operations are described below.

- Refer to MIL HDBK 200, Table V, for instructions when internal inspection or sampling show the need for cleaning tanks.

- When possible, store the same product repetitively in tank cars and tank vehicles to reduce the need for cleaning and to prevent contamination.

- Verify that minimum procedures listed in AR 715-27 have been followed if the product is changed.

- Inspect the interior and mechanical condition of tank cars and tank vehicles to be sure they are in condition to receive the product to be loaded.

- Verify that the products in storage tanks have been checked for shipment tests prescribed in the applicable QS table in MIL- HDBK-200.

- Ensure that qualified filter/separators have been installed in the supply lines from fuel storage tanks to loading racks.

- Placard each vehicle as prescribed in CFR, Title 49-Transportation. Do not split-load tank vehicles because of mixing in common discharge systems. Ensure that the vehicles have required markings and placards IAW AR 55-355 and applicable DOT regulations.

- Check the loaded tank cars and tank vehicles for shipment tests prescribed by the applicable quality surveillance table in MIL-HDBK-200. Perform a visual check on loaded conveyances for water and ensure that it is removed if present. Also check for grade and color of product in discharge systems of tank vehicles.

- Secure dome covers and attach serial numbered seals to the domes and outlets immediately after checking the contents. Seal any place where cargo can be removed. Enter API gravity and all seal numbers on the documents.

- Check seals at destination and perform receiving checks prescribed by the QS table before unloading. If water is present, remove it. If API gravity is more than ± 0.5 of the loaded gravity, hold the shipment and notify the laboratory as soon as possible (DLAM 4155.1/AR 715-27).

Fuels that have a cloudy appearance or an unusual color should not be accepted until laboratory test(s) indicate they are suitable for use.

- Be sure that a tank car or vehicle discharges into the storage tank intended to receive the product. If the contents are transferred to another tank vehicle, be sure that the receiving vehicle is in the proper condition to receive the product with no danger of contamination.

QUALITY SURVEILLANCE DURING PIPELINE OPERATIONS

QARs exercise QS over all movement in government-owned and commercial multi-product pipelines to maintain the quality and quantity of products owned by the government.

Commercial Pipelines. Government-owned products moved in commercial pipelines are inspected as prescribed by the supply contract and commercial tariffs. The inspection of pipeline operations generally include:

- Handling of batches (cycling, pumping rates, progress checks at test points).
- Generation, handling, and evaluation of interfacial mixtures.
- Cutting of batches into receiving tankage.
- Verification of product quality in receiving tankage.
- Use of corrosion inhibitors.
- Periodic checks of government-owned products for solid's content.

The military department having physical possession of the products is responsible for establishing and maintaining an adequate QS program in compliance with MIL-HDBK-200. Army personnel responsible for QS of multiproduct pipeline operations are required to follow these minimum procedures:

- Refer to AR 715-27 for proper sequence of batches and recommended cut points, for computation of volume of interfaces, and for recommended batch change records.

- Verify quality of product in pipeline receiving tankage after receipt. Select identification test IAW MIL-HDBK-200

- Plan tank switches and necessary valve operations in exact compliance with the pumping order for better control of the interface formed when a new batch is pumped into the line.

- See that necessary velocity and pressure for turbulent flow is maintained. See that the pressure is maintained in every part of the line that must be shut down.

- Check color or gravity, depending on the product, in all batch changes at each successive terminal or checkpoint for the dispatcher's information as he follows the progress of batches and makes deliveries from the line.

- Make deliveries at intermediate terminals and to branch pipelines by means of heart cuts.

- Remove interfaces from the pipeline at the last takeoff point for each product to simplify handling and to prevent formation of new interfaces.

- Observe proper batch sequence to form interfaces that can be cut into one or both of the adjacent products. Segregate any interface that cannot be so disposed of.

- Test the segregated interfacial material to determine what products, if any, it can be blended with and in what proportions. The petroleum laboratory determines the disposition.

- Check samples from all storage tanks after receipts from the pipeline, (particularly those from tanks that have received part or all of an interface) to ensure that the product is within use limits.

- Earmark the contents of a tank found to be just within use limits after receipt of an interface, for early issue or shipment. Avoid cutting a second interface into such a tank before it has been emptied.

- Perform ASTM D 2276 to determine particulate contamination in petroleum products

Section IV. Cleanliness Standards for Aviation Fuels

GENERAL

Aviation fuels require special handling and surveillance. QM units are primarily responsible for QS during the receipt, storage, and distribution of bulk petroleum products in a theater of operations. However, the handling and surveillance of a product at unit level is the responsibility of that unit. The aviation unit has the operational responsibility for ensuring the aviation fuel receives the required special surveillance.

FILTER/SEPARATORS

Filters/separators remove solid contaminants and entrained water from liquid fuels. Generally, filter/separators used by the military, use identical filter elements and canisters that meet the requirements of Military Specification MIL-F-52308. When fuels are provided by one military service to another, the filtering done in connection with storing, distributing, and dispensing must meet the requirements of the supported unit. To ensure quality, all fuel must be filtered, regardless of the type of product.

Use of Filter/Separators. Aviation fuel must be kept free of solid and water contamination before using. At a fuel system supply point, filter/separators should be installed on the delivery side between the discharge pump assembly and the receiving side of the dispensing facilities. Aviation fuels must be passed through an approved filter/separator of suitable capability before it is delivered to any receiving unit. It must also pass through a filter/separator before being put into any refueling vehicle. Finally, the fuel is again passed through a qualified filter/separator before being dispensed to an aircraft.

Replacement of Filter Elements. The effectiveness of filtration is indicated by the amount of pressure differential across the filter/separator.

The effectiveness of filtration of aviation fuels should be determined after filter elements are initially installed or changed, and every month thereafter, by following the procedure described in ASTM D 2276. The appropriate TM for each filter separator should be checked for information on the replacement of filters. The pressure differential with clean, new element(s) is usually 2.5 psi or less. The filter elements should be changed for the following reasons:

- The pressure differential drops suddenly, indicating probable rupture, or it exceeds maximum pressure differential specified for the separator.
- The reading on the pressure differential indicator is in the red (3psi and above).
- Laboratory analysis of two successive samples finds that too much water or particulate matter is getting through the filter/separator.
- A conversion is being made from pumping a lower grade product to a higher grade one.
- A DOD standard filter element, NSN 4330-00-983-0998, that has been in use for 24 months should be changed.
- A filter change is made when converting from any fuel to jet fuel.
- Twenty-four months has elapsed or an inspection shows they are ruptured or not properly installed.

SOLID CONTAMINATION

Solid contamination consists of both suspended particles and sediment that may come from any of the following sources: sand or dirt, dust from the air, metal from repair or wear, plasticizers from hose liners, lint, or black (magnetic) and red (non-magnetic) iron oxides. The size of particles and the amount are of critical importance because of small clearances in aircraft and diesel equipment. Fine particles are less than 10 microns in size. A micron is 0.001 millimeter, or 1/25,400 of an inch. These particles are not ordinarily visible to the unaided eye. Thus, a fuel without visible solids is not necessarily acceptable. Fine particles less than 5 microns in size cannot be removed readily

by settling. Coarse particles are 10 microns or larger, and these can be detected visually. Such contamination settles out fairly easily, and all of it can be separated by adequate filtration. For additional information on contamination, see Table 3-1.

WATER CONTAMINATION

Water may be present in the dissolved state or in the free (emulsified) state. Water dissolved in fuel is similar to moisture in the atmosphere. Dissolved water cannot be detected visually, nor can it be removed by filter/separators. Small quantities of water do not harm the fuel if the water remains a solution. However, it separates readily when the fuel cools to a temperature lower than that at which the water went into the solution. Dissolved

water becomes free water when it separates from the fuel.

Free Water. Free water may appear in the form of a cloud or haze. It may also appear as an emulsion. It may appear in the form of droplets clinging to the side of containers, or in larger quantities on the bottoms of containers. Free water is undesirable because it causes icing, corrosion, and malfunctioning of aircraft accessories. Free water in gasoline, diesel fuel, and turbine fuel can be removed easily by settling and by adequate filter/separators.

Table 3-1. Contamination table

Contaminant	Appearance	Characteristics	Effects on Aircraft
Water: Dissolved Water	Not visible	Fresh water only; separates as cloud when fuel cools.	None, as long as it remains in solution; see free water.
Free water	Light or heavy cloud; droplets clinging to sides of container; or large amounts on bottom of container.	Fresh water or salt water.	Icing of fuel system, erratic gage readings; large amounts can cause flame-out; salt water corrodes fuel system components.
Solid matter Rust	Red or black powder, rouge, or grains; may appear as dye-like material in fuel.	Red (Fe2O3) non-magnetic; Black (Fe3O4) magnetic; often comprises 70-90 percent of total solids.	Causes sticking, sluggish or general malfunction of fuel controls, flow dividers, pumps, nozzles,
Sand or dust	Crystalline, granular, or glass-like.	Often comprises 0-20 percent of total solids.	Same as rust.
Aluminum, cadmium or mahnesium.	White or gray powder or paste.	Sometimes sticky or gelatinous when wet; sometimes comprises 0-10 percent of total solids.	Same as rust; and may reduce fight range and high altitude performance.
Emulsions Water-in-fuel	Light or heavy cloud.	Finely divided drops of water in fuel; same as free water cloud; usually settles out at about the same rate as free water.	
Fuel-in-water	Reddish, grayish, or	Finely divided drops of	Same as free water and

	blackish; sticky material variously described as gelatinous or gummy; often appears as fibrous or stringy material in clear or cloudy fuel.	fuel in water; often contains rust that stabilizes the emulsion; adheres to materials normally in contact with fuel; emulsion may persist for indefinite period; contains 50-70 percent water, and 30-50 percent fuel.	sediment or suspended matter; quickly causes filter plugging and erratic readings in fuel quantity probes.
Miscellaneous Interfacial matter	Lacy bubbles or scum in interface; resembles jelly fish.	Result of bacterial action on sulfates in fresh water; H ₂ S may be generated. Easily dissipated	Same as free water; deposits of matter may be left in fuel tanks.
Air bubbles	Cloud in fuel		None.

TESTING EFFLUENT SAMPLES FOR WATER.

Samples from aircraft refueling vehicles should be tested daily on site using the Aqua-Glo series II/III ultraviolet detector kit, to determine the amount of water in the fuel. Also, aviation fuel should be visually examined each time a sample is analyzed for solids. Visual inspection procedures are described below.

- Step 1- Fill a clean 1-liter bottle from the effluent stream and note appearance of fuel. Record appearance as clear and bright, hazy, or cloudy.
- Step 2- Observe samples appearing clear and bright for the presence of minute droplets of water when sampling.
- Step 3- Allow the sample to stand for 15 minutes and repeat step 2 above. Record the presence of any droplets.