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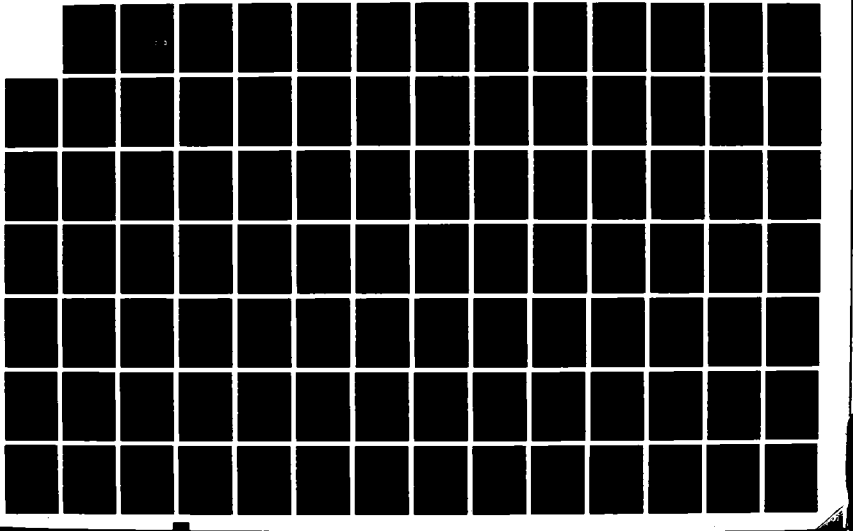

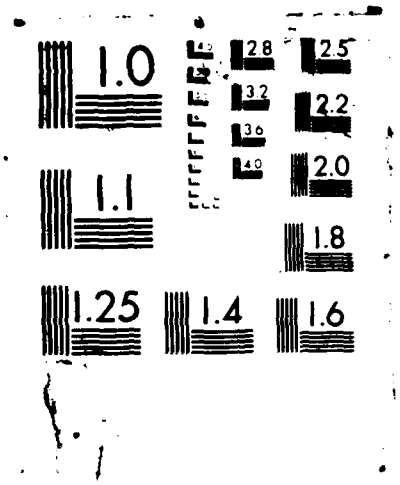
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PETROLEUM QUALITY INFORMATION SYSTEM (PQIS): REQUIREMENTS AND RECOMMENDED DESIGN

Report AL628R1

December 1987

Robert L. Arnberg

Prepared pursuant to Department of Defense Contract MDA903-85-C-0139

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DoD uses about 200 million barrels of petroleum fuels a year, at an annual cost of more than $6 billion. To make sure the various fuels are suitable for their intended uses, standards of quality have been established. But data about quality are not always current or in a form that lends itself readily to analysis.

We find that a suitable DoD-wide system for collecting and analyzing data about fuel quality is possible. Much of the work would be done by computers now used by the Military Departments and Defense Fuel Supply Center (DFSC) for other purposes. Operating costs would be nominal.

We recommend that system development begin with the quality control data of the DFSC for bulk fuels purchased and kept in dormant storage. These are most subject to degradation and contamination by water and impurities. The system would be expanded to include quality control data for all bulk petroleum purchases.

We also recommend collecting data using decentralized microcomputers; transferring data to a DFSC minicomputer for storage, retrieval, and report generation; and moving data to a computer mainframe when statistical analysis is needed. The task of entering data should be delegated to the petroleum quality organizations of the various Departments, by product type: JP4 for the Air Force, JP5 and F76 for the Navy, and ground fuels for the Army.

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Executive Summary

PETROLEUM QUALITY INFORMATION SYSTEM (PQIS): REQUIREMENTS AND RECOMMENDED DESIGN

DoD uses about 200 million barrels of petroleum fuels a year, at an annual cost of more than $6 billion. To make sure the various fuels are suitable for their intended uses, standards of quality have been established. But data about quality are not always current or in a form that lends itself readily to analysis.

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CHAPTER 1

INTRODUCTION

The Department of Defense consumes about 200 million barrels a year of petroleum fuels to power its aircraft, motor vehicles, ships, and energy generators. The annual cost is more than $6 billion. DoD buys a variety of petroleum fuels – jet fuels, diesel fuels, and gasolines – each with specific engine performance and storage characteristics. Petroleum fuels are characterized by precise chemical and physical properties that determine their performance and quality. Providing quality fuel requires inspection at the point of purchase, monitoring quality during storage, and insuring quality while the fuel is distributed to users.

Petroleum fuel quality standards are identified in military, Federal, and commercial product specifications. The fuel must meet these standards when it is purchased and be within specified quality limits when it is consumed by DoD users. These fuels are expensive and easily contaminated by water and impurities during storage and distribution. They must, therefore, be stored under carefully controlled conditions to maintain their quality and prevent deterioration.

DoD now accumulates a wealth of data quantifying fuel quality, but not in a form that is readily analyzed. The Services make ad hoc use of petroleum quality databases to evaluate specific quality control problems and publish statistical reports. Few of these databases contain current data, because data entry and validation are labor intensive. A petroleum quality information system (PQIS) would support better analysis of fuel quality.

The remainder of this chapter describes petroleum logistics, fuel quality, DoD petroleum quality control, and the general functional requirements for a PQIS. Chapter 2 describes in detail the functional requirements for a PQIS. Chapter 3 presents alternative methods of meeting user requirements, and Chapter 4 contains our recommendation for implementation of a PQIS.

PETROLEUM LOGISTICS

Bulk fuels are liquid petroleum products produced at refineries in batches, stored in holding tanks, and transported in batches (tenders) by pipeline; in tanks by ocean tanker, barge, rail tank car; or road tank car/trailer. Responsibilities for management of bulk petroleum products, storage, and distribution facilities are defined in DoD Directive 4140.25.[1] Procedures for management of petroleum products are described in detail in DoD Manual 4140.25-M.[2]

The Assistant Secretary of Defense (Production and Logistics) [ASD(P&L)] establishes policy and provides guidance to DoD Components for managing bulk petroleum logistic programs, systems, and procedures. The Defense Logistics Agency (DLA) procures bulk petroleum products and manages wholesale stocks; the Military Services determine requirements, operate wholesale and retail storage facilities, and manage retail stocks.

DLA's Defense Fuel Supply Center (DFSC) provides integrated material management of bulk petroleum, including procurement, transportation, storage, and distribution to DoD users. DFSC contracts for five types of DoD bulk petroleum purchases: defense stock fund contracts for DFSC terminal (wholesale) purchases; post, camp, and station (PC&S) bulletin contracts for delivery directly to DoD (retail) users; bunker contracts for refueling ships; credit card purchases for service station delivery; and emergency purchases for vehicles, vessels, or aircraft. DFSC also contracts for all Government commercial fueling services including into-plane purchases of aviation fuel at commercial airports, which are technically not bulk fuel purchases.

Defense stock fund contract (wholesale) purchases amounted to 129.2 million barrels, or approximately 85 percent of all DoD commercial purchases in FY86 (Table 1-1). Such purchases involve high-volume shipments (in excess of 100,000 barrels) of fuel from a refinery to a defense fuel supply point (DFSP) via ocean tanker or pipeline. The fuel may later be transferred to another vessel or pipeline before it

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[1]DoD Directive 4140.25. *Management of Bulk Petroleum Products, Storage, and Distribution Facilities*. 5 May 1980.

[2]DoD Manual 4140.25-M. *Procedures for the Management of Petroleum Products*. Dec 1978

reaches its destination. When the shipment arrives, it is loaded into storage tanks and retained until distribution to DoD users.

TABLE 1-1

DoD BULK PETROLEUM PURCHASES IN FY86

Product	Bulk petroleum purchase shipments					Total consumption	
	To terminal (stock fund purchases)		To user (PC&S purchases)		Total	Millions of dollars	Mbbl
	Number	Mbbl	Number	Mbbl	Mbbl		
Naphtha aviation turbine fuel (JP4)	2,043	68.7	11,922	10.3	79.1	2,906	94.7
Kerosene aviation turbine fuel (JP5)	380	25.4	1,443	1.8	27.3	952	28.7
Marine diesel fuel (F76)	332	24.8	321	2.9	27 7	834	26.5
Other fuels	707	10.2	792	8.0	18 3	922	28.7
Total	3,462	129.2	14,478	23.1	152 3	5,614	178.6

Sources: Defense Fuels Automated Management System and Defense Energy Information System

Note: Mbbl = millions of barrels; totals rounded to nearest 100 thousand

PC&S and credit card (retail) purchases are made under regional blanket purchase agreements for the direct purchase of bulk fuels from refineries or wholesalers. These contracts involve a large number of low-volume shipments (less than 30,000 gallons) which are transported mainly by tank truck or tank car.

PETROLEUM PRODUCT QUALITY

Quality control of bulk petroleum products involves establishing product quality standards, ensuring conformity of the product to established technical requirements (specifications), and monitoring fuel quality to determine suitability for its intended use. Responsibility for quality control of bulk petroleum products is diversified: DLA is responsible for procuring quality products and maintaining product quality through transportation, storage, and distribution of wholesale products; the Services develop product specifications (quality control standards),

provide quality test facilities, provide storage facilities, and maintain product quality through the storage and distribution phases of retail product management. Quality control procedures are described in detail in DLAM 4155.1[3] and in MIL-HDBK-200F,[4] the military handbook on standardization and quality surveillance.

The technical requirements (specifications) for petroleum products are established by the Service weapon system development activities. Product specifications usually include special quality requirements established by international standardization working groups, such as those of NATO. The exact specification for a petroleum product is defined in terms of its physical and chemical properties and depends on the intended use(s) and storage requirements. Each chemical or physical property can be associated with a fuel characteristic category, e.g., volatility. Fuel characteristic categories are described in Table 1-2. The chemical and physical characteristics of aviation turbine fuels are listed in Table 1-3, including identification of the associated fuel characteristic categories.

Specifications for petroleum products are of several types: military, Federal, and commercial. A common item, such as a *noncombat* motor gasoline, is held to a Federal standard only. A special purpose *combat* automotive gasoline, on the other hand, must meet military specifications, which may also include NATO requirements.

DoD often designates standard commercial fuels as acceptable substitutes for military fuels that may not be readily available. For example, Jet A1, a commercial jet fuel, may be used as a substitute for JP8 (NATO F34), a kerosene-based turbine fuel for military aircraft. Quality requirements for commercial fuels are generally less demanding than Federal or commercial standards. A list of tests required for different jet fuels is in Appendix A.

PETROLEUM QUALITY MANAGEMENT ORGANIZATIONS

Petroleum quality management is widely dispersed throughout the DoD. The Director of Energy Policy establishes and evaluates policy for the ASD(P&L). DLA

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[3]DLAM 4155.1. *Petroleum Procurement Quality Assurance Manual*. Feb 1985.

[4]MIL-HDBK-200F. *Quality Surveillance Handbook for Fuels, Lubricants and Related Products*. Sep 1981. New revision pending publication.

TABLE 1-2

FUEL CHARACTERISTIC CATEGORIES

Category	Category description
Appearance	Product workmanship and physical appearance
Composition	Chemical hydrocarbon, acid, and sulfur composition
Volatility	Fuel vaporization characteristics
Fluidity	Low-temperature flow properties
Combustion	Fuel ignition and energy effectiveness
Corrosion	Fuel system corrosiveness properties
Stability	Fuel system thermal oxidation stability and storage stability
Contaminants	Existence of contaminants in fuel such as gum and particulates
Additives	The use of fuel performance and storage improvement additives
Other tests	Other specialized testing requirements

has overall responsibility for quality assurance of all bulk petroleum purchases and is responsible for quality surveillance of DLA-owned (wholesale) inventories; the Services' technical quality offices are responsible for quality assurance concerning PC&S (retail) purchases and quality surveillance of all retail inventories. DLA's Defense Contract Administration Service (DCAS) is responsible for quality assurance of stock fund fuels purchased in the Continental United States; DFSC is responsible for stock fund fuels purchased overseas. DFSC provides direction and guidance in technical matters for all petroleum product quality assurance. DFSC quality assurance representatives (QARs) certify fuel quality when it is purchased; DFSC and Service quality surveillance representatives (QSRs) monitor fuel quality during shipment and storage.

Practical responsibility for quality assurance is a function of economics; quality assurance of DLA-owned fuels is the responsibility of DCAS and DFSC; quality assurance of Service-owned (PC&S-purchased) fuels is the responsibility of a Service technical quality office. Since all petroleum products are purchased for consumption by DoD (retail) users, analysis of petroleum fuel quality is ultimately the responsibility of the Service base fuels offices and the associated Service technical quality offices: General Materiel and Petroleum Activity (GMPA) of the Army Materiel Command (AMC), Energy Management Directorate (EMD) of the Air Force

TABLE 1-3

PETROLEUM FUEL QUALITY CHARACTERISTICS

Characteristic	Category
Acidity, total or neutralization number	Composition
Aniline-gravity product/net heat of combustion	Combustion
Antioxidant content	Additives
Antistatic/electrical conductivity additive content	Additives
Aromatic content	Composition
Cetanic index	Combustion
Color, Saybolt	Appearance
Copper strip corrosion	Corrosion
Corrosion inhibitor/lubricant	Additives
Density/API gravity/specific gravity	Volatility
Distillation initial boiling point	Volatility
Distillation 10%, 20%, 50%, and 90% recovery	Volatility
Distillation final boiling point	Volatility
Distillation residue and loss	Volatility
Electrical conductivity	Other tests
Existent gum	Contaminants
Filtration time	Contaminants
Flash point	Volatility
Freezing point	Fluidity
Fuel system icing inhibitor (FSII) content	Additives
Hydrogen content	Combustion
Luminometer number	Combustion
Metal deactivator content	Additives
Naphthalene content	Combustion
Neutralization/acidity	Composition
Olefin content	Composition
Particulate matter	Contaminants
Peroxide number	Contaminants
Smoke point	Combustion
Stability (JFTOT) pressure change and color code	Stability
Sulfur, Mercaptan and total	Composition
Vapor pressure	Volatility
Viscosity	Fluidity
Water reaction interface rating	Contaminants
Water separation index modified (WSIM)	Contaminants

Note: API = American Petroleum Institute, JFTOT = jet fuel thermal oxidation test

Logistics Command (AFLC), and Navy Petroleum Office (NPO) of the Naval Supply Command (NAVSUP). Quality control is, therefore, a joint responsibility of DFSC and the Services' technical quality offices.

The Service weapon system development activities have functional responsibility for fuel standardization: the Army Belvoir Research, Development, and Engineering Center (BRDEC) for ground fuels; the Air Force Systems Command (AFSC) Wright Aeronautical Laboratories (WAL) for aviation fuels; the Naval Air Systems Command (NAVAIR) Naval Air Propulsion Center (NAPC) for Navy-unique aviation fuels; and the Naval Sea Systems Command (NAVSEA) Naval Ships Research and Development Center (NSRDC) for marine fuels.

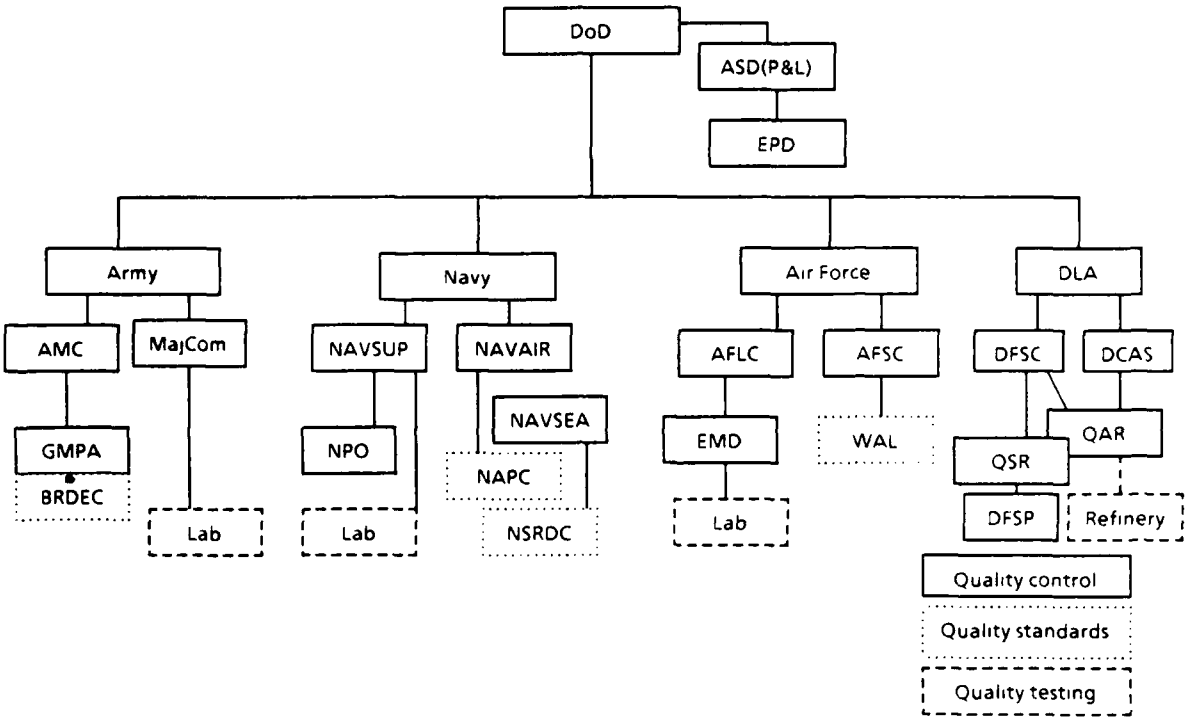
The Services establish and operate DoD petroleum quality laboratories to support all DoD activities that need their services. Each Service manages its laboratories: the Air Force laboratories are part of the AFLC, the Navy laboratories are part of the NAVSUP, and the Army laboratories are under the control of their major commands. These organizations are shown in Figure 1-1.

PETROLEUM QUALITY CONTROL

Petroleum quality is tested by obtaining a representative sample of the product and subjecting it to a series of physical and chemical tests to determine if the product meets technical product specifications. The characteristics must be tested using specific test methods to conduct the tests. Quality assurance involves a full specification test; quality surveillance usually requires only partial testing of product quality characteristics. Quality control test types are described in Table 1-4. Quality control tests for aviation turbine fuels are listed in Table 1-5.

DFSC and Service QARs and QSRs are responsible for assuring (accessing and certifying) and monitoring (evaluating) fuel quality for the DoD (see Figure 1-2). The DFSC has primary technical responsibility for fuel quality assurance and quality surveillance of wholesale products. The Service technical quality offices are responsible for retail products.

A DFSC QAR inspects refinery production and storage facilities and certifies product acceptability when the product is transferred to a pipeline, shipping vessel, or terminal. The QAR verifies and certifies the quality and quantity of petroleum products purchased and shipped to DoD activities. The process is described in detail



Note: EPD = Energy Policy Directorate; MajCom = Major Command

FIG. 1-1. PETROLEUM QUALITY ORGANIZATIONS IN DoD

TABLE 1-4

QUALITY CONTROL TEST TYPES

Test type	Test description
Type A	Complete specification acceptance test
Type B-1	Partial testing of principal characteristics most likely to be affected by transfer
Type B-2	Partial testing of critical product characteristics susceptible to deterioration
Type B-3	Partial testing of product when contamination is suspected
Type C	Quick, simple partial testing to verify product quality

TABLE 1-5

QUALITY CONTROL TESTING OF AVIATION TURBINE FUELS

Category	Test name	Test type			
		A	B-2	B-1 B-3	C
Appearance	Saybolt color	R	R		
	Visual water and solids	R	R	R	R
Composition	Acid content	R	R		
	Aromatic content	R			
	Olefin content	R			
	Sulfur content	R			
Volatility	Distillation	R	R	R	
	Vapor pressure	R	R	R	
	Flash point	R	R	R	R
	Density	R	R	R	R
Fluidity	Freezing point	R	R	R	
	Viscosity	R			
Combustion	Heat content	R			
	Hydrogen content	R			
	Cetane index	R	R		
	Smoke point	R			
	Naphthalene content	R			
Stability	Pressure change	R	R		
	Deposit code	R	R		
Corrosion	Copper strip corrosion	R	R	R	
Contaminants	Existent gum content	R	R	R	
	Particulates	R			
	Water separation	R	R	R	
	Filtration time	R	R	R	
Additives	Fuel system anti-icing	R	R	R	
	Antioxidant	R			
	Corrosion inhibitor	R			
	Metal deactivator	R			
	Antistatic additive	R	R	R	
	Fuel conductivity	R	R	R	

Note: *R = test required*

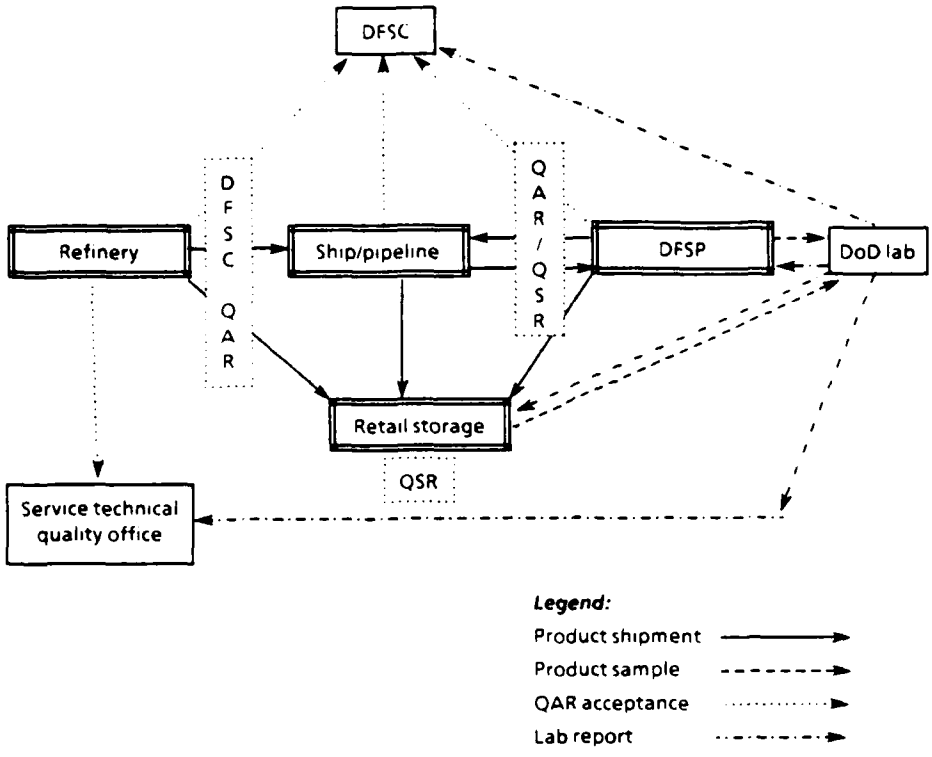


FIG. 1-2. PETROLEUM QUALITY REPORTING

in the *Petroleum Procurement Quality Assurance Manual* (DLAM 4155.1). The certification (DD Form 250-1 or DD Form 250 with associated test reports) is sent to many organizations for use in payment, accounting, and quality control.

Product quality is monitored by DFSC and Service QSRs during storage, distribution, and use to ensure product integrity. Quality control of wholesale products consists of abbreviated tests of samples drawn at every transfer and discharge point. Periodic testing – to check for deterioration – is required in the event of prolonged storage. Additional testing can be performed at any time. The Service laboratories provide testing services for all retail and wholesale customers. The DD Form 250, DD Form 250-1, and laboratory quality test reports are used to evaluate quality control problems and identify the source of the problem. For example, if fuel quality has degraded during storage, DFSC would use these forms and test reports to try to identify the reason for the degradation: whether it was a bad batch of fuel from a refinery, there was contamination during shipment, or

storage conditions were poor. DFSC now has no automated support for retrieving and analyzing quality control data.

Surveillance of the quality of retail fuel is the responsibility of the Service technical quality offices and using organizations. If fuel used in a weapon system causes problems or if fuel quality has degraded during storage or distribution, the Service technical quality organizations would check these forms and test reports to analyze the problem. The Navy now has two automated data systems to support its quality control analysis. The Army recently established informal databases to support its analytic requirements. The Air Force has no such automated support.

FUNCTIONAL REQUIREMENTS

A PQIS for bulk purchases of petroleum products would have wide applicability within the DoD quality control community for research into problems of fuel quality. Such a system would make it easier to identify the source of a quality control problem, analyze the fuel stability characteristics of purchased products, relate fuel characteristics to equipment malfunctions, identify trends in fuel quality, evaluate the quality of domestic production, and evaluate proposed standards and specifications.

Historically, the most significant use of quality control data has been publication of statistical analysis reports for aviation fuels.[5,6,7] These reports include trend analyses, analysis of petroleum quality characteristics, and regional analyses of characteristics by fuel source. Use of statistical analysis should be expanded to include trends in use of waivers, deviations, and additives. An important new application is stability analysis of products in dormant storage – detecting trends in product deterioration so that it can be used before serious problems develop. This application involves accessing quality control test reports and linking them to product acceptance quality control data to determine instability trends, which can be used to evaluate fuel rotation policy and optimize utilization of stored fuel.

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[5]Air Force Wright Aeronautical Laboratories AFWAL-TR-2052. *The Chemical and Physical Properties of JP-4 for 1980 - 1981*. Harrison, W. E., III. Jun 1982.

[6]Naval Air Propulsion Center NAPC PE-105. *Physical and Chemical Properties of JP-5 Fuel, 1980 - 1983*. Ricciardelli, J. Dec 1984.

[7]National Institute for Petroleum and Energy Research (NIPER) Report Number 139. *Aviation Turbine Fuels, 1984*. Shelton, E. M. and C. L. Dickson. Mar 1985.

To support these general functional requirements, the system must include a technical database of quality control test reports that include the following information:

- Test identification data: test identifier, sample date, sampling location, petroleum product being tested, quantity of product represented, and reason for test.
- Source of the product: contract number, refinery, cargo number, batch number, and identification of shore tank or ship tank.
- DoD destination of a shipment or DoD storage location: DoD activity address code (DoDAAC), the subactivity, and storage tank identification.
- Quality control test results: appearance, composition, volatility, fluidity, combustion, corrosion, stability, contaminants, and additives.

The database must also support the following specific functional requirements:

- A data reduction capability, including data entry, data validation, data conversion, data transfer, and a minimal data-inquiry-and-retrieval capability, to ensure timely, accurate data.
- A data retrieval capability for analysis of quality control data:
  - Quality control analysis: retrieval of quality control test reports by product, producer, shipper, and destination or storage location, to evaluate quality control problems.
  - Quality analysis dormant storage: retrieval of a time series of dormant-storage quality-control test reports (linked to product acceptance data), to evaluate long-term fuel-storage stability.
- A data retrieval capability for producing the following:
  - View and print individual test reports.
  - View and print groups of test results for all retrieved test reports.
  - Generate a database extract of selected test results.
- A statistical analysis capability for evaluating trends in product quality characteristics and publishing reports. This function is closely related to evaluation of product specifications and has traditionally been performed by the Services' weapon system development activities.

- A report generation capability, including the following:
  - Ad hoc data-retrieval reports for fuel quality research, requiring identification of the production source, the destination of the shipment, and the quality characteristics of the product purchased.
  - Preformatted reports, such as quality assurance test reports (barge/tanker loading and discharge reports), quality surveillance test reports, periodic dormant-storage test reports and exception/waiver/deviation reports.

Figure 1-3 gives an overview of a PQIS, its users, data, and reports. Data are entered interactively by staff at DFSC or Service technical quality offices using DD Form 250, DD Form 250-1, and Air Force Technical Order Form (AFTO) 456. During data entry, data are checked for accuracy and completeness, and retained in a working database until all editing and validation are completed. The edited data can then be transferred to a central database and the central PQIS database. Once data are in a database, DFSC and Service technical quality offices can retrieve and produce a variety of reports, including trend analyses, preformatted reports, queries on fuel standards, and ad hoc queries. Each general functional requirement (data reduction, quality control analysis, dormant-storage analysis, statistical analysis, and reports) is addressed in more detail in Chapter 2.

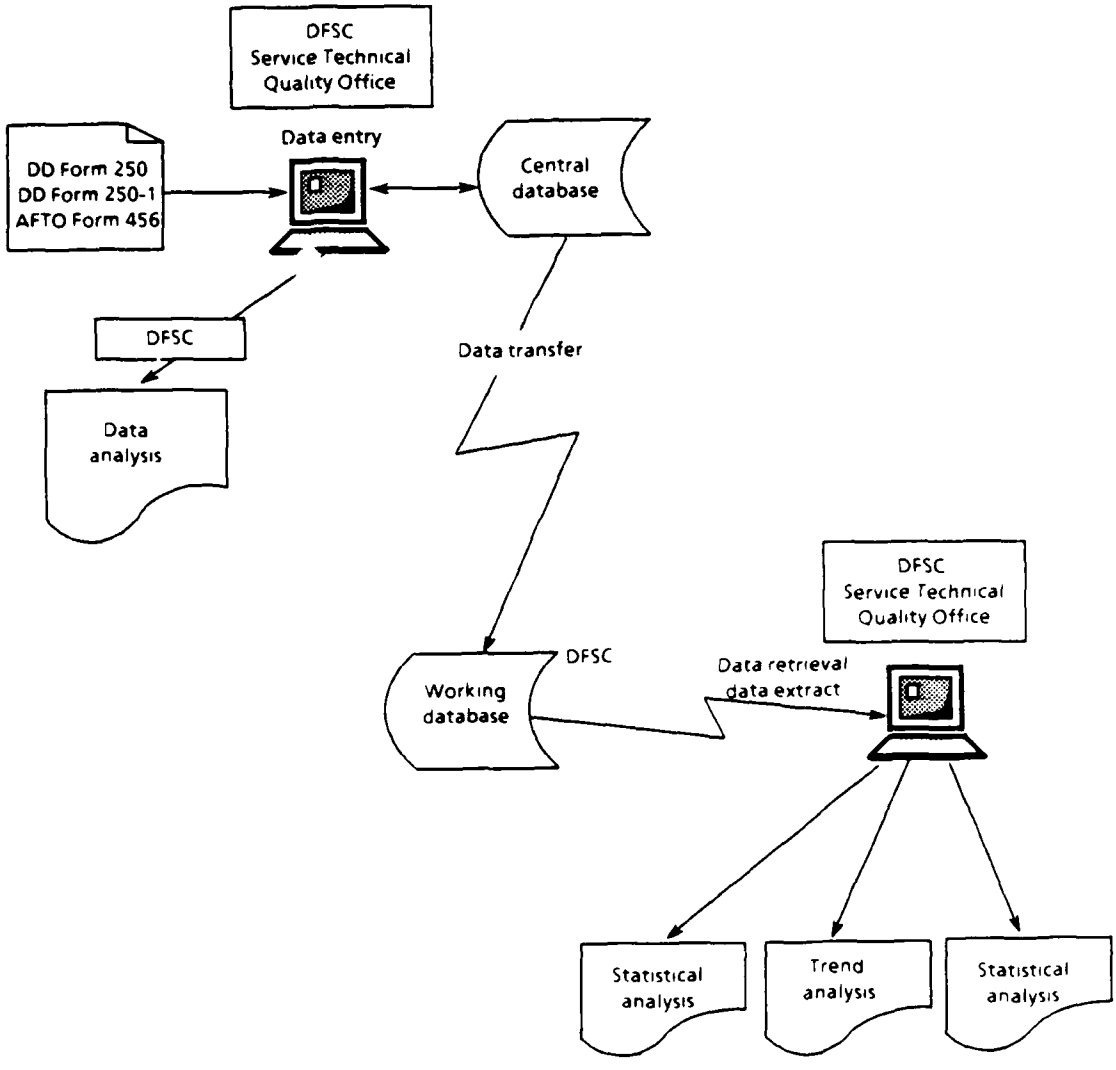


FIG. 1-3. PQIS OVERVIEW

CHAPTER 2

SYSTEM REQUIREMENTS

The quality characteristics of every petroleum product are stated in the military specification for the product. Petroleum quality characteristics for jet and diesel fuels are listed in Table 2-1. The specific product specifications for JP8, a kerosene-based aviation turbine fuel, are displayed in Table 2-2. Each quality characteristic has a standard unit of measure associated with a particular quality control test. These tests are described in more detail in Appendix A, which includes a list of quality control tests and measures, plus product specification summaries for jet and diesel fuels. Most quality control tests apply methods established by the American Society for Testing and Materials (ASTM) which also establishes commercial product specifications for petroleum fuels. To test for quality, representative samples of the product are subjected to a series of tests at a laboratory.

QUALITY CONTROL SOURCE DATA

There are five primary types of source data: DD Form 250-1, Tanker/Barge Material Inspection and Receiving Report; DD Form 250, Material Inspection and Receiving Report; AFTO Form 456, Turbine Fuel Test Report; DoD laboratory quality control test reports; and other nonstandard quality control test reports. Samples of the forms and a description of them are in Appendix B.

The estimated number of annual quality assurance and quality surveillance test reports is identified in Table 2-3 – product acceptance and discharge estimates are based on FY86 data obtained from the Defense Fuels Automated Management System (DFAMS); transfer and periodic testing estimates are based on DFAMS and Defense Energy Information System (DEIS) data.

EXISTING SYSTEMS

There are four automated quality control data systems in the DoD quality control community: two Navy databases (for JP5 jet fuel and F76 marine diesel fuel) and two partial Army microcomputer databases (for diesel fuels and gasolines). The Navy databases are described in Appendices C and D. Current database utility is

TABLE 2-1

PETROLEUM FUEL QUALITY CHARACTERISTICS

Characteristic	Product type
Accelerated stability	Diesel fuel
Acidity, total	Jet fuel
Aniline point	Diesel fuel
Aniline-gravity product	Jet fuel
Antioxidant content	Jet and diesel fuels
Antistatic/electrical conductivity additive content	Jet fuel
Aromatic content	Jet fuel
Ash content	Diesel fuel
Calcium trace metals	Diesel fuel
Carbon residue	Diesel fuel
Cetane number/index	Jet and diesel fuels
Cetane/ignition improver content	Diesel fuel
Cloud point	Diesel fuel
Color, Saybolt	Jet fuel
Copper strip corrosion	Jet and diesel fuels
Corrosion inhibitor/lubricant	Jet and diesel fuels
Demulsification	Diesel fuel
Density/API gravity	Jet fuel
Density/specific gravity	Jet fuel
Distillation initial boiling point	Jet fuel
Distillation 10%, 20%, 50%, and 90% recovery	Jet and diesel fuels
Distillation final boiling point	Jet and diesel fuels
Distillation residue and loss	Jet and diesel fuels
Existent gum content	Jet fuel
Filtration time	Jet fuel
Flash point	Jet and diesel fuels
Freezing point	Jet fuel
FSII content	Jet and diesel fuels
Hydrogen content	Jet fuel
Lead trace metals	Diesel fuel
Metal deactivator content	Jet and diesel fuels

TABLE 2-1

PETROLEUM FUEL QUALITY CHARACTERISTICS (Continued)

Characteristic	Product type
Naphthalene content	Jet fuel
Net heat of combustion	Jet fuel
Neutralization/acidity	Jet and diesel fuels
Olefin content	Jet fuel
Particulate matter content	Jet and diesel fuels
Peroxide number/content	Jet fuel
Pour point	Diesel fuel
Smoke point	Jet fuel
Sodium and potassium trace metal content	Diesel fuel
Stability (JFTOT) pressure change and color code	Jet fuel
Sulfur, Mercaptan content	Jet fuel
Sulfur, total content	Jet fuel
Vanadium trace metal content	Diesel fuel
Vapor pressure	Jet fuel
Viscosity	Jet and diesel fuels
Water reaction interface rating	Jet fuel
WSIM	Jet fuel

limited by labor intensive data entry. Data entry is usually performed by summer interns, and data are generally several months old before they are entered into a database. Lack of timely, accurate, complete data limits use of these databases. They are, however, a source of historical information and can serve as a basis for establishing a PQIS.

The remainder of this chapter will describe the data requirements, processing flow, and reporting requirements of a PQIS.

TABLE 2-2

SPECIFICATION SUMMARY FOR THE JP8 AVIATION TURBINE FUEL

Category	Test name	Specification limit
Appearance	Saybolt color	Report value
Composition	Acid content	Less than (<) 015
	Aromatic content	< 25 0%
	Olefin content	< 5.0%
	Sulfur content	< 0 3%
	Mercaptan sulfur content	< 0 002%
Volatility	Distillation	10% at < 205 degrees Celsius (°C) End point at < 300 °C
	Flash point	Greater than (>) 38 °C
	Density	37 – 51 API°
Fluidity	Freezing point	< -47 °C
	Viscosity	< 8 0 centistokes
Combustion	Heat content	> 42.8 megajoule per kilogram (MJ/kg)
	Hydrogen content	> 13.4%
	Smoke point	> 25 millimeters (mm) > 20 mm with Naphthalene <3%
Stability	Pressure change	< 25 mm
	Preheater deposit	< 3
Corrosion	Copper strip corrosion	< 1
Contaminants	Existent gum content	< 7.0 milligrams (mg)/100 milliliters (mL)
	Particulate content	< 1.0 mg/liter (L)
	Water reaction rating	< 1B
	WSIM	> 85 > 70 with additives
	Filtration time	< 15 minutes
Additives	Fuel system anti-icing content	.10% – 15%
	Antioxidant content	17.2 – 24.0 mg/L
	Corrosion inhibitor content	8.5 – 34.0 mg/L
	Metal deactivator content	< 5.8 mg/L
	Antistatic/electrical conductivity content	conductivity limit
	Fuel conductivity	200 – 600 picosiemens per meter (pS/m)

Source: Military Specification MIL-T-83133B *Turbine Fuel, Aviation, Kerosene Type, JP8* 3 Sep 1987

TABLE 2-3

ESTIMATES OF ANNUAL BULK PETROLEUM QUALITY CONTROL TESTING

Product	Estimated number of annual quality control test reports				
	Stock fund purchases				PC&S purchases
	Acceptance	Transfer	Discharge	Periodic testing	Acceptance
Naphtha aviation turbine fuel (JP4)	2,043	204	2,043	1,340	11,922
Kerosene aviation turbine fuel (JP5)	380	380	380	980	1,443
Marine diesel fuel (F76)	332	332	332	600	321
Other fuels	707	70	707	2,010	792
Total	3,462	986	3,462	4,930	14,478

Sources: Defense Fuels Automated Management System and Defense Energy Information System

Note: Acceptance and discharge estimates are based on FY86 purchase data; transfer and periodic testing estimates have been extrapolated from FY86 purchase data

PQIS DATA ELEMENTS

Quality assurance test information is the basis of the PQIS. It consists of descriptive data and quality control test results, as shown in Table 2-4 and described in detail in Appendix E (specific data element definitions). The test results are complemented by static processing information required for data validation: quality control characteristics, tests, test measures, and specification test limits; DFSP organization codes; DoD laboratory codes; DFSC contractual information; conversion factors for comparable units of measure; and optional data code files for refineries, exceptions, waivers, deviations, etc.

The quality assurance test descriptive data must include product identification, the volume of the product, the source of the product, its intended destination, the date the sample was taken, the laboratory performing the tests, and identification of any exceptions, waivers, and deviations related to the procurement. This must be complemented by several parameters required to manage the data,

TABLE 2-4

DESCRIPTION OF PQIS DATABASE

Descriptive data	
Category	Contents
Source	Refinery, contract, cargo/batch number, ship tank number
Evaluation point	Refinery, ship, or DFSP storage tank
Destination	DFSP name, DoDAAC, subactivity, and tank
Laboratory	Date of test, test identifier
Item	Product type, product quantity
Waiver/deviation	Waiver identification and case number
Comments	Notes or comments about shipment
Control information	PQIS number, PQIS flag, PQIS date
Quality control test results	
Category	Quality Control Tests
Appearance	Clarity, Saybolt color
Composition	Acidity, aromatic, olefin, sulfur, and metal content
Volatility	Distillation, explosiveness, flash point, density
Fluidity	Freezing point, viscosity, pour point, cloud point
Combustion	Btu content, smoke point, and naphthalene content
Corrosion	Copper strip corrosion test
Stability	JFTOT pressure change and preheater deposit code
Contaminants	Gum, particulate, and trace metal content, WSIM
Additives	Anti-icing, corrosion inhibitor, metal deactivator, antioxidant, antistatic/electrical conductivity additive, octane improver, or flow improver
Static information	
Category	Contents
Sources	Refinery codes, names, contract numbers
Destinations	DFSP DoDAACs, names, locations, and products
Laboratories	Laboratory codes, names, and locations
Quality tests	ASTM test names, methods, and measures
Specifications	ASTM tests and acceptable test values
Waiver/deviation codes	Waiver/deviation codes and descriptions

Note: Btu = British thermal unit

including a PQIS test number, a flag to identify the type of data in a given record, an error flag for validating data, and data entry and edit dates.

The quality control test results identify salient quality characteristics of a given quantity of a petroleum product: its appearance, composition, volatility, fluidity, combustibility, corrosiveness, thermal stability, contaminants, and additives. Note that each set of test results is for a given tank or batch, with an abbreviated set of test results provided for the shipment composite. The exact test results provided depend on the type of test performed (see Tables 1-4 and 1-5). The data elements shown in Appendix E include supplementary data elements required to enter and process the minimal set of quality control characteristics required for product certification (this includes data elements for alternative units of measure, which are discarded after the test data have been edited).

The DD Form 250-1 data can be split into two or three types of records: identification data (source, destination, total volume, etc.), individual refinery holding tank or ship tank quality data, and ship composite test data. The data should include references to known waivers, deviations, and exceptions by case number, explicit identification of test values below specification limits, and test values where results were estimated or missing.

DATA ENTRY

The first functional requirement listed in Chapter 1 is a data reduction capability, that is keyed entry or transfer, data validation and conversion, and data inquiry. As shown in Figure 2-1, data can be entered manually or by transfer on disks from DoD laboratories, Service quality standardization offices, and Service technical quality offices.

There are four types of static data: technical, storage location, contractual, and DoD laboratory. Technical data include specifications for fuels, test standards (including ranges), and conversion factors (e.g., to metric units). Storage location data include the DFSP DoDAACs, names, and locations. Contractual data include contract number, contractor name and location, and refinery names and locations. Laboratory data include the names and locations of DoD laboratories.

These data will be entered into the reference files manually by DFSC and distributed to users as required. The technical data require special consideration

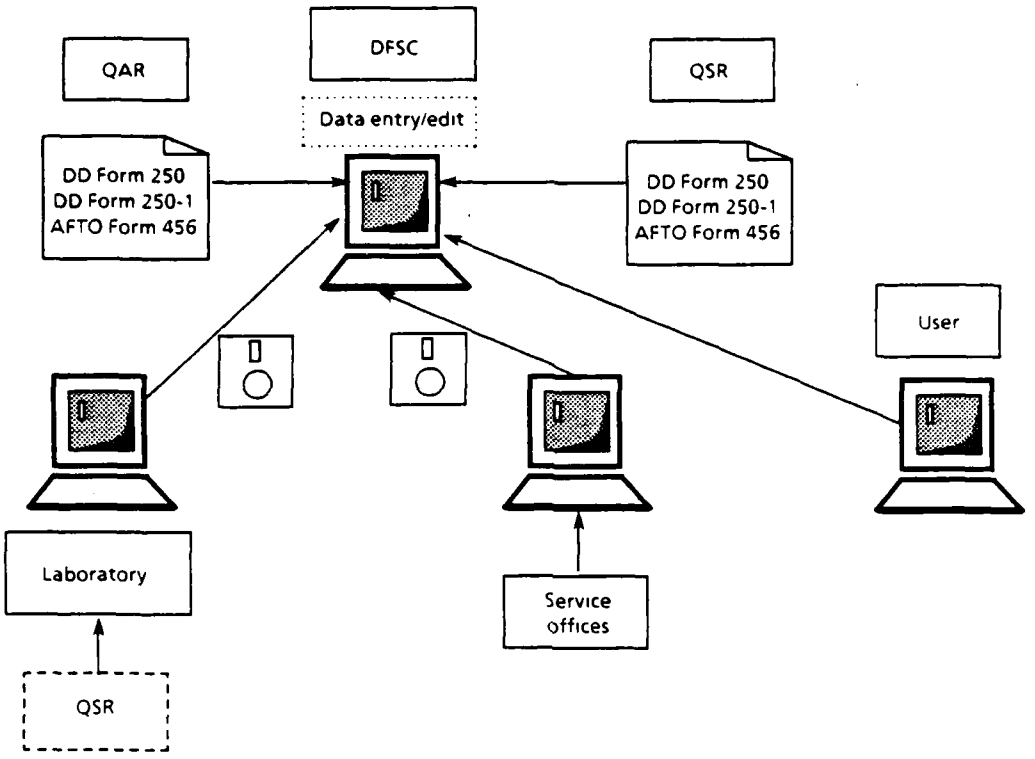


FIG. 2-1. PQIS DATA ENTRY

because they are included in the data entry and validation programs. The product specification and quality control characteristics constitute the core information content of the system. This information is imbedded in the data entry, edit, and validation programs and should also be available as reference information for the novice user. When specifications and test standards change, the new information will be included in the programs which will be tested before being released to PQIS users.

The remaining data for monitoring quality are collected whenever the quality of fuel is tested, and can be entered into the database whenever the reports are received by the using activity.

Data Entry Requirements

The most efficient way to enter data today is with menu-driven data entry screens. However, new technologies may ease the data entry process. These technologies include voice processing systems and optical character recognition

(OCR) equipment and software to assist in the data entry process. OCR is likely to have only limited use, given the nature of the data being processed and the wide variety of input sources: different type fonts, formats, etc.

Standard Quality Control Test Report Forms

Each product has a unique list of quality characteristics. They are reported in random order on the DD Form 250-1, thus complicating the data entry effort. It would be desirable to develop standard test forms for petroleum product quality control tests similar to those used for reporting test results for products transported through the Central European Pipeline System (CEPS) or those used for testing aviation turbine fuels as in the AFTO Form 456, Turbine Fuel Test Report/ ASTM D1655, Inspection Data on Aviation Turbine Fuels.

Electronic Data Transfers

Some of these test reports are produced by automated data systems that may be able to provide the data to PQIS in electronic form:

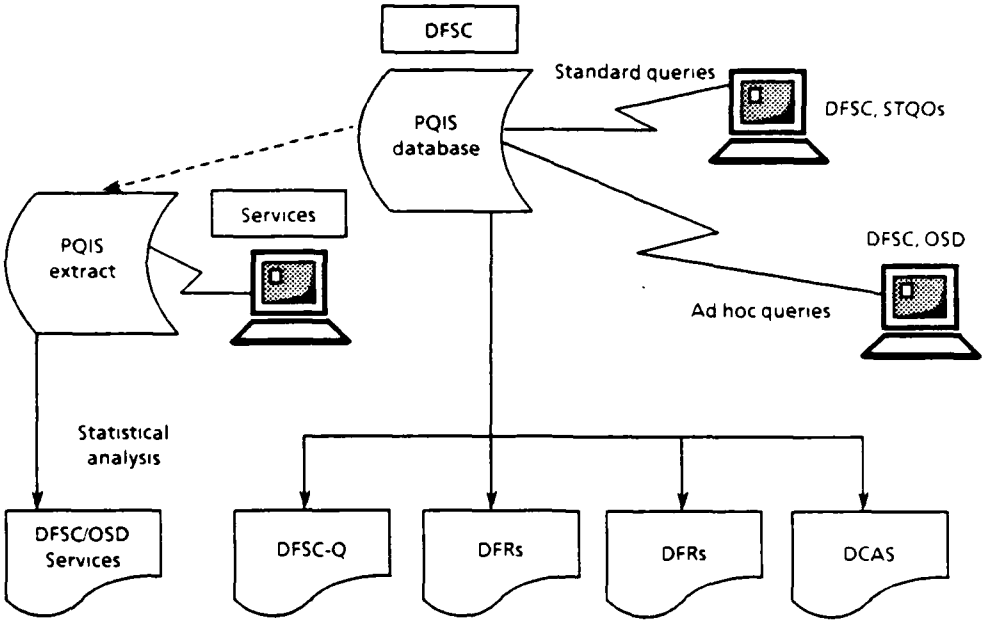
- DoD laboratory data systems. The DoD quality assurance laboratories have automated test report preparation systems, used for printing quality control test reports. Procedures should be established for transferring test data between these systems and PQIS. It is possible to transfer data from existing automated systems to PQIS, either by mailing microcomputer disks or by sending the information over communications networks.

- Refinery data systems. Most of the larger refineries appear to have automated quality control data systems used for printing product quality control characteristics for inclusion in DD Form 250 or DD Form 250-1. A survey of a representative sample of refineries revealed that they produce only one DD Form 250-1 per week or per month, so that electronic data transfer would be of little use to either DoD or the refiners. DoD could provide selected refiners with a PQIS data entry system software and request them to send disks to DFSC weekly, monthly, or as required.

PROCESSING FLOW

Once valid data are entered into a database, the remaining functional requirements described in Chapter 1 consist of quality control analysis, dormant storage analysis, statistical analysis, and reports based on the data. Figure 2-2 highlights this portion of the PQIS. Transition from a central database to a decentralized data entry system will require special consideration for managing data entry, to preclude

duplication of effort and duplicate data records. The following paragraphs describe the analytical capabilities and reports needed to meet user requirements.



Note: STQOs = Service technical quality offices; DFSC-Q = DFSC, Quality Assurance and Technical Services Directorate; DFRs = defense fuel regions

FIG. 2-2. PQIS REPORTS

QUALITY CONTROL ANALYSIS

Quality control analysis is a task that requires human intelligence and experience with petroleum product quality control. PQIS can assist the analyst by providing the raw data required for analysis, e.g., the quality control test reports for products stored at a given location, produced by a given refinery, or shipped by a given vessel. Additional analytical capabilities include providing a time-phased product quality comparison report that will help the analyst to determine the source of the problem. This is a prime area for applying artificial intelligence technology.

ANALYSIS OF DORMANT-STORAGE FUELS

Dormant-storage quality analysis is similar to quality control analysis. It is a task that requires human intelligence and experience with petroleum product quality control. The primary function of PQIS is to provide the analyst with the raw data required for analysis, viz., a time series of quality control test reports for a given

storage tank at a given location. It involves product life-cycle flow tracking – starting with the current DoDAAC/tank location, and tracing the product flow back to refinery batch via intermediate transport vessels and transfer points. Other analytical capabilities include identifying substandard or marginal products in storage, producing test result comparison reports, and computing rate-of-change product deterioration reports. This requirement is also a prime candidate for applying artificial intelligence technology.

STATISTICAL ANALYSIS

Historically, statistical analysis of bulk product purchases has been the primary application of Service quality control data systems. The type of information in the database is of a quantitative nature, lending itself to rigorous statistical analysis, including trend analysis by product, storage location, producer region, defense fuel region (DFR), etc. This application requires careful scrutiny of the data used for the statistical calculations and should be limited to one of four specific types of PQIS data records: PQIS refinery holding tank records, PQIS master (total composite) shipment acceptance records, PQIS receiving tank records, or PQIS master (total composite) shipment receipt records. This application also requires establishment of a historical database of 5 to 10 years of prior-year procurements and would, therefore, require large-scale computer storage and processing resources.

Dormant-storage stability analysis is one of the most important PQIS applications. It will support monitoring the quality of stored fuel to ensure product integrity, optimizing fuel utilization, and minimizing product blending, regrading, and waste. This is a fruitful area for research, requiring development of techniques for identifying marginal quality fuel and predicting deterioration of fuel quality.

REPORTS

Quality Control Test Reports

Since petroleum quality analysis depends on having a database of accurate quality control test results, it is essential to be able to print quality control test reports to verify accuracy and completeness of the data.

Summary Quality Control Test Data

Most practical system applications require comparison of quality control test reports. Therefore, a PQIS must be able to produce such reports for the fuel quality analyst.

Dormant-Storage Analysis Reports

Having dormant-storage fuel quality data in a central database will permit the production of reports that identify storage locations with marginal or substandard fuel that should be processed, regraded, or distributed to users.

Exception, Waiver, and Deviation Processing Forms

This report will provide automated processing of exception, waiver, and deviation requests for DFSC. The DFSC Contracting and Production Directorate (DFSC-P) receives requests for exceptions, waivers, or deviations and must coordinate these requests with the DFSC Quality Assurance and Technical Services Directorate (DFSC-Q). If this information is in electronic form, then the DFSC-P could access PQIS instead of the manually prepared reports to coordinate processing of waiver, deviation, and exception requests.

OTHER USER APPLICATIONS

A basic data retrieval and data extract capability is required by the (local) PQIS database manager for data validation and analysis. A more refined capability is required for designated users who wish to analyze quality control problems and determine trends in product quality. [*Note:* Some product (annual) databases (e.g., F76 and JP5) are projected to be small enough to fit efficiently on an International Business Machines Corporation (IBM) XT, PS/2 Model 50, or equivalent micro computer; thus, file transfer mechanisms should be provided to support complete autonomous remote databases.]

SYSTEM INTERFACES

Contractual, shipment, consumption, delivery, and domestic environmental data could be obtained from the DFAMS and the DEIS for validation and analysis purposes. There must be a viable data transfer mechanism to allow access to other automated data sources. It is particularly important to develop interfaces with DoD laboratory systems and refinery data systems to minimize the data entry effort. In

addition, most of the primary PQIS users will have access to computer resources that can be used to support the analytical requirements of the users. It is imperative to provide a relatively efficient file transfer mechanism for moving large volumes of data between computers.

TECHNICAL CONSIDERATIONS

The DD Form 250-1 and DD Form 250 provide information about the product at the refinery. Data are usually provided by refinery holding tank or refinery batch number, complemented by data on the ship composite, a partial test of product quality. The ship composite usually does not include all tests required by the specification; these test values are provided in the individual tank test reports, which are full-specification tests (see Tables 1-4 and 1-5). Computation of a total ship composite for all test characteristics may not be a meaningful measure of the quality of the product received and stored at the destination, because the shipment may be mixed, blended, and/or split into several storage tanks or pipelines at the destination(s). The data in PQIS should consist of individual tank or batch test results and the ship composite test summary. These data can then be manipulated to provide an "estimated" total ship composite of all test values (volume-weighted), including test data missing from the ship composite test report. Some additives are added to the product at the refinery, e.g., antioxidants, corrosion inhibitors, and metal deactivators, while others such as fuel system icing inhibitor may not be added to the product until it is loaded aboard a vessel or placed in a storage tank at the destination(s). These chemicals, by their very nature, change the physical characteristics of the product and will, therefore, change the results of the quality control tests performed on the product.

The destination (unloading) test report will usually provide DoD product quality information by tank, with all additives included. This is the preferred source of data for tracking specific quality control problems encountered at a DoD storage location. The problem with using this report as the exclusive source of quality control data is that there is a loss of information on original product quality and the identity of the product's source.

Note that there may be several quality test reports for a given shipment. There should be at least one test report at each transfer point, and additional tests if problems are suspected or actually encountered.

CHAPTER 3

PETROLEUM QUALITY INFORMATION SYSTEM ALTERNATIVES

The PQIS described in Chapter 2 can be implemented in a variety of ways:

- The hardware used for the system may be micro, mini, mainframe computers, or some combination.
- The PQIS may be implemented on a single, stand-alone computer with the ability to accept telephone dial-in access.
- The PQIS may be implemented on several computers, all having identical software, or each having a subset of the software and some or all of the available data.
- The PQIS may be implemented on a computer that is part of a local area network (LAN) of the DLA distributed minicomputer systems (DMINS).
- The PQIS may be implemented on a computer that is part of a wide area network, such as the DLA Network (DLANET).
- The PQIS may use a microcomputer for data entry and retrieval plus a minicomputer or mainframe archival database complemented by micro/mini/mainframe interfaces.
- The software may support interactive and/or batch processing.
- The software may be commercially available, such as a database management system (DBMS) modified for PQIS, or custom designed.
- The software may accept data entry on formatted data entry screens, voice input, OCR input, or a combination of these.

DESIGN CONSIDERATIONS

Users

The primary PQIS users will be DFSC, the Service technical quality offices, and the Service quality standardization offices: the NAVAIR NAPC, the NAVSEA NSRDC, the AFLC EMD at the San Antonio Air Logistics Center, the AFSC WAL, the AMC Troop Support Command (TROSCOM) GMPA, and the Army BRDEC. In addition, the DFRs, the DFSPs, and the DoD laboratories may wish to access the

data and use it to manage inventories. The users, their locations, and their hardware, indicate that PQIS should be accessible from Microsoft Disk Operating System (MS/DOS)-compatible microcomputers throughout the United States.

Data Sources

Some data may be transferred electronically from refineries and laboratories. Other data will have to be entered at DFSC unless DFSC can obtain data from Service computer systems by using decentralized data entry systems.

Data Volume

The size of a PQIS must determine the type of computer support required. To minimize data storage requirements, PQIS could (initially) be limited to bulk petroleum product purchases delivered to DFSP terminals. The number of transactions for such a system (Table 3-1) shows that microcomputer support of local (annual) product databases is feasible (with the exception of JP4, a high-purchase-volume fuel), and that with the use of limited advanced technology, even JP4 could be included on a microcomputer system. The problem with such an approach is that existing technology would be pushed to the limit, and use of the system would be confined to current data. Historical analysis, one of the most useful applications for the system, would be inhibited. The requirement for rapid access to current data, combined with limited access to historical data, would constrain the system design to a minicomputer or mainframe system.

Another approach is to establish a hybrid system, including a microcomputer data entry system, microcomputer retrieval applications, and a minicomputer or mainframe archival database that is complemented by micro/mini/mainframe interfaces. The microcomputer systems are easy to use but, for large volumes of data, are limited in capacity and processing speed. The mini/mainframe systems are more sophisticated and have communications facilities and large storage capacities, but are generally more expensive. Minicomputers generally have less storage capacity than mainframes and also have less complex software systems. Mainframe computers are by far the most expensive.

Data Entry

With a decentralized data entry system, it will be necessary to establish rules for assigning unique test report identification numbers, standardizing narrative

TABLE 3-1

DoD BULK PETROLEUM PURCHASE QUALITY CONTROL TEST RECORDS

Product	*Number of quality control test report records*				
	Stock fund purchases				PC&S purchases
	Acceptance	Transfer	Discharge	Periodic testing	Acceptance
Naphtha aviation turbine fuel (JP4)	8,000	1,000	4,000	1,500	12,000
Kerosene aviation turbine fuel (JP5)	1,500	1,000	1,000	1,000	1,500
Marine diesel fuel (F76)	1,500	600	600	1,000	500
Other fuels	3,000	400	1,400	2,500	1,000
Total	14,000	3,000	7,000	6,000	15,000

Sources: Defense Fuels Automated Management System and Defense Energy Information System

Note: Acceptance and discharge estimates are based on FY86 purchase data; transfer and periodic testing estimates have been extrapolated from FY86 purchase data.

data fields (e.g., refinery name), and validating codes and test values. The data entry system should have a record duplication capability, including an algorithm for computing the complete (expanded ship composite) product acceptance characteristics, given the individual tank/batch test results.

Data Validation

The data validation part of the system should have facilities for detecting and correcting errors in data entry and communications. The PQIS subsystems should be built in modules. The data retrieval system could include a data entry or editing system. The system should include processing algorithms for incomplete database records, e.g., those missing destination, test results, or volume data.

Administrative Support Requirements

Establishing a centralized database has an implicit manpower cost associated with it. Data entry for terminal deliveries of DFSC stock fund fuels requires at least two full-time clerks at DFSC. A decentralized database or network alternative, on

the other hand, would free DFSC to concentrate on monitoring purchases of DoD standard fuels (such as JP8) and intensively managing dormant storage of all fuels.

Data Structures

Data structure questions remain open but will determine the size of the database. Should the data be coded, or should there be more narrative data (e.g., use only DoDAAC or only the DoDAAC name)? Should the technical data elements be identified by mnemonics or by standard test identification codes (e.g., AFTO Form 456 test codes)? Should there be one complete record or split data (e.g., a single header with detailed test results, or a header with completed composite and associated tank/batch/ship composite data)?

Data Storage Requirements

The database can be maintained in various forms: a total aggregate database for similar groups of products (jet fuels, diesels, ground fuels); split into databases by fuel type; split by type of test report (e.g., acceptance at the source, transfer point tests, receipt at destination, problem test reports, dormant-storage test reports). If data storage is severely limited, the databases can be segregated by fuel type and limited to an expanded (estimated) total ship composite for fuel acceptance, plus problem test reports and dormant-storage test reports.

Analytic Requirements

Trend analysis of test results requires statistical analysis software. Such software can be written in a higher-level language such as Pascal or C, but would be less flexible than standard statistical analysis systems such as SAS (Statistical Analysis System), SPSS (Statistical Package for the Social Sciences), SAS/PC (micro SAS), or SPSS/PC Plus (micro SPSS).

Data Outputs

The system should print standardized reports (e.g., DD Form 250-1) and statistical reports, use the DBMS to support screens and queries, and have the capability to construct and execute ad hoc queries.

File Transfers

There should be a capability to transfer processed data (file transfers for database extracts or entire databases) between computers of various types and sizes. This capability would minimize the DFSC cost of the system by giving the system users autonomous analytical capabilities (using their own microcomputer or mainframe computer resources).

Security Considerations

Design of the system should include answers to such questions as: What is the requirement for accessing the data? Who should be able to change data? What are the database management responsibilities of the users? What is the level of classification or protection for this type of data? For example, the product acceptance data for a particular refiner may be sensitive information or aggregate data for levels of stocks at various installations may be classified information.

Disclosure of Sensitive Data

What is the policy for release of data, access by unauthorized users (e.g., contractual information, quality of delivered product, sensitivity of waiver/deviation information)?

The remainder of this chapter describes combinations of these alternatives, cites advantages and disadvantages of each, and evaluates them with respect to cost and the system requirements defined in Chapter 2.

MICROCOMPUTER ALTERNATIVES

A PQIS that uses only microcomputer hardware and software can be developed. There are four primary microcomputer design alternatives: a stand-alone system for the sole use of DFSC-Q; a LAN at DFSC that could include the Service petroleum offices at DFSC; a decentralized system with limited intersystem communication and file transfer facilities; and a wide area network with a dedicated microcomputer file server for the central database at DFSC, an external communication port and file transfer facility. Some microcomputer alternatives are displayed in Table 3-2. These alternatives require an initial capital investment (up to $25,000 for a LAN) but have low annual operating costs.

TABLE 3-2

HARDWARE AND SOFTWARE ALTERNATIVES

Hardware	Software
IBM XT or equivalent	DBMS: dBase III Plus, Oracle, or Nomad
IBM AT or equivalent	Statistics: SAS/PC, SPSS/PC Plus
Compaq 386 or equivalent	Languages: Pascal, C, Fortran
IBM PS/2 or equivalent	AI languages: LISP, Prolog
Explorer	AI shells: Insight 2 Plus, M1

Note: Fortran = Formula Translation Language; LISP = List Processing Language

All microcomputer alternatives can provide easy-to-use, low-cost, data-entry-and-retrieval capabilities for dedicated product databases containing up to 12 months of historical data. Augmentation of these databases to include several years of historical data would degrade the system's response time. With more advanced microcomputers there is more capacity and faster speed for a slight increase in purchase price.

Stand-Alone System

Description: DFSC-Q would maintain a dedicated database on existing or new equipment for DFSC. It could send data to other users via floppy discs or fixed-disc cartridges. Software for the system could be developed, using dBase III (or another DBMS), or a higher-level language, such as Pascal or C. A tape or disc-cartridge backup capability would be highly desirable. Storage requirements would be minimized if the database were maintained on Bernoulli disc cartridges.

Advantages: This would be the least-cost alternative and the easiest to use for data entry and limited retrieval.

Disadvantages: DFSC would have to enter all the data. The Service users would not have access to the data but could access and transfer small data files if a communications port and bulletin board software were added. Storage capacity would be limited. Use of the system would be limited to recent reports on quality control and dormant storage. Analysis of historical data and publication of

statistical reports would be severely limited. Processing speed would be slower than with other hardware alternatives.

Local Area Network

Description: DFSC could establish a LAN at Cameron Station, Alexandria, Va. It would include nodes for DFSC-Q, DFSC-P, and Service petroleum offices: the NPO and possibly the Air Force Aeronautical Petroleum Logistics Office (APLO), EMD Detachment 29. There could be full interchange of information between users, and a communications port and bulletin-board software could be added for users not at Cameron Station. This alternative would require the purchase of a dedicated file server for the network and would involve use of DBMS network software (at an estimated cost of $25,000).

Advantages: This is a step toward a multi-user system environment. Even with the (one-time) purchase of hardware, this would still be an inexpensive alternative.

Disadvantages: Even with a dedicated file server, there would still be limited storage capacity. This would limit the system to reports on recent test results and dormant storage. Processing speed and capacity would be limited with existing equipment but would improve if new microcomputers were purchased. The network may not be worth the effort, because there would really be only two system users (DFSC-Q and NPO) since the Air Force EMD APLO at Cameron Station is not actively involved in quality control, and DFSC-P is only peripherally involved in the technical aspects of quality control matters, via requests for deviations.

It would also require new microcomputers since only 80286 and 80386 microcomputers are suitable for network file-servers; any other microcomputers can be linked to the network.

Decentralized System or Network

Description: DFSC could delegate maintenance of independent quality control databases (by product type) to specific Service users (e.g., by assigning JP5 and F76 to the Navy, JP4 to the Air Force, and ground fuels to the Army) while retaining responsibility for JP8 and dormant-storage data for all products. These independent systems could be used to exchange data between users, provided that all systems contained the PQIS kernel software and had communications software. Such an

alternative would provide DFSC with a source of detailed procurement data for analyzing specific problems, should the need arise. One possible decentralized configuration is shown in Figure 3-1.

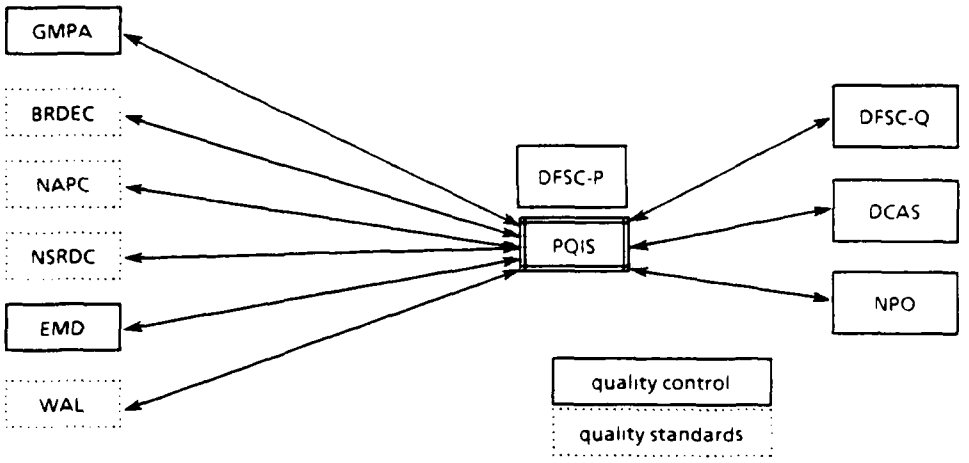


FIG. 3-1. PQIS DECENTRALIZED NETWORK

Advantages: This alternative would have the least cost for DFSC and would have a minimal effect on manpower at DFSC. Maintaining independent databases would minimize data storage and processing requirements for analyzing specific fuels. The using organizations could (at their own expense) acquire other computer resources to complement the microcomputer systems for retrieval and analysis.

Disadvantages: DFSC would have little or no control over the accuracy or timeliness of the databases. Also, the Services might not be willing to devote manpower resources to data entry and analysis.

Wide Area Network

Description: This would be the most expensive microcomputer alternative, involving the purchase of a dedicated file server (80286 or 80386 hardware with 100 megabytes of disc storage) and an effective communications facility. DFSC-Q would maintain the centralized database, which could be accessed by other users in centralized or decentralized configuration. Error-free transmission of large volumes of data might not be possible without dedicated telephone lines, an added operating cost for the system.

Advantages: This alternative provides the greatest accessibility to a central database.

Disadvantages: Microcomputer storage and computational limitations would restrict use of the system to current quality control data and the dormant-storage database.

MINICOMPUTER SYSTEMS

A minicomputer solution is a workable alternative, because DFSC has a Gould 9050 minicomputer available for immediate use. This minicomputer has a large storage capacity with a microcomputer interface capability.

Description: The Gould system includes the Unify DBMS and a high-level language, C, utilizing the Unix operating system with a local communications facility. It has a microcomputer interface plus interfaces with the DLA mainframe logistics systems, including DFAMS. The database software available for the Gould system is the Unify DBMS. A petroleum quality application could be developed, using the Gould system to establish and maintain the PQIS database, employing DBMS data entry screens, and complementing the system with statistical programs. These programs could either be written in the C language by DFSC, or purchased from a software developer.

Advantages: The Gould system offers a faster processing speed, improved communications facilities, alternative storage media, and greater storage capacity than is available from a microcomputer system. It would allow expanded storage of historical quality control data and would provide a means of transmitting data to larger computers for further analysis.

Disadvantages: There would be a nominal operating cost for the system (for computer use, data storage, and communications charges). Statistical software purchase or software development would involve additional costs.

MAINFRAME COMPUTER SYSTEMS

Description: Two equivalent mainframe alternatives are available; using the DLA Administrative Support Center (DASC) IBM 3033 or IBM 4341 mainframe computer with the Model 204 DBMS and SAS.

Both computers offer more than the minicomputer alternative – greater processing speed, increased storage capacity, alternative storage media, established communications facilities, and standard software. The IBM 3033 computer is used to process the DFAMS data; the IBM 4341 is used for developmental work. Both systems have SAS and the Model 204 DBMS.

Advantages: These systems have the greatest storage capacities and best communications facilities of all the the alternatives considered.

Disadvantages: These computers have special security requirements and are not readily available to non-DLA users. In addition, mainframe computers, with their sophisticated software, tend to have a high cost.

HYBRID COMPUTER SYSTEMS

A hybrid computer system could include any combination of the microcomputer, minicomputer, and mainframe computer resources described earlier. The following paragraphs describe several of these alternatives: a micro/minicomputer system, a micro/mainframe system, and a micro/mini/mainframe system. One possible hybrid computer network configuration is shown in Figure 3-2.

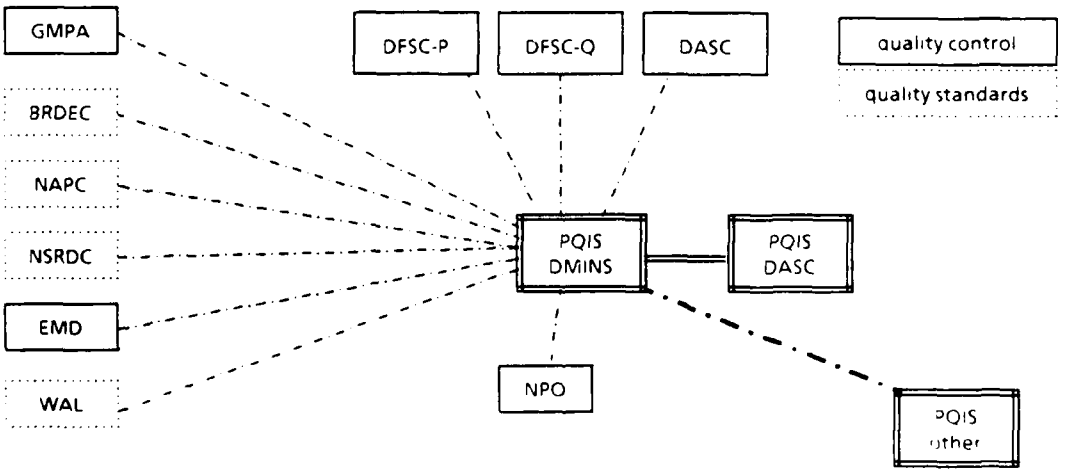


FIG. 3-2. PQIS HYBRID COMPUTER NETWORK

Micro/Minicomputer System

Description: In this alternative, microcomputers would be used to enter and validate the data before transferring them to a minicomputer. The minicomputer

would contain the central database for the PQIS. Small databases could be maintained on microcomputers. Complete data-retrieval-and-analysis capabilities would be provided by the Unify DBMS. Statistical analysis could be provided by use of a micro or mini software package, or by developing applications software for either mini or micro systems. Safeguards should be developed to ensure error-free transfer of data between computers.

Advantages: This alternative offers simplicity of use and greater storage capacity for a nominal increase in operating costs. It also permits an interface with DFAMS and minimizes the costs of data entry and validation. A microcomputer/minicomputer alternative would provide the best features of microcomputer data entry combined with the best features of minicomputer processing and storage capacity.

Disadvantages: Minicomputer applications would have to be acquired for statistical analysis, and remote users would have to pay long-distance communications expenses to gain access to the data.

Micro/Mainframe System

Description: In this alternative, microcomputers would be used to enter and validate data. The data would be transferred periodically to the central database on a mainframe computer. Small databases could be downloaded to microcomputers. Complete retrieval-and-analytical capabilities would be provided on the mainframe computer system, with existing software.

Advantages: Of the alternatives considered, this one offers the least cost for data entry, the greatest storage capacity, and the best communications facilities, plus lower development costs and faster implementation.

Disadvantages: Disadvantages include higher operating costs and greater complexity than the micro/mini alternative. There would be some duplication of data storage.

Micro/Mini/Mainframe System

Description: This is the most complex alternative. It would involve using microcomputers for data entry and validation, plus storage and retrieval of small databases, intermediate storage of historical data on the minicomputer (where the

data could be retrieved and analyzed on a regular basis), and periodic use of mainframe systems for large-scale statistical analysis. To minimize storage costs, only the database structure would have to be maintained on the mainframe computer. Data could be transferred from the minicomputer to the mainframe computer by magnetic tape (to minimize data transfer errors).

Advantages: This alternative offers the least cost for data entry, access to a reasonable data storage capacity and adequate communications facilities, plus lower development costs and faster implementation, all at a nominal increase in operating costs. A micro/mini/mainframe alternative would provide the best features of microcomputer data entry, combined with the best features of minicomputer processing and storage capacity and mainframe statistical analysis.

Disadvantages: Operating costs would be the highest and operation would be the most complex of the alternatives considered. There would be some duplication of data storage.

COMMUNICATIONS INTERFACES

Data communication is an important design consideration. A microcomputer-based system would require disc transfers unless a microcomputer were purchased and dedicated to use as a communications device and file server. The Gould minicomputer could be accessed by local phone communications, the DLA/DFSC mainframe by DLANET subscribers.

SUMMARY OF ALTERNATIVES

In summary, a PQIS can be designed in a variety of ways: microcomputer hardware only, minicomputer only, mainframe only, or a combination of these alternatives. The microcomputer systems have the lowest annual operating costs and can be implemented in several different types of configurations: a single, dedicated stand-alone system; a LAN of computers; a decentralized network of computers; or a wide area network of computers. A minicomputer system would offer more capacity at a nominal increase in annual operating costs. A mainframe computer would provide increased computational sophistication, but at a substantial increase in annual operating costs.

Hybrid systems that include microcomputer, minicomputer, and mainframe components provide the best features of the components in an integrated solution

that maximizes performance cost-effectiveness. The basic hardware and software alternatives are summarized in Table 3-3. The relative advantages and disadvantages are listed in Table 3-4 on a scale from 1 to 10 where 10 is best. For speed best means fastest, for storage best means largest, for software best means least expensive for user-oriented functions, for cost best means least expensive, for usability best means least complex. Table 3-5 evaluates the functional characteristics of the alternatives, again on a scale from 1 to 10 with 10 the best.

TABLE 3-3

PQIS DESIGN ALTERNATIVE SUMMARY

Option	Hardware	Database	Statistics	Language
Micro	8086/80286/80386	dBase III or Oracle	SAS/PC	Pascal/C
Mini	Gould	Unify	None	C
Mainframe	IBM 3033	Model 204	SAS	Fortran
Hybrid				
Micro/mini		dBase III/Unify	None	C
Micro/mainframe		dBase III/ Model 204	SAS	Fortran
Micro/mini/mainframe		dBase III/Unify/ Model 204	SAS	Pascal

TABLE 3-4

COMPARISON OF PQIS DESIGN ALTERNATIVES

Option	Speed	Storage	Software	Cost	Usability
Micro					
8086	3	4	4	10	9
80286	5	5	5	7	8
80386	6	6	5	6	9
Mini	7	9	5	Unknown	Unknown
Mainframe	9	10	9	3	5
Hybrid					
Micro/mini	7	9	5	Unknown	Unknown
Micro/mainframe	8	10	9	3	6
Micro/mini/mainframe	8	10	9	6	6

TABLE 3-5

PQIS DESIGN ALTERNATIVE EVALUATION

System	Data entry	Retrieval	Analysis	Access	Usability
Micro					
8086	8	3	3	3	9
80286	9	4	4	4	9
80386	10	6	6	5	9
Mini	8	7	7	7	7
Mainframe	5	9	10	5	4
Hybrid					
Micro/mini	8	6	7	7	9
Micro/mainframe	5	8	10	9	9
Micro/mini/mainframe	8	9	10	9	9

CHAPTER 4

RECOMMENDED SYSTEM ARCHITECTURE AND DESIGN

RECOMMENDATION

A micro/mini/mainframe hybrid design best meets the PQIS functional requirements. It would provide the maximum potential processing and storage capacity for a nominal annual operating cost.

PQIS should be implemented in phases to accelerate the implementation schedule and minimize costs. The initial system should be limited to DFSC quality control data for bulk petroleum products purchased and retained in dormant storage. The system can later be expanded to include quality control data for all purchases of bulk petroleum. Data entry can be delegated to Service and DFSC petroleum quality control organizations by product type: JP4 for the Air Force, JP5 and F76 for the Navy, and ground fuels for the Army.

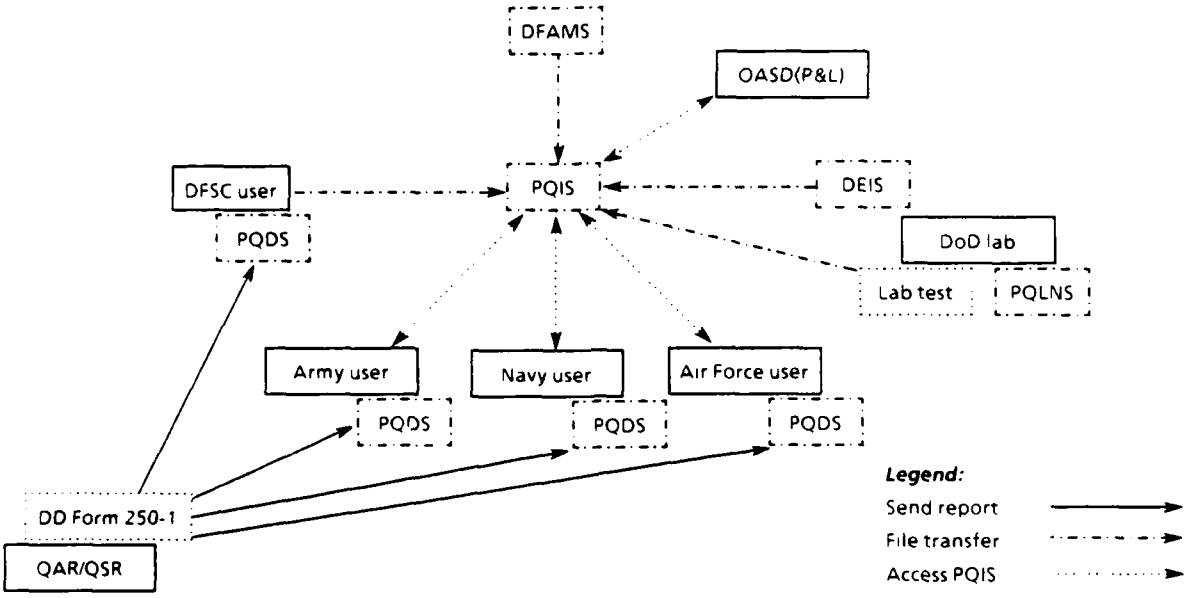
This approach has three main advantages: it provides DFSC with a comprehensive database of quality control information, it assigns data entry to the organization responsible for product quality control, and it minimizes DFSC clerical manpower requirements.

SYSTEM DESCRIPTION

The microcomputer system should be a compiled dBase III computer system that includes comprehensive data entry validation features with limited data-retrieval-and-analysis capabilities. A voice processing data entry module could be added, if desired. The dormant-storage database should contain all quality control available for products placed in long-term storage: DD Form 250-1 test results for acceptance, transfer, and receipt, plus periodic DoD laboratory test reports. The bulk purchase database could be limited to product acceptance test reports or could be expanded to include all available test data.

DFSC, Service quality standardization offices, and Service technical quality offices would enter the data into a microcomputer system and then transfer

processed data periodically to the DFSC Gould minicomputer database, as shown in Figure 4-1. An organization that wished to perform statistical analysis could obtain database extracts of historical data on magnetic tape for transfer to a mainframe computer.



Note: PQDS = petroleum quality data system (PQIS subsystem); PQLNS = petroleum quality laboratory network system (proposed PQIS subsystem)

FIG. 4-1. PQIS PROPOSED DESIGN

Sources of Data

DFSC and the Services would enter the data manually into database systems and then transfer the files to the DFSC Gould central database. Automated sources of data could be obtained from the DoD laboratories for dormant-storage tests and problem test reports.

Storage of Data

DFSC and Service organizations would have specialized databases while having complete access to all data in the central database. Large-scale data transfers between them would be via disc cartridge or magnetic tape.

Access to the Data

The Gould system can be accessed via DLANET or by calling a local telephone number in the National Capital Region (NCR). Non-DLA users outside the NCR would have to pay long-distance telephone charges.

Analysis and Reports

The microcomputer data entry system could produce DD Form 250-1 and laboratory quality control test reports for test results contained in the database. Other specialized reports could be generated with dBase III or the Unify DBMS. Comprehensive statistical analysis could be performed on any mainframe computer, using a standard statistical package, to analyze data obtained via a magnetic tape data extract.

PQIS IMPLEMENTATION PLANNING

The following steps should be considered in planning for PQIS implementation after a preferred design alternative is selected: prepare formal system specifications, develop a system software development plan, and develop an implementation plan.

Prepare System Design Specifications

After selection of the preferred design alternative, the technical system design specifications must be prepared for system development and implementation. The system specifications should be based on the computer hardware and software available to the quality control community, as evaluated in this report. This situation is further complicated by the wide proliferation of computer hardware and software throughout the DoD quality control community that includes use of many existing microcomputers, and access to Service mainframe and supercomputer resources.

Develop a System Software Development Plan

The selected system development activity can then take the specifications and develop operational software packages for distribution to the intended users.

Develop Implementation Plan

We recommend implementation by product type, product destination, and type of report included in the system, as follows:

- *Product type*
  - Aviation turbine fuels
  - Diesel fuels
  - Automotive fuels
  - Distillate and residual fuel oils
- *Destination*
  - Bulk shipments sent to a DFSP storage terminal
  - Bulk shipments sent directly to the user
  - PC&S shipments
- *Type of report*
  - Refinery acceptance loading data (DD Form 250-1)
  - Dormant-storage test reports (DoD labs)
  - Problem test reports (DoD labs)
  - Shipment discharge/receipt data (DD Form 250-1)
  - Intermediate shipment transfer data (DD Form 250-1).

POTENTIAL PQIS EXTENSIONS

DoD Laboratory LAN System

It would be desirable to develop design specifications for the DoD laboratories to use in implementing their own microcomputer network systems. The PQIS software can provide a basis for such a system by providing the minimal essential data-entry-and-retrieval capabilities.

The U.S. Air Force laboratories plan to obtain networked microcomputer systems with the following capabilities: hard discs for storage of prior-year test data, automated printing of test results, generation of test data extract files for transfer to

PQIS, batch processing of test results, and hardware interfaces for obtaining test results from automated test equipment as shown in Figure 4-2.

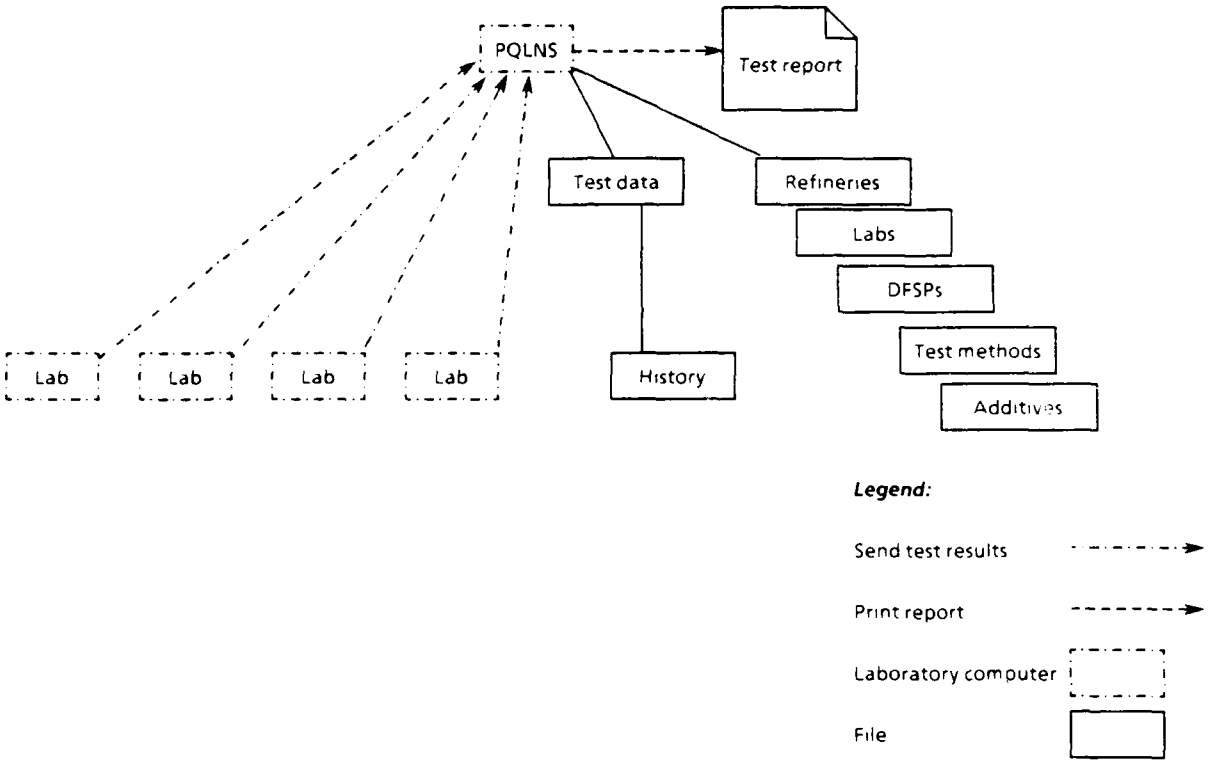


FIG. 4-2. A LABORATORY COMPUTER NETWORK

A standard laboratory system should include formats for test reports, conversion tables for units of measure, and tables containing DoD activity names, addresses, and codes.

PQIS Artificial Intelligence Applications

There are several possible applications of artificial intelligence applications in petroleum quality control. The most significant is as a quality control advisor for aviation turbine fuels. An example of use of artificial intelligence for an aircraft turbine fuels quality analysis advisor is described in Table 4-1.

TABLE 4-1

ADVISOR ON QUALITY ANALYSIS OF AIRCRAFT TURBINE FUELS

Domain description	Profile of intended user
Aircraft turbine fuel petroleum products Product acceptance Product quality evaluation Product handling Product storage	DoD petroleum quality control technicians Quality assurance representative Quality surveillance representative Quality control analyst

Description of advice	Scope of knowledge	Expected difficulties and uncertainties
Accept product Request an exception, waiver, or deviation Reject product Request additional testing Require additional product processing Regrade product	Petroleum fuel logistics Petroleum fuel product characteristics Petroleum fuel product specifications Sources of contamination of petroleum products Equipment dependency on product characteristics	Interface with dBase III database

Sample of consultation	Conceptual design of system
What type of advice *Product acceptance* Does the product meet all specification requirements? Yes – accept No – determine urgency check for required tests check for alternative tests and values Is the product within deterioration limits? Yes – exception/waiver/deviation processing No – reject *Product evaluation* Is there a current set of test results? Is there a complete specification test? Does the product meet specifications? When was the product purchased? Was there an exception/waiver/deviation? Has the product been in long-term storage? Was the product transferred between ships? Is there any product contamination? Is there a trend in product characteristics? *Troubleshooting* When was the product last tested? Was there an equipment malfunction?	Product acceptance evaluator Test completeness evaluator Specification evaluator Product quality evaluator Test status evaluator Quality evaluator Quality trend evaluator Product reprocessing evaluator Product contamination evaluator

GLOSSARY

AFLC	=	Air Force Logistics Command
AFSC	=	Air Force Systems Command
AFTO	=	Air Force Technical Order
AFTO Form 456	=	Air Force Technical Order 456, Turbine Fuel Test Report
AMC	=	Army Materiel Command
API	=	American Petroleum Institute
APLO	=	Aeronautical Petroleum Logistics Office
ASD(P&L)	=	Assistant Secretary of Defense (Production and Logistics)
ASTM	=	American Society for Testing and Materials
ASTM D1655	=	standard specification for aviation turbine fuels
Bernoulli	=	personal computer hard disc technology
BRDEC	=	(Army) Belvoir Research, Development, and Engineering Center
C	=	a higher-level programming language
CEPS	=	Central European Pipeline System
Compaq	=	brand name of a personal computer (IBM-compatible)
CPU	=	central processing unit
DASC	=	DLA Administrative Support Center
dBase III	=	personal computer database management system (dBase III Plus)
DBMS	=	database management system
DCAS	=	Defense Contract Administration Service
DD Form 250	=	Material Inspection and Receiving Report
DD Form 250-1	=	Tanker/Barge Material Inspection and Receiving Report

DEIS	=	Defense Energy Information System
DFAMS	=	Defense Fuels Automated Management System
DFR	=	defense fuel region
DFSC	=	Defense Fuel Supply Center
DFSC-P	=	DFSC, Contracting and Production Directorate
DFSC-Q	=	DFSC, Quality Assurance and Technical Services Directorate
DFSC-Z	=	DFSC, Telecommunications and Information Systems Directorate
DFSP	=	defense fuel supply point
DLA	=	Defense Logistics Agency
DLANET	=	DLA Network
DMINS	=	distributed minicomputer systems
DoDAAC	=	Department of Defense activity address code
EMD	=	(Air Force Logistics Command) Energy Management Directorate
EPD	=	Energy Policy Directorate, OASD(P&L)
Explorer	=	artificial intelligence microcomputer manufactured by Texas Instruments
F76	=	marine diesel fuel
Fortran	=	Formula Translation Language
FSII	=	fuel system icing inhibitor
GMPA	=	General Materiel and Petroleum Activity
IBM	=	International Business Machines Corporation
IBM AT	=	personal computer (first series), advanced technology
IBM PS/2	=	second series of IBM personal computers (personal system 2)
IBM XT	=	personal computer (first series) with a hard disk
Insight 2 Plus	=	an artificial intelligence shell system
Jet A	=	commercial high-flash kerosene-based jet turbine fuel

Jet A1	=	commercial kerosene-based jet turbine fuel
Jet B	=	commercial wide-cut naphthalene jet turbine fuel
JFTOT	=	jet fuel thermal oxidation test
JP4	=	wide cut naphthalene aviation turbine fuel
JP5	=	high-flash kerosene-based aviation turbine fuel
JP8	=	kerosene-based aviation turbine fuel
LAN	=	local area network
LISP	=	List Processing Language
LMI	=	Logistics Management Institute
M1	=	an artificial intelligence shell system
Model 204	=	a database management system
MS/DOS	=	Microsoft Disk Operating System
NAPC	=	(Naval Air Systems Command) Naval Air Propulsion Center
NAVAIR	=	Naval Air Systems Command
NAVSEA	=	Naval Sea Systems Command
NAVSUP	=	Naval Supply Command
NCR	=	National Capital Region
NIPER	=	National Institute for Petroleum and Energy Research
Nomad	=	a relational database management system
NPO	=	(Naval Supply Command) Navy Petroleum Office
NSRDC	=	(Naval Sea Systems Command) Naval Ships Research and Development Center
OASD(P&L)	=	Office of the Assistant Secretary of Defense (Production and Logistics)
OCR	=	optical character recognition
Oracle	=	a relational database management system
OSD	=	Office of the Secretary of Defense

Pascal	=	a higher-level programming language
PC	=	personal computer
PC&S	=	post, camp, and station
PQDS	=	petroleum quality data system (PQIS subsystem)
PQIS	=	petroleum quality information system
PQLNS	=	petroleum quality laboratory network system (proposed PQIS subsystem)
PQSAS	=	petroleum quality statistical analysis system (PQIS subsystem)
Prolog	=	an artificial intelligence language
QAR	=	quality assurance representative
QPL	=	qualified products list
QSR	=	quality surveillance representative
SAS	=	Statistical Analysis System
SAS/PC	=	microcomputer Statistical Analysis System
SPSS	=	Statistical Package for the Social Sciences
SPSS/PC Plus	=	microcomputer Statistical Package for the Social Sciences
STQO	=	Service Technical Quality Office
TROSCOM	=	(Army Materiel Command) Troop Support Command
UNIX	=	microcomputer operating system developed by American Telephone and Telegraph
WAL	=	Wright Aeronautical Laboratories
WSIM	=	water separation index modified
8086	=	Intel 16-bit CPU microprocessor – IBM XT equivalent
8088	=	Intel 16-bit CPU microprocessor – IBM PC equivalent
80286	=	Intel 16-bit CPU microprocessor – IBM AT equivalent
80386	=	Intel 32-bit CPU microprocessor – Compaq 386 equivalent

TECHNICAL ABBREVIATIONS

Btu	=	British thermal unit
C	=	Celsius
CI	=	corrosion inhibitor
cSt	=	centistokes
°	=	degrees
EC	=	electrical conductivity (antistatic) fuel additive
EC/CI	=	electrical conductivity and corrosion inhibitor additives
EC/CI/FSII	=	electrical conductivity and corrosion inhibitor additives and fuel system icing inhibitor
F	=	Fahrenheit
g	=	gram
gal	=	gallon
Hg	=	mercury
"	=	inch
kbbl	=	thousand barrels
kg	=	kilogram
kL	=	kiloliter
KOH	=	potassium hydroxide
kPa	=	kilopascal
L	=	liter
lb	=	pound
m	=	meter
m^3	=	cubic meter
Mbbl	=	millions of barrels
meq/kgs	=	peroxide number
mg	=	milligram

MJ	=	megajoule
mL	=	milliliter
mm	=	millimeter
ppm	=	parts per million
%	=	percentage
pS	=	picosiemen
pS/m	=	picosiemens per meter
psi	=	pounds per square inch

APPENDIX A

PETROLEUM PRODUCT SPECIFICATIONS

PETROLEUM PRODUCT SPECIFICATIONS

Most quality control tests apply methods established by the American Society for Testing and Materials (ASTM) which also establish commercial product specifications for petroleum fuels.[1,2]

This appendix contains the following:

- Table A-1 lists the quality control test name, method for testing for fuel quality, and unit of measure used in the test for all petroleum product characteristics.
- Table A-2 lists – for aviation turbine fuels – the specific test name for each fuels characteristic category.
- Table A-3 lists the quality control test name for each DoD aviation turbine fuel, along with its limit and unit of measure.
- Table A-4 lists the quality control test name for each DoD diesel fuel, along with the test limit and unit of measure.

These tables show the level of detail needed in a data system supporting fuel quality control.

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[1] *1987 Annual Book of ASTM Standards: Petroleum Products, Lubricants, and Fossil Fuels.* Vols. 5.01 – 5.08. American Society for Testing and Materials. 1987.

[2] *ASTM and Other Specifications and Classifications for Petroleum Products and Lubricants Fuels and Oils, Bituminous Materials, and Solvents* Fourth Edition. American Society for Testing and Materials. 1985.

TABLE A-1

PETROLEUM PRODUCT CHARACTERISTICS

Quality control test name	Method	Measure
Accelerated stability	D2274	milligram (mg)/100 milliliter (mL)
Acidity, strong base number	D0974	Strong base number
Acidity, total acid number	D3242	mg potassium hydroxide (KOH)/ gram (g)
Aniline point	D0611	degrees Celsius (°C)
Aniline-gravity point	D1405	Heating value
Antioxidant additive name	Specification	Brand name
Antioxidant content	Specification	g/1,000 gallons (gal)
	Specification	pounds (lb)/thousand barrels (kbbl)
	Specification	mg/gal
	Specification	mg/liter (L)
Antistatic/electrical conductivity additive	Specification	Brand name
Antistatic/electrical conductivity content	Specification	parts per million (ppm)
	Specification	mg/L
Aromatic content	D1319	Volume %
Ash content	D0482	Weight % or mass %
Calcium trace metals	D3605	Weight % or mass %
Carbon residue	D0524	Weight % or mass %
Cetane number	D0613	Cetane number
Cetane index	D0976	Cetane index
Cetane/ignition improver additive	Specification	Brand name
Cetane/ignition improver content	Specification	g/cubic meter (m^3)
	Specification	mg/L
Cloud point	D2500	°C
Color, ASTM	D1500	Numeric value
Color, Saybolt	D0156	Numeric value
Copper strip corrosion	D0130	Code
Corrosion inhibitor/lubricity additive	Qualified products list	Brand name

TABLE A-1

PETROLEUM PRODUCT CHARACTERISTICS (Continued)

Quality control test name	Method	Measure
Corrosion inhibitor/lubricant content	Specification	g/m^3
	Specification	lb/kbbl
	Specification	mg/L
Corrosion number	D0189	Code
Demulsification	D1401	Minutes
Density/American Petroleum Institute (API) gravity	D1298	API°
	D4052	API°
Density/relative gravity	D1298	kilograms (kg)/m^3 or kg/L
	D4052	kg/m^3 or kg/L
Distillation initial boiling point	D0086	°C
	D2887	°C
Distillation 10% recovery	D0086	°C
	D2887	°C
Distillation 20% recovery	D0086	°C
	D2887	°C
Distillation 50% recovery	D0086	°C
	D2887	°C
Distillation 90% recovery	D0086	°C
	D2887	°C
Distillation final boiling point	D0086	°C
	D2887	°C
Distillation loss	D0086	Volume %
Distillation residue	D0086	Volume %
Doctor test	D0484	Positive or negative
Electrical conductivity	D2624	picosiemens per meter (pS/m)
	D3114	pS/m
Existent gum content	D0381	mg/100 mL
Explosiveness	FTMS[a]	Volume %

[a] Federal test method standard

TABLE A-1

PETROLEUM PRODUCT CHARACTERISTICS (Continued)

Quality control test name	Method	Measure
Filtration time	Specification	Minutes
Filtration time, temperature	Specification	°C
Filtration time, vacuum	Specification	millimeters (mm) of mercury (Hg)
	Specification	Inches (") of Hg
Flash point	D0056	°C
	D0093	°C
	D3828	°C
	D3243	°C
Flash point degree measurement	D3828	°C or °Fahrenheit (F)
Freezing point	D2386	°C
Fuel system icing inhibitor (FSII) additive	Specification	Brand name
FSII content	Specification	mg/L
	Specification	Volume %
Hydrogen content	D1018	Weight %
	D3343	Weight %
	D3701	Weight %
Jet fuel thermal oxidation test (JFTOT) preheater deposit code	D3241	Code
JFTOT pressure change	D3241	mm Hg
Lead content	MIL-HDBK-200F	g/L
Lead trace metal content	D3605	Weight % or mass %
Luminometer number	D1740	Number
Metal deactivator additive	Specification	Brand name
Metal deactivator content	Specification	g/100 gal
	Specification	lb/kbbl
	Specification	mg/gal
	Specification	mg/L
Naphthalenes	D1840	Volume %
Net heat of combustion	D0240	British thermal unit (Btu)/lb or megajoule (MJ)/kg
	D2382	Btu/lb or MJ/kg
	D3338	Btu/lb or MJ/kg

TABLE A-1

PETROLEUM PRODUCT CHARACTERISTICS (Continued)

Quality control test name	Method	Measure
Neutralization/acidity number	D0974	mg KOH/g
Octane number, motor (MON)	D2699	
Octane number, research (RON)	D2699	
Olefin content	D1319	Volume %
Oxidation stability	D0525	
Particulate matter content	D2276	mg/L
Peroxide content	D3703	ppm
Peroxide number	D3703	Peroxide number (meq/kgs)
Pour point	D0097	°C
Preheater deposit (tube color code)	D1660	JFTOT code
	D3241	JFTOT code
Smoke point	D1322	mm
Sodium and potassium trace metal content	D3605	Weight % or mass %
Stability (JFTOT) pressure change	D1660	"Hg, mm Hg, or kilopascal (kPa)
Stability preheater deposit (tube color code)	D1660	JFTOT code
	D3241	JFTOT code
Sulfur, Mercaptan	D3227	Weight %
Sulfur, total	D0129	Weight %
	D1266	Weight %
	D1552	Weight % or mass %
	D2622	Weight %
	D4294	Weight %
Unwashed gum content	D3081	mg/L
Vanadium trace metal content	D3605	Weight % or mass %
Vapor/liquid ratio	D2533	
Vapor pressure	D0323	kPa or pounds per square inch (psi)
	D2551	kPa or psi
Viscosity	D0445	centiStokes (cSt)/meter (m)
Visual appearance	D4176	Clear and bright
Visual color (ASTM color scale)	D1500	Numeric value
Water reaction interface rating	D1094	Character rating
Water separation index modified (WSIM)	D2550	WSIM

TABLE A-2

SPECIFICATIONS FOR AVIATION TURBINE FUELS

Category	Test name	Fuel type				
		Military			Commercial	
		JP4	JP5	JP8	Jet A Jet A1	Jet B
Appearance	Saybolt color	R	R	R		
Composition	Acid content	R	R	R	R	R
	Aromatic content	R	R	R		
	Olefin content	R	R	R		
	Sulfur content	R	R	R	R	R
Volatility	Distillation	R	R	R	R	R
	Vapor pressure	R				R
	Flash point		R	R	R	
	Density	R	R	R	R	R
Fluidity	Freezing point	R	R	R	R	R
	Viscosity		R	R	R	
Combustion	Heat content	R	R	R	R	R
	Hydrogen content	R	R	R		
	Smoke point	R	R	R	R	R
	Naphthalene content			R	R	R
	Cetane index		R	R		
Stability	Pressure change	R	R	R	R	R
	Deposit code	R	R	R	R	R
Corrosion	Copper strip corrosion	R	R	R	R	R
Contaminants	Existent gum content	R	R	R	R	R
	Particulate matter content	R	R	R	R	R
	Water reaction rating	R	R	R	R	R
	Water separation index	R	R	R		
	Filtration time	R	R	R		
Additives	Fuel system anti-icing	R	R	R	R	R
	Antioxidant	O	O	O	O	O
	Corrosion inhibitor (CI)	O	O	O	O	O
	Metal deactivator	O	O	O	O	O
	Antistatic additive	O		O	O	O
	Fuel conductivity	O		O	O	O

Notes: Jet A, Jet A1, and Jet B are commercial jet fuel substitutes for JP4, JP5, and JP8 (respectively). R = required test; O = optional test

TABLE A-3

AVIATION TURBINE FUEL PRODUCT SPECIFICATIONS

Quality control test name	JP4	JP5	JP8	Test	
				Limit	Measure
Color, Saybolt	R[a]	R	R	None	Number
Total acid number	015	015	015	Maximum	mg KOH/g
Aromatic content	25.0	25.0	25 0	Maximum	Volume %
Olefin content	5.0	5.0	5 0	Maximum	Volume %
Sulfur content					
Mercaptan sulfur content	002	002	002	Maximum	Weight %
Doctor test	N[b]	N	N	Negative	Code
Total sulfur content	0.4	0.4	0.3	Maximum	Weight %
Distillation properties					D0086 (D2887)
Initial boiling point	R	R	R	Maximum	°C
10% recovery	R	205 (185)	205 (186)	Maximum	°C
20% recovery	145 (130)	R	R	Maximum	°C
50% recovery	190 (185)	R	R	Maximum	°C
90% recovery	245 (250)	R	R	Maximum	°C
Final boiling point	270 (320)	300 (330)	300 (330)	Maximum	°C
Residue	1.5	1.5	1 5	Maximum	Vol %
Loss	1.5	1.5	1 5	Maximum	Vol %
Explosiveness (no longer required)		50		Maximum	%
Cetane index		R	R	None	Index
Flash point		60	38	Minimum	°C
Gravity/specific density	45 (.751)	36 (.788)	37 (.775)	Minimum	API° (kg/L)
	57 (.802)	48 (.845)	51 (.840)	Maximum	API° (kg/L)
Vapor pressure	2.0 (14)			Minimum	psi (kPa)
	3.0 (21)			Maximum	psi (kPa)
Freezing point	-58	-46	-47	Minimum	°C
Viscosity at -20 °C		8.5	8 0	Maximum	cSt
Heating value					
Aniline-gravity product	5 250	4,500		Minimum	Number
Btu per pound	18,400	18,300	18,400	Minimum	Btu/lb
MJ/kg	42 8	42 6	42 8	Minimum	MJ/kg
Hydrogen content	13 6	13 4	13 4	Minimum	Weight %
Smoke point	20 0	19 0	20 0	Maximum	mm
Copper strip corrosion rating	1B	1B	1B	Maximum	Code

Sources: Military Specification MIL-T-5624M, *Turbine Fuel, Aviation, Grades JP-4 and JP-5* (18 April 1987). Military Specification MIL-T-83133B, *Turbine Fuel, Aviation, Kerosene Type, Grade JP-8* (1 Feb. 1987).

[a] Report test results.

[b] Negative test result.

TABLE A-3

AVIATION TURBINE FUEL PRODUCT SPECIFICATIONS (Continued)

Quality control test name	JP4	JP5	JP8	Test	
				Limit	Measure
Thermal stability					
Pressure change	25	25	25	Maximum	mm
Preheater deposit code	3	3	3	Maximum	Code
Existent gum content	7 0	7 0	7 0	Maximum	mg/100 mL
Particulate matter content	1 0	1 0	1 0	Maximum	mg/L
Filtration time	10	15	15	Maximum	Minutes
FSII	0 10	0 15	0 10	Minimum	Volume %
	0.15	0.20	0 15	Maximum	Volume %
Water reaction interface rating	1B	1B	1B	Maximum	Code
WSIM					
with all additives	70	70	70	Minimum	Index
without FSII		80		Minimum	Index
without CI	85	85	85	Minimum	Index
without additives		90		Minimum	Index
Electrical conductivity	200		200	Minimum	pS/m
	600		600	Maximum	pS/m

Sources: Military Specification MIL-T-5624M *Turbine Fuel, Aviation, Grades JP-4 and JP-5* 18 Aug 1987 Military Specification MIL-T-83133B *Turbine Fuel, Aviation, Kerosene Type, Grade JP-8* 3 Sep 1987

TABLE A-4

DIESEL FUEL PRODUCT SPECIFICATIONS

Quality control test name	F76	DFA	DF1	DF2 CONUS	DF2 OCONUS	Test	
						Limit	Measure
Cetane number	45	45	40	40	45	Maximum	Cetane number
Appearance	BC	BC	BC	BC	BC	BC	Bright and clear
Distillation							
10% recovery	R					Maximum	°C
50% recovery	R	R	R	R	R	Maximum	°C
90% recovery	357	288	288	338	357	Maximum	°C
Final boiling point	385	300	330	370	370	Maximum	°C
Residue	3.0**	3.0	3.0	3.0	3.0	Maximum	Volume %
Flash point	60	38	38	52	*56	Minimum	°C
Pour point	-6	-51	-13	R	*	Maximum	°C
Cloud point	-1	*	*	*	*	Maximum	°C
Viscosity	1.7	1.1	1.3	1.9	(1.8)	Minimum	cSt
	4.3	2.4	2.9	4.1	(9.5)	Maximum	cSt
Carbon residue	20	10	15	35	2	Minimum	%
Sulfur, total	1.00	25	50	50	70	Maximum	Mass %
Corrosion, copper strip	1	3	3	3	1	Maximum	Code
Color, ASTM	3					Maximum	Code
Ash content	005	010	010	010	020	Maximum	Mass %
Particulates	10	10	10	10	10	Maximum	mg/L
Trace metal content							
Vanadium	R					Maximum	mg/L
Sodium and potassium	R					Maximum	mg/L
Calcium	R					Maximum	mg/L
Lead	R					Maximum	mg/L
Density/specific gravity	R	R	R	R	815	Minimum	kg/L
					860	Maximum	kg/L
Demulsification	10					Maximum	Minutes
Acidity, total	30	05			10	Maximum	mg KOH/g
Neutrality	N					Maximum	Neutral
Aniline point	R					Maximum	C
Accelerated stability	1.5					Maximum	mg/100 mL
FSII	15	15	15	15	15	Maximum	Volume %

Sources: [illegible] Amendment 2, Fuel Oil, Diesel, [illegible] 1985. Military specification MIL-L-16884H, Amendment 2, Fuel, Naval distillate, [illegible] 1985.

Note: [illegible] divide the Continental United States [illegible] and [illegible] = report test results. ** = residue plus loss. * = specification requirements [illegible].

APPENDIX B

QUALITY CONTROL SOURCE DATA

QUALITY CONTROL SOURCE DATA

DoD utilizes several standard forms and reports for managing the quality of bulk petroleum products as described in DoD 4140.25-M,[1] the petroleum product management manual. The DD Form 250 series reports are used to account for bulk petroleum product shipments: the DD Form 250, Material Inspection and Receiving Report, is used for pipeline and overland shipments while the DD Form 250-1, Tanker/Barge Material Inspection and Receiving Report, is used for shipments by marine vessel. These reports are contractual quality assurance documents that are used for accounting, payment, and quality control. The reports contain information about the product shipment: the type of product, the volume of the shipment, the intended destination, and the quality of the product purchased with reference to contractual specifications. They are also used for quality surveillance of the product shipments.

Quality control information is reported in many different ways. It usually consists of a list of quality characteristics, test names, test results, and test limits. The exact list of items included in the report varies from a complete list of product characteristics in a product acceptance test to an abbreviated list of characteristics in a test for suspected contamination. The quality control information may be included in the product acceptance test, or may be included as a separate document. Quality surveillance tests are normally performed by DoD (or commercial) laboratories and are provided on computer generated reports.

These quality control test reports, described in detail in the following paragraphs, are the data sources for a petroleum quality information system (PQIS).

DD FORM 250-1, TANKER/BARGE MATERIAL INSPECTION AND RECEIVING REPORT

A sample DD Form 250-1 is shown in Figure B-1. It contains an unstructured list of product quality control characteristics with supplemental data on loading and discharge, prior shipments, etc. Test reports are included for individual refinery holding (or ship storage) tanks and are complemented by an abbreviated test report

[1]DoD Manual 4140.25-M. *Procedures for the Management of Petroleum Products*. Dec 1978.

representing the ship composite characteristics, as required by DLAM 4155.1.[2] The form is described in detail in DoD 4140.25-M. It provides detailed reporting of product loading activities when the fuel is transferred to a marine vessel. This identifies quality control characteristics when the product is produced (by batch number) or placed in refinery storage (by refinery storage tank). All product characteristics are identified for each individual refinery holding tank. The DD Form 250-1 report includes an abbreviated list of test results (the ship composite) for the total shipment. Product quality characteristics are also identified after transfer to another marine vessel or a pipeline for shipment to a specified destination.

DD FORM 250, MATERIAL INSPECTION AND RECEIVING REPORT

This is an abbreviated DD Form 250-1 that contains salient loading, acceptance, and shipping information for bulk fuel purchases shipped by overland transport or pipeline. A sample report is shown in Figure B-2. Note that it does not contain quality control information except product quantity and additive content. Quality assurance representatives (QARs) submit a DD Form 250, complemented by an Air Force Technical Order (AFTO) Form 456, Turbine Fuel Test Report (for turbine fuel pipeline shipments), or a similar nonstandard test report.

AFTO FORM 456, TURBINE FUEL TEST REPORT

A sample AFTO Form 456 test report is shown in Figure B-3. This is a structured list of product characteristics, specifically designed for turbine jet fuels, essentially identical to the American Society for Testing and Materials (ASTM) D1655, Inspection Data on Aviation Turbine Fuels, shown in Figure B-4.

DoD LABORATORY QUALITY CONTROL TEST REPORTS

These are computer-generated forms (see the example shown in Figure B-5) produced on laboratory computers. They list test results in the order identified in a product specification. A laboratory can perform any type of quality control test, ranging from a full specification test (type A) to a problem test report (type C), but is most likely to perform dormant-storage (type B-2) and problem (type C) quality control tests.

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[2]DLA Manual DLAM 4155.1 *Petroleum Procurement Quality Assurance Manual*. Feb 1985.

NONSTANDARD QUALITY CONTROL TEST REPORTS

This category includes a variety of special-purpose manual and computer-generated quality control test reports produced by refineries and pipelines, as shown in the examples in Figures B-6 and B-7. These types of reports are usually included with a DD Form 250 to certify product quality. Manual data entry is required for this type of report.

QUALITY CONTROL TEST REPORTS

These quality control test forms are used for both quality assurance and quality surveillance reporting in accordance with the DoD petroleum quality assurance manual (DLAM 4155.1), the quality surveillance handbook (MIL-HDBK-200F),[3] and the petroleum product management manual (DoD 4140.25-M). Uses include the following:

- Product acceptance. This requirement was described in depth in the preceding paragraphs.
- Fuel transfer. Quality control samples are obtained at each transfer point, when the shipment is transferred between ships or between a ship and a pipeline. These samples are tested to identify salient product characteristics that might be affected by the transfer and to provide a record of product quality before and after the transfer operation. Test results are provided by ship tank or pipeline batch, complemented by a ship or shipment composite.
- Discharge/receipt report. At the final destination, the shipment is subjected to another set of quality control tests to quantify the quality of the product received. Product characteristics are identified for each ship tank/pipeline batch and for the ship composite before discharge, and for each storage tank after discharge is completed.
- Problem test reports. A quality control test is normally requested if there is any possibility of product contamination. This test report consists of a set of quality control characteristics for a product shipment or a particular storage location: a particular storage tank, a ship tank, or a pipeline batch. The exact list of product characteristics reported depends on the reason for the test.

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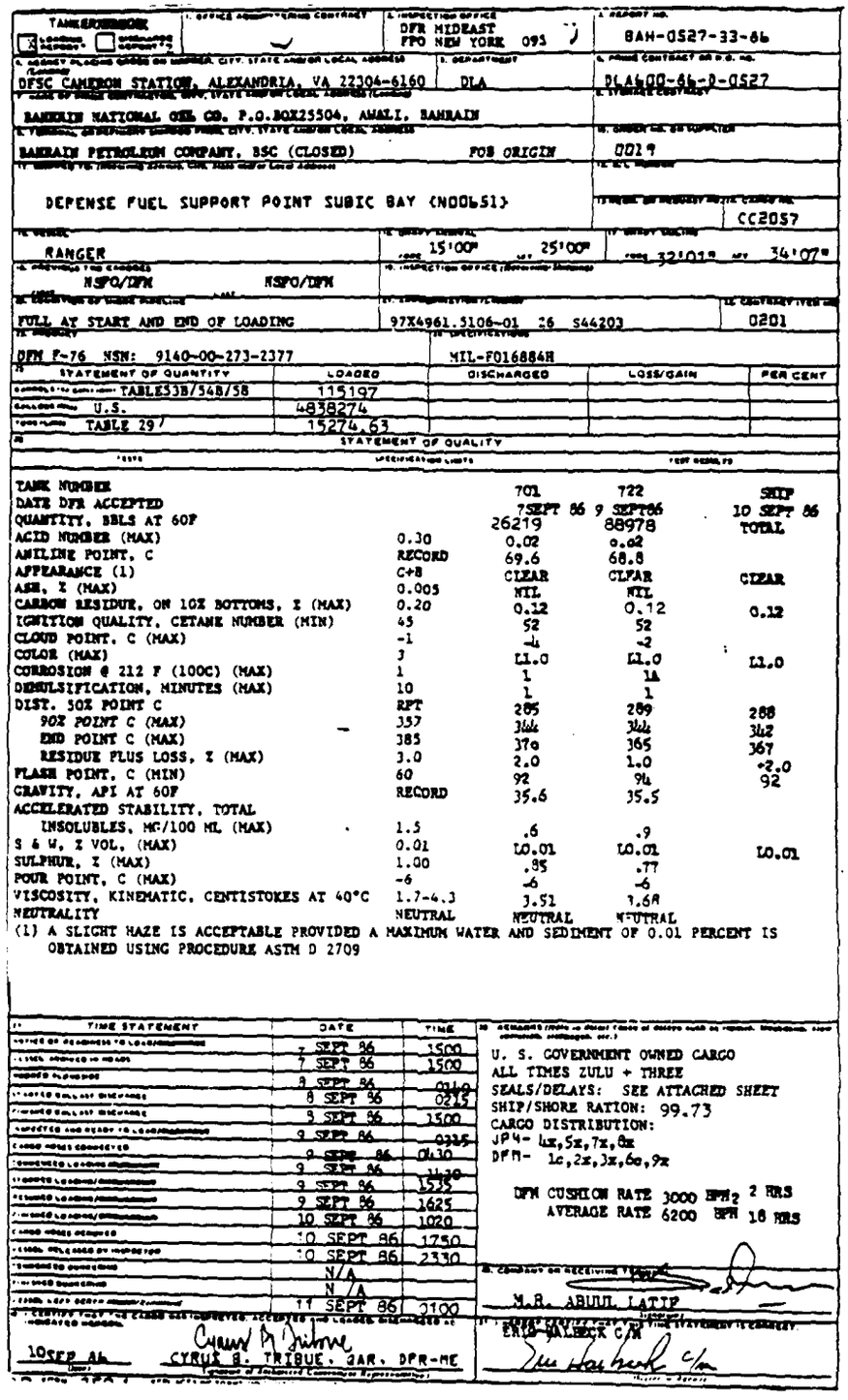
[3]MIL-HDBK-200F. *Quality Surveillance Handbook for Fuels, Lubricants and Related Products*. Sep 1981.

- Dormant-storage test reports. Periodic quality control tests are required for products in long-term storage. Each tank is tested at least once every 6 months to ensure product integrity.



TANKER/BARGE

DFR MIDEAST
FPO NEW YORK 091

8AH-0527-33-86

DFSC CAMERON STATION, ALEXANDRIA, VA 22304-6160 | DLA | DLA400-86-D-0527

BAHRAIN NATIONAL OIL CO. P.O.BOX25504, AWALI, BAHRAIN

BAHRAIN PETROLEUM COMPANY, BSC (CLOSED) FOB ORIGIN 0019

DEFENSE FUEL SUPPORT POINT SUBIC BAY (N00651) CC2057

RANGER 15'00" 25'00" 32'01" 34'07"

NSFO/DFM NSFO/DFM

FULL AT START AND END OF LOADING 97X4961.5106-01 26 S44203 0201

DFM F-76 NSN: 9140-00-273-2377 MIL-F016884H

STATEMENT OF QUANTITY	LOADED	DISCHARGED	LOSS/GAIN	PER CENT
TABLE53B/54B/58	115197			
U.S.	4838274			
TABLE 29	15274.63			

STATEMENT OF QUALITY

		701	722	SHIP
TANK NUMBER				
DATE DFR ACCEPTED		7SEPT 86	9 SEPT86	10 SEPT 86
QUANTITY, BBLS AT 60F		26219	88978	TOTAL
ACID NUMBER (MAX)	0.30	0.02	0.02	
ANILINE POINT, C	RECORD	69.6	68.8	
APPEARANCE (1)	C+B	CLEAR	CLEAR	CLEAR
ASH, % (MAX)	0.005	NIL	NIL	
CARBON RESIDUE, ON 10% BOTTOMS, % (MAX)	0.20	0.12	0.12	0.12
IGNITION QUALITY, CETANE NUMBER (MIN)	45	52	52	
CLOUD POINT, C (MAX)	-1	-4	-2	
COLOR (MAX)	3	L1.0	L1.0	L1.0
CORROSION @ 212 F (100C) (MAX)	1	1	1A	
DEMULSIFICATION, MINUTES (MAX)	10	1	1	
DIST. 50% POINT C	RPT	285	289	288
90% POINT C (MAX)	357	344	344	342
END POINT C (MAX)	385	376	365	367
RESIDUE PLUS LOSS, % (MAX)	3.0	2.0	1.0	2.0
FLASH POINT, C (MIN)	60	92	94	92
GRAVITY, API AT 60F	RECORD	35.6	35.5	
ACCELERATED STABILITY, TOTAL INSOLUBLES, MG/100 ML (MAX)	1.5	.6	.9	
S & W, % VOL, (MAX)	0.01	LO.01	LO.01	LO.01
SULPHUR, % (MAX)	1.00	.85	.77	
POUR POINT, C (MAX)	-6	-6	-6	
VISCOSITY, KINEMATIC, CENTISTOKES AT 40°C	1.7-4.3	3.51	3.68	
NEUTRALITY	NEUTRAL	NEUTRAL	NEUTRAL	

(1) A SLIGHT HAZE IS ACCEPTABLE PROVIDED A MAXIMUM WATER AND SEDIMENT OF 0.01 PERCENT IS OBTAINED USING PROCEDURE ASTM D 2709

TIME STATEMENT	DATE	TIME
	7 SEPT 86	1500
	7 SEPT 86	1500
	8 SEPT 86	0119
	8 SEPT 86	0215
	9 SEPT 86	1500
	9 SEPT 86	0325
	9 SEPT 86	0430
	9 SEPT 86	1130
	9 SEPT 86	1525
	9 SEPT 86	1625
	10 SEPT 86	1020
	10 SEPT 86	1750
	10 SEPT 86	2330
	N/A	
	N/A	
	11 SEPT 86	0100

U. S. GOVERNMENT OWNED CARGO
ALL TIMES ZULU + THREE
SEALS/DELAYS: SEE ATTACHED SHEET
SHIP/SHORE RATION: 99.73
CARGO DISTRIBUTION:
JP4- 4x,5x,7x,8x
DFM- 1c,2x,3x,6c,9x

DFM CUSHION RATE 3000 BPH; 2 HRS
AVERAGE RATE 6200 BPH 18 HRS

M.R. ABDUL LATIF

10SEP 86 CYRUS B. TRIBUE, 2AR, DFR-ME

ERIC HAVERCK C/M

FIG. B-1. TANKER/BARGE MATERIAL INSPECTION AND RECEIVING REPORT (DD FORM 250-1)

MATERIAL INSPECTION AND RECEIVING REPORT

ULA600-86-D-0491 DG-23

NO 1 1

DATE

8 ACCEPTANCE POINT S

2. SHIPMENT NO	3. DATE SHIPPED *	4. B/L	5. DISCOUNT TERMS
HIR-0001Z	SEE BLOCK 23	TCN 8	

6. PRIME CONTRACTOR CODE 8P840

HAWAIIAN INDEPENDENT REFINERY, INC.
P.O. BOX 3379
733 BISHOP STREET
HONOLULU, HAWAII 96842

10. ADMINISTERED BY CODE SC0600

DEFENSE FUEL SUPPLY CENTER
CAMERON STATION
ALEXANDRIA, VIRGINIA 22314

11. SHIPPED FROM (If other than 6) CODE 8P840 FOB:

HAWAIIAN INDEPENDENT REFINERY, INC.
BARBERS POINT, OAHU, HAWAII
91-325 KOMOHANA STREET
EWA BEACH, HAWAII 96707

12. PAYMENT WILL BE MADE BY CODE SA4900

DEFENSE FUEL SUPPLY CENTER
ATTN: DFSC-CDX
CAMERON STATION, BLDG. 5
ALEXANDRIA, VIRGINIA 22314

13. SHIPPED TO CODE EP6000
RIC:DRP

DFSP USAF WAIKAKALAUA/KIPAPA
VIA HIRI PIPELINE

14. MARKED FOR CODE

15. ITEM NO	16. STOCK/PART NO. DESCRIPTION (Indicate number of shipping containers - type of container - container number)	17. QUANTITY SHIP/REC'D *	18. UNIT	19. UNIT PRICE	20. AMOUNT
0201	NSN 9130-00-256-8613 TURBINE FUEL, AVIATION, GRADE JP-4 SPEC. MIL-T-5624L AM.2 ADDITIVES: CONTAINS NO ELECTRICAL CONDUCTIVITY ADDITIVE. CORROSION INHIBITOR (3.0-9.0 LB/MBBL): NALCO 5403 ANTI-ICING VOL. % (0.10-0.15): UCEM	1,676,727	GALS		

21 PROCUREMENT QUALITY ASSURANCE

A. ORIGIN
[X] POA [X] ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract, except as noted herein or on supporting documents.

29SEP86 DATE

Stanley L. Zaucha SIGNATURE OF AUTH GOVT REP

TYPED NAME AND OFFICE QAR HAWAII SJ0621

B. DESTINATION
[ ] POA [ ] ACCEPTANCE of listed items has been made by me or under my supervision and they conform to contract, except as noted herein or on supporting documents.

DATE SIGNATURE OF AUTH GOVT REP

TYPED NAME AND TITLE

22. RECEIVER'S USE
Quantities shown in column 17 were received in apparent good condition except as noted

DATE RECEIVED SIGNATURE OF AUTH GOVT REP

TYPED NAME AND OFFICE

* If quantity received by the Government is the same as quantity shipped, indicate by (✓) mark; if not, enter actual quantity received below quantity shipped and explain.

23 CONTRACTOR USE ONLY

ASTM IP TABLE NO. 6B

SHIPPED FROM: TANK: 511
BATCH: 86-15

API GRAVITY: 54.8

	TIME	*DATE
PUMPING STARTED:	1633	25SEP86
PUMPING FINISHED:	1510	26SEP86
PIPELINE TENDER NO.:	409	
CONTRACT ITEM BALANCE 0101	-0-	
0201	5,221,089	

BONDED FUEL

DD FORM 250 1 NOV 68 REPLACES EDITION OF 1 AUG 67 WHICH MAY BE USED S/N 0102-002-2302

FIG. B-2. MATERIAL INSPECTION AND RECEIVING REPORT (DD FORM 250)

ITEM	METHOD	APPEARANCE	RESULTS	SPECIFICATION
10	D156	Color (Saybolt)	+30	Report
20		Visual (B-Bright and C-Clear)	CB	C & B
		COMPOSITION		
100	D3242	Acidity, Total (mg KOH/g)	.005	0.015 max
110	D1319	Aromatics (vol %)	10.6	25.0 max
120	D1319	Olefins (vol %)	0.8	5.0 max
130	D1323	Sulfur, Mercaptan (wt %)	.	0.001 max
1401	D484	Doctor Test (p-pos, n-negative)	N	N
150	D1266	Sulfur, Total (wt %)	.03	0.40 max
		VOLATILITY		
200	D86	Distillation Initial BP (°C)	154	Report
205		10% Rec @ (°C)	195	Report
210		20% Rec @ (°C)	113	145 max
215		50% Rec @ (°C)	137	190 max
220		90% Rec @ (°C)	166	245 max
225		95% Rec @ (°C)		
230		Final BP (°C)	203	270 max
235		Residue (%)	0.6	1.5 max
240		Loss (%)	1.4	1.5 max
245		Recovery at 400 F (%)	.	
250	FTMS1151	Explosiveness (vol %)		
260	D56	Flash Point (F)		
270	D1298	Gravity, API (60 F)	56.8	45.0-57.0
280	D1298	Density kg/m³ @15°C	751	751- 802
290	D323	Vapor Pressure (lb Reid)	2.7	2.0-3.0
		FLUIDITY		
300	D2386	Freezing Point (°C)	-80	-58 max
3101	D455	Viscosity at -30 F (cSt)	.	
		COMBUSTION		
400	D1405	Aniline-Gravity Product	6469	5250 min
410	D611	Aniline Point (°C)	63.5	Report
420	D1740	Luminometer Number		
430	D1322	Smoke Point	25.0	20.0 min
440	D1840	Naphthalenes (vol %)	.	
450	D1655	Smoke-Volatility Index	.	
		CORROSION		
500	D130	Copper Strip (2 h at 212 F)	1b	1b
510	IP227	Silver Strip		
		STABILITY		
600	D3241	Δ P (mm Hg.)	0	25 max
610	D3241	Tube Color Code	1	<3
		CONTAMINANTS		
700	IP225	Copper Content (ug/kg)		
710	D381	Existent Gum (mg/100 ml)	0.6	7.0 max
720	App.A	Particulates (mg/liter)	0.2	1.0 max
730	D1094	Water Reaction Vol Change (ml)	.	
740	D1094	Water Reaction Ratings Interface	1b	1b max
7501	D2550	WSIM	89	70 min
		ADDITIVES — BRAND		
800	Anti-icing (vol %)	JFA-4	.11	0.10-0.15
810	Antioxidant (lb/M Bbl)	NONE	.	
820	Corrosion Inhibitor (lb/M Bbl)	DCI-4A	3.1	3.0 - 8.0
830	Metal Deactivator (lb/M Bbl)		.	
840	Antistatic, ppm	ASA-3	0.14	
		OTHER TESTS		
900	D2624	Conductivity (C.U.)		
910	App.A	Filterability (Minutes)	4	15 max
920	App.A	Filterability (in.Hg)	23	20 min

REPORT DATE: 8/18/82

CONTRACT NO: DLA600-82-D-0536
DLA600-81-D-3048

ORDER NO:

DATE SAMPLED: 8/18/82

SAMPLE NO: DFA-82-46

BATCH NO:

TANK NO: 316

QUANTITY U.S. GALLONS: 382,500

SAMPLING LOCATION: Winston Refining Co. Fort Worth, Texas

PRODUCT NAME: Turbine Fuel, Aviation

COMPLIES WITH SPECIFICATION: MIL-T-5624L

DESTINATION:

GRADE: JP-4

REMARKS:

APPROVED BY: Don Malone

Simon Edwards, GMS

AFTO FORM OCT 72 476 TURBINE FUEL TEST REPORT

FIG. B-3. TURBINE FUEL TEST REPORT (AFTO FORM 456)

D 1655

INSPECTION DATA ON AVIATION TURBINE FUELS

(See the back of the form itself or Specification D 1655 Appendix A2 for instructions on use of form)

REPORT DATE _____ QUANTITY U.S. GALLONS: _____

CONTRACT No. _____ SAMPLING LOCATION: _____

ORDER No. _____ DESTINATION: _____

DATE SAMPLED _____ PRODUCT NAME: _____

SAMPLE No. _____ COMPLIES WITH SPECIFICATIONS: _____ REMARKS: _____

BATCH No. _____

TANK No. _____

GRADE: _____

Method	APPEARANCE	Results
10 D 156	Color (Saybolt)	
20 —	Visual (B=Bright & C=Clear)	
	COMPOSITION	
100 D 974/3242	Acidity, Total (mg KOH/g)	
110 D 1319	Aromatics (vol %)	
120 D 1319	Olefins (vol %)	
130 D 3227 1	Sulfur, Mercaptan (wt %)	
140 D 484	Doctor Test (P=Pos, N=Neg)	
150 D 1266/1552/2622	Sulfur, Total (wt %)	
	VOLATILITY	
200 D 86	Distillation Init. BP (F)	
205 D 86	" 10% Rec (F)	
210 D 86	" 20% Rec (F)	
215 D 86	" 50% Rec (F)	
220 D 86	" 90% Rec (F)	
225 D 86	" 95% Rec (F)	
230 D 86	" Final BP (F)	
235 D 86	Residue (%)	
240 D 86	Loss (%)	
245 D 86	Recovery at 400 F (%)	
250 FTMS 1151	Explosiveness (vol %)	
260 D 56/3828	Flash Point, Tag Closed (F)	
261 D 93	Flash Point, Pensky Martin (F)	
270 D 1298	Gravity, API (60 F)	
280 D 1298	Gravity, Specific (60/60 F)	
290 D 323	Vapor Pressure (lb Reid)	
	FLUIDITY	
300 D 2386	Freezing Point (F)	
310 D 445	Viscosity at -30 F (cSt)	
	COMBUSTION	
400 D 1405	Aniline Gravity Product	
410 D 1405	Net Heat of Comb. (Btu/lb)	
420 D 1740	Luminometer No.	
430 D 1322	Smoke Point	
440 D 1840	Naphthalenes (vol %)	
450 D 1655	Smoke-Volatility Index	

Method	CORROSION	Results
500 D 130	Copper Strip (2h at 212F)	
510 IP 227	Silver Strip	
	STABILITY	
600 D 1660	Color Δ P (in. Hg)	
610 D 1660	Color Tube Color Code	
611 D 3241	JFTOT at 260C Δ P (mm Hg)	
612 D 3241	JFTOT at 260C Tube Color Code	
613 D 3241	JFTOT at 260C TDR Spun Rating	
614 D 3241	JFTOT at 245C Δ P (mm Hg)	
615 D 3241	JFTOT at 245C Tube Color Code	
616 D 3241	JFTOT at 245C TDR Spun Rating	
	CONTAMINANTS	
700 IP 225	Copper Content (μg/kg)	
710 D 381	Existent Gum (mg/100 ml)	
720 D 2276	Particulates (mg/liter)	
721 Mil-T-5624J APP A	Filtration time, min.	
722 "	vacuum, mm Hg	
723 "	volume fuel filtered, ml	
740 D 1094	Water Reaction interface Rating	
741 D 1094	" " Separation Rating	
750 D 2550	WSIM	
751 D 3602	MSS	
752 D 3948	MSEP	
	ADDITIVES	**Brand**
800	Anti-icing (vol %)	
810	Antioxidant (lb/M Bbl)	
820	Corrosion Inhib. (lb/M Bbl)	
830	Metal Deactivator (lb/M Bbl)	
840	Antistatic, mg/liter	
	OTHER TESTS	
900 D 2624/3114	Conductivity (pS/m)	
901 D 2624/3114	" Temperature (F)	

APPROVED BY _____ _____

Company Representative — Authorized Government Representative

American Society for Testing and Materials

PCN 12-416552-00

FIG. X1.1 Standard Form for Reporting Inspection Data on Aviation Turbine Fuels

FIG. 8-4. INSPECTION DATA ON AVIATION TURBINE FUELS (ASTM D1655)

SUBMITTER NO.: MNW 495
NSN:
CONTRACT NO.:
BATCH NO.: MNW 229/JP8
QUANTITY REP.: 5,955,747 LTRS
CONTRACTOR:

REASON: B1

BRITISH PIPELINE AGENCY LTD.
MISTERTON PSD
WALKERINGHAM
DONCASTER DN10 3ED

TEST REPORT NO.: 86-F-1167
ENERGY MANAGEMENT LABORATORY
OL SA-ALC/SFTLF
RAF MILDENHALL, SUFFOLK, UK

DATE REPORTED: 14 AUG 86
DATE REC'D: 12 AUG 86
DATE SAMPLED: 08 AUG 86
ORIGIN: TK #29

AVIATION TURBINE FUEL
MIL-T-83133A
JP-8

METHOD	TEST	RESULTS	MIN	MAX
D287	Gravity, API	44.6	37	51
	Appearance, Visual	C&B	C&B	
D156	Color, Saybolt	+18	Report	
D2386	Freezing Pt, Deg C	Below -50		-50
D1094	Water Reaction, Interface	1		1b
D2887	Distillation, IBP, Deg C	97		Report
D2887	Distillation, 10%, Deg C	153		196
D2887	Distillation, 20%, Deg C	171		Report
D2887	Distillation, 50%, Deg C	202		Report
D2887	Distillation, 90%, Deg C	254		Report
D2887	Distillation, EBP, Deg C	308		330
D130	Copper Strip Corrosion	1A		1b
D381	Existent Gum, mg/100 ml	0.4		7.0
D93	Flash Point, Deg C	46	38	
D2276	Particulate Matter, mg/l	1.0		1.0
Spec	Filtration Time, min.	6		15
	Odor	Usual	Usual	
	Visual Sediment & Water	None	None	
D1298	Density @ 15 Deg C, kg/l	.802		

REMARKS:
Material Represented by this Sample MEETS Specification Requirements of MIL-T-83133A Grade JP-8 with Respect to the Tests Conducted.
REF TELECON BETWEEN P. NEMECHEK/H. SISCO, 0823 HRS, 14 AUG 86.

REVIEWED BY:

ROGER W. ECKARDT
U.S.

APPROVED BY:

HAROLD T. SISCO
CHIEF, ENERGY MANAGEMENT LABORATORY
DIRECTORATE OF ENERGY MANAGEMENT

FIG. B-5. DoD LABORATORY QUALITY CONTROL TEST REPORT

Chevron U.S.A. Inc.

Test Report

Date 9-29-86 Order No.

Name of Stock Turbine Fuel, Aviation, JP-4 Mil-T-5624L, Am. 2 Cons Order No.

Shipped from Chevron USA, Inc., Richmond Refinery Contract No. DLA-600-82-D-2453

Tank 1292

Shipped Via Date 9-25-86 Batch# R922

TESTS	METHOD NUMBER	SPECIFICATIONS	RESULTS
Gravity; API	ASTM D1298	45.0-57.0	53.7
Distillation: F	ASTM D86		
IBP		Report	123
10% Recovered		Report	198
20% Recovered		293 Max.	2[illegible]
50% Recovered		374 Max.	362
90% Recovered		473 Max.	[illegible]
End Point		518 Max.	5[illegible]
Residue, Volume %		1.5 Max.	[illegible]
Loss, Volume %		1.5 Max.	[illegible]
Existent Gum, MG/100 MLS.	ASTM D381	7.0 Max.	[illegible]
Acid Number, MG.KOH/Gram	ASTM D3242	0.015 Max.	[illegible]
Sulfur, Total, Mass %	ASTM D2622	0.40 Max.	[illegible]
Mercaptan Sulfur, Mass %	ASTM D3227	0.001 Max.	[illegible]
Doctor Test	ASTM D235	Report	[illegible]
Reid Vapor Pressure, PSI	ASTM D323	2.0-3.0	[illegible]
Freezing Point, F	ASTM D2386	-72 Max.	-94
Aniline Point, F	ASTM D611	Report	139.9
Aniline-Gravity Product	ASTM D1405	5250 Min.	6459
Olefins, Volume %	ASTM D1319	5.0 Max.	2.0
Aromatics, Volume %	ASTM D1319	25.0 Max.	11.6
Smoke Point, MM	ASTM D1322	20.0 Min.	27.0
Color, Saybolt	ASTM D156	Report	+17
Corrosion, Cu Strip, 2HR at 100°C	ASTM D130	1B Max.	A
Water Separometer (Microsep)	ASTM D3948	70 Min.	9[illegible]
Water Reaction, Interface Rat	ASTM D1094	1B Max.	1B
Filtration time, minutes	ASTM D2276	10 Max.	3
Particulate Contamination; MG/L	ASTM D2276	1.0 Max.	0.8
JFTOT Press. Drop, MM Merc	ASTM D3241	25 Max.	0
JFTOT Deposit Code	ASTM D3241	3 Max.	1
Corr. Inhibitor; gms/meter^3 (DCI4A)		9-22.5	9.6
Antioxidant; lbs/1000 bbls		6.0-8.4	6.1
Appearance		B&C	B&D*
Metal Deactivator;lb/1000 bbl		2.0 Max.	1.0

***To be filtered upon pumping**

16M BBL FROM 1292R

1cc: Commander/Air Force Systems Command
Attn: AFAPL (SFF)
AF Aero Propulsion Lab
Wright-Patterson AFB, OH 45433

ycc: Commander/San Antonio ALC
Attn: SFQH
[illegible]ly AFB, TX 78241

1cc: QAR-DFSP Ozol
Attn: C. W. Daniels
. O. Box 309, Martinez, CA 94553

1cc: QAR-QCD Richmond

1cc: Information Personnel

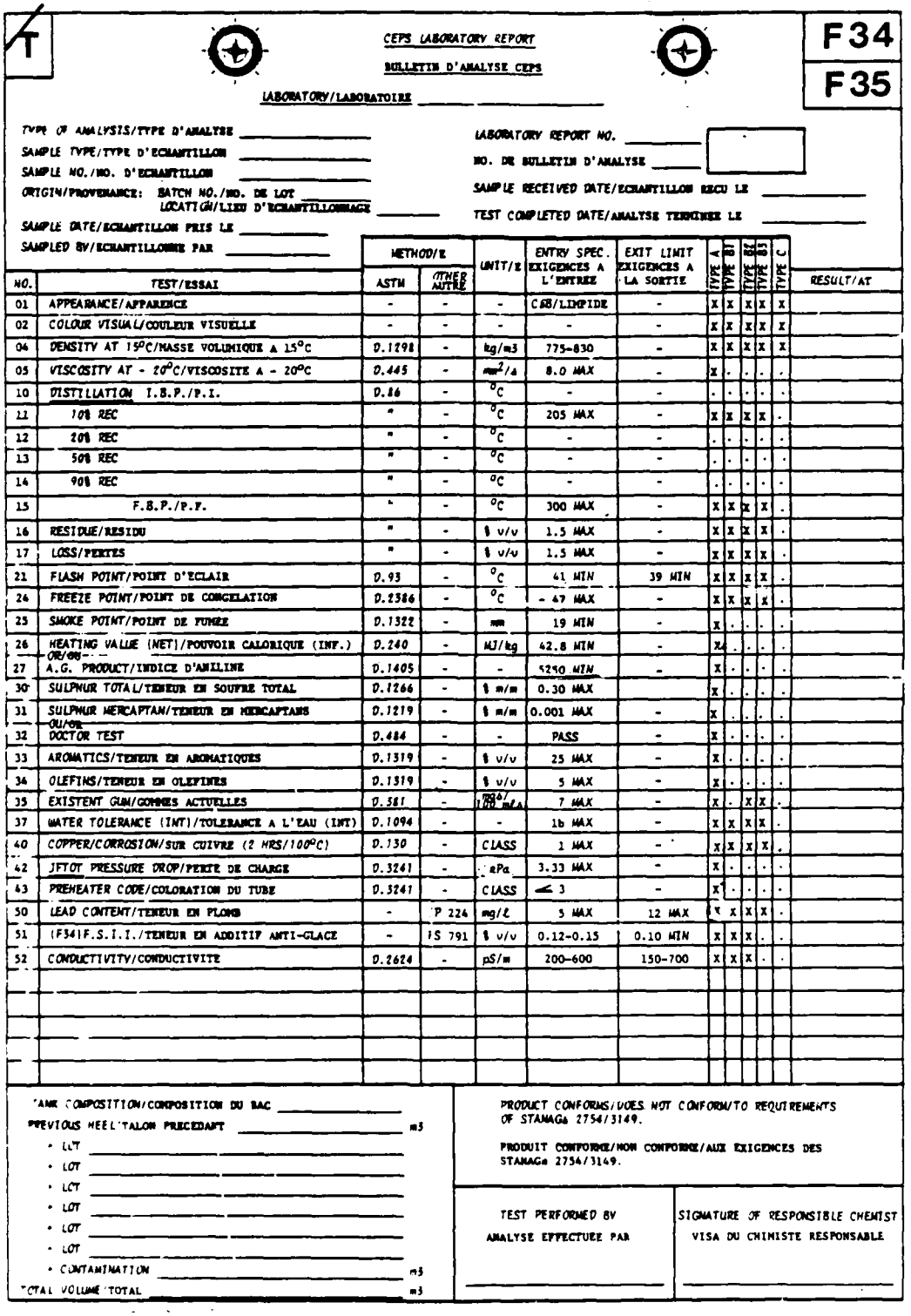
Original to File

Chevron U.S.A. Inc.

Jerry E. Tabers

MFG-1643 Bond (CD-1)

FIG. B-6. NONSTANDARD QUALITY CONTROL TEST REPORT



CEPS LABORATORY REPORT

BULLETIN D'ANALYSE CEPS

F34

F35

LABORATORY/LABORATOIRE _____

TYPE OF ANALYSIS/TYPE D'ANALYSE _____

SAMPLE TYPE/TYPE D'ECHANTILLON _____

SAMPLE NO./NO. D'ECHANTILLON _____

ORIGIN/PROVENANCE: BATCH NO./NO. DE LOT _____
LOCATION/LIEU D'ECHANTILLONNAGE _____

SAMPLE DATE/ECHANTILLON PRIS LE _____

SAMPLED BY/ECHANTILLONNE PAR _____

LABORATORY REPORT NO. _____

NO. DE BULLETIN D'ANALYSE _____

SAMPLE RECEIVED DATE/ECHANTILLON RECU LE _____

TEST COMPLETED DATE/ANALYSE TERMINEE LE _____

NO.	TEST/ESSAI	METHOD/E ASTM	METHOD/E OTHER AUTRE	UNIT/E	ENTRY SPEC. EXIGENCES A L'ENTREE	EXIT LIMIT EXIGENCES A LA SORTIE	TYPE A	TYPE B1	TYPE B2	TYPE B3	TYPE C	RESULT/AT
01	APPEARANCE/APPARENCE	-	-	-	CLR/LIMPIDE	-	X	X	X	X	X	
02	COLOUR VISUAL/COULEUR VISUELLE	-	-	-	-	-	X	X	X	X	X	
04	DENSITY AT 15°C/MASSE VOLUMIQUE A 15°C	D.1298	-	kg/m3	775-830	-	X	X	X	X	X	
05	VISCOSITY AT - 20°C/VISCOSITE A - 20°C	D.445	-	mm^2/s	8.0 MAX	-	X	.	.	.	.	
10	DISTILLATION I.B.P./P.I.	D.86	-	°C	-	-	.	.	.	.	.	
11	10% REC	"	-	°C	205 MAX	-	X	X	X	X	.	
12	20% REC	"	-	°C	-	-	.	.	.	.	.	
13	50% REC	"	-	°C	-	-	.	.	.	.	.	
14	90% REC	"	-	°C	-	-	.	.	.	.	.	
15	F.B.P./P.F.	"	-	°C	300 MAX	-	X	X	X	X	.	
16	RESIDUE/RESIDU	"	-	% v/v	1.5 MAX	-	X	X	X	X	.	
17	LOSS/PERTES	"	-	% v/v	1.5 MAX	-	X	X	X	X	.	
21	FLASH POINT/POINT D'ECLAIR	D.93	-	°C	41 MIN	39 MIN	X	X	X	X	.	
24	FREEZE POINT/POINT DE CONGELATION	D.2386	-	°C	- 47 MAX	-	X	X	X	X	.	
25	SMOKE POINT/POINT DE FUMEE	D.1322	-	mm	19 MIN	-	X	.	.	.	.	
26	HEATING VALUE (NET)/POUVOIR CALORIQUE (INF.) OR/OU	D.240	-	MJ/kg	42.8 MIN	-	X4	.	.	.	.	
27	A.G. PRODUCT/INDICE D'ANILINE	D.1405	-	-	5250 MIN	-	X	.	.	.	.	
30	SULPHUR TOTAL/TENEUR EN SOUFRE TOTAL	D.1266	-	% m/m	0.30 MAX		X	.	.	.	.	
31	SULPHUR MERCAPTAN/TENEUR EN MERCAPTANS OU/OR	D.1219	-	% m/m	0.001 MAX	-	X	.	.	.	.	
32	DOCTOR TEST	D.484	-	-	PASS	-	X	.	.	.	.	
33	AROMATICS/TENEUR EN AROMATIQUES	D.1319	-	% v/v	25 MAX	-	X	.	.	.	.	
34	OLEFINS/TENEUR EN OLEFINES	D.1319	-	% v/v	5 MAX	-	X	.	.	.	.	
35	EXISTENT GUM/GOMMES ACTUELLES	D.381	-	mg/100 ml	7 MAX	-	X	.	X	X	.	
37	WATER TOLERANCE (INT)/TOLERANCE A L'EAU (INT)	D.1094	-	-	1b MAX	-	X	X	X	X	.	
40	COPPER/CORROSION/SUR CUIVRE (2 HRS/100°C)	D.130	-	CLASS	1 MAX	-	X	X	X	X	.	
42	JFTOT PRESSURE DROP/PERTE DE CHARGE	D.3241	-	kPa	3.33 MAX	-	X	.	.	.	.	
43	PREHEATER CODE/COLORATION DU TUBE	D.3241	-	CLASS	< 3	-	X	.	.	.	.	
50	LEAD CONTENT/TENEUR EN PLOMB	-	P 224	mg/l	5 MAX	12 MAX	X	X	X	X	.	
51	(F34)F.S.I.I./TENEUR EN ADDITIF ANTI-GLACE	-	IS 791	% v/v	0.12-0.15	0.10 MIN	X	X	X	.	.	
52	CONDUCTIVITY/CONDUCTIVITE	D.2624	-	pS/m	200-600	150-700	X	X	X	.	.	

TANK COMPOSITION/COMPOSITION DU BAC _____

PREVIOUS HEEL'TALON PRECEDANT _____ m3

- LOT _____
- LOT _____
- LOT _____
- LOT _____
- LOT _____
- LOT _____
- CONTAMINATION _____ m3

TOTAL VOLUME TOTAL _____ m3

PRODUCT CONFORMS/DOES NOT CONFORM TO REQUIREMENTS OF STANAGe 2754/3149.

PRODUIT CONFORME/NON CONFORME/AUX EXIGENCES DES STANAGe 2754/3149.

TEST PERFORMED BY
ANALYSE EFFECTUEE PAR

SIGNATURE OF RESPONSIBLE CHEMIST
VISA DU CHIMISTE RESPONSABLE

Forum C8-W.T Dec 84

FIG. B-7 CEPS (CENTRAL EUROPEAN PIPELINE SYSTEM) LABORATORY TEST REPORT FORM

APPENDIX C

NAVY JP5 DATABASE

NAVY JP5 DATABASE

TABLE C-1

NAVY JP5 DATABASE DESCRIPTION

Item	Data type
Refinery	A30
Date of shipment	A8 mm/dd/yy[a]
Contractor	A30
Contract number	A30
Volume of fuel shipment	N8
Color (Saybolt)	N3
Visual	A2
Acidity	N5.4
Aromatic	N3.1
Olefin	N2.1
Sulfur, Mercaptan	N5.4
Doctor test	A1
Sulfur, total	N3.2
D86 distillation, initial boiling point	N3
D86 distillation, 10%	N3
D86 distillation, 20%	N3
D86 distillation, 50%	N3
D86 distillation, 90%	N3
D86 distillation, final boiling point	N3
D86 distillation residue	N2 1
D86 distillation loss	N2 1
D2887 distillation, initial boiling point	N3
D2887 distillation, 10%	N3
D2887 distillation, 20%	N3
D2887 distillation, 50%	N3

Note: A = alphanumeric, N = numeric

[a] Month/day/year

TABLE C-1

NAVY JP5 DATABASE DESCRIPTION (Continued)

Item	Data type
D2887 distillation, 90%	N3
D2887 distillation, final boiling point	N3
Explosiveness	N3
Flash point	N3
Gravity, American Petroleum Institute	N3.1
Freezing point	N4.1
Viscosity at 20 degrees Celsius (°C)	N4.2
Viscosity at 30 °C	N4.2
Aniline-gravity product	N4
Hydrogen content	N3.1
Smoke point	N3.1
Copper strip	A2
Jet fuel thermal oxidation test (JFTOT) pressure drop	N2
JFTOT preheater deposit code	N1
Existent gum content	N3.1
Particulate	N3.2
Filtration time	N3.1
Filtration vacuum inches of mercury	N2
Water reaction rating	N2
Water separation index modified (WSIM), with antioxidant	N3
WSIM, with antioxidant and fuel system icing inhibitor (FSII)	N3
WSIM, with antioxidant and corrosion inhibitor (CI)	N3
WSIM, with antioxidant, CI, and FSII	N3
Peroxide number	N3.2
FSII additive	N4.3
CI	N3.1
CI brand	A20
Antioxidant	N3.2
Antioxidant brand	A20
Metal deactivator	N2.1
Comments	A200
Locations shipped to	5A30

Note: A = alphanumeric, N = numeri

APPENDIX D

NAVY F76 DATABASE

NAVY F76 DATABASE

TABLE D-1

NAVY F76 DATABASE DESCRIPTION

Item	Data type
Inspection office	A30
Report number	A20
Report date	D8
Prime contractor number	A30
Prime contractor name	A50
Prime contractor address	A50
Prime contractor city	A30
Prime contractor state	A2
Prime contractor zip code	A10
Prime contractor country	A30
Prime contractor region	A5
Storage contract	A30
Refinery name	A50
Refinery address	A50
Refinery city	A30
Refinery state	A2
Refinery zip code	A10
Refinery country	A30
Refinery region	A5
Order number	A20
Destination name	A50
Destination unit identification code	A20
Destination city	A30
Destination state	A8
Destination country	A30
Bill of Lading number	A20
Requisition number	A20
Cargo number	A10

Note: A = alphanumeric, D = date, N = numeric

TABLE D-1

NAVY F76 DATABASE DESCRIPTION (Continued)

Item	Data type
Vessel name	A40
First previous cargo	A20
Last previous cargo	A20
Quantity	N8.2
Properties	
Quantity per tank	N8.2
Tank number	A4
Batch number	A10
Test date	D8
Cetane number	N3.2
Appearance	A10
50% point	N4.1
90% point	N4.1
End point	N4.1
Residue	N2.1
Flash point	N4.1
Pour point	N4.1
Cloud point	N4.1
Kinematic viscosity	N3.2
Carbon residue	N4.3
Sulfur	N3.2
Corrosion	A2
Color	A5
Ash	N4.3
American Petroleum Institute gravity	N3.1
Demulsification	N3.1
Acid number	N4.3
Neutrality	A8
Aniline point	N4.1
Accelerated stability	N3.2
Sediment and water	N4.3
Remarks	
Remark number	N1
Remark text	A80

Note: A = alphanumeric; D = date; N = numeric

TABLE D-1

NAVY F76 DATABASE DESCRIPTION (Continued)

Item	Data type
Waivers	
Property	A25
Value	A25
Waiver text	A80
Destination	
Destination name	A25
Destination unit identification code	A10
Destination city	A30
Destination state	A8
Destination country	A30
Destination quantity	N9.2

Note: A = alphanumeric; D = date; N = numeric.

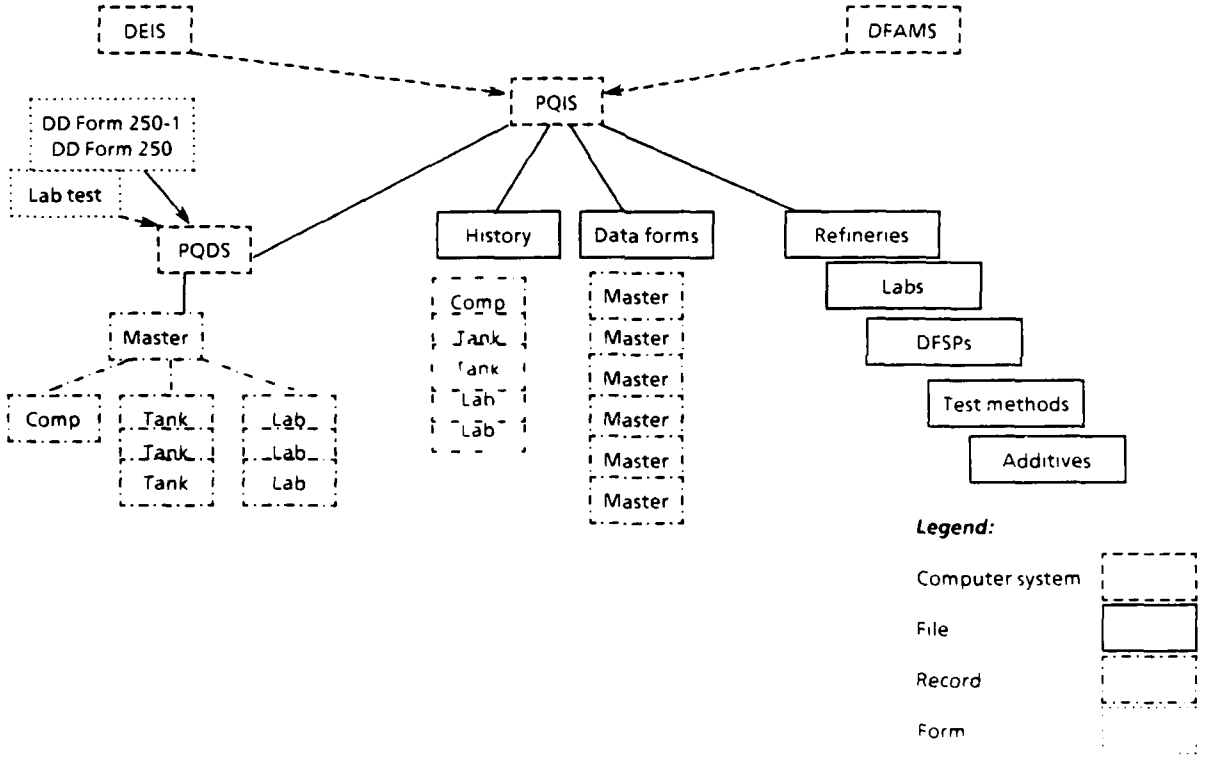
APPENDIX E

PETROLEUM QUALITY INFORMATION SYSTEM PROTOTYPE DATABASE

PETROLEUM QUALITY INFORMATION SYSTEM PROTOTYPE DATABASE

THE PETROLEUM QUALITY INFORMATION SYSTEM PROTOTYPE SYSTEM

The petroleum quality information system (PQIS) prototype uses a relational database management system on a microcomputer. The data structure is shown in Figure E-1.



Note: Comp = composite; DEIS = Defense Energy Information System; DFAMS = Defense Fuels Automated Management System; DFSP = defense fuel supply point; PQDS = petroleum quality data system (PQIS subsystem)

FIG. E-1. PQIS PROTOTYPE DATABASE DESIGN

The prototype system supports limited data reduction, data retrieval, report preparation, and other analytical capabilities:

Data Reduction. The prototype offers a comprehensive set of programs for editing quality control test reports for jet fuels: data entry, data validation,

conversion to standard units of measure, transfer to central database, archiving source data, and retrieving data for review and evaluation. Sample data entry forms are shown in Figures E-2 and E-3. The jet fuels database contains the data elements shown in Table E-1, which are contained in the database structure shown in Table E-2.

Screen 1

```
                JP4 Data Entry Form --- Test Identification Data
FQIS#     IK Test MOH 85-8  Product JP4 Reason A  Lab MOH          Date 04/25/85
Activity AF Turkey          DoDAAC FP5685   Tank
Waiver                                              Waiver Flag N#   0 Case

Volume: Liters   6,361,410   Barrels     40,012.19   Gallons  1,680,512.0
                          Cubic Meters    6,361.410 Metric Tons   5,469.397

Contract DLA-600-84-D-0599   Cargo # ED4272    Vessel Falcon Champion

Refinery Motor Oil Hellas, Corinth Refinery, Greece     Ref # MOHG
Product Characteristics:    Hydrogenated N       Sweetened Y
Crude source: Region GR Greece
              Type Unknown
Additives:
     Anti-icing    Antioxidant   Corros Inhib  Metal Deact   Anti-static
     FSII          Lowinox 624   Hitec E580    None          None
```

Screen 2

```
                JP4 Data Entry Form --- Master Test Data
FQIS#     IK Test MOH 85-8  Product JP4 Contract DLA-600-84-D-0599 Date 04/25/85
Cargo # ED4272      Vessel  Falcon Champion       Tank  784        40,012.19 Bbl
Item   Test    Description          Test Results          Test Limits
 010   D0156   Color (Saybolt)  20 Visual  BC (CB)        Record Value
 100   D3242   Total Acidity (mg KOH/g)  0.006            < .015
 110   D1319   Aromatics (vol %)  12.0                     < 25
 120   D1319   Olefins (vol %)     0.2                     < 5
 130   D3227   Mercaptan Sulfur (wt %) = 0.0007 Doctor  X  < .002 or D3227(N)
 150   D1266   Total Sulfur (wt %)  =   0.05               < .4
 200   D0086   Distillation Initial BP (C)  55 (IC or F)   Record Value
 205   D2387   Test D0086   10% Rec (C)     97            Record Value
 210                        20% Rec (C)    116             145(130) C
 215                        50% Rec (C)    158             190(185) C
 220                        90% Rec (C)    211             245(250) C
 230                        Final BP (C)   249             270(320) C
 235                  Residue (%)          1.0             < 1.5
 240                  Loss (%)             1.0             < 1.5
Notes  Direct Sale to Air Force: Order 8010, Requisition 5090-8010
```

FIG. E-2. DATA ENTRY FORM FOR JP4 PRODUCT ACCEPTANCE DATA

Screen 3

JP4 Data Entry Form --- Master Test Data

PQIS# 1K Test MOH 85-8 Product JP4 Contract DLA-600-84-D-0599 Date 04/25/85

Cargo # EC4272 Vessel Falcon Champion Tank 7B4 40,012.19 Bbl

Item	Test	Description	Test Results	Test Limits
270	D1298	Density/API Gravity	53.6	45 < 46 < 57
280	D1298	Specific Gravity/Density (kg/L)	0.7645	.751<68<.802
290	D0323	Reid Vapor Pressure (lb Reid)	2.6 (2<psi<3) or 18(14<kPa<21)	
300	D2386	Freezing Point = -64 C (C/F)		< -58 C
400	D1405	Aniline-Gravity Product	7,402	> 5,250
410	D1405	Net Heat of Combustion	18,753(Btu/lb) 43.6(MJ/kg)	>18,400 Btu/lb
420	D1740	Luminometer Number 62	Naphthalene Content -.1%	
430	D1322	Smoke Point 27.0mm	D3343 Hydrogen Content 14.4%	>20mm & >13.6%
500	D0130	Copper Strip = 1A		< 1B
600	D3241	JFTOT del P= 0.0(mm Hg)	(kPa)	< 25mm (3.3 kPa)
610	D3241	JFTOT Preheater Deposit Code< 1		< 3
710	D0381	Existent Gum (mg/100mL)	2.0	< 7.0
720	D2276	Particulates (mg/L)	0.4	< 1.
265	D0976	Cetane Index	58	Record Value

Notes Direct Sale to Air Force: Order 3013, Requisition 5090-3013

Screen 4

JP4 Data Entry Form --- Master Test Data

PQIS# 1K Test MOH 85-8 Product JP4 Contract DLA-600-84-D-0599 Date 04/25/85

Cargo # EC4272 Vessel Falcon Champion Tank 7B4 40,012.19 Bbl

Item	Test	Description	Test Results	Test Limits
910	Spec	Filtration Time 6 minutes		< 10
720	D1094	Water Reaction Interface Rating 1B		< 1B
730	D3250	Water Separation Index (WSIM) -1(-DI.II.EC>90) -1(-DI.EC>85) -1(-II.EC>80) 90(-EC>70)	90	70
300	Anti-icing (FSII)	0.11 vol %	FSII	(.1%-.15%)
310	Antioxidant	lb/Mbbl 17.1 mg/L	Lowinox 624	17.2-24.0 mg/L
320	Corrosion Inhibitor	lb/Mbbl 8.5 mg/L	Hitec 5580	8.6-23.9 mg/L
330	Metal Deactivator	lb/Mbbl mg/L	None	< 5.3 mg/L
340	Antistatic/Elec Con	ppm mg/L	None	Conductivity
900	D2624	Electrical Conductivity (pS/m) -1		200<CU<600
730	IP223	Lead Content mg/L		< 5 mg/L

Notes Direct Sale to Air Force: Order 3013, Requisition 5090-3013

FIG. E-2. DATA ENTRY FORM FOR JP4 PRODUCT ACCEPTANCE DATA (Continued)

Screen 1

```
                 JP4 Data Entry Form --- LAB Test Data
PQIS#    6BK Test MBT81-1-1 Product JP4 Reason 81 Lab Refinery     Date 01/01/81
Activity Ogden Dynachem
DoDAAC NONE     Tank 1366            Contract DLA-600-81-D-0453
Waiver                                              Waiver N#   0

Volume:  Liters  18,779,413   Barrels    118,119.32   Gallons  4,961,011.4
                         Cubic Meters   18,779.410 Metric Tons  16,205.633
Cargo # 80-0103     Vessel  Refinery Tank 1366     Batch/Tank

Notes  Ogden Dynachem & Mobile Oil Beaumont, Tx
Product Characteristics:    Hydrogenated  N       Sweetened N
Crude source: Region TX Texas
              Type Unknown
Additives:
     Anti-icing    Antioxidant   Corros Inhib  Metal deact   Anti-static
     EGME          None          None          None          None
```

Screen 2

```
PQIS#    6BK Test MBT81-1-1 Product JP4 Reason 81 Lab REFINERY     Date 01/01/81
Activity Ogden Dynachem                                Contract DLA-600-81-D-0453
Liters 18,779,413  Barrels     118,119  Gallons 4,961,011.4  Tonnes 16,182.347
JP4 Lab Data Entry Form       DoDAAC NONE       1366
Item    Test     Description          Test Results          Test Limits
 070    01298    API Gravity 53.6 Specific Density (kg/L) 0.7640 45 < AG < 57
 010    00156    Color (Saybolt)    30     Visual XY (CB)      Record Value
 300    02386    Freezing Point (C)  = -60 C                   < -58 C
 740    01094    Water Reaction Ratings     1B                 < 1B
 200    00086    Distillation   Initial BP     56 C Test 00086  Record Value
205/210          10% Rec    83 Record      20% Rec  92 (145(130)  Record Value
215/220          50% Rec  180  190(185)   90% Rec 229  245(250)   Record Value
 230                       Final BP      255  (270(320)         Record Value
235/240          Residue (%) 1.0      Loss (%) 1.0             < 1.5
 390    00130    Copper Strip          = 1A                      1B
 710    00381    Existent Gum (mg/100mL) 1.0                     7.0
 720    02276    Particulates (mg/L)      0.1                    1.0
 810    Spec     Filtration Time  [illegible] minutes  PSII  0.14  [illegible]   [illegible]
 500    03241    JFTOT del P=  [illegible]mm Hg Deposit Code = [illegible]    25 mm & [illegible]
 100    03242    Total Acidity (mg KOH/g)      0.001             .015
 120    01319    Olefins (vol %)      0.5                        5
 290    00323    Reid Vapor Pressure (lb Reid) 2.9(2.0(psi(3.0) 20(14(kPa(21)
040/050          Odor UNKNOWN   Visual  Water & Sediment) UNKNOWN
 Notes  Ogden Dynachem & Mobile Oil Beaumont, Tx
```

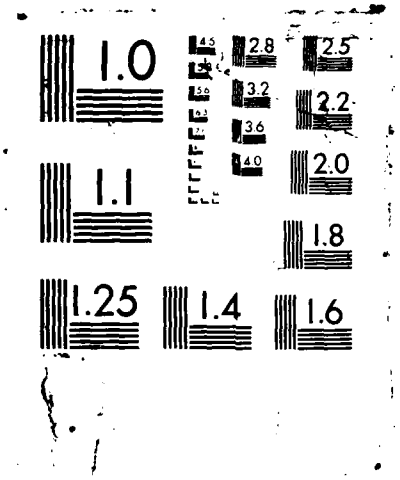
FIG. E-3. DATA ENTRY FORM FOR JP4 LABORATORY TEST DATA

TABLE E-1

PQIS DATA ELEMENT DEFINITIONS

Definition	Field name	Type	Width	Dec*	Field
Acid content	I100	Numeric	5	3	30
Activity name	Activity	Character	40		11
Activity storage tank identification	Tank	Character	5		14
Aniline-gravity product	I400	Numeric	5		59
Antioxidant content, pounds (lb)/thousand barrels (kbbl)	I810	Numeric	5	2	*
Antioxidant content, milligrams (mg)/liter (L)	I810M	Numeric	5	2	87
Antioxidant brand	I810A	Character	12		88
Antistatic content, parts per million (ppm)	I840	Numeric	5	2	93
Antistatic content, mg/L	I840M	Numeric	5	2	94
Antistatic brand	I840A	Character	12		95
American Petroleum Institute (API) gravity	I270	Numeric	4	1	52
Appearance code	I020	Character	2		27
Aromatic content	I110	Numeric	4	1	31
Barrels of product	Barrels	Numeric	12	2	24
Cargo number	Cargo_No	Character	8		16
Cetane index	I265	Numeric	2		51
Copper strip corrosion	I500	Character	2		67
Copper strip qualifier	I500X	Character	1		68
Corrosion inhibitor (CI) content, lb/kbbl	I820	Numeric	5	2	*
CI content, mg/L	I820M	Numeric	5	2	89
CI brand	I820A	Character	12		90
Copper content	I700	Numeric	3		74
Copper sweetening	Cu_Sweet	Logical	1		100
Crude region	Crude_Rgn	Character	2		101
Crude type	Crude_Type	Character	24		102
Cubic meters of product	CMeters	Numeric	12	3	*
Distillation, initial boiling point	I200	Numeric	3		78
Distillation test method	I201	Character	5		81
Distillation temperature measure	Degrees	Character	1		86
Distillation, 10% recovery	I205	Numeric	3		
Distillation, 20% recovery	I210	Numeric	3		
Distillation, 50% recovery	I215	Numeric	3		
Distillation, 90% recovery	I220	Numeric	3		
Distillation, final boiling point	I230	Numeric			
Distillation residue	I235	Numeric			

AD-A192 261 PETROLEUM QUALITY INFORMATION SYSTEM (PQIS): 2/2
REQUIREMENTS AND RECOMMENDED DESIGN(U) LOGISTICS
MANAGEMENT INST BETHESDA MD R L ARNBERG DEC 87
UNCLASSIFIED LMI-AL620R1 MDA903-85-C-0139 F/G 5/2 NL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3.6
4.0
4.5
5.0

TABLE E-1

PQIS DATA ELEMENT DEFINITIONS (Continued)

Definition	Field name	Type	Width	Dec[a]	Field
Laboratory identification	LabId	Character	12		23
Liters of product	Liters	Numeric	12		25
Metal deactivator content, lb/kbbl	I830	Numeric	5	2	*
Metal deactivator content, mg/L	I830M	Numeric	5	2	91
Metal deactivator brand	I830A	Character	12		92
Metric tons of product	Tonnes	Numeric	12	3	*
Naphthalene content	I440	Numeric	3	1	66
Notes and comments	Notes	Character	70		103
Olefin content	I120	Numeric	3	1	32
Olfactory code	I040	Character	5		28
Other test name	I920A	Character	12		*
Other test value	I920	Character	8		*
Particulate matter content	I720	Numeric	3	1	76
Peroxide number/content, ppm	I915	Numeric	3	1	98
PQIS record number	PQIS_No	Numeric	5		1
PQIS processing flag	PQIS_Flag	Character	1		2
PQIS process date	PQIS_Date	Date	8		3
PQIS edit date	PQIS_Edit	Date	8		4
PQIS record type	Data_Type	Character	1		5
Procurement contract number	Contract	Character	18		15
Product code	PCode	Character	3		21
Reason code for the test	Reason	Character	2		7
Refinery code	Ref_No	Character	12		20
Refinery name	Refinery	Character	45		19
Saybolt color	I010	Numeric	3		26
Silver strip test	I510	Numeric	1		69
Smoke point	I430	Numeric	4	1	63
Sulfur, Mercaptan content	I130	Numeric	6	4	33
Sulfur, Mercaptan qualifier	I130X	Character	1		34
Sulfur, total content	I150	Numeric	6	4	36
Sulfur, total qualifier	I150X	Character	1		37
Subactivity code	Sub_Acty	Character	2		13
Test date	TDate	Date	8		22
Test report identifier	TestId	Character	12		6
Vapor pressure, Reid [pounds per square inch (psi)]	I290	Numeric	3	1	54
Vapor pressure, kilopascal (kPa)	I291	Numeric	2		55
Vessel name	Vessel	Character	36		17

[a] Decimal

TABLE E-1

PQIS DATA ELEMENT DEFINITIONS (Continued)

Definition	Field name	Type	Width	Dec[a]	Field
Vessel tank or shore tank number	Ship_Tank	Character	5		18
Viscosity	I310	Numeric	4	1	58
Waiver/deviation code	Waiver	Logical	1		8
Waiver/deviation number	Waiver_No	Numeric	4		9
Waiver/deviation case number	Case_No	Numeric	5		10
Water and sediment	I050	Character	8		29
Water reaction volume change	I730	Numeric	4	1	77
Water reaction rating	I740	Numeric	2		78
Water separation index modified (WSIM)	I750	Numeric	3		79
WSIM - EC additive	I751	Numeric	3		80
WSIM - EC/FSII	I752	Numeric	3		81
WSIM - EC/CI	I753	Numeric	3		82
WSIM - EC/CI/FSII	I754	Numeric	3		83

[a] Decimal

TABLE E-2

PQIS DATABASE STRUCTURE

Field	Field name	Type	Width	Dec	Definition
1	PQIS_No	Numeric	5		PQIS record number
2	PQIS_Flag	Character	1		PQIS processing flag
3	PQIS_Date	Date	8		PQIS process date
4	PQIS_Edit	Date	8		PQIS edit date
5	Data_Type	Character	1		PQIS record type
6	TestId	Character	12		Test report identifier
7	Reason	Character	2		Reason code for the test
8	Waiver	Logical	1		Waiver/deviation code
9	Waiver_No	Numeric	4		Waiver/deviation number
10	Case_No	Numeric	5		Waiver/deviation case number
11	Activity	Character	40		Activity name
12	DoDAAC	Character	6		Activity DoDAAC
13	Sub_Acty	Character	2		Subactivity code
14	Tank	Character	5		Activity storage tank identification
15	Contract	Character	18		Procurement contract number
16	Cargo_No	Character	8		Cargo number
17	Vessel	Character	36		Name of the vessel
18	Ship_Tank	Character	5		Vessel tank or shore tank number
19	Refinery	Character	45		Name of the refinery
20	Ref_No	Character	12		Refinery code
21	PCode	Character	3		Product code
22	TDate	Date	8		Product test date
23	Labid	Character	12		Laboratory identification
24	Barrels	Numeric	12	2	Barrels of product
25	Liters	Numeric	12		Liters of product
*	Gallons	Numeric	12	1	Gallons of product
*	CMeters	Numeric	12	3	Cubic meters of product
*	Tonnes	Numeric	12	3	Metric tons of product
26	I010	Numeric	3		Saybolt color
27	I020	Character	2		Appearance code
28	I040	Character	5		Olfactory code
29	I050	Character	8		Water and sediment
30	I100	Numeric	5	3	Acid content
31	I110	Numeric	4	1	Aromatic content
32	I120	Numeric	3	1	Olefin content
33	I130	Numeric	6	4	Mercaptan sulfur content
34	I130X	Character	1		Mercaptan qualifier

TABLE E-2

PQIS DATA BASE STRUCTURE (Continued)

Field	Field name	Type	Width	Dec	Definition
35	I140	Character	1		Doctors test
36	I150	Numeric	6	4	Total sulfur content
37	I150X	Character	1		Total sulfur qualifier
38	I200	Numeric	3		Initial boiling point
39	I201	Character	5		Distillation test method
*	Degrees	Character	1		Distillation temperature measure
40	I205	Numeric	3		10% recovery
41	I210	Numeric	3		20% recovery
42	I215	Numeric	3		50% recovery
43	I220	Numeric	3		90% recovery
44	I230	Numeric	3		Final boiling point
45	I235	Numeric	3	1	Distillation residue
46	I240	Numeric	3	1	Distillation loss
47	I245	Numeric	4	1	Distillation recovery
48	I250	Numeric	2		Explosiveness
49	I260	Numeric	3		Flash point
*	I260A	Character	1		Flash point measure
50	I260T	Character	5		Flash point test method
51	I265	Numeric	2		Cetane index
52	I270	Numeric	4	1	API gravity
53	I280	Numeric	6	4	Specific gravity
54	I290	Numeric	3	1	Reid vapor pressure (psi)
55	I291	Numeric	2		kPa pressure
56	I300	Numeric	3		Freezing point
*	I300A	Character	1		Freezing point measure
57	I300X	Character	1		Freezing point qualifier
58	I310	Numeric	4	1	Viscosity
59	I400	Numeric	5		Aniline-gravity product
60	I410	Numeric	6		Heat content (Btu/lb)
61	I411	Numeric	4	1	Heat content (MJ/kg)
62	I420	Numeric	2		Luminometer number
63	I430	Numeric	4	1	Smoke point
64	I431	Numeric	4	1	Hydrogen content
65	I431T	Character	5		Hydrogen content test method
66	I440	Numeric	3	1	Naphthalene content
67	I500	Character	2		Copper strip corrosion
68	I500X	Character	1		Copper strip qualifier
69	I510	Numeric	1		Silver strip test

TABLE E-2

PQIS DATABASE STRUCTURE (Continued)

Field	Field name	Type	Width	Dec	Definition
70	I600	Numeric	4	1	JFTOT pressure change, mm
71	I600X	Character	1		JFTOT qualifier
*	I601	Numeric	4	2	JFTOT pressure change, inches
*	I601kPa	Numeric	4	2	JFTOT pressure change, kPa
72	I610	Character	2		JFTOT tube rating
73	I610X	Character	1		JFTOT tube rating qualifier
74	I700	Numeric	3		Copper content
75	I710	Numeric	3	1	Existent gum content
76	I720	Numeric	3	1	Particulate matter content
77	I730	Numeric	4	1	Water reaction volume change
78	I740	Character	2		Water reaction rating
79	I750	Numeric	3		WSIM
80	I751	Numeric	3		WSIM - EC
81	I752	Numeric	3		WSIM - EC/FSII
82	I753	Numeric	3		WSIM - EC/CI
83	I754	Numeric	3		WSIM - EC/CI/FSII
85	I800	Numeric	5	2	FSII content, volume %
*	I800M	Numeric	5	2	FSII content, mg/L
86	I800A	Character	12		FSII brand
*	I810	Numeric	5	2	Antioxidant content, lb/kbbl
87	I810M	Numeric	5	2	Antioxidant content, mg/L
88	I810A	Character	12		Antioxidant brand
*	I820	Numeric	5	2	CI content, lb/kbbl
89	I820M	Numeric	5	2	CI content, mg/L
90	I820A	Character	12		CI brand
*	I830	Numeric	5	2	Metal deactivator content, lb/kbbl
91	I830M	Numeric	5	2	Metal deactivator content, mg/L
92	I830A	Character	12		Metal deactivator brand
93	I840	Numeric	5	2	Antistatic content, ppm
94	I840M	Numeric	5	2	Antistatic content, mg/L
95	I840A	Character	12		Antistatic brand
96	I900	Numeric	3		EC
97	I910	Numeric	2		Filtration time
*	I911	Numeric	2		Filtration vacuum, inches
*	I911M	Numeric	3		Filtration vacuum, mm
*	I912	Numeric	3		Filtration temperature
*	I912A	Character	1		Filtration temperature measure
98	I915	Numeric	3	1	Peroxide number/content, ppm

TABLE E-2

PQIS DATABASE STRUCTURE (Continued)

Field	Field name	Type	Width	Dec	Definition
*	I920A	Character	12		Other test name
*	I920	Character	8		Other test value
99	H_Treated	Logical	1		Use of hydrogen treated stocks
100	Cu_Sweet	Logical	1		Use of copper sweetening
101	Crude_Rgn	Character	2		Crude oil region
102	Crude_Type	Character	24		Type of crude oil
103	Notes	Character	70		Notes and comments
Total	Total length		645		

Data Base Interrogation. The database can be interrogated in a variety of ways to retrieve data by PQIS number, refinery, and destination [DoD activity address code (DoDAAC) or name].

Statistical Analysis. The prototype has a primitive interface with Lotus 1-2-3 to allow the user to analyze small databases.

PQIS Reports. Current reports include a report of the product acceptance test (DD Form 250-1/AFTO Form 456) as shown in Figure E-4, and a laboratory test report as shown in Figure E-5. A time series analysis report will be developed in the near future.

PQIS Waiver Prototype System

The Defense Fuel Supply Center (DFSC) waiver/deviation/exception prototype features include the ability to enter exception requests, add information to waiver requests, and print reports. Future additions are planned to generate statistics and provide graphics to portray monthly and annual activity. This is a relatively simple application that is currently programmed in dBase III, but could easily be converted to a Unify application. It should be developed as a Gould application to take maximum advantage of the existing DFSC local area network (LAN) supporting the Defense Logistics Agency (DLA) distributed minicomputer systems (DMINS). If dBase III is selected for use, it could be implemented on a DFSC dBase III LAN. A

sample data entry form is shown in Figure E-6 for the DFSC Form 12.20, Request for Exception, shown in Figure E-7.

PQIS# 1E Test MOH 85-8 Product JP4 Reason A Lab MOH Date 04/25/85

Activity AF Turkey
DoDAAC FP5685 Tank Waiver N# Case
Volume: Barrels 40,012.19 Tonnes 5,481.670 Liters 6,361,410

Contract DLA-600-84-D-0599 Cargo # EC4272 Vessel Falcon Champion
Refinery Motor Oil Hellas, Corinth Refinery, Greece Ship Tank 784

Item	Test	Description	Test Results	Test Limits
010	D0156	Color (Saybolt) 20	Visual BC <CB>	Record Value
270	D1298	Density/API Gravity	53.6 API	45 < AG < 57
280	D1298	Specific Density	0.7645 kg/L	.751<SD<.802
100	D3242	Total Acidity (mg KOH/g)	0.006mg KOH/g	< .015
110	D1319	Aromatics (vol %)	12.0%	< 25
120	D1319	Olefins (vol %)	0.2%	< 5
130	D3227	Mercaptan Sulfur (wt %)	= 0.0007% Doctor X	< .002
150	D1266	Total Sulfur (wt %)	= 0.03%	< .4
200	D0086	Distillation Initial BP	55 C	Record Value
205	D2887	Test D0086 10% Rec	97 C	Record Value
210		20% Rec	116 C	< 145(130) C
215		50% Rec	158 C	< 190(185) C
220		90% Rec	211 C	< 245(250) C
230		Final BP	249 C	< 270(320) C
235/240		Residue (%) 1.0 %	Loss (%) 1.0 %	< 1.5
290	D0323	Reid Vapor Pressure	2.6 psi (2<psi<3) or 18 kPa	(14<kPa<21)
265	D0976	Cetane Index	38	
300	D2386	Freezing Point	= -64 C	< -58 C
310	D0455	Viscosity	cSt	
420	D1740	Luminometer Number 62	Naphthalene Content -.1%	
430	D1322	Smoke Point 27.0mm	D3343 Hydrogen Content 14.4%	>20mm & >13.6%
410	D1405	Net Heat of Combustion	18,753 Btu/lb (43.6 MJ/kg)	>18,400 Btu/lb
500	D0130	Copper Strip Corrosion	= 1A	< 1B
600	D3241	JFTOT del P= 0.0mm Hg [Pressure Drop]	0.0 kPa	< 25mm [3.3kPa]
610	D3241	JFTOT Preheater Tube Deposit Code	< 1	< 3
710	D381	Existent Gum	2.0 mg/100mL	< 7.0
720	D2276	Particulates	0.4 mg/L	< 1.C
750	D2250	Water Separation Index (WSIM)	-1 -1 -1 90	> 70
740	D1094	Water Reaction Ratings	1B	< 1B
900	D2624	Electrical Conductivity	-1 pS/m	200<CU<600
910	Spec	Filtration Time 6 minutes		< 10

Additives

800	Anti-icing <FSII>	0.11 vol %		FSII	<.1%-.15%>
810	Antioxidant	6.0 lb/kbbl	17.12 mg/L	Lowinox 624	17.2-24.0 mg/L
820	Corrosion Inhibitor	3.0 lb/kbbl	8.56 mg/L	Hitec E580	8.5-23.0 mg/L
830	Metal Deactivator	lb/kbbl	mg/L	None	< 5.8 mg/L
840	Antistatic	ppm	mg/L	None	Conductivity

Notes Direct Sale to Air Force: Order 8013, Requisition 5090-8013

FIG. E-4. PQIS PRODUCT ACCEPTANCE TEST REPORT

Petroleum Quality Information System Test Report

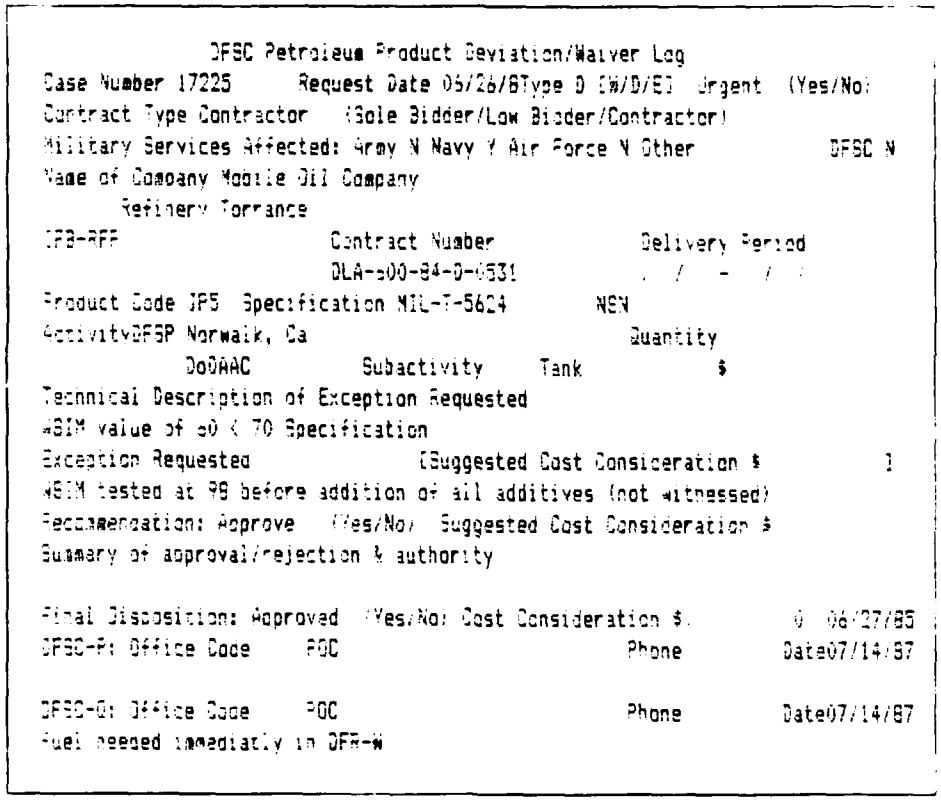
12:24:50 12/23/87

PQIS # 68[LE] Agency: DFSC-Q Edit Date: 12/23/87
Test Report # MBT81-1-1 Test Type: B1 Sample Date: 01/01/81
Product JP4
Laboratory: Refinery
DoDAAC NONE - Tank 1366 Contract DLA-600-81-D-0453
Activity Name: Ogden Dynachem
Volume:
Barrels 118,119.32 Tonnes 16,182.347 Liters 18,779,413

Item	Test	Description	Test Results	Test Limits
270	D1298	API Gravity 53.6	Specific Density 0.7640kg/L	45 < AG < 57
010	D0156	Color (Saybolt) 30	Visual XX <CB>	Record Value
300	D2386	Freezing Point (C)	= -60 C	<-58 C
740	D1094	Water Reaction Ratings	1B	< 1B
200	D0086	Distillation Initial BP (C)	66 C	Record Value
205	D2887	Test D0086 10% Rec (C)	83	Record
210		20% Rec (C)	92	<145(130)
215		50% Rec (C)	180	<190(185)
220		90% Rec (C)	229	<245(250)
230		Final BP (C)	255	<270(320)
235/240		Residue (%) 1.0	Loss (%) 1.0	< 1.5
500	D0130	Copper Strip	= 1A	< 1B
710	D0381	Existent Gum (mg/100mL)	1.0	< 7.0
720	D2276	Particulates (mg/L)	0.1	< 1.0
290	D0323	Reid Vapor Pressure (lb Reid)	2.9 (2.0<psi<3.0)	20(14<kPa<21)
910	Spec	Filtration Time 6 minutes		<10
800	Spec	Fuel System Icing Inhibitor (FSII)	0.14 vol %	.1%-.15%
600	D3241	JFTOT del P= 1.0mm Hg	Deposit Code = 0	< 25 mm & < 3
100	D3242	Total Acidity (mg KOH/g)	0.001	< .015
120	D1319	Olefins (vol %)	0.5	< 5
040/050		Odor UNKNOWN	Visual (Water & Sediment) UNKNOWN	

Notes:
Ogden Dynachem @ Mobile Oil Beaumont, Tx

FIG. E-5. PQIS LABORATORY TEST REPORT



DFSC Petroleum Product Deviation/Waiver Log

Case Number 17225 Request Date 06/26/87Type D (W/D/E) Urgent (Yes/No)

Contract Type Contractor (Sole Bidder/Low Bidder/Contractor)

Military Services Affected: Army N Navy Y Air Force N Other DFSC N

Name of Company Mobile Oil Company

Refinery Torrance

IFB-RFP Contract Number Delivery Period

DLA-s00-84-D-0531 / / - / /

Product Code JP5 Specification MIL-T-5624 NSN

ActivityDFSP Norwalk, Ca Quantity

DoDAAC Subactivity Tank $

Technical Description of Exception Requested

vBIM value of 90 < 70 Specification

Exception Requested (Suggested Cost Consideration $ 1

vBIM tested at 99 before addition of all additives (not witnessed)

Recommendation: Approve (Yes/No) Suggested Cost Consideration $

Summary of approval/rejection & authority

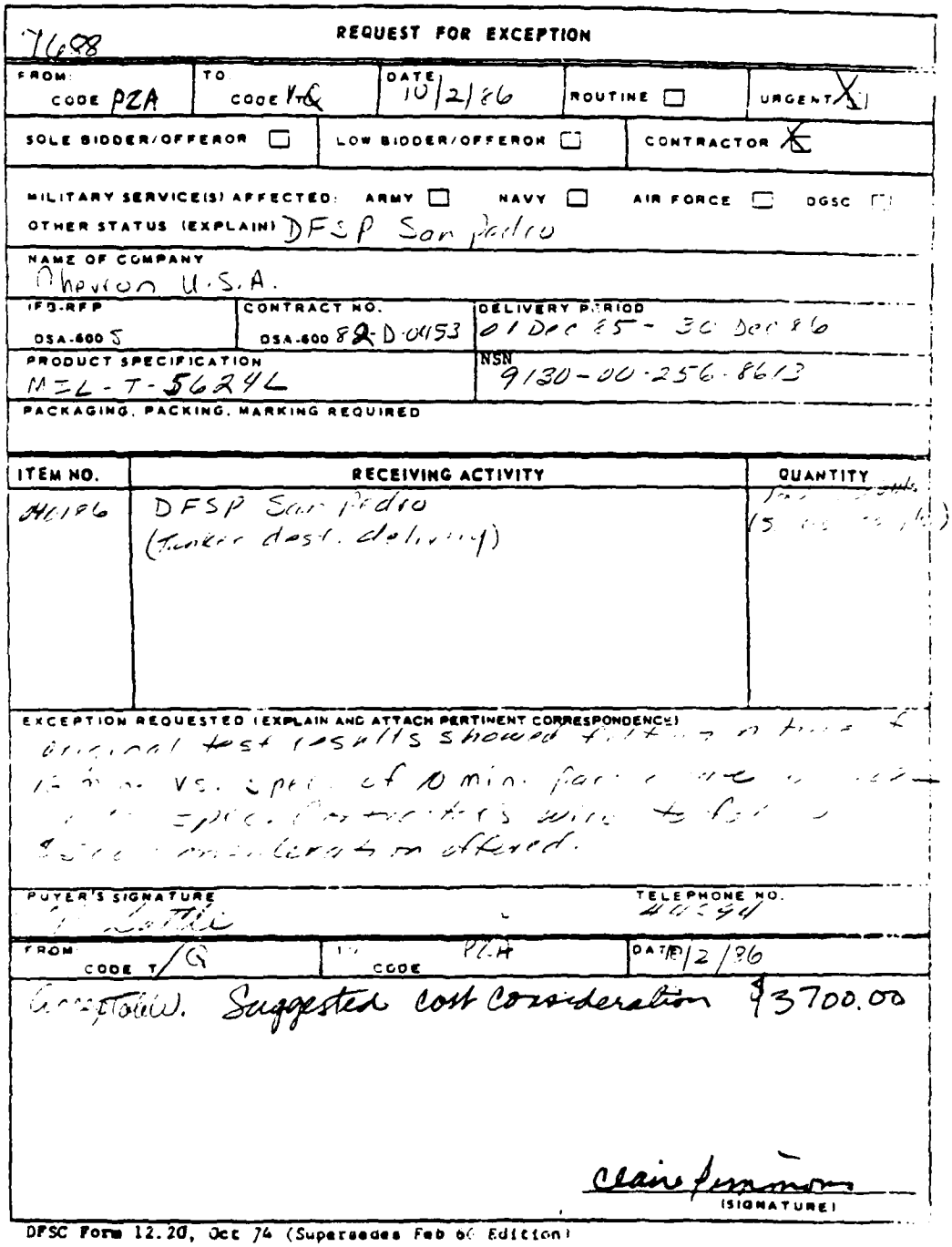
Final Disposition: Approved (Yes/No) Cost Consideration $. 0 06/27/85

DFSC-F: Office Code POC Phone Date07/14/87

DFSC-Q: Office Code POC Phone Date07/14/87

Fuel needed immediatly in DFR-W

FIG. E-6. DATA ENTRY FORM FOR WAIVERS, DEVIATIONS, AND EXCEPTIONS



7688

REQUEST FOR EXCEPTION

FROM: CODE PZA	TO: CODE V-T-C	DATE: 10/2/86	ROUTINE ☐	URGENT ☒

SOLE BIDDER/OFFEROR ☐ | LOW BIDDER/OFFEROR ☐ | CONTRACTOR ☒

MILITARY SERVICE(S) AFFECTED: ARMY ☐ NAVY ☐ AIR FORCE ☐ DGSC ☐

OTHER STATUS (EXPLAIN) DFSP San Pedro

NAME OF COMPANY: Chevron U.S.A.

IFB-RFP: DSA-600 5	CONTRACT NO.: DSA-600 82-D-0153	DELIVERY PERIOD: 01 Dec 85 - 30 Dec 86
PRODUCT SPECIFICATION: MIL-T-5624L		NSN: 9130-00-256-8613

PACKAGING, PACKING, MARKING REQUIRED

ITEM NO.	RECEIVING ACTIVITY	QUANTITY
0001AB	DFSP San Pedro (Tanker dest. delivery)	[illegible]

EXCEPTION REQUESTED (EXPLAIN AND ATTACH PERTINENT CORRESPONDENCE)

Original test results showed [illegible] vs. spec of 10 min. for [illegible] spec. parameters will be [illegible] some considerations offered.

BUYER'S SIGNATURE: [illegible] TELEPHONE NO.: 4[illegible]94

FROM CODE T/G	TO CODE PLH	DATE 12/86

Accepted. Suggested cost consideration $3700.00

Claire Simmons
(SIGNATURE)

DFSC Form 12.20, Oct 74 (Supersedes Feb 66 Edition)

FIG. E-7. DFSC FORM 12.20 REQUEST FOR EXCEPTION

END

DATE

FILMED

6-1988

DTIC