

FM 10-67-2
HEADQUARTERS
DEPARTMENT OF THE ARMY

PETROLEUM LABORATORY
TESTING AND OPERATIONS

DISTRIBUTION RESTRICTION:

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

PETROLEUM LABORATORY TESTING AND OPERATIONS

Table of Contents

	Page
PREFACE	ix
CHAPTER 1 ENVIRONMENTAL RESPONSIBILITIES	1-1
Section I ENVIRONMENTAL PROTECTION STEWARDSHIP	1-1
Scope of Environmental Responsibility	1-1
Environmental Protection Stewardship Goals	1-1
Role of Environmental Protection Stewardship in Leadership	1-2
Environmental Responsibilities of Personnel	1-2
Section II HAZARDOUS MATERIALS	1-3
General	1-3
Hazardous Waste	1-3
Hazardous Materials	1-4
Hazardous Materials Management	1-4
CHAPTER 2 PETROLEUM PRODUCTS	2-1
Section I PETROLEUM-BASE LIQUID PROPELLANTS AND FUELS	2-1
Crude Petroleum	2-1
Types of Petroleum Products	2-1
Petroleum-Base Liquid Propellants and Fuels Category	2-1
Section II FUEL OILS	2-3
Burner Fuels	2-3
Kerosene	2-4

DISTRIBUTION RESTRICTION: Approved for public release;
distribution is unlimited.

*This publication supersedes FM 10-70, 9 May 1983, and FM 10-72,
11 August 1986.

Section III	LUBRICATING OILS AND GREASES	2-4
	Purpose	2-4
	Lubricating Oils	2-4
	Requirements	2-5
	Lubricating Greases	2-6
	Classification of Greases	2-6
	Grease Requirements	2-6
	Properties of Grease	2-6
	Miscellaneous Products	2-6
CHAPTER 3	PETROLEUM QUALITY	3-1
Section I	PETROLEUM INSPECTION PROCEDURES	3-1
	General	3-1
	Quality Control	3-1
	Quality Assurance	3-1
	Quality Surveillance	3-1
Section II	QUALITY ASSURANCE	3-2
	Quality Assurance Program Administrators	3-2
	Quality Assurance Representative Responsibilities	3-2
	Quality Assurance Inspections and Acceptance	3-2
	Quality Assurance Inspection of Contractor Facilities	3-3
	Quality Assurance Inspections of Storage and Transfer Facilities	3-3
	Quality Assurance Inspection of Tankers and Barges	3-4
	Quality Assurance Inspection of Tank Cars and Tank Vehicles	3-4
	Quality Assurance Measurements and Documentation	3-5
Section III	QUALITY SURVEILLANCE	3-6
	Quality Surveillance Program Administrators	3-6
	Petroleum Quality Surveillance And Technical Assistance Program	3-6
	Correlation Programs	3-7
	Quality Surveillance During Storage, Loading and Unloading Operations	3-8
	Quality Surveillance During Storage Operations	3-8
	Quality Surveillance During Tanker and Barge Loading Operations	3-8
	Quality Surveillance During Jet Fuel or Kerosene Loading Operations	3-9
	Quality Surveillance During Tanker and Barge Unloading Operations	3-9
	Quality Surveillance During Tank Cars and Tank Vehicle Loading and Unloading Operations	3-10
	Quality Surveillance During Pipeline Operations	3-10
Section IV	CLEANLINESS STANDARDS FOR AVIATION FUELS	3-11
	General	3-11
	Filter/Separators	3-11
	Solid Contamination	3-12
	Water Contamination	3-12
	Testing Effluent Samples for Water	3-14

CHAPTER 4	PETROLEUM LABORATORY PERSONNEL, FACILITIES, AND TESTING EQUIPMENT	4-1
Section I	PETROLEUM LABORATORY PERSONNEL	4-1
	Petroleum Laboratory Officer	4-1
	Petroleum Laboratory Specialist	4-1
	Duties of Petroleum Laboratory Specialist	4-1
Section II	PETROLEUM LABORATORIES	4-2
	General	4-2
	CONUS Army Laboratory Facilities	4-2
	OCONUS Laboratories	4-2
	Types of Laboratories	4-2
	Base Petroleum Laboratory	4-3
	Modular Base Petroleum Laboratory	4-3
	Mobile Petroleum Laboratory	4-3
	Airmobile Petroleum Laboratory	4-3
	Petroleum Quality Analysis System	4-7
Section III	TEST KITS	4-7
	General	4-7
	Aviation Fuel contamination Test Kit	4-7
	Sampling and Gaging Kit	4-9
	Ground Fuels Contamination Test Kit	4-9
	Captured Fuels Test Kit	4-9
	Aqua-Glo Test Kit	4-9
Section IV	LABORATORY EQUIPMENT MAINTENANCE AND SUPPLY	4-11
	Maintenance	4-11
	Calibration	4-11
	Calibration of Test Kits	4-11
	A-Level Calibration Procedures	4-11
	C-Level Calibration Procedures	4-11
	Supply	4-12
	Inventories	4-12
	Prescribed Load List	4-12
Section V	EQUIPMENT PUBLICATIONS AND FORMS	4-12
	General	4-12
	DODISS	4-12
	DD Form 1425	4-13
	Requisition Processing	4-13
CHAPTER 5	ESTABLISHING PETROLEUM TESTING FACILITIES IN THE THEATER	5-1

Section I	DEPLOYMENT OF PETROLEUM TESTING FACILITIES	5-1
	Preparation for Shipment	5-1
	Shipping Documents	5-1
	Request Channels and Format	5-1
	Request Approval	5-2
Section II	PETROLEUM LABORATORY AREA REQUIREMENTS	5-2
	General	5-2
	Environmental Considerations	5-2
	Laboratory Site Selection	5-3
	Petroleum Base Laboratory Requirements	5-3
	Modular Base Laboratory Requirements	5-3
	Mobile Laboratory Requirements	5-3
	Airmobile Laboratory Requirements	5-4
	Ground Fuels Test Kit Requirements	5-4
	Test Kit Requirements	5-4
Section III	NBC ENVIRONMENT	5-4
	NBC Threat Considerations	5-4
	Nuclear Effects	5-4
	Preparation of Site	5-5
	Laboratory NBC Protection Procedures	5-5
	NBC Defense Fundamentals	5-5
	NBC Operations	5-6
	Nuclear Attack	5-6
	Biological Attack	5-6
	Chemical Attack	5-7
	Operations in a Contaminated Environment	5-7
	Laboratory SOP	5-7
	Training	5-8
	Destruction of Army Laboratories	5-8
CHAPTER 6	PERFORMING QUALITY SURVEILLANCE IN THE THEATER	6-1
Section I	PETROLEUM QUALITY SURVEILLANCE IN THE DEVELOPED THEATER	6-1
	Description of the System	6-1
	Base Petroleum Laboratory	6-1
	Mobile Petroleum Laboratory	6-1
	Airmobile Petroleum Laboratory	6-1
	Test Kits	6-1
	Testing Requirements	6-2
	Procurement of Petroleum Products	6-2
	Standardization Agreements	6-2
	Channels of Communication	6-2
	Laboratory Requirements	6-2
	Quality Surveillance Mission	6-2

Section II	PETROLEUM QUALITY SURVEILLANCE IN THE UNDEVELOPED THEATER	6-5
	Description of the System	6-5
	Testing Requirement	6-5
	Procurement of Petroleum Products	6-6
	Commandeered/Captured Petroleum Products	6-6
	Channels of Communication	6-6
	Laboratory Requirements	6-6
	Additional Requirements	6-6
	Time-Phased Laboratories	6-7
CHAPTER 7	INTRODUCTION TO CHEMISTRY FOR THE PETROLEUM LABORATORY	7-1
Section I	MATTER	7-1
	General	7-1
	Definition	7-1
	Quantity of Matter	7-2
Section II	REAGENTS AND SOLUTIONS	7-4
	General	7-4
	Equations	7-4
	Reagents	7-4
	Solutions	7-4
	Factors Affecting Solubility	7-4
	Concentrations of Solutions	7-5
	Preparing Solutions	7-5
	Primary Standards	7-5
	Secondary Standards	7-6
	Standardization	7-6
	Titration	7-6
	Standardization by Titration	7-6
	pH Scale	7-7
	Indicators	7-7
Section III	BALANCES AND WEIGHING	7-8
	General	7-8
	Analytical Balance	7-8
	The Harvard Trip Balance	7-9
	Triple Beam Balance	7-10
CHAPTER 8	EVALUATING PETROLEUM PRODUCTS	8-1
Section I	PROPERTIES OF PETROLEUM PRODUCTS	8-1
	Critical Properties	8-1
	API Gravity	8-1
	Appearance/Workmanship	8-1
	Aqua-Glo Water Test	8-1

	Ash Content	8-2
	Carbon Residue	8-2
	Cleveland Open Cup Flash Point	8-2
	Cloud Point	8-3
	Color	8-3
	Cone Penetration of Grease	8-3
	Copper Corrosion	8-4
	Distillation	8-4
	Dropping Point of Grease	8-6
	Existent Gum	8-6
	Freezing Point	8-6
	Fuel System Icing Inhibitor	8-6
	Ignition Quality of Diesel Fuels	8-7
	Kinematic Viscosity	8-7
	Lead in Fuels	8-8
	Neutralization Number	8-8
	Oxidation Stability and Potential Gum	8-9
	Particulate Contaminant in Aviation Fuel	8-9
	Pensky-Martens Flash Point	8-9
	Pour Point of Petroleum Oils	8-10
	Precipitation Number	8-10
	Reid Vapor Pressure	8-10
	Smoke Point	8-10
	Sulfur in Petroleum Products	8-10
	Tag Closed Cup Flash Test	8-11
	Thermal Stability	8-11
	Water and Sediment	8-11
	Water Reaction	8-12
	Water Separation Characteristics	8-12
	Conductivity	8-13
Section II	IDENTIFICATION OF UNKNOWN PRODUCTS	8-13
	General	8-13
	Classification by Gravity	8-13
	Light Distillates	8-14
	Heavy Distillates	8-15
	Group A Distillates	8-15
	Group B Distillates	8-15
	Group C Distillates	8-16
	Reports and Recommendations	8-16
Section III	PRODUCT RECLAMATION AND DISPOSITION	8-16
	General	8-16
	Factors Affecting Reclamation	8-17
	Reclamation Techniques	8-17
	Improving Critical Properties	8-17
	Approximating a Blending Ratio	8-18
	Downgrading and Regrading	8-18

	Disposition Procedures	8-19
CHAPTER 9	SAMPLERS AND SAMPLING PROCEDURES	9-1
	General	9-1
	Types of Samples	9-1
	Samplers	9-1
	Sample Containers	9-5
	Sampling Procedures	9-5
	Special Procedures for Millipore Testing	9-8
CHAPTER 10	PETROLEUM LABORATORY OPERATIONS	10-1
Section I	SAFETY DURING LABORATORY OPERATIONS	10-1
	General Precautions	10-1
	Preventing Fires	10-2
	Modular, Mobile and Air Mobile Laboratories	10-2
	Fire Extinguishers	10-3
	Types of Fire Extinguishers	10-3
	Methods of Extinguishing Petroleum Fires	10-4
	Handling Chemicals	10-5
	Substitute Solvents	10-7
	Handling Excess Chemicals	10-7
	Handling Solutions	10-7
	Controlling Pressure and Vacuum	10-8
	Controlling Fumes	10-9
	Electrical Safety	10-9
Section II	LABORATORY ANALYSIS REPORTING	10-10
	General	10-10
	Petroleum Sample Tag	10-10
	Petroleum Laboratory Analysis Report	10-10
	Testing	10-12
Section III	STANDARD PUBLICATIONS AND FORMS	10-13
	General	10-13
	Military Standardization Handbook for Fuels, Lubricants, and Related Products	10-13
	Federal Test Method Standard No. 791	10-13
	ASTM Standards 23, 24, 25, and 27	10-13
	DFSCH 4120.1 Reference List of Specifications and Standards	10-14
	DOD Manual 4140.25-M Procedures for the Management of Petroleum	10-14
	AR 715-27, Petroleum Procurement of Quality Assurance Manual	10-14
	Forms	10-14

APPENDIX A	PETROLEUM LABORATORIES	A-1
APPENDIX B	TEST MAN-HOURS FOR TYPE OF FUEL	B-1
APPENDIX C	CONVERSION CHARTS	C-1
APPENDIX D	POSSIBLE CAUSES OF CONTAMINATION/DETERIORATION	D-1
GLOSSARY		Glossary-1
REFERENCES		References-1
INDEX		Index-1

PREFACE

Purpose and Scope

This manual is a guide for commanders, staff officers, and other personnel concerned with planning, organizing, and carrying out petroleum QS testing in a theater of operations.

The doctrine in this manual concerns operations in a tactical theater and may not relate directly to normal peacetime garrison operations. Doctrine for the development and operation of theater petroleum testing facilities is discussed separately for an improved and unimproved theater of operations. The systems described are applicable to both conventional, and NBC warfare.

This manual is a consolidation of FMs 10-70 and 10-72. It addresses certain environmental issues to be considered in planning petroleum laboratory operations. It provides information concerning the types of petroleum products, and their uses by the military; petroleum quality; the various laboratories and test kits available for implementing quality surveillance in the theater; and the deployment and establishment of these facilities. The final chapters of this manual address basic chemistry used in the laboratory, along with the properties of petroleum, testing methods; samplers and sampling procedures; and general petroleum laboratory operations. This manual is not intended to be the only source of information on the operation of petroleum testing facilities. It does not cover individual items of testing equipment and their maintenance or the internal operation of testing facilities. In addition to this manual, it is necessary to have publications such as those listed in the references in order to provide an adequate petroleum QS program.

User Information

The proponent of this publication is HQ USATRADOC. You are encouraged to submit recommended changes and comments to improve this manual. Make sure you key your comments to the exact page, paragraph, and line of the text in which the change is recommended. Provide reasons for each comment to ensure understanding and complete evaluation. Write your comments on a DA Form 2028 (Recommended Changes to Publications and Blank Forms) or in a letter, and send them to

Training Directorate
Quartermaster Training Division
ATTN ATCL AQ
801 Lee Avenue
Fort Lee, VA 23801-1713

Unless otherwise stated, whenever the masculine gender is used, both men and women are included.

CHAPTER 1

ENVIRONMENTAL RESPONSIBILITIES

Section I. Environmental Protection Stewardship

The Army environmental vision is to be a national leader in environmental and natural resource stewardship for present and future generations as an integral part of our mission.

SCOPE OF ENVIRONMENTAL
RESPONSIBILITY

We must take care of the environment (that is, practice environmental protection stewardship). The definition of stewardship is taking care of property while also caring about the rights of others. We must plan our operations without harming the environment. Good environmental protection stewardship lets leaders take care of soldiers and their families. It also saves resources vital to combat readiness. The Army's environmental concerns include the following.

- The Army has the huge task of reducing the environmental impact on its installations and units throughout the US and the world. Within CONUS, the Army owns 20 million acres of land (an area about half the size of Virginia). This shows the vastness of this task. Each area of our daily operation has some effect on the environment.

- The Army is renewing its emphasis on taking care of the environment. Petroleum units by their nature have a huge impact on the environment. It is critical for the leaders and soldiers in these units to follow safe, legal environmental practices. By doing so, they protect their health and the health of those around them. They also prevent long term environmental damage that can lead to fines and other legal actions.

ENVIRONMENTAL PROTECTION
STEWARDSHIP GOALS

The Army no longer just complies with laws, they want to be a leader in environmental protection. To do this, the Army has set goals for its leaders. These goals include:

- Compliance. Ensure that all Army sites (CONUS, OCONUS) attain and sustain compliance in the face of changing requirements.
- Restoration. Clean up contaminated sites as quickly as resources permit to protect human health and environment.
- Prevention. Adopt and implement integration management approaches, procedures, and operations in all Army mission areas to minimize all environmental contamination and pollution. Do not receive a notice or violation or a fine for not following local, state, and federal environmental regulations.
- Conservation. Conserve, protect, and enhance environmental, natural and cultural resources, using all practical means consistent with missions, so that present and future generations may use and enjoy them.
- Planning. Consider the environment in the planning and decision making process, and initiate environmental planning early in the mission.
- NEPA. Integrate all NEPA procedures into operations.