MCWP 4-11.6
(Formerly MCWP 4-25.5)

Bulk Liquids Operations

U.S. Marine Corps

PCN 143 000009 00

DEPARTMENT OF THE NAVY
Headquarters United States Marine Corps
Washington, DC 20380-1775

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FOREWORD

1. PURPOSE

Marine Corps Warfighting Publication (MCWP) 4-11.6, *Bulk Liquids Operations,* provides doctrinal guidance for bulk liquids support of the MAGTF. This publication is aligned doctrinally with FMFM 4, *Combat Service Support* and tactically with FMFM 4-1, *Combat Service Support Operations*. It specifically addresses the techniques and procedures of bulk fuel and water support of the FMF and the MAGTF in a joint/multinational environment. MCWP 4-25.5 is a follow-on publication of FMFM 13, *MAGTF Engineer Operations*.

2. SCOPE

This publication provides information on the bulk liquids mission, organization, and concept as well as guidance for the planning and conduct of bulk fuel and water support operations for commanders, staffs, subordinate commanders, and personnel in bulk liquid units.

3. SUPERSESSION

Not applicable.

4. CHANGES

Recommendations for improving this manual are invited from commands as well as directly from individuals. Forward suggestions using the User Suggestion Form format to—

COMMANDING GENERAL
DOCTRINE DIVISION (C42)
MARINE CORPS COMBAT DEVELOPMENT COMMAND
3300 RUSSELL ROAD SUITE 318A
QUANTICO, VIRGINIA 22134-50215

5. CERTIFICATION

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

PAUL K. VAN RIPER
Lieutenant General, U.S. Marine Corps
Commanding General
Marine Corps Combat Development Command

DISTRIBUTION: 143 000009 00

Record of Changes

Change No.	Date of Change	Date of Entry	Organization	Signature

Overview of Bulk Liquids Operations

Water and fuel make up the greatest quantities of supply required by the Marine air-ground task force (MAGTF) to conduct modern warfare. As petroleum or water requirements rise above individual or small unit needs, it becomes necessary to handle them in "bulk" form. Bulk handling calls for special equipment, product handling safeguards, and standing operating procedures (SOPs). Plant account/permanent facilities are often used at bases, camps, and air stations; however, deploying MAGTFs require special expeditionary systems. See chapter 3 for discussion on tactical fuel systems (TFSs). This publication will address water and fuel as functional operations. For discussion of water and fuel supply classes, see MCWP 4-6.

Mission success depends on planning for the known and expecting the unknown. This is especially true when planning bulk liquids operations. See part I for bulk fuel operations and part II for bulk water operations. Commanders and their staffs at all levels must be concerned about maintaining water and fuel support to allow completion of the unit's mission. To provide the most effective use of bulk liquids stocks and equipment, bulk liquids planners must be familiar with Marine Corps and Department of Defense (DOD) bulk liquids assets and responsibilities. To ensure adequate support, commanders and their staffs should address planning for these two commodities in all operation plans (OPLANs).

Petroleum and water are supplied as either packaged or bulk products. *Packaged products* differ from bulk products in one respect—the product is received along with the container in a packaged product. Fuel and water are combat-essential bulk commodities that are no longer only supplied by 5-gallon cans or packaged supply methods. Packaged methods require extensive shipping space and provide a reduced throughput capability when compared to "bulk" operations. The current Marine Corps and DOD policy is that packaged or drummed fuel (and water) is not the preferred method of providing bulk liquids. With the many drawbacks to using packaged or drummed products, **the use of packaged or drummed fuel (and water) should be kept to a minimum.**

Bulk liquids are defined as petroleum or water products which are normally transported by pipeline, rail tank car, tank truck barge, or tanker and stored in tanks or containers having a capacity of more than 55 gallons. The exceptions are fuels or water stored in 500-gallon collapsible containers which are considered to be packaged. MAGTF commanders and staff planners need to be aware of and should consider the many options available in bulk liquids operations. Mission success may hinge on proper planning and handling of these complex and dynamic commodities.

User Suggestion Form

From:

To: Commanding General, Doctrine Division (C42), Marine Corps Combat Development Command, 3300 Russell Road Suite 318A, Quantico, Virginia 22134-5021

Subj: RECOMMENDATIONS CONCERNING MCWP 4-25.5, *BULK LIQUIDS OPERATIONS*

1. In accordance with the Foreword to MCWP 4-25.5, which invites individuals to submit suggestions concerning this MCWP directly to the above addressee, the following unclassified recommendation is forwarded:

____	________________	_______	______________
Page	Article/Paragraph No.	Line No.	Figure/Table No.

Nature of Change:

- ☐ Add
- ☐ Delete
- ☐ Change
- ☐ Correct

2. Proposed new verbatim text: (Verbatim, double-spaced; continue on additional pages as necessary.)

3. Justification/source: (Need not be double-spaced.)

NOTE: Only one recommendation per page.

Record of Changes

Change No.	Date of Change	Date of Entry	Organization	Signature

Bulk Liquids Operations

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Part I. Bulk Fuel Operations

Chapter 1

Introduction

Procurement of fuel for the United States Armed Forces can be traced back to the Revolutionary War. Late in November 1775, the Continental Congress resolved that the troops were to be supplied with fuel and bedding. The Quartermaster General was responsible for providing wood, straw, and blankets as well as camp equipage. The requirements for fuel, as we know it today, remained relatively small until World War I. In 1918 after the Armistice, Lord Curzon said, "The World War was won for the allies not only by blood but by oil." Winston Churchill declared, "The allies had floated on a sea of oil to victory."

1001. History of Bulk Fuel

a. Metz, 1944—Fuel Shortage. During the engagement of Metz in 1944, the shortage of fuel in the Third Army was a significant factor. Beginning the pursuit on 1 August 1944 with a 1.5 million-gallon reserve, the Third Army depleted its stockpile by 7 August and had to operate on a "hand-to-mouth" basis. While the fast-paced pursuit is often blamed for Third Army's high fuel use, inaccurate forecasts of consumption were also a significant cause. The 6th Armored Division, for example, used two to three times more fuel than anticipated.

While Patton was racing through France and consuming an average of 350,000 gallons of fuel each day, the famous Red Ball Express was organized to meet his growing demands as well as those of the First Army. The Red Ball Express was a nonstop convoy of trucks that connected supply depots in Normandy with the armies in the field. At its peak the Red Ball Express used 6,000 trucks and burned 350,000 gallons of fuel per day to complete its missions. As Patton advanced deeper, the demands placed upon the Red Ball Express grew faster than it was able to supply. It became obvious to tactical commanders that the Allies were running out of gas. On 28 August, LtGen Patton summed it up this way, "At the present time our chief difficulty is not the Germans, but gasoline. If they would give me enough gas, I'd go all the way to Berlin." Patton's army was forced to ease up when its fuel allocation fell 100,000 gallons short. Even though fuel was in abundance in Normandy, the Red Ball Express could not transport it in sufficient quantities to the Third Army's forward units. On 31 August after receiving no fuel at all, Patton's spearheads came to a halt.

b. Korean Conflict—Fuel Packaging and Moving Problems. During World War II, the fuel needs of the Marine Amphibious Forces were barely met with 5-gallon cans and 55-gallon drums. The problem escalated when beach personnel were tasked to move this fuel. The importance of packaging and moving petroleum products continued to increase in the Korean Conflict where a large percentage of all supply tonnage consisted of petroleum products. To meet this growing requirement, the Marine Corps Equipment Board developed a concept in 1952 for fuel delivery in amphibious operations. This concept called for using collapsible tanks, rubber hose, and portable pumps to provide bulk fuel support. The concept proved workable and evolved into the fuel systems that we use today—the amphibious assault fuel system (AAFS), the tactical airfield fuel dispensing system (TAFDS), and the helicopter expedient refueling system (HERS). The basic and most significant feature of the three systems was and still is flexibility.

c. Vietnam War—Implementing the New Fuel Systems. During the Vietnam War, the AAFS, the TAFDS, and the HERS were successfully combat-tested from the 17th parallel south to the Mekong Delta. The majority of fuel issued to Marine Corps units was issued through either AAFS or TAFDS. The AAFS fuel farm at Chu Lai consisted of 120 10,000-gallon fuel tanks or 1.2 million gallons of fuel. This system operated from September 1965 until 1968 when the Navy installed rigid tanks and assumed responsibility for the operations. Military petroleum consumption during the Vietnam War peaked in 1969 at 398 million barrels, dropping to 211 million barrels in 1974. Even in a limited, jungle-type war, petroleum played a major logistic role.

d. Southwest Asia (SWA) 1990-91—More Improvement of Fuel Systems. Since Vietnam, the Marine Corps has continued to improve and increase the capabilities of the TFSs. Operations Desert Shield and Desert Storm provided the toughest challenge to date for the Marine Corps bulk fuel community. From August 1990 through February 1991, U.S. land-based operations in SWA consumed approximately 1.8 billion gallons of fuel. The Marine Corps used approximately 81 million gallons during SWA, and bulk fuel support played a major role in the Marine Corps' success.

Modern warfare requires tremendous quantities of fuel. For every ten Marines on the battlefield, there are approximately four fuel-consuming items of equipment. Methods and equipment for supplying fuel to the customer are constantly being updated, ensuring that the Marines of today are able to perform their mission.

1002. Concept of Bulk Fuel Operations

Bulk fuel support is a joint venture. While bulk fuel management for joint operations is the ultimate responsibility of the commander of the joint command, each Service is responsible for support of its forces and any other missions assigned by the joint commander. The actual procedures used to provide bulk petroleum support to the Services will depend on conditions in the area of operations (AO), e.g., a developed theater or an undeveloped theater.

a. Developed Theater. A mature or developed theater will usually have host nation assets available such as pipelines, storage facilities, and railways that will help support the bulk petroleum distribution system. Airbases, tactical airfields, and Service bed-down sites will be supported by pipelines whenever tactically feasible. The pipeline and/or hoseline system will extend as far forward as possible.

b. Undeveloped Theater. In the undeveloped theater, host nation or commercial bulk fuel facilities normally will not be available and tactical assets will have to be used. The bulk fuel supply system in the undeveloped theater may include limited tanker mooring systems, floating hoselines, submarine pipelines, inland tank farms, hoselines, and collapsible tanks.

c. Resupply. Bulk fuel resupply is managed in the unified commander in chief (CINC) Joint Petroleum Office (JPO). The CINC JPO coordinates all agreements concerning bulk fuel support between component commands and host nations. For the majority of places that Marine forces will be employed, Marines will have to make maximum use of their organic bulk fuel equipment. However, when available, existing pipelines and storage systems will be used to receive, store, and provide bulk reduction of fuel stocks to the maximum extent possible. Host nation assets will be used to augment U.S. transportation and bulk fuel distribution capabilities. Once resupply lines of communications are established, the JPO will make preparations for resupply from CONUS pushed stocks and/or from theater source stocks (i.e., contracted from theater refineries), as coordinated by either the joint task force (JTF) or the Marine component commander.

d. Marine Forces. Marine forces will obtain initial petroleum supply support from operating stocks carried aboard maritime prepositioning ships (MPS), assault echelon (AE) and assault follow-on echelon (AFOE) shipping (including landing forces operational reserve material (LFORM)), and in-theater bulk petroleum war reserve stocks (BPWRS) stored in selected storage depots throughout the theater. Additionally, maximum use will be made of available host nation support bulk fuel supply systems and stocks as negotiated in standing host nation support agreements. Due to the lack of tanker offloading facilities in many areas, U.S. Navy ship-to-shore capabilities may have to be utilized. Employment of the U.S. Navy offshore petroleum discharge system (OPDS) and amphibious assault bulk fuel system (AABFS) in conjunction with the USMC AAFS will be required to meet Marine Corps needs. Arrangements for this are coordinated by the Marine component commander or Marine expeditionary force (MEF).

e. Inland Distribution. Depending upon the situation, inland distribution of bulk fuel will be by tactical pipeline as much as possible and by mobile refuelers as required. Whenever possible, petroleum distribution to the airfields will be by tactical hoseline from the AAFS to the TAFDS. Mobile refuelers will be used if required to transport bulk fuel to the airfields.

Bulk fuel support will be provided on a "push" basis to ensure the capability of continuous operations. The basic operating concept is to keep storage tanks full at all times. The schedule for movement of fuel through the distribution system is based on ullage (the amount by which a container, storage tank, or storage facility falls short of being full) and anticipated product demand. For Marine Corps retail bulk fuel operations, bulk fuel will be pumped/transported from the main AAFS tank farm to the combat service support detachment (CSSD) tank farms. The CSSD tank farms will provide bulk reduction to the using unit's equipment or mobile refuelers. Movement of fuel from the CSSDs will be by any means available.

Chapter 2

Bulk Fuel Organization

On 1 July 1973, the Defense Logistics Agency (DLA) assumed centralized management of bulk petroleum within the DOD. The Defense Fuel Supply Center (DFSC) was designated the integrated material manager of U.S. military bulk petroleum. The CINCs have established JPOs to discharge staff petroleum logistic responsibilities within the theaters. Each Military Service is tasked with maintaining a petroleum office to manage bulk petroleum within the Services. This chapter discusses the operational organizations and capabilities of petroleum agencies throughout the DOD.

2001. Organization and Responsibilities

a. Defense Fuel Supply Center. The DFSC, a component of the DLA, is the DOD integrated material manager for bulk petroleum products. The DFSC is responsible for procurement of bulk petroleum products and related services and maintains the product until it is delivered to the supported Service. To provide timely and efficient support to the Services, the DFSC has established area defense fuel regions (DFRs). These regions provide close contact and coordination with the Services. The DFRs are located in CONUS, Pacific Command (PACOM), European Command (EUCOM), and the DFR, Middle East. In CONUS, DFR personnel order products from contractors, distribute products to the Services, and perform contract administration. Overseas, DFR personnel provide product ordering and contract administration. The missions and general functions of the DFSC DFRs are outlined in detail in DOD 4140.25M, *Department of Defense (DOD) Management of Bulk Petroleum Products, Natural Gas and Coal* and DOD 4140.25 (directive), *Management of Bulk Petroleum Products, Storage, and Distribution Facilities,* Volume I, Chapter 2.

b. Unified Commands. In unified commands, staff planning and management for bulk petroleum is performed in the J-4 JPO. The JPOs are normally staffed by personnel from each Military Service having a mission in the theater. The JPO coordinates the theater bulk petroleum operations and provides the interface between DFSC and the Service theater bulk petroleum managers. Service theater bulk petroleum managers provide Service bulk petroleum requirements to the JPO. The JPO consolidates the requirements for all the Services and schedules deliveries for the theater. The JPO advises the theater commander and staff on bulk petroleum logistic planning and policy matters. When required, the JPO advises the CINC on the allocation of bulk petroleum products and facilities.

Bulk petroleum management for the entire theater is the ultimate responsibility of the commander of the unified command through the JPO. Daily management is accomplished by the JPO in coordination with the Services. The unified command may also establish sub-area petroleum offices (SAPOs) at the subunified command level to provide in-country or regional staff management functions.

c. Joint Bulk Fuel Support. During joint operations, bulk fuel management for the entire force is the ultimate responsibility of the joint commander. Daily management is accomplished by the JPO or JTF petroleum staff office, in coordination with the inland distribution manager, Service retail managers, DFSC, and applicable host nation activities. The joint commander makes the final decision on the appropriate way to accomplish bulk fuel storage and distribution to include the mix of Service tactical equipment, DFSC contract support, and host nation support. Each Service is responsible for providing retail bulk fuel support to its forces. Retail bulk fuel is fuel that is held primarily for direct support to an end-use customer, i.e., aircraft, vehicles, etc.

d. Joint Task Force. Bulk petroleum management in JTF operations is similar to that in unified commands. The JTF normally establishes a petroleum office within the J-4. This office coordinates the JTF bulk petroleum requirements with the CINC JPO and the component Services. Additional functions performed by the JTF Petroleum Office are to—

- Coordinate petroleum planning and operations within the JTF.
- Coordinate with the component Services bulk petroleum requirements that must be obtained from in-country commercial sources.
- If required, establish a bulk petroleum allocation system within the JTF.

Normally, the JTF petroleum office will rely on the area unified command JPO for wholesale bulk petroleum management and support. Personnel for the JTF petroleum office are normally provided by the Services within the JTF.

2002. Military Services

Each Service is responsible for providing retail bulk petroleum support to its forces. In addition, the Army is charged with the mission of providing overland petroleum support to all U.S. land-based forces overseas except Navy ocean terminals. The Navy, in combination with DFSC, is responsible for the management of Navy ocean terminals and for ship-to-shore petroleum support. In areas without an Army presence, either the dominant user (designated by the unified command) the JTF, DFSC, and/or a combination of both will operate the bulk petroleum distribution systems.

a. U.S. Army. The U.S. Army staff management for petroleum planning and operations is in the Army Energy Office, Office of the Deputy Chief of Staff for Logistics. Daily operational supply of bulk fuel in the Army is managed by the U.S. Army Petroleum Center (USAPC). Principal duties of the USAPC include determining and consolidating Army fuel requirements, submitting procurement requests to DFSC, and maintaining liaison with DFSC and other Military Services on operational and policy matters affecting bulk fuel operations. At the Army theater level, the Theater Army Material Management Command (TAMMC) is the item manager for bulk fuel. In accordance with DOD 4140.25-M, the Army provides overland bulk fuel support to U.S. land-based forces of all the Services. The Army organization responsible for carrying out the inland distribution mission is the U. S. Army Petroleum Group. **This unit** is responsible to the unified commander for the detailed planning and support of all component Services. To perform this task, the U. S. Army Petroleum Group will use available military, commercial, and host nation assets. When operating in a joint theater, a Marine Corps liaison team should be attached to the U.S. Army Petroleum Group.

The Army is tasked with the mission of providing overland theater-level bulk fuel support to U.S. land forces of all overseas DOD components except Navy ocean terminals. This mission includes providing the necessary force structure to construct, operate, and maintain overland pipelines in support of the wholesale theater bulk fuel mission. In areas without an Army presence, either the dominant user designated by the joint commander, DFSC (by contract), or a combination of both will be tasked to operate the bulk fuel distribution system.

b. U.S. Air Force. Staff management responsibility for U.S. Air Force bulk fuel is in the Fuels Policy Branch, Deputy Chief of Staff Logistics and Engineering. Air Force Fuels Division Detachment-29 is the control point for bulk fuel requirements and inventory management. It conducts liaison with DFSC and the other Services on operational and policy matters affecting bulk fuel operations. At the Air Force major command level, the Command Fuels/Supply Officer provides staff and command supervision over bulk fuel operations. In-flight refueling operations are not considered bulk fuel operations and are the responsibility of the Air Mobility Command (AMC). Organizations requiring in-flight refueling support should coordinate directly with AMC.

c. U.S. Navy. Department of the Navy staff management for bulk fuel is in the Navy Energy Office, Deputy Chief of Naval Operations, Logistics. The Navy Petroleum Office (NAVPET) is the control point for bulk fuel requirements and inventory management. NAVPET duties include maintaining liaison with DFSC and the other Services on operational and policy matters affecting bulk fuel operations. At the Navy major command level, fleet petroleum staff officers provide staff management on bulk fuel matters. In joint operations, the Navy supports the ship-to-shore bulk fuel mission. The Navy is responsible for getting bulk fuel to the beach high water mark where the fuel is received by Army or Marine Corps bulk fuel units. The Navy's shore fuel expeditionary mission is filled entirely by Naval Reserve fuel units. These units are managed by NAVPET and the expeditionary support force. They are composed of 22-man units, capable of handling multiple missions including bulk and retail bag farm operations, truck, aviation refueling, OPDS, and augmentation of fixed fuel facilities. There were ten units in existence as of 1994, equally distributed on both coasts.

d. U.S. Marine Corps. Headquarters Marine Corps (HQMC) policy responsibility for bulk fuel resides in the Material Policy Section (LPP-2), Deputy Chief of Staff for Installations and Logistics. NAVPET is also the Marine Corps service control point for bulk fuel. At the major command level, the Marine component commander and/or the MEF assistant chief of staff G-4, is responsible for bulk fuel management, planning, operations, and policy. The Marine component commander/MEF G-4 maintains liaison with the unified command JPOs, NAVPET, and the other Military Services on matters concerning bulk fuel operations and policy. See table 2-1 for MAGTF responsibilities.

(1) Marine Corps Component Commander/MEF. The Marine component commander is responsible for wholesale logistic support at the Service, theater, CINC, and host nation level. The MEF is responsible for tactical bulk fuel receipt, storage, and distribution. Accordingly, the MEF will work all retail logistics provisioning for the major subordinate commands. To this end, the MEF command element is responsible for requirements determination and operations in and forward of the rear combat zone; the Marine component commander is responsible for the communications zone and supported/supporting CINC coordina- tion. All fuel operations in the MEF zone of action or amphibious objective area (AOA) will be coordinated by the MEF bulk liquids officer. Linkage to the in-theater CINC JPO, DFR, host nation, and other Service components is a Marine component commander responsibility.

(2) Marine Aircraft Wing. Within the MAW, fuel support is provided through the Marine wing support group (MWSG). The MWSG in 2d and 3d MAW have four Marine wing support squadrons (MWSSs). Two squadrons are configured to provide fixed-wing support while the other two squadrons are configured to provide rotary wing support. The MWSG in 1st MAW has two MWSSs. One is configured for fixed- wing and one is configured for rotary wing. The MAW G-4 is responsible for bulk fuel planning and coordination. Bulk fuel operations in support of the MAW are performed by the Fuel Branch within the MWSS. These units provide refueling support for MAW aircraft and ground equipment. The MWSS Fuel Branch is responsible for the receipt, storage, distribution, and quality surveillance of bulk fuel in support of MAW operations. The Fuel Branch of a MWSS is capable of providing refueling support at two separate airfields simultaneously. The difference between the rotary and fixed-wing fuel branches is the table of equipment. Each rotary wing MWSS has four TAFDS and seven HERS while each fixed-wing MWSS has six TAFDS and two HERS. Both types of MWSS have ten M970 mobile refuelers/defuelers. (For current quantities, refer to the logistics management information system (LMIS).)

(3) Marine Division (MARDIV) The MARDIV is a fuel user, not a fuel provider. However, the MARDIV has limited organic bulk fuel assets such as mobile refuelers and SIXCONs to support their own units.

(4) Force Service Support Group (FSSG). The FSSG provides bulk fuel supply support for the sustainment of the MEF. They provide all bulk fuel support that is beyond the organic capabilities of supported units. Bulk fuel planning and coordination is performed in the FSSG G-3. To conduct bulk fuel operations, the FSSG uses bulk fuel assets located within the engineer and motor transport organizations.

(a) Engineer Support Battalion (ESBn). The ESBn is responsible for providing general bulk fuel support to the MEF to include receipt, storage, distribution, and quality surveillance. The ESBn is assigned two bulk fuel companies, one of which is in a cadre status. When supporting MAGTF airfields, the ESBn is responsible for fuel distribution to the boundary of the airfield. The bulk fuel company of the ESBn provides coordination and control with the Marine aircraft wing (MAW) for transfer of bulk fuel to the airfields. To perform its mission, the bulk fuel company has 8 AAFS, 60 SIXCON fuel tanks, 20 SIXCON fuel pumps, 56 500-gallon collapsible fuel drums, and 32 expedient refueler systems. For current quantities, refer to the LMIS.

(b) Motor Transport Battalion. Transportation and distribution of bulk fuel for the MEF is provided by the general support company and direct support company in the motor transport battalion. To accomplish this, the motor transport battalion rates 85 SIXCON fuel tanks, 3 SIXCON fuel pumps, and 20 M970 tankers (5,000 gal). The 3d FSSG does not have a motor transport battalion; however, it has a support battalion that rates 15 M970 refuelers.

Table 2-1. MAGTF Responsibilities

Responsibilities	MAR FOR	MEF	DIV	MAW	FSSG
Plan and estimate petroleum requirements in operational plans.					
Coordinate bulk fuel operations to ensure economy of operations and prevent duplication of functions.	X	X			
Monitor fuel stocks.	X	X	X	X	X
Coordinate requirements for host nation support with the CINC/JTF.	X				
Coordinate bulk fuel support for forces attached to the MEF.		X			
Request release of BPWRS from CINC.	X				
Allocate bulk fuel assets and stocks within the MEF.		X			
Identify bulk fuel shortfalls to the JTF or MARFOR.	X	X			
Plan for and establish TAFDS and HERS support at airfields.				X	
Establish internal fuel distribution procedures.		X	X	X	X
Establish quality control procedures for bulk fuel per MIL-HDBK 200 and NAVAIR 00-80T-109.				X	X
Establish accounting procedures to record usage data.	X	X	X	X	X
Plan for and establish AAFS sites as required to support the MEF.	X	X		X	X
Coordinate ship-to-shore bulk fuel operations.		X			X
Plan for and establish distribution of bulk fuel to support the MEF.	X	X		X	X
Coordinate bulk fuel requirements with the MEF G-4. Ensure stocks are sufficient to reach and maintain stockage objectives.	X		X	X	X
Provide bulk fuel laboratory support to the MEF.					X
Coordinate bulk fuel supply for airfields.	X	X		X	X

Chapter 3

Tactical Fuel Systems

Marine Corps bulk fuel equipment has to meet a wide spectrum of requirements from ship-to-shore operations to aircraft refueling. To meet these requirements, the Marine Corps has developed a family of tactical fuel systems (TFS). Each system is designed and configured specifically to support a unique mission using similar components. The ability to alter fundamental system configurations and interchangeability of components allows the creation of limitless combinations of tailored systems to meet mission requirements.

3001. Amphibious Assault Fuel System

The Amphibious Assault Fuel System (AAFS) (USMC TAMCN B0685) is the largest of the TFS. Consisting of many self-contained units, the AAFS is used to receive, store, transfer, and dispense all types of fuel. The AAFS supplies bulk fuel to all elements of a MAGTF including distribution by hoseline to airfields. The system can receive fuel from offshore vessels, railcars, tank trucks, bulk storage tanks, pipeline/hoseline, and drums. Fuel is stored and can be transferred to another storage site or dispensed to individual containers, vehicles, tank trucks, and other fuel systems.

a. Composition. Six assemblies make up the AAFS:

- Beach unloading assembly.
- Drum unloading assembly.
- Two booster station assemblies.
- Two adapting assemblies.
- Dispensing assembly.
- Five tank farm assemblies.

Each AAFS has one beach unloading assembly used for receiving fuel during ship-to-shore operations. Two booster station assemblies in each AAFS are used when the distance between storage sites is greater than the pumping distance. The AAFS storage capacity comes from the five tank farms. One drum unloading assembly in each AAFS provides the capability to defuel 55-gallon drums. One dispensing assembly in each AAFS provides the capability to dispense fuel. The AAFS has two adapting assemblies to make the system compatible with commercial and other Services' fuel systems. Versatility is an important part of the AAFS. It can be deployed as a whole or tailored to meet mission requirements. However, each AAFS may contain only one type of fuel.

b. Capacity. The AAFS storage capacity is 600,000 gallons made up from its five tank farms. The AAFS has approximately 3.5 miles of 6-inch hose and uses ten 600-gallons per minute (gpm) pumps. Using quick-connect, cam-lock fittings, the AAFS can be assembled without tools and is compatible with the other Marine Corps TFSs.

3002. Tactical Airfield Fuel Dispensing System

Similar in design to the AAFS tank farm, the Tactical Airfield Fuel Dispensing System (TAFDS) (USMC TAMCN B0675) is used to provide bulk fuel support at Marine Corps expeditionary airfields. The primary purpose of the TAFDS is aircraft refueling. This system is air-transportable and versatile and can be quickly assembled. Compatible with other Marine Corps TFSs, the TAFDS can receive fuel from almost any source with the appropriate adapters. Fifty-five gallon drums may be defueled using the drum unloading portion of the TAFDS. This system is used for receiving, storing, transferring, and dispensing aviation fuel in support of expeditionary airfields. With the single fuel on the battlefield concept, the TAFDS will be able to supply aviation and ground fuel for airfields.

The TAFDS consists of six 20,000-gallon collapsible tanks for a storage capacity of 120,000 gallons. Each TAFDS rates three pumps of either 350 or 600 gpm. With its designed pumping rate and equipment to set up 12 dispensing points, the TAFDS has a multi-plane fueling capability. The TAFDS may also be used to replenish tank vehicles. Filtration of the fuel to meet naval air requirements is accomplished using filter separators and fuel quality monitors. The TAFDS is used for hot or cold aircraft refueling.

3003. Helicopter Expedient Refueling System

The Helicopter Expedient Refueling System (HERS) (USMC TAMCN B1135) is designed for support of helicopter operations in advanced areas and remote sites. It is normally used at forward arming and refueling points (FARPs). Versatility, easily transportable, and a quick setup are the key elements of the HERS. Equipped with 2-inch hoses and adapters, the HERS is compatible with other Marine Corps TFSs. The HERS has a maximum capacity of 9,000 gallons from 18 500-gallon collapsible drums. The HERS has two 100 or 125 gpm pumps and enough components to set up four refueling points. It may be deployed as a whole or in part to meet operational requirements. Due to the limited storage capacity and the flow rate of the HERS (100 gpm), the HERS is best used for attack and utility helicopters to increase their range.

3004. Expedient Refueling System

The Expedient Refueling System (ERS) was designed for support of ground vehicles in advanced positions. Easily transportable and highly mobile are key elements of the ERS. The ERS is normally used with the 500-gallon collapsible fuel drum and consists of either a 100 or 125 gpm pump and with hoses and fittings for two refueling points. All components within the ERS have 2-inch couplings. *The ERS does not have filtration equipment and should not be used for aircraft refueling.*

3005. SIXCON

The Marine Corps Liquid Storage, Transporting, and Dispensing System, is commonly called a SIXCON. Certain SIXCONs are used to store, transport, and dispense fuel. A SIXCON is transportable by air or ground. Components of the fuel SIXCON system are a fuel pump module and five fuel tank modules. The modules form a fuel distribution source that can be transported as a unit or individually.

a. Fuel Pump Module. The SIXCON fuel pump module (USMC TAMCN B1580) consists of a 125 gpm pump, 100 gpm filter separator, 100 gpm fuel quality monitor, meter assembly, and hose reel. The fuel pump was designed to dispense fuel from several types of fuel tanks, for defueling, or for filtering aircraft or ground fuels. The rate of transfer for the SIXCON pump module is up to 100 gpm.

b. Fuel Tank Modules. Each SIXCON fuel tank module (USMC TAMCN B2085) is made of stainless steel and has a capacity of 900 gallons. It is encased by a standard 8’ X 8’ X 20’, International Standards Organization (ISO) container. The fuel tank is equipped with all the hoses and adapters to connect the tanks to the pump unit.

c. Accessories. SIXCON modules are interconnected using special horizontal and vertical ISO connectors. Fuel is transferred via 2-inch hoses with dry-break couplings. This allows rapid assembly and disassembly without loss of fuel or damage to the environment.

d. Cyclic Resupply. SIXCON modules are assigned to general combat service support (CSS) organizations. These organizations may implement a cyclic resupply procedure where full modules are exchanged for empty ones. SIXCONs may also be assigned to using organizations for minimal fuel handling at the operator level.

3006. M970 Mobile Refueler

The M970 5,000-gallon mobile refueler (USMC TAMCN D0215) provides aircraft refueling/defueling and over-the-road transportation of bulk fuel. It is assigned to both the aviation combat element (ACE) and the combat service support element (CSSE). Within the ACE, the M970 is organic to the MWSS and is used primarily to refuel aircraft. Within the CSSE, the M970 is organic to the motor transport battalion and is assigned to CSSE motor transport and/or engineer detachments. The CSSE uses the M970 to transport bulk fuel between storage sites or directly to the customer.

3007. Tactical Petroleum Laboratory-Medium

The Tactical Petroleum Laboratory-Medium (TPLM) (TAMCN B0695) provides the essential testing components integrated into an ISO container to monitor the critical physical and chemical characteristics of aviation and ground fuels. JP-4, JP-5, JP-8, diesel, and their commercial grade equivalents can be tested for composition and quality against minimum standards as specified in MIL-HDBK-200, *Quality Surveillance Handbook for Fuel, Lubricants and Related Products*. The TPLM can also test captured fuels.

3008. USMC Aircraft Bulk Fuel Handling Systems

Air-to-air refueling or transfer of bulk aviation fuel can both extend the range of aircraft and provide a means for the MAGTF to "air deliver" jet fuel to forward operating sites (jet fuel can also be used as diesel fuel). Table 3-1 is a listing of I/II MEF bulk fuel equipment.

a. USMC KC-130R Transport. The primary mission of the KC-130R Transport is air-to-air refueling. It can air-to-air refuel both tactical Marine fixed-wing aircraft and CH-53 helicopters. The KC-130R can also land at distant airfields carrying up to 10,000 gallons of jet fuel.

b. Tactical Bulk Fuel Distribution System (TBFDS). The TBFDS consists of fuel range extension tanks, hoses, and couplings that can be loaded internally on a CH-53 helicopter. This system can be used to extend the operating range of the CH-53 or allow for helicopter delivery of fuel to distant forward areas. The TBFDS configured CH-53 can refuel aircraft at FARPs or refuel diesel engine ground vehicles and equipment.

3009. Joint Service Interoperability

Joint support to the MAGTF may include providing or receiving fuel support from other Services, foreign forces, or commercial sources. The MAGTF command element (CE) is responsible for coordinating bulk fuel support for the MAGTF. Joint bulk fuel interoperability is addressed in Joint Pub 4-03, *Joint Bulk Petroleum Doctrine*.

a. U. S. Navy Ship-to-Shore Systems. Initial phases of amphibious or maritime prepositioning force (MPF) operations may require bulk fuel delivery by ship-to-shore. Both amphibious ships and maritime prepositioning ships squadrons (MPSRONs) employ floating hose lines to provide bulk fuel issue via ship-to-shore operations. Additionally, the OPDS can be employed to support and sustain MAGTF or JTF operations ashore.

(1) Amphibious Assault Bulk Fuel System (AABFS). The AABFS provides a fuel line from the supplying ship to the high water mark ashore where the fuel lines are connected to shore-based bulk fuel

Table 3-1. I MEF/II MEF Bulk Fuel Equipment

Unit	AAFS	TAFDS	HERS	500-Gal Drums	Pump SIXCON	Tank SIXCON	M970	TPLM
FSSG	8	0	0	56	~52	188	20	2
MWSS F/W (2)	0	12	4	In HERS	4	18	20	0
MWSS R/W (2)	0	8	14	In HERS	2	12	20	0
TOTAL	8	20	18	56	~58	218	60	2

Legend: ~ (approximately)

systems of the landing force. The AABFS consists of buoyant, 6-inch (diameter) reinforced rubber hose lines up to 10,000 feet in length. Two or more buoyant lines can be connected to achieve greater distances between the ship and the shoreline. However, they require floating booster stations to do fuel transfer when the distance is more than 5,000 feet. Buoyant hose systems are employed to support the initial phases of amphibious landings. An AABFS can be installed in 4 to 6 hours under favorable surf conditions.

(2) Offshore Petroleum Discharge System (OPDS). The OPDS is designed to discharge petroleum products to USMC AAFS, U.S. Army tactical petroleum terminals (TPTs), or U.S. Army inland petroleum distribution system (IPDS) pipelines. The OPDS can be installed up to 4 statute miles off-shore and supports ship-to-shore fuel replenishment rates of up to 1.2 million gallons per day (based on a 20-hour operating day). The OPDS can produce delivery rates of 1,000 gpm.

If the ship stand-off distance is less than 2 statute miles, dual lines can be used which results in faster product transfer.

The OPDS includes the initial fuel tanker (ship) which provides the initial delivery of fuel (up to 15 million gallons) and the mooring apparatus for itself and follow-on tankers. The OPDS employs either a 4 point moor or a single anchor leg mooring (SALM) with surface buoy to allow the ship to moor and "weather vane" in the prevailing winds in a 360-degree arc.

The system is installed by Military Sealift Command civilian crews with the assistance of naval support personnel. Besides underwater divers and support personnel from an amphibious construction battalion, the system requires side-loadable warping tugs and/or powered or non-powered causeway sections to conduct the installation.

b. U.S. Army Petroleum Systems. Theater support may be provided from U.S. Army fuel sources. Fuel support, which includes interface with Marine Corps TFSs, must be planned and coordinated in advance. The selection of specific systems depends on the projected requirements. The U.S. Army theater fuel manager coordinates fuel delivery requirements. When operating with the U.S. Air Force, the U.S. Army can airdrop fuel in quantities up to 10,000 gallons in support of operating forces. Fuel support equipment employed may include TPTs, IPDS, or line haul vehicles.

c. U.S. Air Force Air-based Petroleum Systems. Refueler aircraft and aircraft equipped with aerial bulk fuel delivery systems (ABFDS) may be required to support MAGTF operations. Support capability ranges from air delivery of packaged fuel (500-gallon collapsible drums) to bulk fuel pumped from transport aircraft or aircraft internal tanks. See table 3-2. Wet-wing refueling/defueling methods may be prescribed for special mission support operations. These methods may range from the transfer of jet fuel from a delivery aircraft to receiving tactical storage systems or into a receiving aircraft.

Table 3-2. Aircraft Fuel Delivery Capability

Type Aircraft	500-Gal Drum Delivery Model And Gallon Capacity	Wet-Wing Delivery Model And Gallon Capacity
C-130	5,000	4,400
C-141	9,000	12,500
C-5A/B	27,000	29,000

Chapter 4

Bulk Fuel Planning

Normally, bulk fuel capabilities are spread throughout the MAGTF. This is especially true of bulk fuel distribution capabilities. But with the smaller forces of today, there is often a benefit to consolidating the bulk fuel assets. For example, if a mobile refueler was controlled by a central organization, it could be used to support several units and would be used to the maximum extent possible. This would not be true if each unit had its own mobile refueler. The MAGTF has also provided central organizations—the ACE and the CSSE—for its bulk storage requirements.

To be effective, the overall bulk fuel effort needs to be planned and coordinated at the MAGTF level as early as possible. The planning and coordination effort must continue throughout the operation. Due to the significant bulk fuel capabilities within the Marine Corps, Marine Corps requirements for bulk fuel support can be met in most situations if bulk fuel capabilities are properly used.

4001. Planning Requirements for Bulk Fuel

Planning for bulk fuel support can be a complex and challenging task. Time, space, distances, terrain, resources, and the operating environment are all planning factors that have to be considered. There are six major elements of bulk fuel planning—*requirements, sourcing and procurement, transportation, storage, distribution, and equipment.*

a. Requirements. Determining bulk fuel requirements is one of the most important planning elements for bulk fuel support. Requirements have to be determined before any of the other elements can be effectively considered. Requirements will be the main factor in deciding equipment, personnel, and stockage objectives.

b. Sourcing and Procurement. Determining the source and provider of bulk fuel stocks to the MAGTF or Marine forces varies greatly depending on the situation. Before deploying, the planner needs to determine fuel sources and establish procurement procedures.

c. Transportation. Planning for bulk fuel transportation involves movement of fuel from the fuel source to the Marine Corps bulk fuel sites. This is usually a wholesale function that will be provided or arranged by the joint petroleum office. Transportation methods include ships, railcars, tank trucks, pipeline, and aircraft.

d. Storage. Planning for bulk fuel storage requires a consideration of requirements, stockage objectives, and the frequency of resupply. The joint commander prescribes bulk fuel supply levels for the theater in days of supply (DOS). Marine component and/or MAGTF commanders prescribe supply levels for Marine forces based on requirements and equipment availability. When operating in a joint environment, the Marine Corps planners must plan for the supply levels of all organizations that it may be supporting.

e. Distribution. Distribution consists of transporting fuel from the bulk storage site to the using units. Distribution can also be called the retail end of the transportation system.

f. Equipment. The bulk fuel equipment required to support the mission is based on the other five elements for bulk fuel planning—requirements, sourcing and procurement, transportation, storage and distribution. Planning for bulk fuel equipment must include both stationary and mobile bulk fuel equipment.

4002. Planning Considerations

The bulk fuel supply system must be designed according to the mission, terrain, and climate. The planner must consider the following:

- The mission and force to be supported.
- The fuel requirements of that force.
- The capability of installations and/or unit (to include host nation) to provide the required support.
- The time to construct an operational bulk fuel system.
- The requirements for bulk fuel storage facilities, offshore unloading facilities, pipeline/hoseline, and distribution points.
- The availability of bulk fuel units and other units needed to construct, install, operate, and maintain the bulk fuel system.
- The terrain, since this impacts both the ability to install the bulk fuel system and fuel usage factors.

4003. Planning Categories

Bulk fuel planning falls into two basic categories—*logistical* and *operational.*

a. Logistical Planning. Logistical planning involves determining specific fuel requirements and distribution plans based on factors such as fuel consuming equipment, mission, terrain, and climate. Logistical planning is started well in advance of actual operations at the JTF, Marine component, and MAGTF level. The primary purpose of logistical planning is to ensure that fuel products, equipment, bulk fuel operating units, and host nation or commercial support will be available when needed.

b. Operational Planning. Operational planning includes planning to reach the required capacity of the bulk fuel supply system and to maintain the required capacity for meeting mission requirements. This planning is carried out before and during operations. Operational planning has to be flexible and allow for changes due to tactical developments, losses in fuel stocks and equipment, and other factors that may keep the system from operating as planned.

4004. Planning for Joint Bulk Fuel Operations

The supported CINC and/or the joint commander is responsible for the overall planning of bulk fuel logistical support. The unified or joint command plan is the basis for all subordinate bulk fuel support plans. This plan establishes concepts, objectives, assigns missions, and allocates available resources. Operation plans submitted to the joint staff will include a petroleum appendix to the logistics annex in the format prescribed in Joint Pub 5-03.2, *Joint Operation Planning and Execution System (JOPES),* Volume II. See appendix A. The Service components develop a bulk fuel support concept based on the tactical plan. Once the concept is approved by the joint commander, the Service components then prepare the implementing bulk fuel support plan. During operations, the joint staff and the Service bulk fuel planners revise the basic plans as required to support the mission.

a. Army Petroleum Group. Normally, the Army petroleum group or designated dominant Service is responsible for theater bulk fuel planning and the theater inland petroleum distribution plan. This planning is done in concert with the component Services' bulk fuel plans. The theater inland petroleum distribution plan is prepared and published as an annex to the theater logistic support plan.

b. Compatibility. During joint operations, the compatibility between the Services' bulk fuel systems is a key factor. Compatibility must be addressed during the planning cycle with emphasis on the following interfaces:

- Ship-to-shore offload facilities.
- Aircraft fuel dispensing systems.
- Land-based distribution systems and mobile refueling equipment.

4005. Marine Corps Bulk Fuel Planning

The Marine Corps must maintain the ability to deploy rapidly to a variety of environments and tactical situations. Once in place, our forces must be able to operate with a full spectrum of bulk fuel support. A key factor to successful bulk fuel planning is early coordination between the fuel planners and the operators. To develop an effective fuel plan, the planners must have a good understanding of the concept of operations and the tactical equipment being used.

a. Determine Requirements. The first step is to collect data so the planner can get an estimate of the fuel requirements for Marine forces. While this is not intended to be an exact figure, it does need to be as accurate as possible because of the large impact fuel requirements have on other planning elements. It is often said that it is better to have too much fuel than to run out. While this is true, it can be taken to the extreme.

(1) Automated Systems. Marine Corps fuel planners have become dependent on automated systems for computing fuel requirements. While these systems save time and man-hours, they usually compute fuel requirements that are higher than operating forces actually need. Using the higher requirements during planning will result in having too much fuel on hand, but more importantly, it could result in the MAGTF taking too much bulk fuel equipment and occupying embarkation space that could be used for something else. During planning, the best method of determining fuel requirements will be to use equipment densities and consumption rates. Consumption is affected by combat intensity, hours of operation, mission, quantity of equipment, and theater of operation. It is important that the proper effort be placed on bulk fuel requirement planning to ensure the best allocation of assets.

(2) Time Phasing. An equally important function of bulk fuel requirements identification is time phasing. Bulk fuel requirements must be time-phased to coordinate transportation, storage, and distribution. Time-phased requirements begin with a determination of daily requirements in the objective area. This includes daily demand, storage capacity, throughput capability, and time delay from initial request until delivery.

(3) Methods of Computing Fuel Requirements. All MAGTF elements are responsible for estimating their fuel requirements and submitting them in a timely manner. Fuel requirements should be computed at the staff level based on historical data, equipment density, time, and operational tempo. Fuel planners need to provide specific guidance to the units on the procedures to be followed. The guidance should provide data concerning hours-per-day, resupply times, DOS on hand, and operational tempo. To prohibit units from using any "fudge factor", planners need to keep in mind that there is a point where too much fuel is not economical in terms of equipment and personnel. The bulk fuel staff officers will review requirements submissions for accuracy.

Current planning factors for **ground fuels** are based on the consumption rates in the item data file (IDF) of the logistics management information system (LMIS). Consumption rates are calculated for each item of equipment by multiplying the gallons-per-hour usage rate by the hours-per-day rate. This is the main reason fuel requirements are often overestimated.

The IDF lists most equipment as operating 20 hours per day. This method does not distinguish between equipment in combat units and equipment in support units. Nor does it allow for variation in the operational tempo of the unit or in the method of employing the equipment. While the IDF can usually be used for gallons-per-hour, the hours-per-day rate for various types of equipment should be determined by the operational planners.

Spreadsheets have been developed for ground equipment that allow the planner to input the hour-per-day rate for each item of equipment and the spreadsheet computes a daily requirement. These spreadsheets are available from the MEF bulk liquids sections or the Marine Corps Detachment, Fort Lee, Virginia.

Aviation fuels are computed using aircraft characteristic manuals. These manuals are more accurate than the IDF and historically aviation fuel requirements are not as overstated as ground fuel requirements. This method takes into account the operational tempo, sortie rates, sortie lengths, and fuel rates for each type of aircraft. It is also recommended that aviation fuel

requirements be computed at the staff level based on the aircraft density and the operational tempo provided from the G-3/S-3. Fuel planners need to provide specific guidance to the units on the procedures to be followed. The bulk fuel staff officers will review requirements submissions for accuracy.

(4) Notional MAGTF Bulk Fuel Requirements. Notional fuel requirements are often used during planning, especially before an equipment list has been generated or compiled. Notional requirements are based on fuel consumption rates and hours per day from the IDF multiplied by the T/E for all participating units.

Notional requirements are for initial planning only and should never be used for detailed planning or for procuring fuel stocks. Table 4-1 is the notional fuel requirements for various MAGTFs. The data is from MAGTF II, *Logistics Automated Information System*.

b. Sourcing and Procurement. Marine planners **must** be aware of the various agencies and procedures for procuring bulk fuel. The source of bulk fuel procurement is as varied as the possible missions and objectives that could be assigned a MAGTF. After analyzing fuel requirements, the Marine planner turns to the theater petroleum manager or joint staff to coordinate fuel sourcing and transportation. The procurement of petroleum products includes funding and ordering petroleum products and services. The U.S. Navy (O&MN) and USMC (O&M MC) budget support for Marine aviation and ground fuel requirements. Acquisition procedures are the responsibility of the component commander.

c. Transportation. Transportation planning may include commercial contracted hauling, railway tankers, shipping, other Service assets and pipeline availability. MAGTF planners should look at all available transportation assets in the area and plan for adequate tactical transportation assets to be deployed in a timely manner. These transportation assets are also key elements in determining the fuel support equipment and personnel required. Based on this information, the fuel planner has to recommend a stockage objective to the Marine commander. If the fuel source is close and transportation is readily available, the planner may not have to provide as much storage capacity. If the lines of communication (LOCs) are long and resupply is not timely, the planner may have to increase the stockage objective which means storage equipment will have to be increased.

d. Storage. Based on the above elements and the tactical plan, the fuel planner then looks at the total fuel support package needed to support the mission. The fuel planner must consider storage and distribution assets required and personnel to operate and maintain them. Storage requirements are derived from time-phased requirements and the stockage objective as established by the commander. Stock levels to be stored will depend on consumption rates, resupply methods, transportation assets, and distribution systems. Storage methods, land requirements, and security are the key factors in storage planning. It is important that the bulk fuel storage equipment be scheduled for delivery to the operating area in order to allow for installation of the storage systems in time to support the transportation schedule.

e. Distribution. Distribution is often the most difficult of the bulk fuel missions. Equipment, time-phased requirements, and distance are the main factors affecting

Table 4-1. MAGTF Notional Fuel Requirements (1990)

Force Size	Aviation Element	Daily Fuel Requirements (gallons)
MEF	full MAW	1,539,496
MEF	helicopters and AV8	1,129,772
MEF (Fwd) (MEB Size) + MEU	helicopters and AV8	515,366
MEF (Fwd) (MEB Size)	helicopters and AV8	493,820
MEU	helicopters and AV8	53,382

distribution. Distribution problems will normally become more complex the longer the operation, the greater the consumption rates, and the farther inland the MAGTF goes. Resupply concepts of unit versus supply point distribution will also affect the type and amount of resources needed to support bulk fuel distribution to the MAGTF.

4006. War Reserve Requirements and Stocks

a. Bulk Petroleum War Reserve Requirements (BPWRR). To ensure the supply of petroleum products in the initial phases of a contingency, the Unified Commands and the Services develop requirements to size petroleum war reserve stocks properly. The BPWRR is based on the need to support specific contingency operations until normal LOCs are established. The Joint staff develops guidelines, approved by the Office of the Secretary of Defense (OSD), on DOS and appropriate assumptions on secure sources of resupply. These guidelines are provided to the Services and CINCs and serve as the basis for determining requirements. Using these guidelines, the Services develop and apply structured, auditable methods of computing BPWRR for each theater/com- mand OPLAN. Bulk fuel requirements for the MAGTF are filled from a combination of sources such as the CINC joint petroleum offices, sub-area petroleum offices, defense fuel regions, host nation, Navy Petroleum Office, and landing forces operational reserve material.

b. Bulk Petroleum War Reserve Stocks (BPWRS). BPWRS is the onhand product designated to satisfy BPWRR. This stockage is in addition to the primary operating stock (POS) for each location. Commanders of unified commands are authorized to release or reallocate BPWRS in emergency situations. BPWRS are often stored in theater and are managed by the appropriate CINC JPO/SAPO.

c. Computation of Bulk Fuel Requirements. The MEF G-4 calculates bulk fuel BPWRR based on aircraft and equipment density and the concept of logistics support, to support each operation/contingency plan. The bulk fuel requirements are computed and time-phased by location and type product.

(1) Aviation Fuel. Consumption factors used in the requirements determination process for aviation fuel can be found in NAVAIR NOTICE C10340 or C13100.

(2) Ground Fuel. Ground fuel requirements are computed using MAGTF II based on the MEF's equipment density in the appropriate OPLAN.

d. MEF BPWRR. The Joint Staff establishes the time period that Marine forces will initially be committed for each OPLAN. The MEF computes BPWRR based on the time period, contingency location, and type of product required. The Joint Staff also establishes prepositioning objectives for regions and areas worldwide in the form of combat days of petroleum supply to be maintained in accordance with DOD Directive 4220.7. These objectives consider such factors as wartime tanker sailing times, in-theater distribution times, attrition factors, and appropriate safety levels. As a result, the amount of bulk fuel BPWRR (DOS) that the MEF can register varies depending on the theater in which the MEF is operating. The MEF will usually have less than 60 DOS of bulk fuel as accompanying supplies or BPWRS, and resupply will begin at a date earlier than D+60.

(1) DD Form 1887. The BPWRR not stored by Marine forces (LFORM) will be reported to DFSC as a terminal prepositioning requirement on DD Form 1887, Prepositioned War Reserve Requirements for Terminal Storage (DOD 4140.25-M). The DD Form 1887 or its equivalent must be coordinated with the naval component or with the CINC JPO if the Marines are a component command. This coordination is required prior to submission of the completed DD Form 1887. If Marine forces are operating under a naval component, the naval component will submit the completed DD Form 1887 to DFSC via NAVPET. If operating as a Marine component, the commander will submit the completed DD Form 1887 to DFSC via NAVPET. DFSC and the CINC JPOs announce when the DD Form 1887 submissions are due. Normally the input to the JPOs for coordination is due on 1 October and the input to NAVPET is due 1 November of each year.

(2) Consolidated Defense Fuel Supply Points. The DFSC consolidates Military Service BPWRR for storage at defense fuel supply points (DFSP) and assigns maximum and minimum storage levels in the inventory management plan (IMP). In consonance with approved stock fund operating plans and budgets, it is possible that the entire amount of BPWRS that the MEF is authorized in a particular theater may not be sourced. If the Marine forces have a bulk fuel shortfall, the Marine component commander will notify the appropriate CINC JPO. The document that identifies the amount of BPWRS that are allocated to the MEF is the DFSC IMP. The IMP contains the MEF BPWRR by location and identifies the BPWRS that are sourced to meet that requirement. The Marine component G-4 and the MEF bulk liquids section maintain current copies of the IMP.

(3) Prepositioned BPWRS. DFSC will attempt to preposition BPWRS at the terminal location nominated by the Military Service. Where storage or operational conditions are limited, DFSC will locate stocks, at the most appropriate alternate terminal, following coordination with the unified command and the requiring Military Service. Malpositioned stocks shall be counted against the total BPWRR. However, these stocks may not be counted as days of support available at the point of planned use during assessment of operation plans capability.

Chapter 5

Bulk Fuel Theater Operations

In theater operations, the MAGTF commander may be part of a developed or undeveloped theater. Bulk fuel support concerns and requirements are addressed according to the development stage of a theater. The three main objectives of bulk fuel support are supplying fuel when needed, distributing fuel where needed, and providing fuel resupply on time. When the MAGTF is involved in a sustained operation ashore, bulk fuel operations are deployed in three phases: development, lodgment, and buildup.

5001. Developed Theater

In a developed theater, an existing bulk fuel distribution system is usually available to help support Marine Corps forces. The existing system helps offset the requirements for Marine Corps TFSs. A developed theater usually consists of tanker unloading facilities, terminals, pipelines, pump stations, dispensing facilities, and rail tank car facilities.

Actual procedures for accomplishing the delivery of bulk fuel to the user will vary between theaters. These facilities will normally be operated by civilian personnel or the theater Army. However, Marine Corps bulk fuel units could be tasked with operating the facilities, particularly during the early phases of operations before the theater Army has all its assigned forces.

a. Pipeline System. In a developed theater, the pipeline system usually extends into the Army corps rear with hoseline extensions into Army corps storage sites and Marine Corps force combat service support areas (FCSSAs) and airfields. When practical, branch lines from the pipeline are used to supply major users such as Marine Corps CSSDs and MWSSs. If required (and if available), the pipeline/hoseline system is supplemented by military tank trucks and commercial vehicles. These bulk transports can be used to move bulk fuel in the supply times. Also, the stockage objective that Marine theater zone and up to and including the Army corps rear area.

b. Theater Stockage Objectives. In a developed theater, most of the theater stockage objectives are usually held in fixed facility storage tanks. This reduces the quantity of bulk fuel that the Marine Corps would need to store in tactical bulk fuel systems. Theater stockage objectives will vary between theaters depending on resupply times. The stockage objective that Marine forces need to hold in tactical fuel systems will depend on resupply times from theater storage and the daily fuel requirement. Generally, MAGTF TFSs should be capable of storing a minimum of 5 DOS in a developed theater. This will allow for continuous fuel support to Marine forces if fuel resupply from theater sources is delayed.

5002. Undeveloped Theater

Providing fuel support in an undeveloped theater pre- sents many problems not faced in a developed area. TFSs have to be brought into the area and mooring facilities, storage facilities, pipeline, and/or hoselines have to be installed. During the early stages of an operation, forces have to rely on their organic equipment and personnel. As the operation progresses, additional equip- ment and personnel are brought in to expand the fuel system. A TFS capable of supporting the mission is developed in the area when practical. Initial fuel storage facilities should be expanded when possible so floating storage (tankers or barges) holding reserve fuel for shore units may be released.

Any available commercial or host nation support will be considered for use as part of the bulk fuel system. Use of these systems and their bulk fuel products should be obtained through DFSC contracts, local purchase procedures, or through host nation support agreements.

a. Minimum Bulk Fuel Stockage Objective. The minimum bulk fuel stockage objective for the undeveloped theater is 15 DOS. This includes bulk fuel stored in tactical equipment and off-shore shipping or floating dumps. Fuel is distributed from beach storage by hoseline, tank vehicles, helicopters, and any other means available. As the fuel system is developed, it will consist of hoselines and collapsible storage tanks. The primary method of receiving bulk fuel in the undeveloped theater will be ship-to-shore operations using Navy shipping with the AABFS or the OPDS.

b. Tactical Hoseline. Large users such as tactical airfields are supplied by tactical hoseline when possible. The tactical hoseline and/or pipeline will extend as far forward as possible, usually into the Army corps rear area, to reduce mobile transport requirements. Although hoselines are the most rapid and easily deployed system, a more permanent system is normally installed if the system must stay in place for long periods. When possible, the rear area communications zone, corps support, and FSSA areas will be established. In the early stages, the theater may only consist of a JTF support area, MEF forward area with CSSDs, or Army division support area, and later an Army corps support area. The rear area communications zone may never be formed de-pending on the duration of the operation.

c. Air Lines of Communications. In the early stages of an undeveloped theater, there is often a re- quirement to support forces with air lines of communications (ALOC). The Air Force Air Mobility Command provides this support with C-130, C-141, and C5A aircraft. Requirements for ALOC support are coordinated through channels established in the OPLANs. The following types of aerial bulk fuel support are available from the Air Mobility Command (AMC):

(1) Packaged Products. The 500-gallon collapsible drums and 55-gallon drums may be internally loaded in cargo aircraft for delivery to airfields near the units be- ing supported.

(2) Airdrop. When suitable aircraft loading and unloading areas are not available, fuel may be airdropped or delivered by low altitude parachute extraction systems (LAPES).

(3) Aerial Bulk Fuel Delivery System (ABFDS). The Air Force has aircraft specially equipped with internal collapsible tanks and a pump for deliveries of bulk fuels into areas where suitable landing sites are available.

(4) Wet Wing Refueling. The C-130, C-141, and C5A aircraft have internal pumps for defueling. Using Marine Corps or Army ground equipment (hoses and nozzles), these aircraft can deliver aviation fuel into Marine Corps or Army storage containers located at suitable landing areas. Refer to table 3-2, page 3-5.

5003. Phases of Bulk Fuel Operations

During sustained operations ashore, tactical bulk fuel equipment must be deployed to provide support to the MAGTF. To best support the MAGTF, bulk fuel operations should be conducted in three phases: *development*, *lodgment*, and *build-up*.

a. Development. Due to the high consumption and limited bulk fuel capabilities, the development phase is often the most critical phase of bulk fuel operations. The commander and staff need to look closely at the fuel range of the vehicles going ashore, the time-phased resupply available, and the equipment available to support the MAGTF during this phase. The development phase may be initiated as an airborne, airmobile, amphibious assault, or an uncontested debarkation at a friendly port.

The first units of the MAGTF entering an operational area will probably carry only enough bulk fuel for im-mediate purposes. Resupply of these units must begin rapidly. During initial deployment, fuel will probably be provided in prepackaged containers (drums, cans, 500-gal tanks), SIXCONs, and mobile refuelers and delivered to the AOA by surface or air from off-shore am- phibious ships. These items must be continually recovered and sent back to the source to be reused. All bulk fuel resources within the AOA must be considered and exploited during this phase.

b. Lodgment. The lodgment phase involves the establishment and expansion of bulk fuel transportation, storage, and distribution systems. Shore basing the MAGTF, the arrival of AFOE, and sustainment operations will increase the demand beyond the capabilities of those systems deployed during the development phase. Larger bulk fuel systems will have to be established ashore to handle the requirements of the MAGTF.

c. Build-up. Once the lodgement phase is established, build-up of the bulk fuel systems can begin. The mission and the commander's intent as to required stockage objective on the ground will dictate the final requirement for the bulk fuel systems.

5004. Bulk Fuel Operations Within the MAGTF

The MAGTF Master Plan states that future Marine Corps forces will be lighter with additional emphasis on expeditionary capabilities. The emphasis on these capabilities include a refinement of over-the-horizon amphibious assault capabilities, increased flexibility of maritime prepositioning forces, fast and flexible schemes of maneuver for the ground combat element (GCE), and development of an ACE composed predominantly of short takeoff and vertical landing (STOVL) aircraft.

Expeditionary operations will require compatible concepts of bulk fuel support. One concept that may not be compatible is the "large footprint on the beach." This concept takes time to establish and it limits flexibility. If bulk fuel supply operations are to be conducted with only a minimal buildup ashore, the emphasis should be on proper planning and operational management. Employing the most compatible concept along with accurate planning and efficient operations should ensure that units ashore should not run out of fuel nor should they be saddled with excess bulk fuel stocks and equipment. Bulk fuel units are task organized to accomplish the bulk fuel support mission.

The MAGTF may require a partial system, complete system, or multiple fuel systems. When using a partial system, commanders need to ensure they have adequate equipment to perform the unit's bulk fuel mission. For example, if the mission only requires one tank farm from an AAFS but also has a requirement or possibility for ship-to-shore operations, the beach unloading assembly must also be taken.

a. Command Element (CE). The CE plans and coordinates bulk fuel support for the MAGTF with the appropriate theater agencies. The CE will coordinate the MAGTF bulk fuel concept with the theater plan to ensure that the MAGTF is prepared to meet any special bulk fuel tasking from the theater commander. Additional tasks for the MAGTF could include such things as providing area support to other Services or refueling other Services' aircraft.

Normally, the CE will consolidate all the MAGTF fuel requirements and submit them to the appropriate theater agency or the JTF. Even though daily bulk fuel management is done within the other MAGTF elements, the CE should ensure economy of effort for bulk fuel support. The CE is also responsible for setting the MAGTF bulk fuel stockage objective and for allocation of bulk fuel within the MAGTF if requirements exceed availability. The CE will ensure that all bulk fuel reporting requirements established in the OPLANs are met.

b. Combat Service Support Element (CSSE). The CSSE is responsible for bulk fuel support and daily management of bulk fuel except within the airfields. In order for the CSSE to carry out this responsibility, exercise and operational plans should address procedures and coordination requirements for fuel support in detail. The CSSE then consolidates the requirements and passes them to the CE for sourcing. Depending on the size of the MAGTF and the size of the geographical area, the CE may task the CSSE with sourcing the consolidated requirements with the theater agency. MAGTF elements that receive direct fuel support from the CSSE must coordinate their fuel and support requirements (fuel deliveries, storage, etc.).

Normally, bulk fuel management is the responsibility of the CSSE G-3/S-3 and G-4 supply support. However, this responsibility is sometimes delegated to the CSSE engineer. CSSE bulk fuel units can range from a complete bulk fuel company (or companies) to a small section, depending on the mission.

c. Aviation Combat Element. The ACE is responsible for bulk fuel support and daily management of bulk fuel for the airfields and FARPs. These responsibilities are performed by the ACE G-4/S-4 or within the airfield operations division of the MWSS. The ACE provides bulk fuel support to all organizations within the boundaries of the airfield. This includes support to other Services' aircraft if directed in the theater bulk fuel plan.

For ground equipment fuel support, the ACE is primarily equipped to be self-sufficient. If ground fuel support requirements within the boundaries of an airfield exceed the ACE capabilities, the CSSE should provide any additional support requested.

Bulk fuel sourcing and support procedures for the ACE airfields vary depending on the situation. If the airfields receive bulk fuel directly from theater sources, the CE may task the ACE with coordinating its fuel requirements directly with the theater agency. If the airfield receives fuel support from the CSSE, the ACE will coordinate its fuel requirements directly with the CSSE.

d. Ground Combat Element (GCE). The GCE is primarily a bulk fuel user, not a provider. However, the GCE does have mobile fuel equipment to provide direct support to division units. The GCE coordinates fuel support requirements with the CSSE that is providing direct support. Normally the GCE will use SIXCONs and mobile refuelers for fuel support to its end users (i.e., tanks, vehicles, etc.). If GCE fuel requirements exceed the GCE's fuel support capability, the GCE will request fuel support from the CSSE.

5005. Bulk Fuel Support for the MAGTF

a. Resupply. The MAGTF bulk fuel distribution system is a push-pull resupply system. Bulk fuel is moved forward (pushed) throughout the MAGTF bulk fuel system based on storage space available and anticipated customer demands. The basic principle is to keep storage tanks full. The customers request (pull) fuel from the bulk fuel system based on their demands. The CE monitors the push side of the resupply system to ensure fuel movement throughout the system is coordinated with the operation plans. For example, if a CSSD with a fuel storage system moves to another location, its fuel stocks are drawn down so it can move its equipment. In that case, the CE would not push fuel to the CSSD empty storage. During the drawdown, the CE would ensure continuous fuel support to the units being supported by that CSSD.

b. Bulk Fuel Storage. Normally, bulk fuel for MAGTF operations is stored ashore in tactical fuel systems. A bulk fuel company can install and operate eight AAFS with a storage capacity of 4,800,000. Each MEF has one active duty bulk fuel company, so this storage capacity generally is the maximum available for a MEF-sized (or smaller) MAGTF. A small amount of storage is available in the ACE TAFDS, but this is not a resource of the bulk fuel company. These resources are adequate to store a ten-day supply of bulk fuel ashore for a MEF forward (MEB-sized) operation, including the ACE. However, these resources can provide less than a four-day supply for a MEF, including a full MAW. The 3d FSSG does not have a full bulk fuel company and only has four AAFS.

Aircraft are not normally brought ashore until adequate fuel stocks are available. However, refueling operations may commence by relying on afloat storage once the ship-to-shore pumping rate meets the daily requirement. Another option is to have the aircraft refuel from ships or theater airfields not in the AOA, thus reducing the shore-based requirement.

At issue is the tradeoff between start dates for shore-based air operations and the risk of a fuel cutoff. Any interruption in sea-based fuel support would create a fuel shortage without adequate fuel ashore. Although ocean tankers and pumping rates from ship-to-shore are adequate to support MEF-sized ground and air operations, the bottleneck is the time required to install the AAFS and the number of AAFS available to the MAGTF. Table 5-1 shows the DOS that eight AAFS can provide to various MAGTFs based on the following assumptions:

- Ground forces consuming fuel at intense rates,
- ACE requiring shore-based fuel, and
- Aircraft sorties being flown at a sustained rate.

Current bulk fuel company assets are adequate to provide ten DOS to all MAGTFs except for a MEF with aviation element. To support a MEF with the aviation element requires at least two bulk fuel companies' capabilities. Normally, the second bulk fuel company will come from the reserve component. A MEF-sized CSSE is capable of storing up to 9,600,000 gallons of bulk fuel products. Table 5-2 is based on the same assumptions as Table 5-1 and shows the number of AAFS required by MAGTFs of various sizes if ten DOS was the stockage objective.

5006. Maritime Prepositioning Ships

The rapid offloading and availability of bulk fuel are essential to MPS operations. Notionally, each maritime prepositioning ships squadron (MPSRON) currently carries eight AAFS, ten TAFDS, and eight HERS embarked in 8x8x20 foot containers. The TFSs are spread-loaded among the various ships so that each ship has a bulk fuel capability. They must be established ashore before the ships can offload their cargo fuel. Therefore, the AAFS and TAFDS are embarked in a manner that allows them to be one of the first items of equipment offloaded. MPS have the capability to carry cargo bulk fuel. Depending on the type of ship, they can carry up to 1.6 million gallons of JP-5 and up to 210K gallons of mogas.

a. Fuel Offload. The MPS can offload fuel through a single 6-inch hoseline at 600 gpm from a distance of up to 2 miles. They can also offload fuel at pierside or instream. At the flow rate of 600 gpm, it takes approximately 36 hours to offload the JP-5 and 5 hours to offload the mogas from a single ship. For the offload of both mogas and JP-5, separate lines and storage facilities are required. Fuel is pumped ashore through the AABFS which is carried aboard the MPS. The system consists of 10,000 feet of 6-inch diameter hose mounted on a powered hose reel. For installation, the hose reel is loaded on a landing craft utility (LCU) or a side-loadable warping tug (SLWT) and is normally installed from the beach to the ship. The shore end of the hose is connected to the AAFS with the beach interface unit (BIU) supplied by the amphibious construction battalion. Under favorable conditions, the hoseline system can be installed in 8 to 10 hours and retrieved in 10 to 16 hours.

Table 5-1. MAGTF Storage Capability (Gallons) With One Bulk Fuel Company (Eight AAFS)

MAGTF Size	Aviation Element	Daily Fuel Requirement	Days of Supply
MEF	no air	251,656	22.9
	helicopters and AV8s	849,105	6.8
	full MAW	1,539,496	3.7
MEF (Fwd) (MEB Size)	no air	103,103	55.9
	helicopters and AV8s	372,904	15.4
	full ACE	574,837	10
MEU	no air	10,763	535.2
	helicopters	36,012	159.9

Table 5-2. Required AAFS for Ten DOS

MAGTF Size	ACE	AAFS Requirements
MEF	no air	3.5
	helicopters and AV8s	11.8
	full MAW	21.4
MEF (Fwd) (MEB Size)	no air	1.4
	helicopters and AV8s	5.2
	full ACE	8
MEU	no air	0.15
	helicopters	0.8
	helicopters and AV8s	0.7

b. Unloading Fuel Systems. Early unloading of the fuel systems allows for installation to begin while the rest of the equipment is being offloaded. All fuel-consuming equipment being offloaded should be filled on the ships before offload. This will reduce the immediate need for shore-based fuel support. Mobile refuelers should also be filled before offloading so they can provide required fuel support ashore. Once the ship has offloaded its cargo, it can then be positioned to deploy the hose reel and offload its cargo fuel to the AAFS. In the time it takes to offload the equipment from the ship and deploy the hose reel, the AAFS installation should be to the point that it can start receiving fuel. During site selection for MPS, operations planners need to consider terrain requirements and locations for the bulk fuel systems and the ship-to-shore fuel transfer.

5007. Bulk Fuel Reports

Bulk fuel reporting requirements and procedures will vary depending on the exercise and/or operation. Appendixes B through D are examples of bulk fuel reports that may be required of the MAGTF in a joint environment. These examples are from the United States Message Text Format (USMTF) Handbook.

Chapter 6

Bulk Fuel Inventory Management

The management of fuel inventories involves a full range of actions associated with orders/requisitions, receipt, transfer, issue, and storage of fuel. Bulk fuel support must be planned so product quantities are maintained to support planned operations. The major objectives of an inventory management program are to—

- ***Ensure that all orders, receipts, transfers, issues, losses, gains, and adjustments are properly documented.***
- ***Maintain accountable records on all products.***
- ***Ensure that an audit trail of fuel transactions is performed.***
- ***Maintain control over the physical environment to ensure that proper product storage can take place with minimal losses.***
- ***Ensure that fuel losses are held to a minimum.***

6001. References

The requirements and procedures for the accountability of petroleum products are in DOD 4140.25-M and Maine Corps Order 4400.17O, *Control and Accounta- bility of Petroleum and Related Products and Coal*. These references provide policy and guidance for the accountability of petroleum products by Marine Corps activities.

Regardless of the type of fuel equipment being used, units must maintain accounting procedures and records as accurately as possible. This applies to fixed facilities, mobile refueling equipment, and TFSs. Accounting for fuel in fixed facilities and mobile equipment is fairly accurate. However, when bulk fuel units perform a physical inventory for TFSs, the physical inventory becomes more difficult and less accurate due to the use of collapsible tanks and miles of tactical hose that may be employed. The key to more accurate accounting for TFSs is for commanders and their staff is to ensure that local bulk fuel SOPs address unit procedures and requirements for fuel accountability when using TFSs.

6002. Inventory Management Procedures

Inventory management procedures depend on whether the fuel is owned by DOD (wholesale) or by the Service (retail). DOD fuel is purchased at the wholesale level by DFSC for direct delivery to the customer. When the Service orders and receives fuel from a defense fuel supply point (DFSP) or a DFSC contract, a "sale" takes place, and the fuel becomes Service-owned retail stock.

Whether a Service is holding wholesale or retail bulk fuel stocks, certain rules of accounting apply to all Services. All bulk fuel holding activities should maintain a property book or logbook inventory record and a physical inventory record. Property book records are an administrative (check book) record that provides an audit of all receipts, transfers, and issues and provide an estimate of the fuel inventory on hand. They are kept on a daily basis. Physical inventory is a physical measurement of the actual fuel on hand at 60 degrees Fahrenheit. A physical inventory is conducted periodically (daily, weekly, monthly) depending on the situation. When a physical inventory is conducted, the responsible bulk fuel unit adjusts the on-hand fuel quantity recorded in the property book records to the actual quantity of the physical inventory. If the difference between the property book records and the physical inventory exceed the allowable loss/gain, it must be reported through the chain of command.

6003. Fuel Accountability

As with all supplies, the commander considers the accountability of bulk fuel essential. Commanders are also aware that procedures and requirements for bulk fuel accountability will vary depending on the operation, the type of fuel equipment being used, and the situation (i.e., combat, training exercise, joint operations, etc.). To ensure proper and sound accounting procedures are being followed, the commander and staff need to ensure that accounting procedures are contained in operation plans and exercise letters of instruction.

However, due to the nature of fuel, certain losses will occur as a result of evaporation, transportation, storage, and handling. Allowable tolerances have been established for these losses and gains by the American Petroleum Institute (API) and adopted by the DOD. There are many variables involved in accounting procedures to be followed. However, the following procedures are common and apply to all bulk fuel operations.

- Access to fuel tanks must be controlled. Quality and quantity inspections must be made on all receipts prior to accepting fuel into a storage system. At a minimum, samples should be checked for water and sediment and to ensure that the fuel is "clear and bright." If the fuel does not meet specifications, it should not be off-loaded and the senior fuel personnel should be contacted.

- The quantity of a fuel delivery should be validated prior to off-loading. This is done by ensuring the vehicle is loaded to the proper fill mark and all seals (if applicable) are intact.
- Truck meters are authorized for recording receipts if the meters are calibrated semi-annually. If necessary, before and after gauging of the receiving tank will be conducted to verify quantity.

- The unit of measurement for all fuel receipts is the U.S. gallon at 60 degrees F. Each receipt and issue greater than 3,500 gallons will be corrected for volume to 60 degrees F. In accordance with MCO 4400.170, all receipts from commercial tankers regardless of quantity will be corrected for volume to 60 degrees F. All corrections will be done using Tables 5B and 6B, ASTM D1250-80.

- Discrepancies must be documented and reported which are in excess of allowable losses/gains per local directives between the bill of lading and actual delivery amounts.

- Only authorized personnel will make fuel issues. The attendant must be present for issues to record any required information. Documentation must be complete and verification of random issues is recommended. Proper audit trails must be maintained. Special attention is necessary with issues to other than end-use vehicles (i.e., portable containers or trucks used for multiple deliveries) to ensure that proper authorization is obtained.

6004. Reports

Daily status reports, daily fuels issue reports, and monthly bulk fuel accounting summaries are used to maintain accountability of bulk fuel receipts, issues, and stocks on hand.

a. Daily Status Report. The daily status report is an administrative report for the fiscal accounting of bulk fuel issued by Marine forces. The report is prepared at the bulk fuel supply point and submitted to higher headquarters. Higher headquarters then use this report to determine allocation adjustments and maintain continuous bulk fuel support. This may be prepared an informal report format or according to one that the commander prescribes. Table 6-1 is an example of a daily status report.

b. Daily Fuels Issue Report. Table 6-2 is an example of a daily fuels issue report. This can be maintained as an official logbook or produced as a single report.

c. Monthly Bulk Fuel Accounting Summary. Table 6-3 is an example of a monthly bulk fuel accounting summary. It is used to report all gains or losses identified in the inventories. Inventory losses on this form must be supported by a report of survey if the losses exceed those allowed by MCO 4400.170 or are disapproved by the approving authority. Gains in excess of the allowable limit- must be investigated to determine the cause. The report should be completed by the bulk fuel unit and submitted to higher headquarters.

Peacetime procedures and responsibilities for the accountability of bulk fuel will not be practical in wartime due to the highly mobile combat environment. Summary fuel accounting is then enacted; it gives the Services discretionary authority to stop property book or stock record accounting. The unified CINC can determine when operations warrant a transition from formal fuel accounting to summary fuel accounting. Summary accounting applies only to fuel officially received by the Service from DFSC.

Table 6-1. Sample Daily Status Report

Unit Submitting Report: MWSS-174 Fuel Branch

ISSUES			
Unit Name	**Product**	**Qty this Report**	**Total Qty to Date**
HMM-164	JP5	25,000	80,000
MWSS-172	MoGas	500	2,000
Qty issued to ground equipment (green dollars)		5,000	20,000
Qty issued to aircraft (blue dollars)		20,000	60,000
RECEIPTS			
Product	**Source**	**Qty this Report**	**Total Qty to Date**
JP5	MCAS CPNC	25,000 gal	100,000 gal
MoGas	MCB CLNC	1,200 gal	2,500 gal

6005 Wartime Accounting

Table 6-2. Sample Daily Fuel Issue Report

	Issues Gal			Receipts Gal				
Vehicle Number	JP5	JP8	MG	JP5	JP8	MG	Unit and Address	Signature/ Grade
566	25						2d Tank Bn CLNC	
322			12				Comm Bn CLNC	
122				500			MCAS CPNC	
Total Receipts				500	0	0		
Total Issues	25	0	12					

Table 6-3. Monthly Bulk Fuel Accounting Summary

Products	JP5/JP8	MoGas	Diesel
Opening Inventory			
Receipts			
Issues			
Closing Book Balance			
Physical Closing Inventory			
Monthly Gains/Loss			
Maximum Allowable Gain/Loss			
Remarks:			
Name & Grade of Accountable Officer:			
Name & Grade of Approving Officer:			

Chapter 7

Bulk Fuel Quality Surveillance

Quality surveillance is the process of determining and maintaining the quality of government-owned petroleum and related products so that these products are suitable for their intended use. The quality of petroleum products is controlled at origin by the DFSC. After receipt of the petroleum products, each Service is responsible for continued surveillance to maintain the quality of petroleum products.

7001. Quality Assurance Program

To meet specifications set by DOD, petroleum products undergo quality surveillance from time of purchase until used. The JPO, responsible to the theater commander, ensures there is a quality surveillance program within the command and monitors and assists Service components in this program. The theater Army command is responsible for setting up and maintaining a quality surveillance program to support theater Army users. Each Service component is responsible for establishing and maintaining a quality surveillance program for Service petroleum stocks.

7002. Marine Corps Quality Assurance Program

A vigilant quality surveillance program implemented by properly trained personnel is necessary to protect the original product quality. The fuel systems of modern aircraft and ground vehicles will not function properly if fuel is contaminated with dirt, water, other fuel, or any foreign matter. Actions will be taken to ensure that the product conforms to established technical requirements. These actions include preventive maintenance (PM) of equipment, mandatory use of filter separators for aviation fuels (and highly recommended for ground fuels), daily recirculation and visual examination of the product, proper storage, handling, and drainage of water bottoms, and proper concentrations of additives such as fuel system icing inhibitor (FSII). The Military Handbook 200 (MIL-HDBK-200) is the approved DOD reference for quality surveillance and should be referred to in any cases of dispute.

a. Bulk Fuel Personnel. The bulk fuel officer (MOS 1390) or the bulk fuel SNCOIC (MOS 1391) is responsible for establishing procedures that will ensure the quality of bulk fuel products that are stored and issued. All fuel handling personnel are responsible for following established procedures and ensuring they take the required steps to deliver clean fuel to vehicles and aircraft.

An effective quality surveillance program requires properly trained personnel. Every Marine involved in handling petroleum should be suitably trained in quality control. The activity having physical possession of a product is responsible for quality surveillance. Local SOPs must conform to Table II, III, and IV of the MIL-HDBK-200 for testing requirements.

b. Tactical Petroleum Laboratory, Medium (TPLM). Each FSSG rates two TPLMs (TAMNC B0695) and is responsible for correlation testing for all MEF units in accordance with MCO 11275. The TPLM is capable of full "B" level testing. The FSSG is also responsible for fuel testing that exceeds other units' capabilities.

c. Detecting Contaminated Aviation Fuel. Each MWSS fuel branch rates the contaminated fuel detector (CFD) and the aviation fuel contamination test kit. The MWSS is responsible for the quality surveillance program for aviation fuels aboard airfields. NAVAIR 00-80T-109, *Aircraft Refueling Naval Air Training and Operating Standardization (NATOPS) Manual,* establishes aviation-specific fuel quality surveillance requirements for all naval aviation.

7003. Deterioration Limits

Bulk fuel deteriorates when subject to long periods of storage. Therefore, it is important that bulk fuel be issued on a first-in, first-out basis or as quality surveillance indicates. Deterioration occurs when one or more characteristics of the product changes to a level outside the specification limits. Examples of deterioration are weathering, oxidation, or loss of additives.

Deterioration limits are tolerances established to permit use of products that do not fully meet specifications. When petroleum products do not meet the deterioration limits, quality surveillance personnel report the facts and circumstances and recommend alternative use or disposition to the commanding officer. If appropriate, proposed recovery measures are also reported.

a. Types of Tests. Various types of fuel have critical properties and requirements which must be maintained. Tests determine a product's physical and chemical properties. Each petroleum product has a specification which lists the chemical and physical requirements of the fuel. The specifications listed in table 7-1 are common government-owned fuels in use by the military today. Each specification is approved for use by all departments and agencies of the DOD.

Table 7-1. Fuel Specifications

TYPE FUEL	SPECIFICATION
TURBINE FUEL, AVIATION GRADES JP-4/JP-5	MIL-T-5624P
TURBINE FUEL, AVIATION GRADE JP-8	MIL-T-83133C
FUEL OIL, DF-2, DFA	VV-F-800D
JET-A/JET-A-1	ASSTM D1655

Depending on the location, mode of storage, and transportation, the type testing is defined in table 7-2. See also table 7-3 for the significance of military fuel tests.

Table 7-2. Types of Fuel Tests

Type A	Complete specification acceptance tests.
Type B-1	Partial testing of the principal characteristics most likely to be affected in transfer of a product.
Type B-2	Partial testing of critical product characteristics that are susceptible to deterioration due to age.
Type B-3	Partial testing of a product to be performed when contamination is suspected.
Type C	Quick, partial testing for

b. Correlation Testing. Correlation samples are sent to a supporting laboratory once a month to verify the accuracy of local tests. However, this does not preclude sending correlation samples more frequently if concerns arise about the results being obtained with local equipment. To ensure the product can be used for the intended purpose, products stored in collapsible containers (i.e. 20K collapsible container) are tested (Type B-2) monthly. Table III of the MIL-HDBK-200 shows the minimum sampling and testing requirements. The TPLM is be used for the monthly B-2 testing of all MEF units. The personnel authorized to operate the TPLM must have completed the formal school 77L Petroleum Laboratory Specialist Course, U.S. Army Quartermaster School & Center, Ft. Lee, Virginia.

c. Daily/Weekly Testing. MWSS units that conduct weekly/daily Type C testing use the aviation fuel test kit and the CFD. All personnel in the MOS 1391, Petroleum Supply Specialist, are qualified to use the test kits.

7004. Reclamation

Reclamation is the process of restoring or changing the quality of an unsuitable product to meet quality assurance specifications. Fuel can be reclaimed for use by downgrading, blending, purifying, or the removal of water.

Fuel that cannot be used for its intended purpose may be used as a lower grade of the same or similar product if it meets that product's specifications.

The most common causes of off-specification fuel are contamination and deterioration. Contamination occurs when one or more grades or types of products are inadvertently mixed, or a product contains foreign matter such as dirt, dust, rust, water, or emulsions. Once a product has been identified as being off-specification, the following reclamation procedures can be taken:

- **Downgrading**. Approval for an off-specification or contaminated product for other than its intended use.
- **Blending**. Predetermined quantities of two or more similar products are mixed to produce a petroleum product or intermediate grade or quality.
- **Purification.** The removal of contaminating agents by filtration or dehydration.
- **Dehydration.** The removal of water by a filtering or settling process. Water in most light products will settle out if allowed to stand undisturbed for 12 - 24 hours.
- **Inhibiting.** Adding or restoring additives.
- **Disposal.** Defense Reutilization Marketing Office (DRMO) should be a last resort as to the disposition of the product.

7005. Captured Fuel

Any captured fuel should be tested prior to use. The time and mission will dictate the extent of testing.

Table 7-3. Significance of Military Fuel Tests

Knock Values	Cetane Number
Knock values indicate whether a fuel will burn uniformly and evenly in a cylinder without pre-ignition or detonation. The knock values are expressed as octane numbers for automotive-type engine gasoline and as a combination of octane and performance numbers for aviation gasoline. These values are determined by comparing the knocking tendency of fuel samples to those of standard test fuels of known knock values in a standard test engine. Fuel of inadequate knock value will reduce the power output of all types of engines. If used for more than brief periods, it could cause overheating of the engine, burned or melted pistons and cylinders, and lubrication failure.	The ignition quality of a diesel fuel, which is based on a scale resembling that of an octane number, is expressed as a cetane number. This number indicates the length of time (ignition lag) between injection of the fuel and combustion. The cetane number requirement varies with the type of diesel engine. Large and slow-speed units in stationary installa- tions do not require diesel fuel with cetane ratings above 40. Smaller, high-speed engines (1000 rpm or more) require fuel of a higher cetane number. In the absence of test engines, cetane numbers are approximated from the calculated cetane index.

Table 7-3. Significance of Military Fuel Tests (continued)

Color

Color is primarily used as an aid for identifying fuels such as aviation and automotive gasolines which have charac teristic colors. Failure of fuel to meet its color requirement may indicate the possibility of contamination or deterioration. Darkening of the color of jet fuel may indicate the formation of insoluble gums.

Corrosion

Quantitative and qualitative tests for corrosion indicate whether products are free of corrosion tendencies. The quantitative test determines total sulfur content. This is important, particularly when a product is to be burned in lamps, heating appliances, or engines. The qualitative test shows if fuel will corrode themetal parts of fuel systems.

Existent Gum

As the name implies, gum is the sticky, tacky, varnish-like material that is undesirable to have in fuel systems. Existent gum is the nonvolatile residue present in gasoline or jet fuels after they have been tested. The results indicate the quantity of gum deposit that may occur if the product is used immediately but do not indicate the possibility of gum formation when the product is stored. When present in excess, gum clogs fuel lines, filter and pump screens, and carburetor jets; causes manifold deposits and sticky intake valves; and reduces the knock value of gasoline.

Potential Gum

Potential gum (sometimes called oxidation stability) is determined by a test that indicates the presence of gum-forming materials and the relative tendency of gasolines and jet fuels to form gums after a specified period of accelerated aging. This value is used as an indication of the tendency of fuels to form gum during extended storage.

Retention of the original properties of a fuel after prolonged storage is known as the stability of the fuel. When added to fuels, chemical inhibitors retard gum formation but will not reduce gum that has already been formed. The effects of the potential gum are similar to those described for existent gum. Gum may be expressed as the "induction period" (sometimes called the breakdown time). This is a measure of the time in minutes that elapse during the accelerated test until the fuel rapidly absorbs oxygen. For aviation gasoline and jet fuel, the potential gum may be expressed as the potential for accelerated gum. This is the gum plus the lead deposits (from lead fuels) measured at the end of a specified accelerated aging (oxidation) period.

Flashpoint

The flashpoint is the lowest temperature at which vapors rising from a petroleum product or when exposed to test flame under specified conditions will ignite momentarily (flash) on application. The flashpoint of a petroleum product indicates the fire hazard in handling and storing it. It applies to fuel oils, diesel fuels, JP5, kerosene, and solvents. It is not used for JP4. The flashpoint test also indicates the combination of a product. For example, the presence of very small quantities of gasoline will make the flashpoint of a diesel fuel considerably lower than the minimum operating level. The flashpoint of a new lubricating oil is used primarily for identification and classification. The flashpoint of the oil must be above the operating temperature of the engine in which it is to be used.

Cloud and Pour Points

The cloud point is the temperature at which wax crystals (normally held in solution or water) in an oil separate, causing the oil to appear cloudy or hazy. In wick-fed systems, the wax crystals may clog the wick. Both wax crystals and water may block filter passages in fuel systems. The pour point of an oil indicates its behavior at low temperature. The fact that an oil has a specific pour point is no guarantee that it can be handled or is a satisfactory lubricant at that temperature.

Distillation

This process is used to measure the volatility of a petroleum product. The lower boiling fractions of gasoline indicate the starting ability of a gasoline engine at a given temperature and the engine's ability to warm up quickly. An excessive amount of highly volatile constituents in gasoline may cause vapor lock. Conversely, a gasoline with an excessive amount of "heavy ends" may not completely burn in the combustion chamber. This may cause damage through excessive dilution of crankcase oil. Specifications designate minimum and maximum percentages of fractions to be evaporated at specified temperatures, as well as initial and final boiling points. A gasoline with a high end point and a high percentage of residue may be contaminated with fuel oils or other oils. A fuel oil with a considerably lower initial boiling point flashpoint than normal may be contaminated with gasoline.

Table 7-3. Significance of Military Fuel Tests (continued)

Viscosity

Viscosity is the measure of a liquid's resistance to flow. Specified minimum and maximum flow rates are required for all fuel oils and lubricating oils. A fuel oil's viscosity determines how the oil will flow to the burners, the extent to which it would be atomized, and the temperature at which the oil must be maintained to be atomized properly .

Reid Vapor Pressure

The vapor pressure of a fuel, which indicates the tendency to vaporize, is determined by the reid vapor test. For any given gasoline, vapor pressure increases with temperature. Gasolines must have a certain vapor pressure to ensure adequate starting and accelerating qualities.

Carbon Residue

The carbon residue test indicates the carbonizing properties of a lubricating or burner oil. However, carbon residue from lubricating oils is not directly related to carbon formation in the engine. This test gives an indication of the type of carbon formation (loose or flaky or hard and flinty). It is used primarily as an identify and control test in conjunction with other specification tests. After distilling 90% of diesel fuel, the carbon remaining in the 10% residue must be low enough to avoid carbon deposits. High carbon fuels should be checked carefully for carbon formation.

Bottom Sediment and Water

Petroleum products may gain sediment and water during storage and handling. This can adversely affect the performance of the equipment in which the products are used.

- Aviation Fuels. Contamination by bottom sediment and water can often be detected visually. As a general rule, aviation fuel must be clean and bright and contain no free water. The terms clean and bright do not refer to the natural color of the fuel; the various grades of the fuel have dyes added. Jet fuels are not dyed and could be any color from water white to amber. Clean means the absence of any cloud, emulsion, readily visible sediment, or entrained water. Bright refers to the shiny appearance of clean dry fuels. A cloud, haze, specks of sediment, or entrained water indicate thatthe fuel is unsuitable, pointing to a breakdown of fuel handling equipment. Steps should be taken to find the trouble immediately. All the following information is also applicable to automotive fuels.

- Cloudy or Hazy Fuel. Cloudy or hazy fuel usually indicates water, but it may also indicate excessive amounts of fine sediment or finely dispersed stabilized emulsion. Fuel containing either is not acceptable. When clean and bright fuel cools, a light cloud may form indicating that dissolved water has precipitated out. A precipitation cloud represents a very slight amount of fresh water. However, even a slight amount of fresh water is not desirable in aviation fuel. Fuel that shows some precipitation may not be clean and cannot be accepted or used. Filter separator elements should be replaced and water and emulsion should be removed from the source tank. A filter/separator can be used to remove the precipitation by recirculation or by draining the fuel upstream.

- Sediment in Fuel. Specks or granules of sediment indicate particles in size range greater than 0.8 microns. An appreciable number of such particles in a sample indicate a failure of the filter/separator, or a dirty sample container. Even with the most efficient filter/separatorand careful fuel handling, an occasional visible particle will be noted. The sediment ordinarily noted is an extremely fine powder, rouge, or silt. In a clean sample of fuel, sediment should not be visible. If sediment continues to be noted, appropriate surveillance tests and corrective measures must be applied to the fuel handling systems.

- Diesel Fuels and Burner Oils. To avoid fuel pump and injector difficulties, diesel fuels must be clean and should not contain more than a trace of foreign substances. Excessive sediment and rust in burner oils will plug the burner tip, and the fuel will not atomize properly. Water can cause ragged operation and may corrode the fuel handling system. The types of equipment and burner oils will determine the amount of sediment permissible in the fuel.

- Lubricating Oils. Care should be taken to avoid contaminating lubricating oils with water. Water will hasten decomposition of many oils, wash out additives, cause the oil to emulsify, and lead to engine failure. In used lubricating oils, sediment and water may have been caused by poor maintenance, failure of screens, or by condensation of combustion products.

Table 7-3. Significance of Military Fuel Tests (continued)

Ash

The ash in oil is determined by burning off the organic matter and weighing the remaining inorganic matter. Straight mineral oils usually contain a small trace of ash. Oils containing metallic salts as additives will have larger amounts of ash. Increased amounts of ash indicate contamination with inorganic matter such as sand, dust, and rust. Increased ash in straight mineral oils may indicate contamination with additive type oils. The ash in diesel fuels must be very low because any abrasive substances may damage the internal metal surfaces of the engines and may form deposits on working surfaces. Residual fuel oils should also have low amounts of ash to prevent corrosion or embrittlement of fire boxes and boiler tubes.

Foam Stability

All oils will foam to some extent when agitated. The foam that is formed in oils that contain additives is often very stable. Instead of breaking up quickly, the foam tends to build up,and oil is lost through the breather outlets and other openings in the engine crankcase. Therefore, additive-type motor oils are frequently treated with antifoam agents to eliminate potential foam problems. The foam test requires agitating the oil until the foam is formed and then noting the time required for the foam to break up and disappear.

Gravity

Accurate determination of the gravity of petroleum is necessary for converting measured volumes to volumes of the standard temperature of 60 degrees. Gravity is a factor governing the quality of crude oils. However, the gravity of a petroleum product is an uncertain indication of its quality. Combined with other properties, gravity can be used to give approximate hydrocarbon composition and heat of combustion. The gravity scale most used in the United States is the API (American Petroleum Institute) gravity. A change of gravity may indicate a change of composition caused by mixing grades of products.

Water Reaction

This test determines the presence of water-miscible components in aviation gasolines and tribune fuels, and the effects of these components on the fuel-water interface.

Fuel System Icing Inhibitor (FSII) Test

This is a quantitative test used to determine the concentration of the fuel system icing inhibitor in jet fuel. The FSII additive (ethylene glycol monomthyl ether-glycerol) prevents ice formation in aircraft fuel systems. Testing is performed by many methods; i.e., colormetric, seisor refractometor, freezing point, and titration. The potassium dichromate-sulfuric acid titremetric procedure is the method preferred by the Air Force.

Water Separometer Index Modified (WSIM)

The WSIM test measures the ease with which a fuel releases dispersed or emulsified water. Fuels having a low WSIM rating will prevent filter/separators from functioning properly.

Particulate Contaminant

Excessive sediment will clog fuel lines and internal fuel filters on aircraft. Sediment may also cause wear on metal parts and, when burned, may form deposits causing premature engine failure. The two tests for particulate contaminant in aviation turbine fuels are the milipore test and the color comparison standards test the Air Force method)

Undissolved Water

Undissolved (free) water in aviation fuels can encourage the growth of microorganisms and subsequent corrosion in aircraft tanks. It can also lead to icing of filters in the fuel system. Free water is controlled in ground fueling equipment by filter/separators. The Aqua-Glo test is a quick and accurate way to determine the amount of free water in liquid petroleum products. The procedure is found in ASTM D-3240. Water in fuel can cause the following severe problems:

- Corrosion of tanks, equipment, and lines due to the formation of hydrogen sulfide, an extremely corrosive compound.
- Removal of FSII from aviation turbine fuels.
- Clogging of fuel lines and filters, particularly at high altitudes.
- Suport of microbiological growth, sometimes found in water and fuel interface in jet fuel tanks.

Part II. Bulk Water Operations

Chapter 8

Introduction

Potable water supply has always been a critical factor on the battlefield. A lack of water can demoralize and debilitate personnel. Three of the four major causes of death in the Civil War were due to contaminated water. With the discovery of bacteria, scientists began to understand that contaminated water caused diseases and infected wounds. A lack of water can also determine the outcome of a war. In 1915, the British commander at Gallipoli, LtGen Sir Frederick Stopford, and his commander, who was actively involved in the landing at Sulvia Bay, believed that the shortage of water was the major cause for their failure to take the heights before the Turks occupied them in force.

8001. History of Bulk Water

a. World War I - Vietnam In World War I, the U.S. supplied troops with potable water delivered in horse-drawn wagons. Mechanized forces in World War II replaced the horse-drawn wagons and truck-mounted fresh water purification units produced potable water. The six-day Yom Kippur War of 1967 tragically demonstrated the consequences of poor water support to armed forces; 20,000 casualties were caused by heatstroke from water deprivation (*Military Misfortunes: The Anatomy of Failure in War*). Water shortages severely limited mission capabilities and were a major factor in determining the outcome of the battle. During the Vietnam War, water was usually available but due to the tropical climate, it was not always potable. Iodine tablets were used in the canteens to disinfect drinking water.

b. Southwest Asia (SWA). The Middle East is "a long way to bring your beans and bullets," was an observation attributed to Marine Corps LtGen P.X. Kelley, former Rapid Deployment Force commander. But beans and bullets are not all that will be needed in an arid theater of operations. Marines need water, not only for drinking but also for aircraft, vehicles, sanitation, con- struction, and medical operations. In Southwest Asia, the Army, as DOD executive agent for land-based water, enhanced water support throughout the theater. Based on the approved theater planning factor of 20 gallons per man per day, the operation of tactical water purification equipment produced a total capacity in excess of 6 million gallons per day. Bottled water was used by units during deployment and on arrival in-country until their organic equipment arrived and the water support units could supply them. The bottled water, provided by the host nation, was vital to the daily support of units and was especially valuable as a reserve water source. During Operations Desert Shield and Desert Storm, a total of 9,357,555 cases of bottled water was provided to U.S. forces by Saudi Arabia.

c. Improvements to Water Support. The Marine Corps is constantly seeking to improve its water support capability to meet the needs of the Marine Corps and if necessary the needs of other Services. Consumption factors have been developed to assist in planning for adequate water support and new equipment has been developed to process both fresh and saltwater. Through the latest technology, quality, and expedient training, the bulk water units are better prepared to provide Marines a most valuable commodity—water.

8002. Concept of Bulk Water Operations

The basic concept of bulk water support is to source or produce water as close to the user as possible. This requires proper planning of the water point selection for bulk water, if required, and purification, storage, and distribution of bulk water.

a. Bulk Water Support Responsibility. Bulk water support is normally a Service responsibility. However, during joint operations, the joint force commander may assign the Services areas of responsibility for water support. Areas of responsibility are usually assigned based on the predominant user concept. This means that the greatest-volume user in an area would provide bulk water support to all forces operating in the area. The actual procedures used to provide bulk water support to the Services will depend on conditions in the area of operations.

b. Deployments. In most deployments, Marine Corps forces will be capable of partial or complete water self-sufficiency using organic water equipment and host nation or commercial support. In geographic regions with adequate surface water resources, the commander is likely to establish multiple water points in the vicinity of his forces.

c. Production and Storage. The production of water is the purification of existing sources of water into potable and non-potable water at a given water point. The extent to which a water point is developed depends primarily on the time, materials, and the Marines available to do the work. At forward sites, the water point will probably only be developed to provide potable water to using units. In the larger combat service support areas, the water point will probably be developed to provide potable and non-potable water support for the entire force.

Water storage at the production site should be sufficient to meet the daily peak demands and allow water production to continue. Having adequate water storage avoids frequent time-consuming start-ups and shutdowns of the water production equipment.

d. Distribution. In most situations, water distribution is the weak link of the water support system. Getting water from the production and storage sites to the user can be equipment and manpower intensive. Marine forces must make efficient use of all available assets in conducting water distribution operations. Getting water from the storage site to the using units can involve utilizing SIXCON water modules, 500-gallon water drums, water cans, and bottled water.

Chapter 9

Water Equipment

Marine Corps water equipment has to meet a wide range of requirements, from providing support for near shore operations to supporting inland operations. To meet these requirements, the Marine Corps has developed various water equipment end items and the family of water supply support system. USMC equipment has the capability to purify both fresh water and salt water. However, the Marine Corps does not have an organic well drilling capability. The MAGTF must be augmented by elements from the naval construction force (NCF) in order to have this capability.

9001. Water Equipment End Items

a. Shower Unit. The Shower Unit (TAMCN B0050) consists of six separate, identical, and interchangeable shower modules with interconnecting hoses, electric feed water and drain pumps, and a drain hose. The unit has a self-contained, oil-fired boiler water heater capable of providing 120 degree F water at a rate of 20 GPM. This shower unit will replace all trailer-mounted units.

b. Field Laundry Unit. The Laundry Unit (TAMCN B1226) is a pallet-mounted, self-contained unit. It consists of a washer, dryer, extractor, and air compressor mounted on two pallets. The unit provides the capability to launder all washable fabrics worn by individual Marines and bulky organizational items with a maximum output of 120 pounds per hour.

c. 65 GPM Pump Set. The 65 GPM Pump Set (TAMCN B1620) is a compact, base-mounted, portable water pump. It is comprised of a single stage centrifugal pump directly connected to an air-cooled gasoline engine.

d. 3,000 Gallon Collapsible Fabric Tank. The 3K Tank (TAMCN B2130) is a collapsible tank designed for easy application in the field. It has a 3,000 gallon capacity and may serve as a temporary or semi-permanent water storage facility.

e. Reverse Osmosis Water Purification Unit (ROWPU). The ROWPU (USMC TAMCN B2604) is a ISO frame-mounted, portable water purification system. It is powered by a 30KW generator set. The ROWPU can purify almost any type of water, to include fresh, brackish, and salt water. It can also purify water that has been exposed to nuclear, biological, chemical (NBC) contaminants. The ROWPU is capable of producing up to 600 gallons per hour (gph) of potable water.

f. Medium Freshwater Purification Unit 3,000 LMT. The medium freshwater purification unit is a frame-mounted, skid-based, diesel-operated, diatomite-type unit capable of purifying fresh water. It can purify up to 3,000 GPH from a freshwater source. This unit is the replacement for the U22 Water Purification System.

g. Water Quality Analysis Kit - Purification. The Water Quality Analysis Kit (WQAK) (TAMCN B2630) consists of the equipment necessary for testing water quality. It is self-contained in a portable, waterproof suitcase.

h. Small Mobile Water Chiller. The Water Chiller (TAMCN B2641) is a skid-mounted, gasoline engine cooling unit. It can cool up to 40 GPM of potable water from 120 degrees F to 60 degrees F. Although designed for use with the M149 Water trailer, the water chiller is compatible with other water storage assets.

i. M149 Water Trailer. The M149 Water Trailer has a 400-gallon stainless steel water tank. A manhole is located on the top of the water tank for filling and cleaning. There are four faucets and a drain faucet for dispensing water. The trailer can be towed at a speed of 50 mph on the highway and 30 mph cross country.

j. SIXCON. Specific SIXCON modules are designed for water storage. Its main function is to provide a source of potable water to remote locations. A SIXCON is transportable by air or ground. Water SIXCON modules are similar to fuel SIXCON modules. Components of the water SIXCON system are a pump module and five water tank modules. The modules form a water distribution source that can be transported as a unit or individually. Table 9-1 shows MPS and MEF allowances for water equipment.

9002. Family of Water Supply Support Systems

To provide flexible and responsive water support, the Marine Corps has developed a family of water supply support systems. Each system is designed and configured specifically to support a unique mission using similar components. The ability to alter fundamental system configurations and interchangeability of components allows the creation of limitless combinations of tailored systems to meet mission requirements. The family of water supply support systems consists of 22 TAMCNs. See table 9-2 for MPSRON and MEF allowances.

Table 9-1. Water Equipment Allowances

TAMCN	NOMENCLATURE	MPSRON-1	MPSRON-2	MPSRON-2	I MEF	II MEF	III MEF
B0055	bath, shower unit	19	19	19	61	54	32
B1226	laundry unit, field	14	14	14	40	32	29
B1581	water pump module	55	55	55	*	*	*
B1620	65-gpm pump set	35	35	35	60	54	32
B2086	water tank module	215	215	215	300	264	204
B2130	3k collapsible tank	104	104	104	695	582	386
B2604	ROWPU	41	41	41	121	101	56
B2628	medium freshwater purification unit	*	*	*	35	32	20
B2630	WQAK	*	*	*	12	12	7
B2641	water chiller	83	83	83	67	56	45
D0880	M149 water trailer	110	110	110	298	285	183

*** Allowances to be determined**

Legend: ROWPU - reverse osmosis water purification unit
WQAK - water quality analysis kit

Table 9-2. Family of Water Supply Support Systems Allowances

TAMCN	NOMENCLATURE	MPSRON-1	MPSRON-2	MPSRON-2	I MEF	II MEF	III MEF
B0332	water tank chest	26	26	26	7	7	7
B0571	500-gal water drum	42	42	42	66	48	66
B0676	forward area water point supply support system (FAWPSS)	7	7	7	11	8	11
B1140	hypochlorination unit	6	6	6	5	2	3
B1582	350-gpm water pump	6	6	6	5	2	3
B2131	dual tank connection kit	16	16	16	7	5	5
B2132	bag filler connection kit	2	2	2	2	0	0
B2133	4“ hose connection kit	4	4	4	5	3	3
B2134	2” hose connection kit	6	6	6	5	5	5
B2135	4“ discharge hose interconnection kit	4	4	4	4	2	2
B2136	hose nozzle connection kit	8	8	8	5	5	5
B2137	tank accessory kit	2	2	2	3	1	1
B2138	350-gpm pump connection kit	4	4	4	3	3	3
B2139	125-gpm pump connection kit	4	4	4	3	3	3
B2391	pump station	6	6	6	1	1	1
B2392	storage assembly	2	2	2	0	0	0
B2393	distribution point	2	2	2	0	0	0
B2394	600-gpm pump	6	6	6	2	2	2
B2395	10-mile segment kit	1	1	1	0	0	0
B2396	hose assembly	128	128	128	20	20	20

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Chapter 10

Water Support Planning

The key to successful water support is innovative and flexible planning. Planning for water support may range from a MAGTF contingency operation in areas without a pre-established water support base to an operation involved in allied/host nation support where water support is partially supplied. For contingency operations, water planners must ensure that water units are structured to allow situation-dependent growth and maturity. This flexibility is a key to the MAGTF commander's ability to support the operation.

Water support planning is a continual process that involves operational scenario, strategic lift availability, and prepositioned supplies and equipment. Planning for water support must ensure that the MAGTF can perform its mission in the time required. Water support units and equipment need to be time phased in the area of operations (AO) so that water support and preventive medicine units arrive on time to provide adequate and continuous water support during an operation.

10001. Planning Guidance

Water planners at all levels must include water supply procedures and guidance in exercise and operation plans. The water supply procedures are set forth in NAVMED P-5010-5, *Preventive Medicine Manual* (Navy) or in TB MED 577, *Occupational and Environmental Health Sanitary Control and Surveillance of Field Water Supplies (Army)*. Planners also need to ensure that the force structure has adequate resources for water production, storage, and distribution.

Water support planning is a continual process that begins with the identification of the force size and planned deployment rate. Time-phased water requirements are then determined and units are selected and scheduled for deployment based on the requirements.

Some specific areas that are critical to effective water support planning are as follows:

- Development of detailed water distribution plans.
- Identification of water support requirements for other Services, allied forces, or host nation labor forces.
- Water support structure (personnel and equipment) that is capable of providing the required water purification, storage, and distribution.
- Water quality procedures

10002. Water Requirements

Planning for water support begins with determining water requirements. Water requirements will depend upon the environment, the tactical situation, and the size of the force. Water requirements are flexible. They may not be the same each day. Some requirements such as cooking may be indefinite while others may only be for a specific period of time.

10003. Consumption Requirements

A number of water consumption requirements are based on the size of the force. These are as follows:

- Drinking
- Heat Treatment
- Personal
- Hygiene
- Food Preparation
- Laundering
- Centralized Hygiene

Other water requirements are not directly related to the number of personnel. The combat environment, work load, and/or numbers of equipment determine these requirements.

- Hospitals
- NBC Decontamination
- Vehicle Maintenance
- Graves Registration
- Engineer Construction
- Aircraft Washing

a. Region. Water consumption also depends on the region. Water sources are normally abundant in temperate, arctic, and tropical regions. Since nonpotable water is easily available in these areas, consumption estimates only deal with potable requirements. In arid regions, water sources are sparse and water must be transported forward. To prevent having two separate water systems in arid regions, requirements for both potable and nonpotable water will be met with potable water. As a result, total potable requirements will increase in the arid regions. In all regions, plan for ten percent of the water to be lost through evaporation or waste.

b. Requirements Determination. A number of computations must be made to determine supply, purification, and storage requirements for water.

(1) Supply Requirement. To compute the total daily water requirement of the force, multiply the actual strength by the proper consumption factor. The total, expressed as gallons per day, includes ten percent for evaporation and waste loss.

(2) Purification Requirement. The amount of purification equipment to support the daily requirement has to be determined. To do this, divide the total daily requirement by the daily production capability of one purification unit. Under normal conditions, water purification equipment is operated twenty hours per day. However, many other factors affect the water production. Planners should coordinate with the equipment operators to get an accurate estimate of the water production capability.

(3) Storage Requirement. Temperate, tropical, and arctic regions usually do not require large amounts of water to be stored. Nonpotable requirements can be met by raw water sources, and the potable requirements can be met by the water purification unit's organic storage tanks. In arid regions, large quantities of potable water must be stored. The storage requirement is based on resupply times, daily requirements, and the DOS requirement established by the MAGTF commander.

c. Essential Consumption. When enough potable water cannot be produced to meet all the requirements, all but essential consumption must be reduced. Essential water requirements include drinking, personal hygiene, field feeding, medical treatment, heat casualty treatment, and in arid regions, vehicle and aircraft maintenance. Consumption rates under these conditions are classified as "minimum", enough for a force to survive up to one week. Requirements exceeding one week are classified as "sustaining." In this classification, nonessential consumption includes that for centralized hygiene, laundry, and construction. Tables 10-1 through 10-4 on the following pages provide water consumption data for each region—*temperate, tropical, arctic,* and *arid.*

Table 10-1. Water Requirements for Temperate Zones

COMPANY	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	1.5	1.5
Personal Hygiene	1.7	0.3
Field Feeding	0.3	0.8
SUBTOTAL	3.5	2.6
+ 10% WASTE	0.6	0.3
TOTAL	3.9	2.9

BATTALION	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	1.5	1.5
Personal Hygiene	1.7	1
Field Feeding	2.8	0.8
SUBTOTAL	6	3.3
+ 10% WASTE	0.6	0.3
TOTAL	6.6	3.6

REGIMENTAL LANDING TEAM	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	1.5	1.5
Personal Hygiene	1.7	1
Field Feeding	2.8	0.8
Division-Level Medical Treatment	0.4	0.4
SUBTOTAL	6.4	3.7
+ 10% WASTE	0.6	0.4
TOTAL	7	4.1

MEF	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	1.5	1.5
Personal Hygiene	1.7	1
Field Feeding	2.8	0.8
Division-Level Medical Treatment	0.4	0.4
Hospital-Level Medical Treatment	0.7	0.7
SUBTOTAL	7.1	4.4
+ 10% WASTE	0.7	0.4
TOTAL	7.8	4.8

Table 10-2. Water Requirements for Tropical Zones

COMPANY	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	0.3
Field Feeding	0.3	0.8
Heat Casualty Treatment	0.2	0.2
SUBTOTAL	5.2	4.3
+ 10% WASTE	0.5	0.4
TOTAL	5.7	4.7

BATTALION	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Heat Casualty Treatment	0.2	0.2
SUBTOTAL	7.7	5.0
+ 10% WASTE	0.8	0.5
TOTAL	8.5	5.5

REGIMENTAL LANDING TEAM	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Heat Casualty Treatment	0.2	0.2
Division-Level Medical Treatment	0.4	0.4
SUBTOTAL	8.1	5.4
+ 10% WASTE	0.8	0.5
TOTAL	8.9	5.9

MEF	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Heat Casualty Treatment	0.2	0.2
Division-Level Medical Treatment	0.4	0.4
Hospital-Level Medical Treatment	0.9	0.9
SUBTOTAL	9.0	6.3
+ 10% WASTE	0.9	0.6
TOTAL	9.9	6.9

Table 10-3. Water Requirements for Arctic Zones

COMPANY	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	2.0	2.0
Personal Hygiene	1.7	0.3
Field Feeding	0.3	0.8
SUBTOTAL	4.0	3.1
+ 10% WASTE	0.4	0.3
TOTAL	4.4	3.4

BATTALION	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	2.0	2.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
SUBTOTAL	6.5	3.8
+ 10% WASTE	0.7	0.4
TOTAL	7.2	4.2

REGIMENTAL LANDING TEAM	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	2.0	2.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Division-Level Medical Treatment	0.4	0.4
SUBTOTAL	6.9	4.2
+ 10% WASTE	0.7	0.4
TOTAL	7.6	4.6

MEF	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	2.0	2.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Division-Level Medical Treatment	0.4	0.4
Hospital-Level Medical Treatment	0.7	0.7
SUBTOTAL	7.6	4.9
+ 10% WASTE	0.8	0.5
TOTAL	8.4	5.4

Table 10-4. Water Requirements for Arid Zones

COMPANY	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	0.3
Field Feeding	0.3	0.8
Heat Casualty Treatment	0.2	0.2
Vehicle Maintenance	0.2	0.2
SUBTOTAL	5.4	4.5
+ 10% WASTE	0.5	0.5
TOTAL	5.9	5.0

BATTALION	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Heat Casualty Treatment	0.2	0.2
Vehicle Maintenance	0.2	0.2
SUBTOTAL	7.9	5.2
+ 10% WASTE	0.8	0.5
TOTAL	8.7	5.7

REGIMENTAL LANDING TEAM	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Heat Casualty Treatment	0.2	0.2
Vehicle Maintenance	0.2	0.2
Division-Level Medical Treatment	0.4	0.4
Centralized Hygiene	1.8	0.0
Construction	0.5	0.0
Aircraft Maintenance	0.2	0.2
SUBTOTAL	10.8	5.8
+ 10% WASTE	1.1	0.6
TOTAL	11.9	6.4

MEF	Daily Gallons-Per-Man Requirements	
Function	Sustaining	Minimum
Drinking	3.0	3.0
Personal Hygiene	1.7	1.0
Field Feeding	2.8	0.8
Heat Casualty Treatment	0.2	0.2
Vehicle Maintenance	0.2	0.2
Division-Level Medical Treatment	0.4	0.4
Hospital-Level Medical Treatment	2.8	2.8
Centralized Hygiene	1.8	0.0
Construction	1.5	0.0
Aircraft Maintenance	0.2	0.2
Laundry	2.1	0.0
SUBTOTAL	16.7	8.6
+ 10% WASTE	1.7	0.9
TOTAL	18.4	9.5

Chapter 11

Water Support Operations

Effective water support is essential to mission accomplishment. The water support mission is to get potable water to each Marine. Each Service is responsible for its water support. However, the Army is the theater manager for water support and may provide backup water support when the Services' requirements exceed their capabilities. When a Service requires backup water support, the supported Service must provide detailed water requirements to the Army planners. The Army will provide GS water support to other Services in the theater as required. FM 10-52, Water Supply in Theater of Operations, provides detailed information on Army roles and responsibilities for water support in the theater. The Theater Army Material Management Center monitors water priorities and allocation procedures and provides the JTF commander with water supply data. During JTF operations, the JTF commander may assign water support responsibilities on an area basis. Under this "predominant user concept", the predominant Service in an area may be tasked to provide water support to all Services operating in that area.

11001. MAGTF Water Support

MAGTFs may require water support for contingency operations in areas without a pre-established water support base to an operation involving allied/host nation support. MAGTFs provide water support on an area basis using supply point distribution. Water support operations comprises three areas—*water purification, water storage*, and *water distribution*.

11002. MAGTF Water Support Responsibilities

Normally the water supply system is an automatic resupply operation. Generally, its only limitations are water availability and the capability of receiving units. The forward movement of water is based on storage and distribution assets available.

a. MAGTF Command Element. The command element is responsible for overall water support planning and operations for the MAGTF. When demand exceeds supply, the MAGTF commander establishes an allocation system and support procedures. The allocation system is based on priorities to support the tactical plan.

To accomplish its mission, the CE performs the following tasks:

- Ensures water supply is sufficient to support the entire MAGTF and any other water missions assigned by the JTF commander.
- Submits required water data to the JTF or theater Army.
- Directs Storage and distribution procedures and priorities.

- Provides inventory management of GS water supplies and sets allocations if required.
- Ensures economy of management of all water support equipment within the MAGTF.

b. ACE, CSSE, and GCE. All other elements of the MAGTF are responsible for planning, directing, and supervising their organic water support assets. Each element will ensure it has the capabilities to perform any water support tasking assigned by the MAGTF commander. Daily management of the water points and water distribution is the responsibility of the GCE, ACE, and CSSE. Water support requirements that are beyond the organic capabilities of an element will be passed to the MAGTF CE. Each MAGTF element has water purification, distribution, and storage capability. However, the CSSE has the preponderance of water support equipment. As a result, the CSSE must be prepared to provide GS to the other elements of the MAGTF as needed.

11003. Water Purification

Water purification is the first phase of water support operations. During the purification phase, water is drawn from the source and purified to either potable or nonpotable standards. Potable water is certified safe for human consumption. Nonpotable water is used for washing clothes, equipment, construction, and any other use that does not require human consumption. Water is purified with a Reverse Osmosis Water Purification Unit (ROWPU) or a Medium Freshwater Purification Unit. Standards are verified by a member of an Environmental Protection Medical Unit or any Corpsman with a Water Quality Analysis Kit and the knowledge of how to use it.

11004. Water Storage

Water storage is the second phase of water support operations. Storage is normally done at or very close to the purification sites. The goal of water storage is to keep one day of supply on hand. This will prevent a water shortage if several purification units go down at one time. Storage can be done with any water tight container on hand. Normally, it will be done using one or a combination of 3,000, 20,000, and 50,000 gallon tanks. Water distribution begins from the storage sight.

11005. Water Distribution

Water distribution is often the critical link in water support operations. If this link fails, the Marine goes thirsty. It is important that units organize so they will have sufficient organic water distribution equipment to provide supply point distribution. Marine units must have enough water distribution capacity to supply minimum requirements for water while making only one trip to the water point per day. During the early phases of deployments and in emergency situations, airlift of packaged water will be the primary means of resupply in forward areas. As the CSSEs are established and LOCs are developed, units will begin pulling water from water points using organic 400-gallon water trailers and SIXCON water modules.

a. Water Supply Operations in Arid Regions. Water sources are either nonexistent or extremely limited in arid regions. The options available to the MAGTF will be limited to importing water, desalination of seawater, or development of new water supply sources. Units will need to make maximum use of organic water equipment for storage and distribution. Water purification teams and detachments will often be required to operate from the shore purifying seawater with reverse osmosis water purification units (ROWPUs). The family of water supply support equipment is used to store and distribute potable water to operating forces. Water moved forward is either stored in forward water supply points or issued to the using units. Water supply points are established as far forward as possible, considering the location of water sources, the location of using units, and the tactical plans. Based on resupply times and water availability, MAGTF commanders will have to establish the required DOS for water to be held at each echelon. Operational and direct support (DS) units will normally maintain a minimum of one DOS.

Water supply operations are conducted in three phases to ensure effective and continual water support.

(1) Development Phase. This phase may begin as an air or amphibious assault or as an uncontested entry at a friendly port. The first MAGTF elements will probably be combat forces with little CSS. Using canteens, 5-gallon cans, and other organic equipment, these forces carry only enough water for immediate survival purposes. Resupply must begin quickly by either air or from the sea. During this phase, packaged water will be primarily provided from offshore or from the air from non-theater support bases. Nonexpendable equipment used during this phase, such as 500-gallon drums and 5-gallon cans, must be recovered and reused. MAGTF commanders must exploit all water sources while keeping the impact on the local population to a minimum.

(2) Lodgment Phase. The arrival of follow-on forces in the AO will increase water requirements beyond the capabilities of aerial resupply except for forward-deployed or isolated units. During this phase, in-country water support systems must be established. CSS units will provide purification, storage, and distribution of water in support of the MAGTF. CSS units will exploit any source of water in the AO using organic water purification equipment.

(3) Buildup Phase. Once the lodgment is established, expansion of the logistics base begins. Additional water support units and equipment will arrive. The distribution system should be expanded to include tactical water distribution system (TWDS) hoselines whenever possible. Bulk water can be introduced into the AOA via joint logistics over the shore (JLOTS). Water points will be expanded and moved as far forward as possible.

b. Water Supply Operations in a Nonarid Environment. Water support operations in an undeveloped, nonarid environment include development, lodgment, and buildup phases, and are identical to those described in the arid environment. There are three distinct nonarid environments or regions; temperate, tropical, and arctic. See chapter 10 for associated planning factors. Planning and operational considerations for each are discussed below:

(1) Temperate Regions. Temperate regions have seasonal variations that may affect water support operations such as hot summers and cold winters. These variations may have a significant impact on where water points may be located. In spring and fall, heavy rains may flood streams and rivers. In the summer water sources may be low preventing sufficient water flow for purification operations. These factors require careful consideration by water planners and coordination with meteorology and map/area reconnaissance when selecting water sites.

(2) Tropical Regions. Water sources in tropical regions are often contaminated with waterborne diseases and parasites. Disinfection and filtration of raw water may be required for bath and laundry operations. As a result, water purification operations and additional water storage tanks may be required to pretreat the raw water.

(3) Arctic Regions. Water supply points in arctic regions must have equipment to prevent or retard freezing. Equipment can include shelters and heaters. Water sources in arctic regions will present unusual problems. These problems can include ground and source water freezing and distribution problems due to poor mobility.

11006. Host Nation Considerations

Host nation water sources, facilities, and equipmentshould be used as much as possible. MAGTF water planners should assume that no host nation water is available in arid regions. Minimal water sources and poor water quality may limit any operations that depend on host nation support to meet the criteria set forth in NAVMED P-5010-5 or TB MED 577 for water quality standards. In the early stages of deployment, host nation processed or bottled water may be used if it has been certified as potable by preventive medicine personnel. However, in both developed and undeveloped theaters, MAGTF commanders and water planners must be aware of the following:

a. Article 54 of the Geneva Convention. This article "prohibits attacking, destroying, or rendering useless drinking water installations and supplies and irrigation works. In no event shall actions against these objects be taken which may be expected to leave the civilian population with such inadequate food or water as to cause its starvation or force its movement."

b. Labor Force Personnel. The host nation must provide for the needs of its labor forces unless otherwise provided in host nation support agreements. In the absence of an agreement, U.S. forces may have to assume some responsibility for the care of labor forces.

c. Refugees. Article 55 of the Geneva Convention states that the host country, as the territorial sovereign, is responsible for refugees on its territory. In the event its resources are strained by an influx of refugees, the host country may request assistance from U.S. forces. U.S. forces would have a legal responsibility to provide refugee care where they have occupied enemy territory and have established a military government.

d. Enemy Prisoners of War. Article 26 of the Geneva Convention requires the U.S. to provide humane treatment to prisoners in its custody. This includes providing adequate water and food.

Appendix A

POL Appendix

The following is the format for the POL appendix for CINC, JTF, and MAGTF OPLANs, and OPORDs.

Appendix 1 To Annex D

Petroleum, Oils, and Lubricants Supply

CLASSIFICATION

APPENDIX 1 TO ANNEX D TO OPLAN /// PETROLEUM, OILS, AND LUBRICANTS SUPPLY ( )

( ) REFERENCES: LIST DOCUMENTS NECESSARY FOR A COMPLETE UNDERSTANDING OF THIS APPENDIX; INCLUDE CURRENT PETROLEUM STUDIES, JOINT AGREEMENTS, AND OTHER RELEVANT GUIDANCE AS APPLICABLE.

1. ( ) GENERAL

a. ( ) Purpose. State the purpose of this appendix.

b. ( ) Users. Describe the concept of petroleum supply operations by designating the users to be supported, including allied forces and civilian requirements, where applicable. Identify the agreements whereby support for the latter users would be undertaken.

2. ( ) CONCEPT OF OPERATIONS

a. ( ) Availability and suitability of commercial petroleum products, petroleum storage, tanker unloading facilities, and petroleum distribution systems within the area of operation.

CLASSIFICATION

b. ( ) Tanker offloading facilities and terminal facilities needed to meet US military requirements for petroleum support.

c. ( ) Concept of inland distribution.

d. ( ) Requirements for intertheater or intratheater movement of bulk petroleum to include points of origin, destination, type, and facilities available or required to receive this type product. List POL data by product. Upon fielding of new TPFDD format, the JOPS produced listing will be used.

e. ( ) Requirement for local procurement of commercial petroleum products and petroleum distribution and storage services within the area of operations.

f. ( ) Establishment of a quality control activity within the area of operations.

3. ( ) RESPONSIBILITIES

a. ( ) Assign specific tasks to military organizations, including the component commanders, when appropriate.

b. ( ) Delineate support responsibilities of the Joint Petroleum Office, JTF, JTF component commanders, subarea petroleum offices, appropriate unified commands or their components, for the supply of petroleum, including responsibility for its transportation.

4. ( ) LIMITING FACTORS. Describe limitations that could adversely affect petroleum supply operations, such as inadequate air and ocean terminal capacity, lack of storage facilities, malpositioned storage, inadequate transportation, inadequate in-theater stocks, lack of alternate facilities, and similar logistic constraints.

ESTIMATE OF POL SUPPORT REQUIREMENTS. Refer to TAB A, if applicable. Describe methodology used to compute requirements if Service planning factors were not applicable or if unique factors were considered.

Appendix B

POLALOT Message Text Format Report

The following is a message text format (MTF) report that is used to identify bulk fuel allocations when required. The report may be used by the CINC to the component commands and by the MEF to the MSCs. The report is only used when bulk petroleum stocks or support cannot meet all the requirements. For instructions and codes, refer to the MTF Handbook.

Bulk Petroleum Allocation

POLALOT

```
FM (JTF/COMMARFOR
TO II MEF) OR (II MEF TO MSC'S)
TO CG MAW//G4/G3// CG MARDIV//G4/G3// CG FSSG//G3/G4//
INFO (AS REQUIRED)
BT UNCLAS  //N04020//
EXER// OPER//
MSGID/POLALOT/MEF G4/0001/NOV//
REF//
AMPN//
NARR//
PERID/150500Z/TO:160500Z/ASOF:141800Z//
6POL /
CMPCMD       /FUELTYP/QTY /UOVOLM/POLDELMD/DELPOS /
   MAW           /JP5    /100K/GAL   /TKRTRK  /LZ BLUEBIRD /
   MAW          /MUR    /  5K/GAL   /TKRTRK  /LZ BLUEBIRD /
   FSSG          /DF2    / 20K/GAL   /BARGE   /LZ BLUEDIRD /
   FSSG         /MUR    / 10K/GAL   /TKRTRK  /LZ FALCON /
   FSSG          /JP8    / 50K/GAL   /TKRTRK  /LZ FALCON /
   FSSG          /JP5    /600K/GAL   /TKRSHP  /ONSLOW BEACH /
   MARDIV       /DF2    / 25K/GAL   /TKRTRK  /GRID 432756 /
   MARDIV        /DF2    /  5K/GAL   /TKRAC   /GRID 479832//
BT #
NNNN
```

(reverse blank)

Appendix C

POLRQMT Message Text Format Report

The following is a message text format (MTF) report that is used to identify bulk fuel requirements and provide an overall assessment of the bulk fuel status. The report may be used by MEF units to submit their bulk fuel requirements to their supplier. FSSG and MAW wholesale bulk fuel sites will submit the POLRQMT report to the area wholesale manager of bulk fuel. For instructions and codes, refer to the MTF Handbook.

Bulk Petroleum Requirements Forecast

POLRQMT

```
FM  (REPORTING UNIT)
TO  (ORGANIZATION PROVIDING PETROLEUM
SUPPORT/COORDINATION)
INFO (AS REQUIRED)
BT
UNCLAS  //N04024//
EXER//
OPER//
MSGID/POLRQMT/MSC/-/NOV//
REF//
AMPN//
NARR//
HEADING/BULK PETROLEUM ON HAND//
4POL
/FUELTYP/ONHD/DSUP/RECD
/JP5        /100K /   4/     20K
/DF2        / 50K /   5/      5K
/MUR        /  5K  /   5/       0//
HEADING/BULK PETROLEUM REQUIREMENTS//
PERID/150500Z/TO:160500Z/ASOF:141800Z//
UNITLOC/FSSG/LZ FALCON//
```

```
9POL
/FUELTYP/QTREQ/TRANSMODE /PRY
/JP5          /  50K    /ROAD       /  3
/DF2          /  20K    /ROAD       /  3
/MUR          /   5K    /ROAD       /  4//
UNITLOC/MAW/LZ BLUEBIRD//
9POL
/FUELTYP/QTREQ/TRANSMODE /PRY
/JP5          /  20K/      PIPLIN   /  2

/MUR          /   5K/      ROAD     /  3//
UNITLOC/MARDIV/GRID 534768//
9POL
/FUELTYP/QTREQ/TRANSMODE /PRY
/DF2          /  10K/      ROAD     /  1
/MUR          /  500/      ROAD     /  3//
GENTEXT/FACILITY AND EQUIPMENT DAMAGE/MAKE ANY
COMMENTS REQUIRED TO ADDRESS PROBLEMS IN BULK FUEL
SUPPORT.  IDENTIFY ANY MAJOR EQUIP DAMAGE THAT HAS AN
IMPACT ON BULK FUEL SUPPORT.  UPDATE PREVIOUSLY REPORTED
EQUIP DAMAGE.//
BT #
```

Appendix D

REPOL Message Text Format Report

The following is a message text format (MTF) report that is used to provide summary information on bulk fuel inventories, damage, and damage assessment on bulk fuel distribution systems. The REPOL is normally submitted by the CINC JPO or SAPO. The MEF will submit REPOL feeder reports as required by the CINC to the appropriate agency. For instructions and codes, refer to the MTF Handbook.

Bulk Petroleum Contingency Report

REPOL

```
FM CG MEF//G4//
TO (AS REQUIRED)
INFO  (AS REQUIRED)
BT
UNCLAS  //N04020//
EXER//
OPER//
MSGID/REPOL/MEF G4 POL/0001/NOV//
REF//
AMPN//
NARR//
ASOFDTG/171800Z//
7FACDAM
/DE     /FACILITY          /DAMAGE      /ERSD
/01     /CHERRY POINT NC   /MOD         /921205
/02     /CLNC              /LGT         /921201//
GENTEXT/COMMAND ASSESSMENT/BOMB DAMAGE MINOR; NO
DECREASE IN OUTPUT.//
7PROSTAT
/DE    /ACTLOC            /PRODUCT/INVENT/STORCAP/DOS
/01    /FCSSA BLUEBIRD    /JP5   /  500  /  550  / 9
/02    /CHERRY POINT NC   /JP5   /  600  /  700  / 7//
7TOTSTAT
```

/PRODUCT /INVENT /STORCAP /DOS
/JP5 / 1100 / 1250 / 16//
7DEFSTAT
/DE /PORT /PRODUCT/QUANTITY /PERREQ
/01 /CHERRY POINT NC /JP5 / 1000 /1-DEC//
GENTEXT/GENERAL SUMMARY/FREE TEXT.__________//
BT #

Appendix E

Environmental Regulations

Compliance with environmental laws and pollution control standards is necessary within the U.S. and its territories. MCO P11000.8B provides policy for complying with the existing laws and regulations. At bulk fuel facilities, the major area of environmental concern centers on the handling and storage of petroleum products. There are several environmental requirements which relate directly to fuel operations and facilities. All bulk fuel personnel shall be familiar with reporting requirements, equipment, and training needs that support environmental concerns.

1. Clean Water Act

The Clean Water Act requires state and federal regulators to enter into programs designed to prevent, reduce, or eliminate pollution of navigable waters of the United States. The Water Quality Improvement Act of 1974 governs the discharge of oil into navigable waters. On December 11, 1973, the Environmental Protection Agency (EPA) published regulations to prevent pollution of U.S. waters by oil coming from onshore and offshore facilities not related to transportation. These regulations are identified in Title 40, Code of Federal Regulations, Part 112 (40 CFR, Part 112), and became effective on January 10, 1974.

2. Oil Pollution Act of 1990

The Oil Pollution Act of 1990 (OPA) consolidates and changes existing laws which govern prevention, oil spill liability, and preparedness and cleanup. The law affects pipelines, vessels, oil rigs, piers and terminals (on shore) that transport, handle, or store crude oil and petroleum products. Many new and important provisions that will affect the DOD fuel facilities are contained in the act, including increased liability for oil spills, more comprehensive oil spill contingency plans, training and drill requirements, better response capability and tougher enforcement. Additionally, the OPA has strengthened the role of three separate federal agencies: The U.S. Coast Guard (USCG), the EPA and the U.S. Department of Transportation [Research and Special Programs Administration (RSPA)].

3. Spill Prevention Control and Countermeasure Plan

The spill prevention control and countermeasure plan (SPCCP) is designed to help prevent the discharge of oil. A spill contingency plan is developed based on guidance from the commander or the local base commander and the Environmental Protection Agency. An outline of a typical contingency plan is provided in figure E-1. The plan addresses responsibilities and procedures for containing and cleaning up spills. The following items must be addressed in the SPCCP:

- Oil is defined as petroleum products, including gasoline, kerosene, jet fuel, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged soil.
- An SPCCP is valid for 3 years, if no changes are made to the plan or the facility.
- Coast Guard, EPA, or RSPA approval is required.
- "Worst Case" scenario must be addressed.
- Response capability must be documented.
- EPA Regional Administrator must be notified of spills in accordance with local SOPs.
- The SPCCP and facility Spill Response Plan must be available for inspection at the facility.

- The appropriate regulatory agency must be notified in the event of a spill.

Figure E-1. Outline of a Typical Contingency Plan.

Oil Spill Contingency Plan Outline

I. BACKGROUND

a. Inventory of petroleum products handled
b. Identification of most likely areas where a spill could occur.
c. Types of operations which could result in a spill.
d. Location of biological, recreational, or other sensitive areas.
e. Spill responsibilities assigned by the local commander and EPA.
f. Inventory and location of spill clean-up equipment and materials.

II. SPILL PLAN(S)

a. Spill reporting procedures.
b. Telephone numbers for key points of contact and fire department.
c. Spill containment and clean-up procedures for possible scenarios including personnel resources requirements.

(1) Type of product spilled
(2) Size of spill.
(3) Location of spill.
(4) Time of spill.
(5) Weather conditions.

d. Disposal procedures for product and clean-up materials.
e. Public affairs coordination.

III. SUPPORT

a. Procedures for obtaining spill equipment and material
b. Spill equipment maintenance program.
c. Training.
d. Contacts for specialized assistance.

Regulations require the preparation and implementation of a SPCCP for all non-transportation related facilities which have discharged, or could reasonably discharge, oil into U.S. navigable waters, or the adjoining shorelines. The SPCCP must also be reviewed and certified by a registered professional engineer (PE) for oil storage facilities with a total aboveground storage capacity of more than 1,320 gallons, or an underground storage capacity of 42,000 gallons or more, and located on or near navigable waters (which is almost any body of water or continuous stream).

If a spill occurs, the appropriate EPA Regional Administrator will be given the following information in accordance with local SOPs:

- Name of facility.
- Name(s) of the owner or operator of the facility.
- Location of the facility.
- Date and year of initial facility operation.
- Maximum storage or handling capacity of the facility and normal daily throughput.
- Description of the facility, including maps, flow diagrams, and topographic maps.
- A complete copy of the SPCCP with any amendments.
- The cause(s) of such spills(s), including a failure analysis of the system or subsystem in which the failure occurred.
- The corrective actions and countermeasures taken, including an adequate description of equipment repairs and/or replacements, and the cost involved.
- Additional preventive measures taken or contemplated to reduce the possibility of recurrence.
- Other information, as the Regional Administrator may reasonably require, pertinent to the plan or spill event.

4. Emergency Response Actions

Other federal and state regulations exist which prohibit the discharge of petroleum products into the environment (such as soil, ground water, and surface waters). If a spill occurs, the following steps must be taken immediately:

Step One. Stop the Spill. Prevent a further release of fuel to the environment by shutting off valves in a leaking pipeline, removing product from a leaking storage vessel, etc.

Step Two. Contain the Spill. To contain spill, construct berms around the area, use absorbent materials to soak up the spill, use containment boom on surface water spills, excavate cut-off trenches, etc. For handling JP-4 and other volatile fuel spills on water, divert and contain the fuel away from structures and try to remediate as soon as

at government fuel facilities are ignitable, there should be no smoking, open flames, or equipment with magneto-sparked engines, catalytic converters, or equipment which might otherwise produce sparks or static electricity in the vicinity of the spill site. Also, many fuels can cause skin irritation, dizziness, fainting, or even death, and therefore should be handled with caution.

Step Three. Report the Spill. Personal safety is more important than environmental protection. If there is a threat to life or health, the local fire department should be the first official agency notified. As soon as feasible and within 24 hours after the spill, the appropriate regulatory agency must be notified. A list of agencies and phone numbers for reporting various types of spills should be included in all exercise plans and LOIs. Information that may be requested when the spill is reported is included in figure A-2. To protect a downstream public or water supply in the event of a spill, call the appropriate public works department or plant manager to have them shut down the intake valves . Report spills into or upon the navigable waters of the United States or adjoining shores to U.S. Coast Guard, Washington, D.C. National Response Center (NRC), 24 - hour (800) 424-8802 or (202) 267-2675. See figure E-2 for spill reporting information.

Step Four. Clean Up the Spill. After stopping and containing the spill, recover the spilled product and remediate the impacted soil, ground water, and/or surface water. Because Government fuel facilities often do not have the necessary equipment, resources, or experience to assess and remediate the impacted areas, obtain a spill response contractor through the Defense Fuel Region as quickly as possible to expedite the cleanup in order to reduce the spread of contamination.

Step Five. Notify the Defense Fuel Region. Once the Defense Fuel Region has been notified of the spill, they will notify DFSC which will then make arrangements to have a remediation contractor brought on site, if needed. Regional contracts have been set up through DFSC to expedite the remediation process for DFSC facilities. Under the terms of the contracts, the remediation contractor must have a knowledgeable project manager on site within 24 hours of being notified. The facility Quality Surveillance Representative, the facility engineer, or POL officer should cooperate with the environmental contractor in providing any information requested to expedite the cleanup process.

5. Assessment and Remediation

In the petroleum industry, the strategy for a comprehensive assessment and remediation is straightforward—the quicker the cleanup, the less the spread of contaminants. Therefore, assessment activities should be completed in a timely manner so that a remediation system may be designed and installed before significant migration of the contaminant plume occurs. Before remediating a site, the vertical and horizontal extent of contamination must be defined.

a. The Defining Method. The defining method used depends on the type of spill. For a surface spill, the method for defining the extent of contamination is by visual inspection and shallow soil sampling. For a subsurface spill, the method for defining the extent of contamination is through the installation of ground water monitoring wells.

b. Corrective Action. The cleanup of a subsurface spill can be a very slow, time-consuming process; therefore, long-term (several years) monitoring and operation of the remedial action system will likely be required. Once the extent of the contamination has been defined, more corrective action technologies can be selected and implemented. The type of technology selected is based on site-specific information, such as—

- Volatility of the spilled product
- Type of media impacted (clay soil, sands, surface water, or ground water)
- Size of contaminant plume

- Cleanup goals

6. Preventive Booming Policy

DFSC practices preventive booming whenever state or local regulations dictate and according to the following guidance:

SPILL REPORTING INFORMATION

Spill discovery time: ____________________ Date: ______________________________________

Weather conditions/sea state: ____

Material spilled: ____

Amount spilled: ____

Size of slick/area affected: ____

Location and source of spill: ____

Environmental damage/nearby freshwater terrain: ____

Cause/circumstance of spill: ____

Existing/potential hazards (fire, explosions): ____

Personal injuries or fatalities: ____

Corrective action being taken/timetable for control, contain, cleanup: _________________________

____

Any other unique/unusual circumstances: ____

____

____

____

Name, address, phone number of person who discovered spill: ______________________________

____

Name of supervisor/manager in charge: ____

Contacts:

Agency	Date	Time	Person

Figure E-2. Spill Reporting Information.

- Transfers of nonpersistent fuels such as JP-4 and gasoline must not be boomed unless ordered by the Coast Guard.
- Fixed boom will not be required in the areas of swift current (1.5 knots or greater) when fuel will be deflected over the top or under the boom.
- Do not boom in situations deemed unsafe.

a. California. The state of California implemented a preventive booming regulation on November 21, 1992 and began enforcement on December 21, 1992. The state has concluded that most spills occur during bunkering operations; however, a significant amount of fuel is spilled in California waters during loading and unloading operations from tankers and naval oilers. The state further determined that preventive booming is good environmental policy to contain such spills and should be exercised to the greatest extent practicable. Thus, the state regulation requires a boom to be deployed, prior to initiating a fuel transfer, to encircle the vessel in order to contain any fuel spilled into the water. Now, terminals must either contract for the booming services or provide the manpower to deploy and retrieve boom during fuel transfer operations. Preventive booming is not required at DOD facilities in situations deemed unsafe or where impractical or ineffective. Preventive booming is not required in the following situations:

- Nonresistant fuels, such as JP-4 and gasoline should not be boomed due to the presence of explosive vapor. In this case, dispersion is the best solution as it allows the fuel to evaporate. Only persistent POL products (heavy ends and relatively high flash points) must be boomed.
- Fixed boom will not be required for marine transfer operations where the current is greater than or equal to 1.5 knots for at least 180 days of the year. Fixed boom will not effectively contain spills in such areas; the fuel will slide under or over the top of the boom.
- The state requires trained personnel standing by in a boat with adequate boom ready to deploy.

b. Other States. Until California implemented a preventive booming regulation, it was only a matter of local policy whether to boom. California perceived that spills occur most often in fuel bunkering operations. However, preventive booming during all pier fuel transfer operations, when practical and safe, provides an added measure of assurance. Spills which are immediately contained in a congested harbor are easier to clean up and they provide for accurate identification of the spiller. Although preventive booming is required for transfer involving persistent products (crude and heavy oils) in Alaska and is proposed for Maine, there is no requirement to boom light grade fuels in any other state. The requirement for preventive booming, which affects marine fuels transfer operations at wharf or pier facilities throughout the state of California, may be under consideration for adoption by the EPA, the Coast Guard, and other states.

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Appendix F

Glossary

I. Acronyms

AABFS ....amphibious assault bulk fuel system
AAFS ....amphibious assault fuel system
ABFDS .... aerial bulk fuel delivery system
ACE .... aviation combat element
AE .... assault echelon
AFFF .... aqueous film-forming foam
AFOE .... assault follow-on echelon
ALOC ....air lines of communications
AMC ....Air Mobility Command
AO ....area of operations
AO .... United States Ship, Auxiliary, Oiler
AOA ....amphibious objective area
AOG .... United States Ship, Auxiliary, Oiler, Gasoline
AOR .... area of responsibility
API .... American Petroleum Institute
ASTM ....American Society for Testing and Materials

BDA .... bomb damage assessment
BIU ....beach interface unit
BPWRR .... bulk petroleum war reserve requirements
BPWRS .... bulk petroleum war reserve stocks
B/2 .... anti-icing additive refractometer and test kit

CAS ....close air support
CE .... command element
CFD .... contaminated fuel detector
CFR ....code of federal regulations
CINC ....commander in chief
COMMARFOR ...... Commander, Marine Forces
COMMZ .... communications zone
CONUS ....continental United States
CSS .... combat service support
CSSD .... combat service support detachment
CSSE .... combat service support element
DFAMS ....defense fuel automated management system
DFR .... defense fuel region
DFSC ....defense fuel supply center
DFSP ....defense fuel support point
DLA .... Defense Logistics Agency
DOD .... Department of Defense
DOS .... day(s) of supply
DRMO .... Defense Reutilization Marketing Office
DS ....direct support

EAF .... expeditionary airfield
EOB .... enemy order of battle
EPA ....Environmental Protection Agency
ERS ....expedient refueling system
ESBn ....engineer support battalion
EUCOM .... European Command

FARP .... forward arming and refueling point
FAWPSS .... forward area water point supply support system
FEBA ....forward edge of the battle area
FMFM .... Fleet Marine Force manual
FOB ....free on board
FSII .... fuel system icing inhibitor
FSSA ....force service support area
FSSG .... force service support group
FWPCA ....federal water pollution control act

GCE .... ground combat element
gph .... gallons per hour
gpm ....gallons per minute
GS ....general support

HERS .... helicopter expedient refueling system
HN .... host nation
HNS .... host nation support
HQMC ....Headquarters, U. S. Marine Corps

IDF .... item data file
IMM ....integrated material manager
IMP .... inventory management plan
IPDS .... inland petroleum discharge system
ISO ....

JCS .... Joint Chiefs of Staff
JLOTS .... joint logistics over the shore
JOPS .... joint operation planning system
JP .... aviation fuel, "jet propulsion."
JPO ....joint petroleum office
JTF .... joint task force

LAPES ... low-altitude parachute extraction system
LCU .... landing craft utility
LFORM ....landing forces operational reserve mate-
rial LMIS logistics management information system
LOC .... lines of communications

MAGTF ....Marine air-ground task force
MARDIV ....Marine division
MARFOR .... Marine forces
MAW ....Marine aircraft wing
MCAS ....Marine Corps air station
MCB .... Marine Corps base
MCO ....Marine Corps Order
MEB .... Marine expeditionary brigade
MEF .... Marine expeditionary force
MEU .... Marine expeditionary unit
MIPR ....military inter-departmental purchase request
MILHDBK .... military handbook
MK-I .... free water detector kit, older model
MK-II .... free water detector kit, newer model
MK-III ...... solid contaminant detector kit, newer model
MK-IIIs
MoGas ....automotive gasoline
MOS .... military occupational specialty
MOU .... memorandum of understanding
MPF ....maritime prepositioning force
MPS .... maritme prepositioning ships
MPSRON ....maritime prepositioning ships squadron
MSC .... Military Sealift Command
MTBn ....motor transport battalion
MTF .... message text format
MWSG .... Marine wing support group
MWSS ....Marine wing support squadron

NAVAIR ....naval air
NAVPET .... Navy petroleum office
NBC .... nuclear, biological, and chemical
NCF .... naval construction force
NOB .... naval order of battle
NRC .... national response center
NSF ....Navy stock fund

O&M MC ...... operation and maintenance Marine Corps
O&MN ....operation and maintenance Navy
OPA ....oil pollution act
OPDS .... off-shore petroleum discharge system
OPLAN .... operation plan
OPORD ....operation order
OPSEC ....operations security
OSD .... Office of the Secretary of Defense

PACOM ....Pacific Command
PM .... preventive maintenance
POL ....petroleum, oils, and lubricants
POLALOT .... petroleum allocation
POLRQMT ....petroleum requirement
POS ....primary operating stocks
Purple K .... chemical firefighting agent; potassium bicarbonate

QA .... quality assurance
QS ....quality surveillance

RCZ .... rear combat zone
REPOL .... bulk petroleum contingency report
ROWPU .... reverse osmosis water purification unit
RSPA .... research and special programs administration

SALM .... single anchor leg mooring
SAPO ....sub-area petroleum office(r)

SCP .... service control point
SIXCONs .... six containers together
SLWT .... side loadable warping tug
SNCOIC .... staff noncommissioned officer-in-charge
SOP .... standing operating procedure
SPCCP .... spill prevention control and countermeasures plan
STOVL .... short takeoff and vertical landing
SWA .... Southwest Asia

TACOPS .... tactical operations
TAFDS .... tactical airfield fuel dispensing system
TAM .... table of authorized material
TAMCN .... table of authorized material control number
TAMMC .... Theater Army Material Management Command
TAU .... twin agent unit
TBFDS .... tactical bulk fuel distribution system
TDS .... total dissolved solids
T/E .... table of equipment
TFS .... tactical fuel systems
TPLM .... tactical petroleum laboratory, medium
TPTs .... tactical petroleum terminals
TWDS .... tactical water distribution system

USAPC .... U.S. Army Petroleum Center
USCG .... U. S. Coast Guard
USMTF .... United States Message Text Format

WQAK .... water quality analysis kit
WSIM .... water separometer index modified

II. Definitions

A

additive - An agent used for improving existing characteristics or for imparting new characteristics to certain petroleum products.

aerial refueling - The use of aerial tanker configured aircraft to provide refueling service to helicopters, fixed-wing, and tilt-rotor aircraft in flight. Aerial refueling extends the range, time on station, mobility, and flexibility of MAGTF aircraft. (FMFRP 0-14)

American Petroleum Institute (API) - The institute represents and is supported by the petroleum industry. It standardizes the tools and equipment used by the industry and promotes the advancement of research in the petroleum field. (FM 10-70-1)

American Society for Testing and Materials (ASTM) - A national scientific and technical organization formed for the development of standards or characteristics and performance of materials, products, systems, and services and the promotion of related knowledge.

amphibious assault bulk fuel system - The U. S. Navy system of flexible, buoyant hose used to effect ship-to-shore transfer of fuels. Five thousand feet of 6-inch hose connects amphibious shipping to shore-based fuel storage systems located at the high water mark. (FMFRP 0-14)

amphibious assault fuel system - The Marine Corps' primary fuel storage system used to support amphibious operations. This system is composed of a number of components capable of receiving, transferring, and dispensing mogas, diesel, or aviation fuels. The system can be set up in a wide variety of configurations to meet varying operational requirements. (FMFRP 0-14)

amphibious objective area - A geographical area, delineated in the initiating directive, for purposes of command and control within which is located the objective(s) to be secured by the amphibious task force. This area must be of sufficient size to ensure accomplishment of the amphibious task force's mission and must provide sufficient area for conducting necessary sea, air, and land operations. (Joint Pub 1-02)

api gravity - An arbitrary scale expressing the gravity or density of liquid petroleum products. The measuring scale is calibrated in terms of degrees API. The gravity of any petroleum product is corrected to 60 degrees F.

appearance - Refers to the visual examination of fuels. The terms used to describe appearance are clear and bright, hazy and cloudy. (FM 10-70-1)

B

barrel (bbl.) - A common unit of measurement of liquids in the petroleum industry. It equals 42 U.S. gallons.

berm - An earthen wall constructed around a fuel tank to contain potential fuel leaks or spills.

berm liner - A cloth or plastic tarp, impervious to fuel, used to line a berm.

blending - Mixing on-specification fuel with off-specification fuel to bring the latter to specification or use limits. Used as a method of reclamation.

bonding - Making an electrical connection between items of equipment/tanks. Bonding equalizes electrical potential between items, and reduces the threat of sparks due to static electricity passing between the items of equipment.

bottom sediment and water - Amount of sediment and water in the bottom of fuel tanks.

bulk fuel company - A unit that performs all functions incident to the supply of class III and class III (A) to elements of a MAGTF, to include distribution to, but not within, air bases during an amphibious assault and subsequent operations ashore; to ensure that class III (A) products distributed to supported air elements are of the required type, quality, and purity. (FMFRP 0-14)

bulk liquid - Fuel or water itself, not inclusive of the container or handling apparatus. A term also used to define quantities of fuel or water above either 55 gallons or 250/500 gallons; the former when handling product in 55-gallon metal drums is common, the latter when 250/500- gallon collapsible water drums or 500-gallon collapsible fuel drums are in use.

bulk petroleum product - Those petroleum products (fuels, lubricants) which are normally transported by pipeline, rail tank car, tank truck, barge, or tanker and stored in tanks or containers having a capacity of more than 55 gallons, except fuels in 500-gallon collapsible containers, which are considered to be packaged. (FM 10-70-1)

C

carbon dioxide - A heavy, colorless gas, CO2, which will not support combustion (therefore being useful as a fire-extinguishing agent).

carbon monoxide - A colorless, odorless, and poisonous gas, CO, resulting from the incomplete combustion of carbon.

centrifuge - A whirling instrument for separating liquids or liquids and solids of different specific gravity by use of centrifugal force.

class III - Petroleum products, POL (petroleum, oils and lubricants), often broken down into class IIIA for aviation fuel, and class III(W) for ground equipment fuel.

combat service support detachment - A separate task organization of combat service support assets formed for the purpose of providing rearming, refueling, and/or repair capabilities to the Marine air-ground task force or designated subordinate elements; e.g., a battalion conducting independent operations or an aircraft squadron operating at a remote airfield. The combat service support element normally provides the command element of a combat service support detachment. (FMFRP 0-14)

contaminant - A foreign substance in a product.

D

defense fuel supply center (DFSC) - An activity under the Defense Logistics Agency (DLA) with the responsibility as the integrated material manager (IMM) for wholesale bulk petroleum products until their delivery to the point of sale. This responsibility includes contract administration in an oversee area. (FM 10-70-1)

defense fuel supply point (DFSP) - Any military or commercial bulk fuel terminal storing products owned by DLA. (FM 10-70-1)

Defense Logistics Agency (DLA) - The agency, at the Department of Defense level, charged with providing the most effective and economical support of common supplies and services to the Military Departments and other designated Department of Defense components. It is the agency under which DFSC operates. (FM 10-70-1)

drum - Either 16- or 18-gage steel cylindrical containers (generally, 55-gallon size) or 250/500- gallon collapsible water containers/500-gallon collapsible fuel containers.

F

flash point - The temperature at which a fuel will "flash" when exposed to test flame — flame diameter of approximately 1/8 inch, like a butane lighter flame adjusted as low as possible; also a test performed per ASTM.

force service support group - The combat service support element of the Marine expeditionary force (MEF). It is a permanently organized Fleet Marine Force command charged with providing combat service support beyond the organic capabilities of supported units of the MEF. If supporting a force of force of greater size, additional assets are necessary to augment its capabilities. Although permanently structured with eight functional battalions, task organizations from those battalions would normally support MEF operations over a wide geographic area. (FMFRP 0-14)

forward arming and refueling point - A temporary facility, organized, equipped, and deployed by an aviation commander, and normally located in the main battle area closer to the area of operation than the aviation unit's combat service area, to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat. The forward arming and refueling point permits combat aircraft to rapidly refuel and rearm simultaneously. Also called FARP. (Joint Pub 1-02)

free water - See "water; water, free."

G

gallon - A unit of measure of volume. A U.S. gallon contains 231 cubic inches or 3.785 liters; it is 0.83268 times the imperial gallon. One U.S. gallon of water weighs 8.3374 pounds at 60 degrees F.(15.6 degrees C.).

grounding - Electrically connecting single or bonded units to a ground rod so static potential is discharged into the earth.

ground cloth - A protective cloth placed beneath collapsible bulk liquid tanks to protect the bottom of the tank from sharp objects.

H

halon - Halogenated hydrocarbon fuel fire extinguishing agent. It comes in various chemical composition models; Halon 1211, Halon 1301, etc.

I

inventory - Bulk tankage contents measured to current product level; includes tank bottoms and associated pipeline fill. (FM 10-70-1)

J

joint operation - An operation carried on by a force which is composed of significant elements of the Army, Navy, or the Marine Corps, and the Air Force, or two or more of these Services operating under a single commander authorized to exercise unified command or operational control over joint forces. Note: A Navy/Marine Corps operation is not a joint operation. (FMFRP 0-14)

joint petroleum office - An office established by the Joint Chiefs of Staff with petroleum logistics responsibilities in a unified command in overseas areas. (FM 10-70-1)

O

operating level - The quantity of materiel required to sustain operations during the interval between the arrival of successive replenishment shipments. (FMFRP 0-14)

P

petroleum - Crude oil. Petroleum is a mixture of gaseous, liquid, and semisolids hydrocarbons varying widely in gravity and complexity. Petroleum can be removed as a liquid from underground reservoirs, and it can be separated into various fractions by distillation and recovery. Petroleum is a general term that includes all petroleum fuels, lubricants, and specialties.

R

rear operations - Military actions conducted to support and permit force sustainment and to provide security for such actions. (FMFRP 0-14)

reverse osmosis - The application of pressure to a concentrated solution which causes the passage of a liquid from the concentrated solution to a weaker solution across a semipermeable membrane which allows the passage of the solvent (water) but not the dissolved solids (solutes). The liquid produced is a demineralized water. (FM 10-70-1)

S

sortie - In air operations, an operational flight by one aircraft. (Joint Pub 1-02)

specification - Prescribed limits of control tests used to maintain uniformity of a specific product. (FM 10-70-1)

storage capacity - Total of existing bulk tankage assigned for product storage. Capacity is measured to maximum fill level for each tank and includes nonrecoverable tank bottoms. (FM 10-70-1)

sub-area petroleum office (SAPO) - A sub-office of a JPO established by the JPO to fulfill petroleum logistics responsibilities in a section of the geographical area for which the JPO is responsible. (FM 10-70-1)

T

tactical airfield fuel dispensing system - An expeditionary system providing bulk fuel storage and dispensing facilities at airfields not having permanently installed fuel systems; also used to support fuel dispensing at established airfields. (FMFRP 0-14)

tank - A storage container for liquid products.

tanker - A seagoing vessel for transporting liquids. Coastal tankers have less draft (depth of a ship below the waterline) than oceangoing tankers. (FM 10-70-1)

terminal - A bulk facility for receipt, storage, transportation, and issue of petroleum products. The facility may be a base terminal for receipt and shipment of product by tanker, a pipehead terminal (head terminal) at the downstream end of the pipeline, or tank farm complex, tank farm manifold, and central pump station area. (FM 10-70-1)

total dissolved solids - All of the dissolved solids in a water. TDS is measured on a sample of water that has passed through a very fine mesh filter to remove suspended solids. The water passing through the filter evaporated and the residue represents the dissolved solids.

U

ullage - The amount by which a container, storage tank, or storage facility falls short of being full.

V

volume correction - The correction of measured quantity of product, determined by gauging at observed temperature and gravity and reference to a gage table, to net quantity of product at 60 degrees F. after deducting bottom water and sediment. (FM 10-70-1)

W

water - An odorless, colorless, transparent liquid, solid (ice), or gas (steam), compound H^2O.

water, dissolved - All fuel contains some water in solution, and amounts will vary with temperature. This type water is not separated from fuel by filter separators or other mechanical means.

water, entrained - “Free” water which is suspended throughout a fuel (or sample) and has not yet settled to the bottom of fuel container/tank.

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Appendix G

References and Related Publications

Joint Publications

Joint Pub 1-02	Department of Defense Dictionary of Military and Associated Terms
Joint Pub 4-03	Joint Bulk Petroleum Doctrine
Joint Pub 5-02.2	Joint Operation Planning System (JOPS), Volume II
USMTF Handbook	United States Message Text Format Handbook

Department of Defense Publications

DOD 4140.25-M I-IV	Department of Defense (DOD) Management of Bulk Petroleum Products, Natural Vol. Gas and Coal
DOD 4140.25-M Vol. V	Management of Bulk Petroleum Products, Storage, and Distribution Facilities
MIL-HDBK-200	Quality Surveillance Handbook for Fuel, Lubricants and Related Products

U. S. Navy Publications

NAVSUP PUB 558	Fuel Management Ashore
NAVAIR 00-80T-109	Aircraft Refueling Naval Air Training and Operating Procedures Standardization (NATOPS) Manual
NAVMED P-5010-5	Preventive Medicine Manual (Chapter 5, Water Supply Ashore)
NAVMED P-5010-9	Preventive Medicine Manual (Chapter 9, Preventive Medicine for Ground Forces)
TM T9540-AE-0M1-020/	Offshore Petroleum Discharge System (OPDS)

Marine Corps Orders

MCO P5090.2	Environment and Protection
MCO 11240.66B	Standard Licensing Procedure of Military Motor
MCO 3501.4	MCCRES Vol. 3 Rotary Wing Squadron
MCO 4400.170	Control and Accountability of Petroleum and Related Products and Coal

Fleet Marine Force Manuals

FMFM 4	Combat Service Support
FMFM 4-1	Combat Service Support Operations
FMFM 13	MAGTF Engineer Operations
FMFM 13-4/NWP 22-9	Naval Construction Force Support of MAGTF Operations

Marine Corps Technical Manuals

TM 11275-15/4	Tactical Engineering Equipment Licensing Examiner's Manual
TM-3835/15-1	Installation Operation and Maintenance of AAFS and TAFDS
TM-4700-15/1	Ground Equipment Record Procedures
TM-9130-12	Fuel Handling Products

Fleet Marine Force Reference Publications

FMFRP 0-14	Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms

U. S. Army Publications

FM 1-104	Tactics, Techniques, and Procedures for Forward Arming and Refueling Points
FM 10-52	Water Supply in Theaters of Operations
FM 10-52-1	Water Supply Point Equipment and Operations
FM 10-67	Petroleum Supply in Theaters of Operations
TB MED 577	Occupational and Environmental Health Sanitary Control and Surveillance of Field Water Supplies