SUBCOURSE **EDITION**

QM 5092 **A**

DIRECT GENERAL PETROLEUM OPERATIONS

THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT

ARMY CORRESPONDENCE COURSE PROGRAM

DIRECT GENERAL PETROLEUM OPERATIONS

Subcourse Number QM 5092

EDITION A

United States Army Combined Arms Support Command
Fort Lee, VA 23801-1511

2 Credit Hours
Edition Date: January 1999

SUBCOURSE OVERVIEW

This subcourse was designed to provide the soldier with information on the proper methods for supervising a pilferage program and sampling and gaging activities while ensuring safe and effective handling of petroleum products.

There are no prerequisites for this subcourse.

This subject reflects the doctrine which was current at the time it was prepared. In your own work situation, always refer to the latest official publications.

Unless otherwise stated, the masculine gender of singular pronouns is used to refer to both men and women.

TERMINAL LEARNING OBJECTIVE:

ACTION: The soldier will learn about the MOS 77F duties, terminology associated with the petroleum industry, how to direct a pilferage control program, sling load operations, sampling and gaging operations, a fire and safety program, and an environmental stewardship program.

CONDITION: Given subcourse QM 5092

STANDARDS: The soldier must score a minimum of 70 percent on the end of subcourse examination.

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ADMINISTRATIVE INSTRUCTIONS

1. Number of lessons in this subcourse: Ten

2. Materials you need in addition to this booklet are a Number 2 lead pencil, the ACCP examination response sheet, and the preaddressed envelope you received with this subcourse.

3. Supervisory requirement: None

GRADING AND CERTIFICATION INSTRUCTIONS

Examination. This subcourse contains a multiple-choice examination covering the material in the ten lessons. After studying the lessons and working through the practical exercises, complete the examination. Mark your answers in the subcourse booklet, and then transfer them to the ACCP examination response sheet. Completely blackout the lettered oval which corresponds to your selection (A, B, C, or D). Use a Number 2 lead pencil to mark your responses. When you have completed the ACCP examination response sheet, mail it in the preaddressed envelope you received with this subcourse. You will receive your examination score by return mail. You will receive two credit hours for successful completion of this examination.

LESSON 1

PETROLEUM OPERATIONS

OVERVIEW

In addition to his duties and supervisory requirements, a petroleum staff NCO should have knowledge of military petroleum products, general petroleum terminology, proper loading and dispensing of petroleum products from transport vehicles, and current trends in petroleum material development and confined space entry.

Lesson Description:

During this block of instruction we will discuss the duties and supervisory requirements of a petroleum staff NCO and general petroleum operations.

Terminal Learning Objective:

Action: Acquire knowledge on military petroleum products, general petroleum terminology, environmental considerations, and new trends in petroleum material development and confined space entry.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

Self-development is one of the key components of the leader development program. It is a planned progressive and sequential program followed by leaders to enhance and sustain their military competencies. It consists of individual study, research, professional reading, practice, and self-assessment. Under the self-development concept, the NCO, as an Army professional, has the responsibility to remain current in all phases of the MOS.

PART A - DUTIES AND SUPERVISORY REQUIREMENTS OF A PETROLEUM STAFF NCO

The petroleum supply specialist supervises the receiving, storing, accounting, dispensing, issuing, and shipping of bulk or packaged petroleum fuel, oil, and lubricant (POL) products:

- Inspecting petroleum markings, vehicles, and equipment.
- Supervising sampling and gaging.
- Determining petroleum requirements.
- Preparing accounting summaries.
- Monitoring an environmental control program.
- Supervising the operation and maintenance of petroleum distribution and dispensing equipment used in Class III supply points.
- Supervising the operation and maintenance of petroleum equipment used by combat arms units.
- Training combat arms personnel to perform as fuel handlers.
- Supervising terminal operations, procedures, and PMCS of equipment.
- Directing pipeline operations.
- Directing tank vehicles.
- Conducting tests and interpreting test results for quality surveillance.
- Permitting and training personnel in the regulations and procedures related to confined space entry.

PART B - MILITARY PETROLEUM PRODUCTS

- **Gasoline**, automotive (MIL-G-3056) Combat MOGAS is red in color. Types of MOGAS are:
  - **Type I** for temperatures above 0 degrees Fahrenheit (for normal climates).
  - **Type II** for average temperatures below 32 degrees Fahrenheit (for very cold climates).
- **Aviation fuels** - AVGAS is the Army's word for aviation gasoline. AVGAS is a leaded fuel. AVGAS is used as the primary fuel for all reciprocating aircraft engines.
- **Jet fuels** - Jet fuels differ from aviation gasoline because they do not contain lead.
- **Diesel fuel oils** - There are two general classifications of diesel fuels: those intended for shipboard use and those intended for general purposes. Fuel oil marine (DFM) is used in submarines and other shipboard operations at temperatures above 10 degrees Fahrenheit. Fuel oil diesel (DF) is a general purpose fuel oil supplied in several grades depending on the use. Fuel oil diesel, VV-F-800 will be used as the primary fuel for all compression ignition engines and gas turbine engines other than those in aircraft systems. Diesel fuels are procured for use in automotive diesel and compression ignition engines. Diesel fuels depend entirely on the heat of compression for ignition. They may be used in place of light burner oils. DF-2 (regular grade) is most commonly used in military vehicles. DF-1 (winter) is used in cold climates. DF-A (arctic) is used in extremely cold climates.
- **Burner fuels** - Burner fuel oils are intended for use in various types of fuel burning equipment under various temperature conditions. Burner fuels are burned under boilers or in furnaces to generate power or heat. There are different grades of burner fuels.
- **Lubricants** - Lubricants are oils and greases used to reduce friction between the moving surfaces and to remove heat generated in the equipment being lubricated.
- **Specialty items** - Specialty items are those items which are used for a specific task only. Any item which does not fall in the previous three categories will be a specialty item. Some of the more common solvents are listed as follows:
  - **Solvents** - Solvents are used for cleaning tools and or dry cleaning clothes. SD-1 and SD-2 are the most common.

- **Hydraulic fluids** - There are many grades of hydraulic fluids used for various purposes such as in hydraulic brakes, hydraulic jacks, and hydraulic systems on forklifts, etc.
- **Special purpose oils** - Cutting oils used in cutting steel and insulating oils used in transformers, etc., are examples of special purpose oil.
- **Others** - Antifreeze, coolants, protective compounds, and waxes are some of the examples.

PART C - GENERAL PETROLEUM TERMINOLOGY

- **Class III Petroleum Oil Lubricants (POL) -** Included are petroleum fuels, lubricants, hydraulic and insulating oils, temporary protective, liquid and compressed gases, chemical products, liquid coolants, de-icing and antifreeze compounds, together with components/additives to such products. Class III is broken down into two major groups:
  - **Class III (Air).** Petroleum and chemical products used in support of aircraft.
  - **Class III W (Ground).** Petroleum/chemical products used in support of ground and marine equipment.
- **Bulk fuel products.** Petroleum products (fuels, lubricants, etc.) which are normally transported by pipeline, rail tank car, tank truck, barge, tanker, and any other product stored in tanks or containers having a capacity of 500 gallons or less and fuels in 500-gallon collapsible containers are considered to be packaged.
- **Packaged petroleum fuels.** Fuels that are stored, transported, or issued in containers having a capacity of 500 gallons or less and in 500-gallon collapsible containers.
- **Packaged petroleum products**. Petroleum products other than fuels (generally lubricants, greases, and specialty items) that are stored, transported, and issued in containers having a capacity of 55 gallons or less.
- **Modes of Transportation.**
  - **Pipelines** - a line of pipe with pump stations, storage tanks, and accessory equipment, for the movement of petroleum products.
  - **Tanker** - a sea going vessel for transportation of liquids. Coastal tankers have less draft (depth of a ship below the water line) than ocean going tankers.
  - **Tank cars** - tank cars may be used to supplement pipeline transportation of petroleum products when rail facilities are available. Generally, a tank car should be used exclusively to carry one grade of product; if this is not possible, the car must be inspected and cleaned as necessary between loads to avoid contamination. Tank cars vary in capacity and design. Those used for petroleum products usually have one compartment and range in capacity from 6,000 to 16,000-gallons. Some tank cars, however, have more than one compartment and may transport more than one product at a time.
  - **Tank vehicles** - used most often for petroleum distribution in the theater of operations. The U.S. Army has two major types of tank vehicles: tank trucks and tank semitrailers. Tank semitrailers can be further divided into two sub-types: fuel-servicing tank semitrailers and fuel-transporting tank semitrailers. Fuel servicing means the vehicle is used not only to move fuel and transfer it to bulk containers, but also to dispense fuel to combat vehicles, aircraft, and other containers. All fuel-servicing tank semitrailers have filter/separators. Fuel transporting, on the other hand, means the vehicle is used only to move fuel and transfer it to bulk containers. This type of semitrailer has no filter/separator, hose reels, or dispensing nozzles.
  - **Air.** There are 3 main methods used to transport petroleum products utilizing aircraft.
    - Aerial Bulk Fuel Delivery System (ABFDS) - This system uses 3,000-gallon aerial pillow tanks with pumping modules mounted on a modular platform (2 on a C-130, 3 on a C-141, or 10 on a C-5A) to convert the aircraft quickly to an aerial tanker. This system has an off-load capacity of 1,200 GPM and can be off-loaded into trucks, bladders, other containers, and in extreme emergencies, other aircraft.
    - Wet-Wing Defueling – A means of transferring fuel from fixed-wing aircraft fuel tanks to collapsible fabric tanks or tank semitrailers. This method allows the aircraft to carry an internal load of dry cargo plus aviation turbine fuel without requiring addition aircraft to provide fuel support.
    - External Loads. This method involves transporting petroleum in 500-gallon fabric drums using sling loads. Using helicopters, this method enables obstacles to be overcome that hinder other modes of transportation.

Petroleum Peculiarities. Fuels are lighter than water, and when mixed with water, the fuel will float on top of the water.

Petroleum fuels breathe. They expand as temperatures increase and contract as temperatures decrease. As the fuel expands due to high temperatures, light ends are lost. When heated fuel begins to cool and contract, water accumulates in the fuel through condensation.

PART D. CONFINED SPACE ENTRY

As a petroleum staff NCO a major and ongoing responsibility involves the vapor freeing and cleaning of petroleum storage tanks, railcars, and tank trucks. Safety is of the utmost importance when performing any operation dealing with petroleum and the various methods of storage. The following information concerns your general responsibilities and the training of personnel having to do with the federal regulations that govern tank cleaning operations.

Sources of hazards. Storage tanks, tank cars, and tank trucks which have been in service, may contain residues of dangerous materials, whether left over from the transportation of hazardous cargoes.

Forced air ventilation. Forced air ventilation shall be sufficient to keep the atmospheric concentration of flammable materials below 10% of the lower flammable limit (LFL) (or lower explosive limit (LEL), whichever term is used locally). Appropriate respirators will be provided and shall be used in addition to providing forced ventilation if the forced ventilation does not maintain acceptable respiratory conditions.

Attendant. The area supervisor shall designate an employee to maintain communication by employer specified means with employees working in tanks to ensure their safety. The attendant may not enter any permit entry confined space to rescue an entrant or for any other reason, unless authorized by the rescue procedure and, even then, only after calling the rescue team and being relieved by an attendant or another worker.

Communications and observation. Communications between attendant and entrant(s) shall be maintained throughout entry. Methods of communication that may be specified by the permit include voice, voice powered radio, tapping or rapping codes on tank walls, signaling tugs on a rope, and the attendant's observation that work activities such as chipping, grinding, welding, spraying, etc., which require deliberate operator control continue normally. These activities often generate so much noise that the necessary hearing protection makes communication by voice difficult.

Rescue procedures. Acceptable rescue procedures include entry by a team of employee-rescuers, use of public emergency services, and procedures for breaching the tank. The area permit specifies which procedures are available, but the area supervisor makes the final decision based on circumstances. (Certain injuries may make it necessary to breach the tank to remove a person rather than risk additional injury by removal through an existing manhole. However, the supervisor must ensure that no breaching procedure used for rescue would violate terms of the entry permit. For instance, if the tank must be breached by cutting with a torch, the tank surfaces to be cut must be free of volatile or combustible coatings within 4 inches (10.16 cm) of the cutting line and the atmosphere within the tank must be below the LFL.

Retrieval line and harnesses. The retrieval lines and harnesses generally required under this standard are usually impractical for use in tanks because the internal configuration of the tanks and their interior baffles and other structures would prevent rescuers from hauling out injured entrants. However, unless the rescue procedure calls for breaching the tank for rescue, the rescue team shall be trained in the use of retrieval lines and harnesses for removing injured employees through manholes.

Control of atmospheric hazards. A "used" tank shall be brought into areas where tank entry is authorized only after the tank has been emptied, cleansed (without employee entry) of any residues, and purged of any potential atmospheric hazards.

Permits. An entry permit valid for up to 1 year shall be issued prior to authorization of entry into used tank trailers, dry bulk trailers or trucks. In addition to the pre-entry cleaning requirement, this permit shall require the employee safeguards specified for new tank fabrication or construction permit areas.

Authorization. Only the area supervisor may authorize an employee to enter a tank trailer, dry bulk trailer or truck within the permit area. The area supervisor must determine that the entry permit requirements have been met before authorizing entry.

LESSON 1

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. Which of the following is a duty or supervisory requirement of a petroleum staff NCO?
   A. Conduct sampling and gaging.
   B. Operate tank vehicles.
   C. Perform PMCS on equipment.
   D. Training combat arms personnel to perform as fuel handlers.

2. How do jet fuels differ from aviation gasoline?
   A. Aviation gasoline does not contain lead.
   B. Jet fuels do not contain lead.
   C. Jet fuels are red in color.
   D. Aviation gasoline is red in color.

3. What may diesel fuels be used in place of?
   A. Type I MOGAS.
   B. Type II MOGAS.
   C. Light burner oils.
   D. Jet fuels.

4. What can tank cars be used to supplement in moving petroleum products when rail facilities are available?
   A. Coastal tankers.
   B. Tank vehicles.
   C. Pipelines.
   D. Ocean going tankers.

5. When heated fuel begins to cool and contract, what accumulates in the fuel?
   A. Water.
   B. Sediment.
   C. Rust.
   D. Dust.

LESSON 2

IMPLEMENT A PETROLEUM FIRE AND SAFETY PROGRAM
Critical Task:
101-519-3310

OVERVIEW

The operation of a petroleum facility is extremely hazardous however there are a number of precautions which can be taken to reduce the possibility of a serious incident occurring.

Lesson Description:

During this block of instruction we will discuss how we can prevent loss of life and property caused by fire and safety hazards through the application of proper safety procedures.

Terminal Learning Objective:

Action: Identify methods of controlling or eliminating vapor formation, sources of ignition, and static electricity; identify the health hazards associated with handling petroleum products; and identify first aid procedures for POL accidents.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

Because of the very nature of petroleum products, there are many hazards involved in the handling and storing them. The greatest and most obvious is fire. However, we must not overlook the many health and safety hazards in addition to fire that are also present in petroleum facility operations.

PART A - CLASSES OF FIRES

There are four main classes of fire. They are based on the combustion characteristics of the material that is ignited:

- **Class A fire** - These fires occur in combustible materials such as bedding, mattresses, books, cloth, wood, and paper. The remains of these fires are charred embers.
- **Class B fire** - These fires occur in flammable liquids such as gasoline, jet fuels, kerosene, oils, paints, turpentine, grease, and tar.
- **Class C fire** - These are electrical fires, and can occur in wiring, electrical switches, and generators.
- **Class D fire** - These involve combustible chemicals and metals such as sodium, potassium, titanium, magnesium, zirconium, and phosphorous.

PART B - NATURE OF FIRE

Three elements are required to start and sustain a fire:

- Heat (source of ignition) such as sparks, open flame, or static electricity.
- Oxygen (air) which is always present.
- Fuel (vapors) which in petroleum operations include items such as MOGAS, diesel fuel, and JP4.

By removing or preventing the presence of any one of these elements, a fire can be prevented or extinguished.

PART C - VAPORS

Vapor characteristics. In a fire, it is the vapor that actually burns.

- Vapors are heavier than air and collect in low areas.
- Vapors will hang low to the ground and spread over large areas.
- On hot humid days vapors are produced in greater volume.
- When vapors are allowed to collect, flash backs can occur as the vapors come in contact with a heat source and the heat travels back to the source of the vapors, causing a fire and possibly an explosion.
- A 1 to 8 percent ratio by volume of vapors when mixed with air will form an explosive range. An explosive range is that point where the vapor and the air mixture will burn. A mixture above 8 percent is too rich in vapors and will not ignite. A mixture below 1 percent is too lean in vapors (too rich in air) and will not ignite.

Control of vapors.

- Empty containers (5 gallon, 55 gallon) that have previously contained petroleum product are more dangerous than full ones. Fill the containers as soon as possible, or when stored empty, ensure caps and bungs are on tight.
- Store containers that have fuel in them or containers that previously contained product in a safe area.
- Do not overfill, or fill containers at too fast a rate as vapors will be displaced to the atmosphere and become a hazard.
- Repair leaking pipes and containers as soon as possible.
- Clean up spills immediately (as long as the contamination is present, vapors are a hazard).

Sources of ignition. A source of ignition can be a flame, spark, or other heat generating mode. Some of the most common causes of heat are:

- Smoking material (i.e., matches, lighters, and cigarettes).
- Sparks (i.e., static electricity, moving fuel, moving equipment, welding and cutting).
- Spontaneous combustion (oxidation and chemical reaction).

As a minimum, you should post “No smoking with 50 feet” signs in critical areas of the facility and enforce the rule. Other precautions should also be observed/practiced, such as:

- Designate all smoking areas at least 100 feet away from refueling operations.
- In very hazardous areas, collect smoking materials at the entrance to the facility and keep them in separate airtight containers at the entrance to the facility.
- Welding and grinding should only be done under controlled conditions (i.e., fire department notified, vapor freeing completed, or when product in a pipeline is moving).
- Electrical equipment must be maintained in safe working condition (i.e. approved electrical fixtures), and grounding and bonding procedures must be utilized to minimize static electricity and arcing.
- Ensure dispensing and receiving equipment is bonded and grounded.
- Bottom load whenever possible, as top loading generates static electricity and splashing while filling.
- Ensure that all personnel involved in gaging activities are trained to always bond themselves before gaging storage tanks and tank vehicles.
- Before gauging and sampling, allow a minimum of thirty minutes time for the static charge to dissipate from fuel receipts.
- Always ensure that all fire extinguishers are in place and are operational.

PART D - INSPECTING FIRE EXTINGUISHERS

Fire extinguishers must be inspected at least monthly for serviceability. Any fire extinguisher found unserviceable or discharged should be taken to the fire station for repair or recharging. The areas on the extinguisher to be checked are:

- In the body, check for dents, cracks, and excessive rust.
- In the hose, check for dry rot, cracks, and missing parts.
- Ensure that the seal is intact.
- Ensure that the pressure gauge is in the “green”, fully charged position.

PART E - FIRE EXTINGUISHERS

There are four types of fire extinguishers: water, carbon dioxide, dry chemical, and Halon.

- **Water extinguishers** (pumped or pressurized) - May be used for Class A fires. This type of extinguisher is used to control the heat. DO NOT USE for electrical, combustible metal, or flammable liquid fires.
- **Carbon dioxide extinguishers** - May be used on electrical, chemical, or petroleum fires (Class B, C, and D). This type of extinguisher controls the fire by diluting the air, thus choking the fire.
- **Dry chemical extinguishers** - May be used on Class B, C, and D fires. This type of extinguisher is used to smother the fire.
- **Halon extinguishers** - Are effective against Class A, B, and C fires. The Halon extinguisher works chemically to stop the combustion process. The agent is discharged as a liquid, and becomes a gas when it contacts the fire.

PART F - PRINCIPLES OF EXTINGUISHING FIRES

There are three methods used to control and extinguish a fire:

- **Control the heat** - Cooling or reducing the temperature of the fire below the ignition point will remove the source of heat and control the fire.
- **Control the air** - By reducing or eliminating oxygen in the air, combustion will no longer be supported. Air is diluted by reducing the percentage of oxygen to the point where it will no longer support combustion. If all air is cut off at the surface of combustion, a fire is smothered.
- **Control the fuel** - Removing the combustible material or shutting off the flow of fuel will control the fire.

PART G - GENERAL PROCEDURES TO EXTINGUISH A FIRE

- Sound the alarm.
- Call the fire department.
- Determine the class of fire (A, B, C, D).
- Select the appropriate fire extinguisher.
- Stand upwind so that the flames and smoke blow away from you.
- Point the fire extinguisher nozzle at the base of the fire.
- Move the nozzle from side to side until the fire is extinguished.

PART H - FIRE FIGHTING TOOLS

There are several types of tools used to fight ground cover fires.

- **Rakes** - Rakes are used to rake ground cover and dirt, and to chop light growth. The types of rakes used are as follows:
  - McLeod.
  - Council.
  - Rich Tool.
- **Fire Swatters** - The fire swatter, or flapper, is used to beat the flames out. It may be effective on small fires, but could cause a fire to spread due to flying embers.

PART I - FIRE FIGHTING SAFETY TECHNIQUES

The following techniques are used when fighting a ground cover fire:

- Always know the current escape routes.
- Safety may be gained by moving into the burned area (as a last resort only).
- Always work a fire on a slope from below.
- Always work downwind of a fast-moving fire.
- Use caution in felling or cutting trees.
- Pace yourself; ground cover fires usually require long periods of hard work.
- Stay with your crew.
- When working on the fire line, stay 10-15 feet from the nearest co-worker.
- Post a lookout to watch for a change in the fire's behavior.
- Work as a crew; this is not a contest to see who can cut the most line.

PART J - HEALTH HAZARDS

Dusts. Dust results from the grinding, scraping, sanding, or sandblasting of tanks especially in the case of tanks that have held leaded fuels. Lead dust can also result from burning sludge taken from leaded gasoline storage tanks. Lead, manganese, mercury, arsenic, and any compound made of these items can produce dust that is poisonous to the body. Silica dust resulting from the operation of grinding and polishing machines or sanding and sandblasting operations can be fibrous producing, causing injury to the lungs. Nuisance dusts may cause inflammation and respiratory ailments.

Gases and Vapors. The terms "gas" and "vapor" are often used to mean the same thing, although there is a difference. A gas exists as a gas at ordinary temperature and pressure. A vapor is a gas-like form of a substance that is ordinarily a liquid. Gasses and vapors are divided into four groups. Poisonous or toxic gasses and vapors have various effects on the body. They may injure or destroy the visceral organs, the blood-forming system, tissues, or bones. Examples of poisonous gasses or vapors are hydrogen sulfide found in crude oil of high sulfur content and tetraethyl lead vapor from leaded gasoline. You must avoid exposure to them at all times. Simple asphyxiates are gasses and vapors that keep the lungs from getting air. In other words, they replace oxygen that is in the air. Anesthetic gasses and vapors have a narcotic effect, depressing the central nervous system to the point where respiratory failure may occur. All hydrocarbon vapors have this effect. Irritant gasses and vapors inflame the lungs and respiratory tract. They may cause

pneumonia and other pulmonary diseases or make the victim more susceptible to them. Most flammable gasses and vapors are irritants whether or not they are poisonous or narcotic.

PART K - FIRST AID FOR SITUATIONS INVOLVING PETROLEUM PRODUCTS

After swallowing petroleum products:

- Keep the victim calm, if possible.
- DO NOT INDUCE VOMITING.
- Get the victim to medical help immediately.

In the eyes:

- Flush the eyes for several minutes with clean water to try to remove the product.
- Cover the eyes for several minutes with a sterilized dressing, and prevent the victim from rubbing the eyes.
- Seek medical help immediately.

On the clothing:

- Remove the clothing, after soaking the (fuel soaked) clothing with water. (This should prevent sparking).
- Wash with soap and water and rinse thoroughly.
- Get to medical help, if needed.

PART L - COMPLETION PROCEDURES FOR AN ACCIDENT REPORT

The immediate supervisor of an individual involved in an accident prepares the appropriate forms and submits them to the department safety officer after the accident occurs. Accident reports are not delayed pending statements of charges, reports of survey, or line-of-duty determinations.

Military Personnel. When military personnel are involved in an accident, the following procedures are followed: A sick slip is prepared and forwarded in duplicate when personnel are treated for minor injuries on duty and report for duty prior to midnight the day following the accident. An accident report is prepared and forwarded in quadruplicate when military personnel are injured on duty and are unable to report for duty by midnight of the day following the injury. In case of a fatality, two additional copies of the accident report are required.

Civilian Personnel. If the person involved in an accident is not military personnel but civilian personnel, a record of injury is prepared and forwarded in duplicate when civilian personnel are injured on duty and unable to report for duty on the next regular working day. Also, an accident report is prepared and forwarded in quadruplicate when civilian personnel are injured on duty and are unable to report for duty on the next regular working day. In case of a fatality, two additional copies of the accident report are required.

LESSON 2

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. Class C fires involve
   A. Combustible material.
   B. Combustible chemicals and metals.
   C. Flammable liquids.
   D. Electrical items.

2. Personnel involved in gaging activities must be trained to always _____ before gaging storage tanks and tank vehicles.
   A. Have the wind at their back.
   B. Bond themselves to the tank.
   C. Ground themselves.
   D. A and B.

3. After a fire is discovered and the alarm is sounded you should
   A. Select a fire extinguisher.
   B. Call the fire department.
   C. Determine the class of the fire.
   D. Move all vehicles from the area.

4. When working on a fire line you should stay _____ feet from your nearest co-worker.
   A. 5 –10.
   B. 10-15.
   C. 15-20.
   D. 20 -25

5. In a petroleum facility lead dust can result from
   A. Burning sludge taken from leaded gasoline storage tanks.
   B. Sandblasting of the outer skin of a leaded gasoline storage tank.
   C. Welding repair operations to a leaded gasoline storage tank.
   D. All of the above.

LESSON 3

THEATER OPERATIONS

OVERVIEW

Distribution of fuel to U.S. Army, Air Force, Navy, and Marine organizations and allied forces in a theater of operations requires knowledge of the types of U.S. Army units responsible for the distribution of petroleum.

Lesson Description:

During this block of instruction we will discuss how U.S. Army units distribute petroleum to military organizations and allied forces in a theater of operations.

Terminal Learning Objective:

Action: Acquire knowledge on distributing fuel to U.S. Army, Air Force, Navy, and Marine organizations, and allied forces in a theater of operations, the types of U.S. Army units responsible for the distribution of petroleum in a theater of operations, and environmental considerations.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

In any major conflict, the anticipated tonnage associated with bulk petroleum products will account for over 50 percent of the total tonnage shipped into a theater of operations. The petroleum distribution system must be flexible enough to meet the changing priorities of a fluid battlefield, and reallocate resources as necessary. Adjustments must be made to meet variations in intensity of warfare. As a petroleum NCO, understanding the petroleum distribution system will assist you in planning for support.

PART A - DISTRIBUTING FUEL IN A THEATER OF OPERATIONS

The flow of fuel requirements begins with the submission of fuel forecasts from consuming units. Forecasted fuel is then distributed as far forward as possible to satisfy the most forward needs first and then and only then is any fuel placed in storage.

The using unit submits their forecast through the S-4 channels to the Division Material Management Center (DMMC). The DMMC prepares the division forecast from the main support battalion (MSB), forward support battalions (FSB), and Aviation Brigade (AVN BDE) units logistics report and forwards the requirements to the Corps Material Management Center (CMMC).

The CMMC consolidates all the requirements from other divisional and nondivisional commands within the Corps and forwards the entire corps forecast to the Theater Materiel Management Center (TAMMC).

PART B - UNITS RESPONSIBLE FOR DISTRIBUTION

Communications Zone. The communications zone (COMMZ) is the rear part of the theater of operations and contains the lines of communication, establishment for supply and evacuation, and other agencies required for the immediate support and maintenance of the field forces. The Joint Petroleum Office (JPO) consolidates theater petroleum requirements for all services. Prepares the “slate” (request for delivery of fuel byproduct, quantity, and location) and forwards to Defense Energy Support Center (DESC). The Petroleum Group operates the bulk petroleum distribution system extending from ports of entry through the COMMZ and as far into the combat zone as practicable (refer to Figure 3-1).

Combat Zone. The Combat Zone is the area required by combat forces for the conduct of operation. The territory forward of the Army rear area boundary.

Corps Area. The Corps Support Command (COSCOM), located in the corps area, provides combat service support to Army forces in the corps area: direct support (DS) and general support (GS) to nondivisional units, and GS to divisional units.

- Petroleum Supply Battalion. Provides DS and GS petroleum in the corps and divisional areas.
- Petroleum Supply Company. Receives, stores, and issues bulk petroleum to divisional and nondivisional DS companies on a 24-hour basis. Receives fuel from the petroleum pipeline and terminal operating company. Issues fuel to divisional and nondivisional DS supply and services companies and aviation brigade and/or battalions. The capabilities and/or responsibilities of this organization are:
  - Install, operate, and retrieve approximately 10 miles of collapsible hoseline per day.
  - Maintain prescribed reserve stock supply.
  - Provide limited mobile filling station service.
  - Operate two to four supply points at different locations. Storage capacity includes twenty-eight 10,000-gallon collapsible tanks and twenty-four 50,000-gallon collapsible tanks for a total of 1,480,000-gallon capacity.
- Medium Truck Company (Petroleum). Provides transportation for bulk petroleum between GS and DS petroleum organizations. The capabilities and/or responsibilities of this organization are:
  - Assigned sixty 5,000-gallon tanker trucks.
  - Can line haul 450,000 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and two round trips completed each day.
  - Can local haul 900,000 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and four round trips completed each day.
  - Has storage capacity of 300,000 gallons in the 5,000-gallon tanker trucks.

COSCOM Support Group. Provide area supply and services to units passing through or located in its assigned corps areas.

- Supply and Services Battalion. Provides supplies and field services on a DS basis to nondivisional units passing through or located in the corps area.
- Supply and Services (S&S) Company DS. Provides direct support petroleum supply to non divisional units located in or passing through the corps area. Receives fuel from the Petroleum Supply Company. The capabilities and/or responsibilities of the organization are:
  - Storage capacity of 120,000 gallons in two Fuel System Supply Points (FSSP).
  - Assigned nine 5,000-gallon tankers.
  - Can line haul 81,900 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and two round trips completed each day.
  - Operate mobile filling stations when required.

Divisional Area. The Division Support Command (DISCOM), located in the divisional area, provides division-level combat service support (except COMSEC logistics, construction, financial services, legal services, and public affairs) to all organic and attached elements of the division. Subordinate elements of the DISCOM are the main support battalion (MSB) and three forward support battalions (FSB).

- MSB. Provides division-level combat service support to all organic and attached elements of the division. The MSB provides direct support to units located in the division support area (DSA) and backup to the FSB.
- Supply and Services (S&S) Company DS. Provides division-level supply and services to all organic and attached elements of the division. The S&S Company provides direct support to units located in the DSA and backup to the FSB Supply Company. Receives fuel from petroleum Supply Company. The capabilities and/or responsibilities of this organization are:
  - Storage capacity of 304,000 gallons in two fuel system supply points (FSSP), two Forward Area Refueling Equipment (FARE) systems, thirty-four 5,000-gallon tanker trucks, and two Tank and Pump Units (TPU).
  - Can line haul 258,600 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and two round trips completed each day.
  - Can local haul 517,200 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and four round trips completed each day.
  - By doctrine, can handle only ground fuel (MOGAS and diesel).
- Forward Support Battalion (FSB). Provides brigade level combat service support to all organic and attached elements of the brigade.
- Supply Company. Provides brigade-level petroleum to all organic and attached elements of the brigade. Receives fuel from the Petroleum Supply Company and backup from the MSB AMS Company. The capabilities and/or responsibilities of this organization are:
  - Storage capacity of 53,600 gallons in ten 5,000-gallon tanker trucks and two tank and pump units.
  - Can line haul 78,600 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and two round trips completed each day.
  - Can local haul 157,200 gallons of fuel each day. This is based on an assumption of 75 percent vehicle availability and four round trips completed each day.
  - By doctrine, handle only ground fuels (MOGAS and diesel) and single fuel on the battlefield (JP8/MOGAS).
- Combat Aviation Brigade (CAB). Provides DS petroleum to the units organic to the CAB. The CAB receives fuel directly from the COSCOM by means of either hoselines or tanker trucks from the Petroleum Supply Battalion. Capabilities - The CAB provides petroleum to its subordinate units using either the air transportable 500-gallon collapsible drums, heavy expanded mobility tactical trucks (HEMTTs) or the tank and pump units. The CAB will normally form forward area refueling points in the division forward area to minimize the time required to replenish the aviation logistics necessary to continue combat operations.
- Light Division, Division Support Command (DISCOM). In the light divisions, the DISCOM fulfills its petroleum DS mission through its organic Supply and Transportation (S&T) Battalion. The S&T Battalion establishes refuel points in the DSA and forwards in the BSA to provide fuel on an area basis. It will use the organic Truck Company to refuel the refueling points via the 5,000-gallon tankers organic to the company.

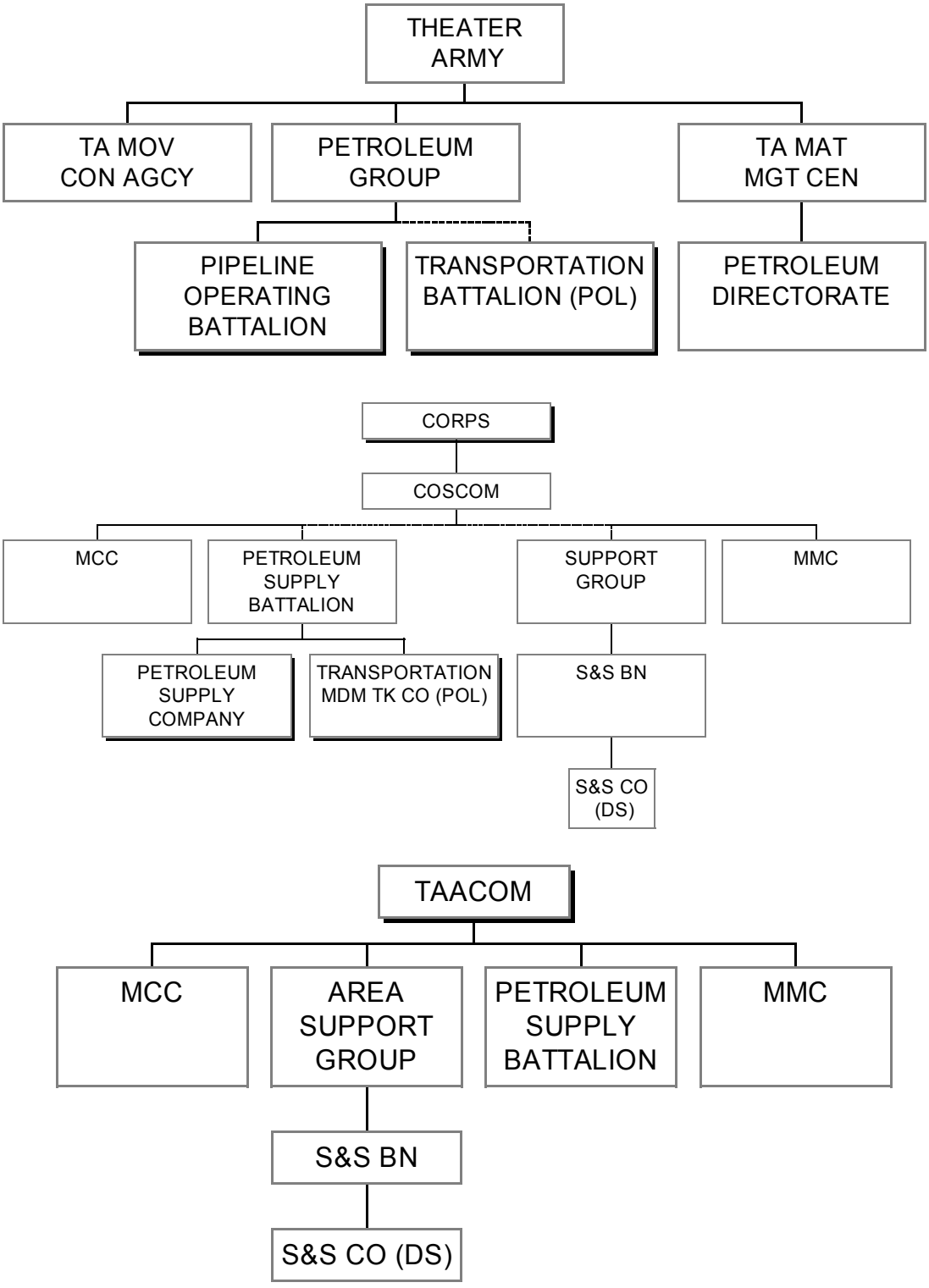

Figure 3-1, Petroleum Organization in a Theater of Operations.

LESSON 3

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. What does the flow of fuel requirements begin with?
   A. Satisfying the most forward needs first.
   B. Placing fuel in storage.
   C. The submission of fuel forecasts from consuming units.
   D. Consolidation of all requirements by the CMMC.

2. What is the function of the petroleum Supply Company in the Corps Area of the Combat Zone?
   A. To receive, store, and issue bulk petroleum to divisional and nondivisional DS companies on a 24-hour basis.
   B. To provide transportation for bulk petroleum between GS and DS petroleum organizations.
   C. To provide DS and GS petroleum in the corps and divisional areas.
   D. To provide direct support petroleum supply to non divisional units located in or passing through the corps area.

3. Which of the following is a capability or responsibility of the Supply and Services Company DS of the COSCOM support group?
   A. Can line haul 81,900 gallons of fuel each day.
   B. Has storage capacity of 300,000 gallons in the 5,000-gallon tanker trucks.
   C. Can operate two to four supply points at different locations.
   D. Assigned sixty 5,000-gallon tanker trucks.

4. By doctrine, the Divisional Area Supply Company handles only what kind of fuel?
   A. MOGAS.
   B. JP8.
   C. Diesel.
   D. Ground fuels and single fuel on the battlefield.

5. Where does the Divisional Area Combat Aviation Brigade receive fuel from?
   A. DISCOM.
   B. COSCOM.
   C. S&S.
   D. TPU.

LESSON 4

DETERMINE PETROLEUM REQUIREMENTS

OVERVIEW

During petroleum operations, various mathematical techniques are used in computing numerical quantities.

Lesson Description:

During this block of instruction we will discuss how to compute the numerical quantities required during petroleum operations.

Terminal Learning Objective:

Action: Acquire knowledge on various mathematical techniques used in computing requirements for petroleum operations.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

One of the most important functions of a petroleum manager is the adequate forecasting of petroleum requirements. Without an accurate forecast of requirements, the orderly flow of petroleum products is threatened. There are five methods for computing petroleum requirements. They are listed in order from best to worst: historical data method, combat profile, fuel consumption unit (STANAG 2115), equipment consumption, and gallons per person per day.

PART A - HISTORICAL DATA METHOD

The historical data method is the best method and considers the following factors: same vehicles, same distances, and similar resupply source, weather, terrain, etc. Record keeping for actual consumption during major training exercises, tactical marches, etc., is essential for correct calculations using this method.

PART B - COMBAT PROFILE

The combat profile method tracks combat vehicles only. Referring to Tables 4-1 and 4-2, you must use FM 101-10-1/2, Table 2-12 (line item number, fuel NSN, equipment type, etc.), to obtain consumption rates and table 2-14 (geographical usage rates). Add together the subtotals and multiply by the number of vehicles to get the total fuel requirement.

	CONSUMPTION FACTOR		USAGE RATES		SUBTOTAL
IDLE		X		=	
CROSS COUNTRY		X		=	
SECONDARY ROADS		X		=	

PART C - FUEL CONSUMPTION UNIT

The NATO STANAG 2115 method is a standard used by NATO in determining fuel consumption. The fuel consumption of unit (FCU) considers combat, terrain, and climate. You must use tables found in FM 101-10-1/2, table 2-12 (line item number, fuel NSN, equipment type, etc.) and table 2-13 (geographical usage rates). You must use table 3-1 in FM 10-13 (Supply and Service Reference Data (combat, terrain, and climate). Refer to Tables 4-3 and 4-4.

COMBAT CONSUMPTION RATE		QUANTITY OF EQUIPMENT		USAGE RATE		TOTAL GALLONS
	X		X		=	

TOTAL GALLONS		COMBAT FACTOR		TERRAIN FACTOR		CLIMATE FACTOR		FCU
	X		X		X		=	

PART D - EQUIPMENT CONSUMPTION

When using the equipment consumption method, you must know what equipment is to be used (TOE, TDA, or equipment listing) and must use tables found in FM 101-10-1/2, tables 2-12 (line item number, fuel NSN, equipment type, etc.) & 2-13 to obtain equipment usage rates. Geographical area (FM 101-10-1/2, Table 2-14) will also factor in the equipment consumption method. This method may be used at all levels. Here is an example:

Combat Consumption Rate		Quantity Equipment		Area Usage		Bulk Fuel Rate Requirement
	X		X		=	

PART E - GALLONS PER PERSON PER DAY

The least desirable or accurate method is the gallons per person per day method and it is primarily used for early planning stages and for funding. You must use FM 101-10-1/1 and FM 10-13, Table 3-2 (types of fuel, geographic consumption rates). Refer to Table 4-5.

TROOP STRENGTH	X	THEATER CONSUMPTION	=	ESTIMATE PETRL REQ

Table 2-12. Combat Consumption Rates for Bulk Fuels (Excerpt)

LI	EI NSN	SNSN CMD	FUEL NSN	EQUIP TYP	CONSUMP CD	IDL/AV	XCNTRY	2NDRDS	NOMENCLATURE	MULTIFUEL
Z38195	2302 01 123 1602	K	9140 00 273 2377	WV	K	0.1367			LT ARMD VEH M1047	
Z44650	2340 Z4 465 0001	K	9130 00 160 1818	WV	K	0.0249			MOTORCYCLE XM1030	
Z46347	1520 01 125 5476	H	9130 00 256 8613	AV	H	39.90			CPTR RECON OH-58D	

Figure 4-1, Combat Consumption Rates for Bulk Fuels (FM 101-10-1/2).

Table 2-14. Daily Equipment Usage Rates for Tracked Combat Vehicles (Excerpt)

		KOREA			EUROPE			ALASKA			PANAMA CANAL ZONE			CONUS		
LIN	NOMENCLATURE	IDLE/ AV	XCNTRY	2NRDS	IDLE/ AV	XCNTRY	2NRDS	IDLE/ AV	XCNTRY	2NRDS	IDLE/ AV	XCNTRY	2NRDS	IDLE/ AV	XCNTRY	2NRDS
A93125	M551 ARAAV 152MM	6.0	6.5	5.0	6.0	6.5	5.0							4.8	7.7	4.6
C76335	CAV FGT VEH XM3	3.0	5.5	5.5	3.0	5.5	5.5	3.0	5.5	5.5	3.0	5.5	5.5	3.0	5.5	5.5
D10726	M125A1 CARR 81MM	4.1	5.0	5.0	4.0	5.0	5.0	2.9	0.5	3.6				5.0	3.8	1.6

Figure 4-2, Daily Equipment Usage Rates for Tracked Combat Vehicles (FM 101-10-1/2).

Table 2-13. Daily Equipment Usage Rates for Other than Tracked Combat Vehicles (Excerpt)

Equipment Type Code	Nomenclature	Alaska	Panama Canal Zone	CONUS	Europe	Korea
AB	Amphibious	15H	20H	10H	12H	10H
AV	Aviation	4H	4H	4H	4H	4H
CE	Construction	15H	20H	10H	12H	10H

Figure 4-3, Daily Equipment Usage Rates for other than Tracked Vehicles (FM 101-10-1/2).

Table 3-1. Additional Situations

Situation	Multiplication Factor
Combat	
Attack	2.5
Delay / withdrawal	2.0
Defense	1.5
Terrain	
Flat	1.0
Hilly	1.2
Mountain	1.5
Cross-country	1.5
Climate	
Hot	0.9
Temperate	1.0
Cold	1.3

Figure 4-4, Additional Situations (FM 10-13).

Table 3-2. Planning Factors

Type of Fuel	Consumption Rates (gallons per man per day)			
	Europe	Pacific	Alaska	Canal Zone
MOGAS	1.5821	1.0606	2.4821	2.4273
Diesel (including diesel used for heating)	5.9217	2.1566	2.6361	0.8738
JP-4 (jet fuel)	2.2111	4.1830	7.8115	1.6991
JP-4 and JP-5				

Figure 4-5, Planning Factors (FM 10-13).

LESSON 4

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. What is considered the best method for computing petroleum requirements?
   A. Historical data method.
   B. Equipment consumption method.
   C. Gallons per person per day method.
   D. Fuel consumption unit method.

2. What is essential for correct calculations using the historical data method for computing petroleum requirements?
   A. FM 101-10-1/2, table 2-12.
   B. STANAG 2115.
   C. Record keeping for actual consumption during major training exercises, tactical marches, etc.
   D. FM 10-13, table 3-2.

3. What factors does the fuel consumption of unit method for computing petroleum requirements consider?
   A. Troop strength and theater consumption.
   B. Equipment and geographical area.
   C. Same vehicles, same distances, and similar resupply source.
   D. Climate, combat, and terrain.

4. What is considered the least desirable or accurate method of computing petroleum requirements?
   A. Equipment consumption method.
   B. Combat profile method.
   C. Historical data method.
   D. Gallons per person per day method.

5. Which of the following is true of the equipment consumption method of computing petroleum requirements?
   A. This method tracks combat vehicles only.
   B. This method may be used at all levels.
   C. This method is a standard used by NATO.
   D. This method is primarily used for early planning stages and for funding.

LESSON 5

PREPARE ACCOUNTING SUMMARIES

OVERVIEW

Petroleum accountability includes preparing bulk petroleum accountability documents, determining allowable and actual losses, describing implementation of required adjustment actions, and computing volume corrections.

Lesson Description:

During this block of instruction we will discuss how to prepare bulk petroleum accountability documents, determine allowable and actual losses, describe implementation of required adjustment actions, and compute volume corrections.

Terminal Learning Objective:

Action: Acquire knowledge on preparing bulk petroleum accountability documents, determining allowable and actual losses, verifying implementation of required adjustment actions, and compute volume corrections.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

Until bulk petroleum products are consumed, they must be handled many times. Accurate records for receipts, storage, issue, and shipment of petroleum products must be maintained. As a petroleum manager, your duties will require supervising and reviewing accountability procedures. Accountability is necessary in determining the quantities of petroleum products on hand and for the verification of quantities received and issued.

PART A - PETROLEUM ACCOUNTABILITY

Procedures to properly manage, control, safeguard, and account for petroleum products must be pursued and involve prompt and accurate identification of shortages and overages. Take action to identify the causes of the deviation.

Organizations handling bulk fuels will establish, maintain, and provide an SOP to operating personnel for handling and accounting for bulk fuel by the particular organization. Organizations will train petroleum handling personnel to ensure that the safe and proper procedures are followed. All storage tanks greater than 10,000 gallons will have a certified capacity table. Certification of capacity table for tanks of 10,000 gallons or less is optional.

PART B - PREPARING BULK PETROLEUM ACCOUNTABILITY DOCUMENTS

Soldiers storing or transferring Class III products must accurately account for receipt, issue, and stocks on hand for both bulk and packaged products. The biggest challenge in accounting for Class III products (particularly bulk products) is adequately measuring them. Illustrations and procedures for completing the forms listed below can be found in AR 710-2-1. Petroleum accounting records include:

- Daily status report. Soldiers operating a Class III facility, submit reports showing quantities of product received, issued, and on hand.
- DD Form 1348-1, DOD Single Line Item Release/Receipt Document. Soldiers receiving petroleum into a Class III facility use this form to record the receipt. FM 10-69 (Petroleum Supply Point and Equipment Operations) contains the procedures required to properly complete this form.
- DA Form 2765-1, Request for Issue or Turn-In. Customers use this form to request packaged and bulk products or to turn in excess cans, drums, or supplies. FM 10-69 (Petroleum Supply Point and Equipment Operations) contains the procedures required to properly complete this form.
- DA Form 3643, Daily Issues of Petroleum Products. This form is the basic accountability record for receipts and issues at a supply point. DA Pam 710-2-1 contains the procedures required to properly complete this form.
- DA Form 3644, Monthly Abstract of Issues of Petroleum Products and Operating Supplies. Soldiers doing accountability post summarized information from DA Form 3643 to this form to show total monthly issues and receipts. AR 710-2-1 contains the procedures required to properly complete this form.
- DA Form 4702-R, Monthly Bulk Petroleum Accounting Summary (MBPAS). Units use this form to report all losses or gains revealed by monthly inventories. DA Pam 710-2-1 (Using Unit Supply System Manual Procedures) contains the procedures required to properly complete this form.
- DA Form 2064, Stock Record Card. Personnel operating Class III storage facilities must establish a stock record card or property record for each type or grade of product. They use this form to post accountable records. AR 710-2-1 contains the procedures required to properly complete this form.
- Stock/property records. Either DA Form 1296 or DA Form 3-8 can be used to keep day-by-day stock/property records that reflect where and how much of each product is on hand at a storage facility.
- DA Form 3853-1, Innage Gage Sheet (Using Innage Tape and Bob). This form is used to record physical inventories of bulk fuel. AR 710-2-1 contains the procedures required to properly complete this form.

PART C - DETERMINING ALLOWABLE AND ACTUAL LOSSES

Some losses or gains are to be expected when handling and storing volatile products. Allowable loss and gain percentages prescribed in the regulation are considered sufficient to accommodate expected normal product losses and gains. Handling loss or gain of jet fuels, AVGAS, gasoline, and all other products are allowable up to the extent of the actual loss or gain allowances. Losses or gains for jet fuels (excluding JP-8), AVGAS, and all other types of gasoline as 1 percent of the total of the opening inventory, plus receipts for the month.

Losses or gains for all other petroleum products must be computed as ±1/2 of 1 percent of the total opening inventory, plus the receipts for the month. Additional information on the Monthly Bulk Petroleum Accounting Summary (MBPAS), including procedures for completing required forms can be found in AR 710-2-1.

- In instances where the total loss of a specific bulk petroleum product may be less than the loss allowance for that product, only the actual loss will be allowable.
- For actual losses that exceed the stated allowance and the entire loss has a monetary value of $500 or more, a report of survey is required.
- Actual losses exceeding the allowable, but having a total monetary value less than $500 will require a causative research to be initiated. A copy of either the report of survey or causative research will be attached as supporting documentation to the MBPAS.

PART D - ADJUSTMENT OF ACCOUNTABLE RECORDS

The DA Form 1296 (Stock Accounting Record) for bulk petroleum products will be adjusted by using DA Form 4702-R (MBPAS) for all losses and gains revealed by the monthly inventory. The accountable officer will complete the MBPAS, assign it a voucher number, and post it to the respective accountable records within 3 working days of the last day of the month for the report.
The MBPAS is used to reflect the on-hand inventory and to make adjustments to the accountable stock records.

- Losses due to spillage or contamination will be documented by the accountable/responsible officer for quantities over 25 gallons.
- The documentation of loss will be attached to the MBPAS as a supporting document to adjust the accountable records.
- Adjustments to product inventories are required for blending, or regarding actions as follows:
  - The accountable/responsible officer will prepare a statement stating the quantities of all products blended/regraded during the month and the reason for action.
  - The statement and a copy of the proper laboratory report are attached to the MBPAS as supporting documents.
- The MBPAS upon completion will be forwarded to the approving authority, who may disapprove any item on the MBPAS. If the approving authority disapproves an item, the initiation of a report of survey is required.
- The MBPAS with all supporting documents (receipts and issues) will be retained in an active file for 1 year and inactive file for 2 years.

PART E - COMPUTING VOLUME CORRECTIONS

Use the volume correction factor to correct fuel volume observed at temperatures other than 60° F. Do this after obtaining the API gravity reading at 60° F and the average temperature of product in the tank.

- Volume correction of quantities less than 3,500 gallons is optional.
- Correct the volume of residual fuel (FO #4, FO #5, FO #6) regardless of measured quantity.
- Volumes that equal or exceed 3,500 gallons must be corrected. Use the volume correction factors in ASTM tables 5B and 6B for petroleum products other than JP4.
  - ASTM Tables 5A and 6A will be used for JP4.
  - Use ASTM Tables 52, 53B, and 54B to correct measured volumes to gallons at 15 degrees Celsius.

LESSON 5

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. What kind of storage tanks need to have a certified capacity table?
   A. All storage tanks of 10,000 gallons or less.
   B. All storage tanks greater than 10,000 gallons.
   C. All storage tanks.
   D. Certified capacity tables are optional.

2. What is the biggest challenge in accounting for Class III products?
   A. Completing the daily status report.
   B. Completing the MBPAS.
   C. Training petroleum handling personnel to ensure that safe and proper procedures are followed.
   D. Adequately measuring the products, particularly bulk products.

3. What is required when actual losses of petroleum product exceed the stated allowance and the entire loss has a monetary value of $500 or more?
   A. A report of survey.
   B. A causative research.
   C. Stock and property records.
   D. Request for Issue or Turn-In.

4. What is the MBPAS used for?
   A. To record the receipt of petroleum into a Class III facility.
   B. To request packaged and bulk products or to turn in excess cans, drums, or supplies.
   C. To reflect the on-hand inventory and to make adjustments to the accountable stock records.
   D. To post accountable records.

5. When should you correct fuel volume using the volume correction factor?
   A. When losses or gains are less than ±1%.
   B. When losses or gains exceed ±1%.
   C. When volume quantities are less than 3,500 gallons.
   D. When volumes observed at temperatures other than 60°F equal or exceed 3,500 gallons.

LESSON 6

IMPLEMENT A PETROLEUM ENVIRONMENTAL STEWARDSHIP PROGRAM
Critical Task:
101-519-3312

OVERVIEW

The U.S. Army and other services are highly mechanized and use thousands of barrels of petroleum, oils, and lubricants. In order to supply petroleum products to using units, we must operate loading and unloading facilities for ships, barges, tank trucks, rail tank cars, as well as operate pipelines and storage facilities. Every time a product is handled a potential for spills exists.

Lesson Description:

During this block of instruction we will discuss how we can prevent oil spills through the application of proper procedures and how to properly contain, treat, and dispose of a petroleum spill.

Terminal Learning Objective:

Action: Identify the common causes of oil spills and the preventive measures necessary to avoid such spills; identify the purpose and function of the spill prevention control and countermeasures plan (SPCC) and the installation spill contingency plan (ISCP); and identify the containment and cleanup procedures used in handling oil spills.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

Even when a product is lying dormant in a pipeline or storage tank, there is the possibility of a spill occurring. The costs involved in petroleum spills are high: revenues lost from a valuable resource and containment, cleanup, disposal, and restoration costs. Spills contaminate the soil and water, resulting in the loss of seafood and fowl. Spills also pollute beaches, lakes, and rivers causing lost revenues from recreational facilities. Both the federal and state authorities can levy fines against the individual or company which causes the spill.

PART A - COMMUNICATION OF GOOD ENVIRONMENTAL ETHICS TO SUBORDINATES

Each mission has, in some way, an impact on the surrounding environment. The environmental impact considerations for each mission should be weighed and considered when possible in every situation. When training subordinates to identify the environmental impact of a mission, the following elements should always be present in training standards:

- Identify hazards to the environment during mission analysis. Environmental hazards are conditions that have the potential to pollute the air, soil, water, and/or degrade natural/cultural resources.
- Assess probability of environmental damage/violations using risk-assessment matrices.
- Make decisions and develop measures to reduce high risks.
- Implement environmental measures by integrating them into plans, orders, SOP's, training performance standards, and rehearsals.
- Supervise and enforce environmental standards and train to the standard.

The most important technique for training subordinates to identify environmental risks and possible impact is to make them think like they are in their house, and it is their health, land, and water at stake.

Getting subordinates to see the relevance and importance of good environmental ethics is crucial. Not only is the identification of environmental risks and their potential impact important, but also equally important are the consequences of noncompliance with environmental laws and regulations. The importance of protecting the environment can be stressed by discussing the consequences of environmental degradation and the benefits of environmental protection.

Consequences of Environmental Degradation. Consequences of environmental degradation include the following:

- The loss of historical sites, vegetation, water resources, and wildlife.
- Diminished quality of available realistic training areas.
- Diminished operational security.
- Ineffective tactical operations.
- The creation of safety hazards to personnel and equipment.
- An increase in training, maintenance costs, and litigation.

Benefits of Environmental Protection. There are many benefits of environmental protection:

- Enhance combat readiness.
- Ensure mission completion.
- Conserve the fighting strength.
- Protect the environment.
- Reduce the Army's and nations current and future cost for environmental restoration.

Consequences of Non-Compliance with Environmental Laws and Regulations. An excellent way to communicate the consequences of noncompliance to subordinates is to explain, in general, that noncompliance under the FFCA (Federal Facilities Compliance Act) can empower federal and state regulatory agencies to impose fines on federal agencies (including the Army) for Resource Conservation and Recovery Act (RCRA) violations. Penalties and intervention can take any of the following forms:

- Damage awards.
- Intervention from the EPA and other federal, state, and regional agencies.
- An increase in monitoring from federal agencies.
- Fines.

Unit leaders and their subordinates are required to comply with all federal, state, and local laws to protect the environment. Violators can be held personally liable for cleanup costs and civil or criminal penalties. Violators include the actual person who causes the contamination and the commanders, supervisors, and leaders who allowed the contamination to occur and didn't take immediate action to prevent or correct the occurrence. The penalty can be up to $50,000 for each day in violation and/or up to two years in jail.

After Action Report. After action reports (AAR) are an excellent platform for reporting environmental considerations and can be incorporated into everyday work life through training, SOP, orders, mission planning, etc. Upon completion of an exercise or other training function, always remember to include any environmental considerations, good or bad, into the report.

Environmental Laws and Policies. As a Petroleum Supply Supervisor, it is imperative that your subordinates are familiar with the local unit SOP and policies which should be explained and available immediately upon arrival at post. These are often the most stringent and all-inclusive, as they tend to combine federal, state, and local laws, regulations, and policies. The local and state environmental laws vary by region and should be available to all subordinates as an important reference within the lab. The major federal laws and regulations can be found in FM 20-400 (Military Environmental Protection). Subordinates should be routinely quizzed and observed in the performance of their duties to ensure that they are in some way familiar with the laws and regulations that are applicable to them. The host nation environmental laws and regulations may be very numerous and complex, the same as the U.S., or almost nonexistent. At any rate, given the fact that you may be in a foreign country where the penalties can be very tough, it is a good idea to ensure that your subordinates are familiar with the laws and regulations of the host nation.

PART B - ENVIRONMENTAL RISK ASSESSMENTS

The identification of environmental risks associated with a given mission or training exercise is one of the most important functions you perform as a supervisor or unit leader. In the Army, as you all know, much importance is placed on environmental stewardship and the idea of identifying possible risks ahead of time. There are three major phases of environmental risk identification associated with training missions: actions before training, actions during training, and actions after training.

Assessing Environmental Risks. Environmental risk assessment allows the commanders and unit leaders to address environmental considerations using the following steps:

- Identify the hazards to the environment during mission analysis. Environmental hazards are conditions that have the potential to pollute the air, soil, water, and/or degrade natural/cultural resources.
- Assess probability of environmental damage/violations using environmental risk assessment matrices.
- Make decisions and develop measures to reduce high risks.
- Brief the chain of command (to include the installation environmental office, if applicable) and appropriate decision maker on proposed plans and residual risk.
- Implement environmental measures by integrating them into plans, orders, SOPs, training performance standards, and rehearsals.
- Supervise and enforce environmental standards. Train to the standard.
  The Environmental Risk Assessment Matrix provides an approach to assess the relative risk of generic unit-level activities on specific environmental areas. Each environmental risk assessment matrix has three main categories: environmental area, unit operation, and risk impact value.
- Environmental Area.
  Air pollution.
  Archeological and historic sites.
  Hazardous materials and hazardous waste.
  Noise pollution.
  Threatened and endangered species.
  Water pollution.
  Wetland protection.
- Unit Operations (Company Level Activities).
  Movement of heavy vehicles and systems.
  Movement of personnel and light vehicles/systems.
  Assembly area activities.

Field maintenance of equipment.
Garrison maintenance of equipment.

- Risk Impact Value (Numeric Value). This value represents an estimate of the conditions under which the unit will operate and is an indicator of the severity of environmental degradation.

RISK ASSESSMENT MATRIX						
		Probability				
Severity		Frequent (A)	Likely (B)	Occasional (C)	Seldom (D)	Unlikely (E)
Catastrophic	(I)	E	E	H	H	M
Critical	(II)	E	H	H	M	L
Marginal	(III)	H	M	M	L	L
Negligible	(IV)	M	L	L	L	L

Risk Category

Extremely High (E)

Mission failure if hazardous incidents occur during mission. A frequent or likely probability of catastrophic loss (IA or IB) or frequent probability of critical loss (IIA) occurs.

High (H)

Significantly degraded mission capabilities in terms of required mission standard or not accomplishing all parts of the mission, not completing the mission to standard (if hazards occur during mission). Occasional to seldom probability of catastrophic loss (IC or ID). A likely to occasional probability of a critical loss occurring (IIB or IIC) with material and soldier system. Frequent probability of marginal (IIIA) losses.

Moderate (M)

Expected degraded mission capabilities in terms of required mission standard. Will have reduced mission capability (if hazards occur during mission). Unlikely probability of catastrophic loss (IE). The probability of a critical loss occurring is seldom (IID). Marginal losses occur with a probability of no more often than likely (IIIB or IIIC). Frequent probability of negligible (IVA) losses.

Low (L)

Expected losses have little or no impact on accomplishing the mission. The probability of critical loss is unlikely (IIE), while that of marginal loss is no more often than seldom (IIIB through IIIE).

Figure 6-1, Risk-assessment matrix.

Use the following steps for assessing environmental impacts on planned activities:

- Identify hazards to the environment: degradation of wetlands, polluting streams, disturbing endangered species habitat and archeological sites and/or structures, creating oil spills, and improperly handling HW and HM.
- Assess probability of environmental damage/violations using environmental risk-assessment matrices.
- Make decisions and develop measures to reduce high risks.
- Brief chain of command and installation environmental office, if applicable, on proposed plans and pertinent high-risk environmental matrices.
- Integrate environmental measures into plans, SOPs, training performance standards, and rehearsals.
- Supervise and enforce environmental standards. Train to the standards.

Controls to Reduce Risks. Once the risks are identified, plans must be developed and implemented to control and reduce the risks. The development of environmental risk controls can come from AARs and environmental risk assessments. These controls are identified from known and previous risks that have been identified. Some examples of risk controls that can be implemented are:

- Restrict high-risk land areas, if practical, from vehicular operations.
- Sensitize personnel on performing maintenance or other tasks involving hazardous materials and substances near water sources.
- Use portable containment systems for field handling of hazardous substances.
- Be prepared to correctly respond to spills (have qualified personnel and correct equipment on hand).
- Have highly qualified leaders supervise high-risk tasks/operations.

Supervise and Evaluate Risk Controls Implemented. As part of environmental risk reduction measures, implementing risk controls involves incorporating them into mission planning, orders, SOP, training performance standards, rehearsals, and other activities where environmental considerations should be addressed. The supervision and evaluation of environmental risk controls can involve the following considerations: the mission, the enemy, terrain and weather, troops and equipment, and time.

- Mission.
  Anticipate or assess environmental risks during planning.
  Analyze the effects of environmental risks on mission operations.
  Simplify scheme of maneuver.
  Issue complete and concise orders.
  Ensure key leaders track the exercise and render timely reports.
  Identify alternative training scenarios or techniques.
  Use large-scale battalion or brigade sector sketches for detail.
  Send key leaders on objective reconnaissance.
  Set the environmental standard within the unit, and ensure soldiers are aware of and comply with that standard.
  Keep the chain of command informed of environmental problems and concerns.
  Take immediate, effective action in response to spills and other emergencies.
- Enemy (Opposing Forces [OPFOR]).
  Ensure the OPFOR commander understands environmental problems and concerns.
  Know enemy characteristics and equipment.
  Identify environmental impacts of decisions.
- Terrain and Weather.
  Ensure high-risk areas (surface waters, archeological sites, and endangered species) are identified/marked.
  Navigate accurately; know your location.
  Ensure that unit boundaries are identifiable.
  Ensure that there are redundant navigation aids or checks.
  Know weather effects (dry/windy or wet/soggy conditions) and limit/alter operations accordingly.
- Troops and Equipment.
  Ensure that soldiers are briefed on environmental concerns/standards.
  Demand situational awareness – units, enemy, hazards, and environment.
  Anticipate where maneuver density will be highest.
  Use validated SOP to simplify operations.
  Insist on accurate and timely spot reports.

Recognize soldier stress.
Rehearse always.

- Time.
  Maximize planning time.
  Prioritize tasks, rehearsals, and reconnaissance.
  Adjust pace and tempo.

Again, the best way to supervise and evaluate any type of controls or measures takes a wide-ranging effort. By continually stressing environmental stewardship in everyday work duties and functions, you as the supervisor can ensure that your subordinates integrate environmentally friendly and sustainable actions into their daily duties.

PART C - PLANNING AND CONDUCTING ENVIRONMENTALLY SUSTAINABLE ACTIONS AND TRAINING

When planning training exercises or preparing a petroleum facility SOP, always address the environmental risks associated with the activity. Make sure that subordinates are aware of the risks involved with a given exercise, mission, or other activity. Then, ensure subordinates are able to identify environmental risks associated with everyday and out of the ordinary tasks.

In the absence of specific guidance (when laws, regulations, and policy do not necessarily apply), it should be assumed that the toughest laws apply. This is the root of the Army's environmental ethic. Imagine the worst possible scenario as a consequence of not acting morally right with regard to the situation.

PART D - VERIFICATION THAT HAZARDOUS SUBSTANCES ARE TURNED-IN AND STORED IAW LOCAL UNIT POLICY AND APPLICABLE ENVIRONMENTAL REGULATIONS

Using your local Hazardous Waste Management Plan, ensure that the following have been checked and completed: DD Form 1348-1 (DOD Single Line Item Release/Receipt Document), the containers, fill capacity, markings, labeling, empty containers, and inspection.

DD Form 1348-1 (DOD Single Line Item Release/Receipt Document). The Hazardous Waste Accumulation Facility Manager completes DD Form 1348-1. The materials need to be properly classified, described, packaged, marked, labeled, and in proper condition for transportation.

MIL-STD-129. The minimum requirements for the uniform marking of military supplies and equipment for shipping and storage are provided in MIL-STD-129.

Containers. If a container is not in good condition or begins to leak, the contents are transferred to a serviceable container or over-packed immediately. Only DOT-approved containers, compatible with the materials being stored, will be used. A container holding waste is always closed during storage. Containers holding waste are not opened, handled, or stored in a manner which causes the container to rupture or leak. Containers holding ignitable or reactive wastes are located at least 50 feet from the installation's property line.

All containers must be labeled with label marking pens, e.g., the Sharpie extra-fine point marking pen. Do not use ballpoint pens. Labels and markings must be replaced if they become damaged or lost. Store containers to allow easy access to container labels. The type of label corresponds with the type of waste. Labels are not placed over labels. All drums and drum-like containers are labeled as to their contents. Empty drums and drum-like containers are labeled "empty."

A container or an inner liner removed from a container that has held any hazardous waste is empty if all wastes have been removed using the practices commonly employed to remove materials from that type of container by pouring, pumping, aspirating, or scraping. A container that held a hazardous waste of compressed gas is empty when the pressure in the container is at atmospheric pressure. A container or inner liner removed from a container that held an acutely hazardous waste is empty if: it is triple rinsed using a solvent capable of removing the commercial chemical product or manufacturing chemical intermediate, and is then cleaned by another method that has been shown in the scientific literature, or by tests conducted by the generator, to achieve equivalent removal; or if the inner liner that prevented contact of the commercial chemical product or manufacturing chemical intermediate with the container is removed.

Inspection. Facilities provided to store, handle, or use hazardous substances will be periodically tested and inspected. Some HM/HW considerations for inspection include:

- Are amounts of HM on hand limited to the minimum needed (no stockpiling of HM)?
- Is the unit's HM/HW inventory (quantity and location) up to date?
- Do HW containers have drum logs to account for all additions and to specify personnel authorized to make additions to the containers?
- Are MSDSs on hand for all HM? Are MSDSs readily available to all workers with exposure to HM?
- Is HW accumulated in authorized containers?
- Are containers labeled according to directives?
- Are containers in good condition and closed when not in use?
- Are contents of containers compatible with the container?
- Are accumulation start dates and HW labels on each HW container?
- Are container storage areas inspected at required intervals?
- Is HM/HW managed for prompt pick up and transportation to disposal facility according to directives?
- Are used oil accumulation tanks used for collection of HW and other pollutants?
- Are danger and warning signs conspicuously placed?
- Is spill-prevention and -control equipment adequate?
- Are personnel trained in the proper handling, collection, storage, or transportation of HM/HW?
- Are dumpsters free of HM/HW items?
- Are used POL cans and drums disposed of properly?
- Are asbestos-containing parts (brake shoes, clutch plates, and equipment insulation) removed, collected, and disposed of properly?
- Are batteries stored/disposed of properly?
- Is equipment containing radioactive sources (i.e., gun/mortar sights, M8A1 alarms) properly stored to prevent breakage and release of radioactive materials? Are incidents reported properly?
- Is ammunition stored properly?

PART E - VERIFICATION OF THE PROPER CONSERVATION OF RESOURCES

AR 200-1 addresses the Army Hazardous Materials Management Program. This program outlines the procedures to be implemented by installations and units to minimize or eliminate the use of hazardous materials when possible, using the following alternatives:

- Substitute less hazardous or nonhazardous material.
- Modify processes or procedures to reduce or eliminate use.
- Restrict user inventory.
- Reduce consumptive use.
- Direct ordering.
- Extend shelf life.
- Regenerate spent material.
- Downgrade and reuse spent material.
- Reuse for other purposes.
- Combinations of the above.

Hazardous materials required for testing petroleum products can be some of the most dangerous substances in use. Most of the hazardous materials used to perform the various tests in the petroleum lab are not substitutable. Therefore, supervisors have to focus the hazardous materials management efforts on minimization and conservative use of these materials.

Unit Recycling Program. Ensure that subordinates are familiar with and participate in the recycling program. You can verify support among your unit by ensuring that all recyclable materials are being recycled, such as:

- Computer paper.
- Corrugated cardboard.
- Newspaper.
- High-grade white paper.

- Aluminum cans.
- Plastics.
- Oil.
- Solvents.
- Glass.
- Steel.
- Brass.

Make sure that recyclable material is separated at the source. Contaminated or otherwise unrecyclable material should be removed, cleaned, or properly disposed of. Check with the installation environmental office to verify and get information on the material being recycled in your area.

Implementing Techniques to Avoid Overuse or Pollution. Implementation of techniques to protect training area land can be accomplished by integrating them into the environmental risk assessment matrices, mission planning, SOP, orders, and training/performance standards.

PART F - VERIFICATION OF EQUIPMENT, PERSONNEL, AND CORRECT PROCEDURES TO CONTAIN AND CLEAN UP A HAZMAT SPILL

Equipment and material required for each work area can be found in the local unit ISCP and SPCC. Prior to beginning any operation, conduct an inspection of the petroleum facility to verify the presence/condition of the following hazardous materials spill containment and cleanup equipment/materials:

- Solusorb Solvent Absorbent.
- Gloves.
- Scoops.
- Disposal bag/tie/label.
- Instructions.

Periodically check the equipment/materials for serviceability, making sure that they are in serviceable condition. Ensure that personnel are familiar with the local unit ISCP and SPCC.

Spill Containment and Clean-Up Training Verification. Periodically the supervisor of the petroleum facility should conduct exercises to verify that personnel are trained in up-to-date spill containment and cleanup procedures. Verify that petroleum facility personnel are current with the emergency spill containment and cleanup procedures/requirements. Upon discovery of a spill, personnel shall take action as follows:

- Safely stop the source of the spill, if possible (closing valves, uprighting containers, etc.).
- Contain the spill.
- Apply absorbents.
- Ensure adequate ventilation.
- Erect barriers or otherwise restrict or stop flow.
- Block sewers.

When reporting a spill to the installation's fire and emergency service or 911, the following questions should be considered to determine the nature and severity of the spill.

- Is the spilled substance classified as a flammable liquid?
- Is the quantity spilled 25 gallons or more?
- Is the spill confined to a hard surface?
- Is it possible that the spill will reach surface waters, wetlands, groundwater, streams, ditches, sewers, or drains?
- Does the reporting activity have the capability to contain or clean up the spill?
- Is the spilled substance classified with a required quantity (RQ) value?

Not only is the appropriate equipment important when handling a spill, but it is also important to have properly trained personnel. The supervisor's duty is to verify that personnel conducting an operation are trained in the proper use of spill cleanup and containment equipment. Those handling the spill must also employ the proper procedures IAW the ISCP and SPCC.

Once the spill has occurred and been taken care of, it must be reported. The petroleum or other hazardous spill must be reported immediately via the chain-of-command and cleaned up immediately after

personal safety precautions have been taken and notification to people in the area has been made IAW the ISCP, the SPCC, and unit SOP.

Spill Prevention Control and Countermeasures Plan (SPCC). The purpose of the spill prevention control and countermeasures plan (SPCC) is to identify potential sources of oil and hazardous substances and the measures required to prevent and contain any accidental discharge resulting from equipment or storage facility failure. At a minimum the SPCC must contain a detailed description of oil spill prevention, control, and countermeasures. This includes structures and equipment for diversion and containment of discharges, facility drainage, and identification of resources to clean up spills, a description of spills which have occurred in the last 12 months with corrective action taken and plan recurrence, and an inventory list of storage, handling, and transfer facilities which present oil spill hazards. Include prediction of direction of flow, rate of flow, and total quantity which could be discharged.

Containment of Spills. It is important to contain spills in order to prevent oil dispersement, lessen the degree of pollution, and ease the problem of cleanup. In a situation where there is a spill-related fire, containment prevents a larger fire hazard and contains the existing fire.

Water spills present a unique set of environmental factors which affect how such spills are handled. Strong wind or current creates headwaves which may go over or under a single boom. However, large waves at sea will aid in breaking up the spill. Low temperatures and atmospheric conditions such as snow, fog, and sleet cause oil to be more viscous and therefore dispersants work more slowly.

Containment of spills in water is typically done with the aid of booms. The booms should be positioned downwind or down current. In a situation where there are large headwaves, use more than one boom. In addition, you can use fire hoses, propeller wash, wind jet, or piston film to control a water spill.

Containment of land spills requires you to consider several factors. Elevation of storage site, direction spill would flow, and the proximity to water sources need to be evaluated before a containment method is employed. Depending on the situation, berms made of sandbags, piles of dirt, straw, cloth, fiber, or wood chips and dikes, ditches or natural barriers may be used to contain a spill. In addition, alarms and automatic shutoff devices, drip pans, and slop tanks can be used to prevent ground contamination.

Spill Cleanup Methods. Spill cleanup in water is accomplished with the use of sorbents (adsorption and absorption) such as rolls, sweeps, pads, particulate, oil snares, bags, and booms. Depending on the situation, weir, belt, or drum oil/water skimmers may also be employed to remove the oil.

Spill cleanup on land is performed in different ways depending on the size and nature of the spill. Sorbents are used on small spills, while large spills would require the use of mechanical equipment such as scrappers, graders, or bulldozers. In some instances, plowing and tilling of the soil is all that is required. Pumps may also be utilized to remove oil from some areas and washed into retrieval areas.

Beaches are extremely sensitive to oil spills; oil will penetrate two inches and, if chemically treated, will penetrate two to five times deeper. Federal studies indicate chemicals can cause more harm than the spill itself. EPA approval is needed to use chemical cleanup methods such as dispersants, biological agents such as oil-eating bacteria/enzymes, sinking agents, gelling agents, and burning agents. Chemical agents can be used with government approval under two conditions:

- Danger of fire which could be harmful to lives.
- When a spill is traveling in the direction of fish or wildlife-sensitive area.

PART G - RESOURCES AND PROCEDURES FOR PROPER DISPOSAL AND HANDLING OF HAZARDOUS MATERIALS

In order to maintain compliance with the necessary safety guidelines in a petroleum facility, there must be on hand reference materials to which technicians can refer. The latest versions of hazardous material references are required to be kept in a central, visible, and easily accessible location within the petroleum facility.

ISO 9000-2. Every petroleum facility should maintain a copy of the latest version of ISO 9000-2. This document contains procedures for the safe handling and disposal of hazardous materials listed by type of substance or material.

Hazardous Material Information System (HMIS) sheets for hazardous substances can be maintained for each applicable substance used in your facility. Procedures for the safe handling and disposal of these hazardous substances are listed on each sheet under the heading “Precautions for Safe Handling And Use.”

Material Safety Data Sheets (MSDS) are required at a minimum to be maintained for each hazardous substance used in your facility. Procedures for the safe handling and disposal of these hazardous substances are listed under the heading of “Handling and Storage Precautions” for handling and “ Spill or Leak Procedures” for disposal.

LESSON 6

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. Major Federal laws and regulations can be found in
   A. MIL-HDBK-200.
   B. FM 20-400.
   C ISO 9000-2.
   D. HMIS.

2. What are the three main categories of each environmental risk assessment matrix?
   A. Mission, enemy, and time.
   B. SOPs, training performance standards, and rehearsals.
   C. Air pollution, noise pollution, and water pollution.
   D. Risk impact value, environmental area, and unit operation.

3. When laws, regulations, and policy do not necessarily apply, how should environmental issues be addressed?
   A. Base decisions on laws in a similar environment.
   B. Apply laws that are average for the area.
   C. Assume that the toughest laws apply.
   D. Apply the laws from the nearest location.

4. How far should containers holding ignitable or reactive wastes be located from the installation's property line?
   A. 25 feet.
   B. 50 feet.
   C. 75 feet.
   D. 100 feet.

5. Which of the following cleanup equipment/materials should be present at the petroleum facility before beginning any operation?
   A. Newspaper, aluminum cans, and corrugated cardboard.
   B. Piston film, fire hoses, and propeller wash.
   C. Booms, pads, and water skimmers.
   D. Instructions, gloves, and solusorb solvent absorbent.

LESSON 7

MANAGE PACKAGED FUELS

OVERVIEW

As a supervisor, you will need to understand the special requirements, inventory management, accountability, and quality surveillance of packaged fuels.

Lesson Description:

During this block of instruction we will discuss the special requirements, inventory management, accountability, and quality surveillance of packaged fuels, as well as identifying environmental impediments and viable resolutions.

Terminal Learning Objective:

Action: Acquire knowledge on inventory management, accountability, quality surveillance of packaged fuels, and identification of environmental considerations.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

As petroleum managers, we concern ourselves with bulk petroleum and the problems of quality and quantity control. The problems encountered with quality and quantity control of packaged products are just as important as those of bulk petroleum, and in some cases, are just as difficult to handle. Therefore, it is just as important to understand the receipt, storage and issue procedures for packaged products as it is for bulk.

PART A - SPECIAL REQUIREMENTS

Packaged petroleum fuels include fuel in reusable containers of 500 gallons or less. The containers used most often are 5-gallon cans, 55-gallon drums, and 500-gallon collapsible drums. Fuels are usually issued in bulk. The need to transfer bulk petroleum fuels to packaged containers depends on operational factors, the quantities required for daily operations, the capabilities of the units to receive and store fuels, the existence of a bulk distribution system, and the overall tactical situation.

PART B - INVENTORY MANAGEMENT AND ACCOUNTABILITY

Locator System.

- The locator system provides a simple accurate way to find specific supply items quickly.
- It is centrally located and contains a separate record for each location.
- Separate storage locations should be maintained for items with different shelf life, and dates of pack: (First in, First out).
- A planograph should be made of your storage area showing rows, aisles, columns, stacks, levels, and segments or bins.
- Stock locator cards are used to identify and locate supplies in storage, and are made up number and letters. Example: A3E21 or FC23B. A= Area, 3= Row, E= Column, 2= Level, 1= Segment. Use the letters A to Y omitting I, O, Z. And numbers 1-9 omitting 0. When location numbers are established, place location signs on all storage areas, rows, aisles, columns, levels, and segments to help find supplies quickly.
- The location cards are filled in national item identification number (NIIN). Automated DSUs use a DA Form 2000 (Inventory/Location Notification Card). Manual DSUs use a DA Form 4243 (Location/Change Notification Card). DA Form 3785 (Location Request) is used by the storage section to report additions or deletions to the location file.
- Use of the location file: Request for issue, DA form 2765-1 from customers will be annotated with storage locators and given to the warehouseman. He will rely on the location to find supplies. Also, replenishment supplies are received, shipping documents will be annotated with locations to tell control section where to store them. The shipping document also tells the stock control section where to find the items.

Inventory of Package POL. This includes the determination of stocks on hand and the reconciliation of stock record balances with actual stock on hand. Give the accountable officer the necessary information to reconcile stock balances with the financial inventory records.

- When a complete shutdown inventory is to be taken, advance notice to customers would be given.
- Cyclic inventory can be determined by the accountable officer.
- A special inventory can be accomplished when:
  - The stock record card and the warehouse card show a zero balance.
  - A warehouse refusal if the stock record shows a balance and the warehouse has zero on hand.

Inventory Procedures.

- Establish cut-off date.
- Date receipt documents and mark before or after inventory.
- Freeze receipts, issue and shipping documents. Set up a control register and notify customers thirty nine days in advance and push high priority requisitions.
- Process before inventory documents.
- Hold all inventory documents and any supplies received in a separate area. (Do not include in inventory.)
- Prepare inventory count cards, and listings.

- Conduct the inventory.
- Inspect the inventory and make sure each item is verified. (Recount until discrepancies are resolved.)
- Process supply actions as rapidly as possible in order to return your activity to normal.

Issues. Ensure that request for supplies are authorized. Oldest items issued first (shelf life should be considered). Substitution of one unit pack for another is common with packaged products. Substitute items may be offered, but should be checked to make sure it will do the job. Proper issue documentation will be used for items sent to a laboratory for testing.

Turn-Ins. Turn-ins from Customers must be inspected and classified by Class III Section personnel prior to being accepted at the supply point. The product must be sampled and stored in an area away from good product until lab results are obtained. The lab will normally recommend results. In some cases, local SOPs require the unit to hold the products until lab results are obtained.

PART C - QUALITY SURVEILLANCE OF PACKAGED FUELS

As a petroleum NCO you will often be responsible for monitoring the quality and usability of packaged products. Most packaged petroleum products have a Type II extendable shelf life, which means that upon expiration the item may be extended for use after appropriate inspection and testing actions. The retest frequency is a prescribed item, in months, from the date of manufacture on the container or carton. The SLC (Shelf Life Code) is a one position code that establishes the frequency which Type II items must be sampled/retested. The SLC codes are the same as prescribed in MIL-HDBK-200, and are listed as follows:

- 0 – Nondeteriorative
- 1 – 3 months
- 2 – 6 months
- 3 – 9 months
- 4 – 12 months
- 5 – 18 months
- 6 – 24 months
- 7 – 36 months
- 8 – 48 months
- 9 – 60 months

Products with an expired shelf life may not be used pending assurance that the items suitability for use has been verified through laboratory analysis. All packaged products on hand/in storage will be inspected every 90 days to determine if the product is within shelf life usability, and to determine container condition in accordance with AR 710-2 and unit/user level procedures.

Stock Rotation. Stock rotation will ensure that the oldest products are issued used first. When expired products are found in storage ensure that personnel use DA Form 5832-R (Packaged Petroleum, Oils, and Lubrications Submission Log) to report the NSN, contract number, lot/batch, size of container, and quantity on hand to the installation petroleum manager/next higher supply level for consolidation. The installation petroleum manager/next higher supply level will have in their possession the QSL (Quality Surveillance Listing) which will be consulted to determine further actions to be taken with outdated products.

Applicability. A fuel must be laboratory tested before and after government acceptance to make sure that it meets specifications. It must be clean and dry. A fuel is clean when it is free of suspended matter, sediment, and emulsions. A fuel is dry when it contains no undissolved water. A clean, dry fuel has a bright appearance, without cloud, haze, or visible solids. Depend on qualified filter/separators to keep fuels at the Class III supply point clean and dry.

Laboratory Tests. Laboratory tests are made to ensure that fuels meet specifications, to identify unknown products, to detect contamination, to verify unfavorable field tests, and to recommend disposition of unacceptable fuel. The laboratory tests include, but are not limited to, distillation, gravity, corrosion, water tolerance, particulate matter, freeze point, vapor pressure, gum content, tetraethyl lead, and sulfur. Fuel must be tested by a laboratory when:

- Requested by petroleum offices.
- The quality of fuel is questioned or it cannot be classified.
- A filter/separator is first placed in service after the filter elements have been changed and every month after that.

- Aviation gasoline or jet fuel has been in aboveground storage for 30 days, without addition of fresh stocks, in climates where the temperature is 90°F or higher, and when the fuel has been in aboveground or underground storage for ninety days, without addition of fresh stocks, in climates where the temperature is lower than 90°F.
- It is determined that an aviation fuel may be contaminated or commingled. Take samples and submit them to the laboratory for analysis. Do not use the suspected fuel unless laboratory tests prove it is usable.

PART D - ENVIRONMENTAL AND SAFETY CONSIDERATIONS

Containers. Check the general condition for rust, leaks, and damage. Check that markings include stock number, date of pack, batch number, NATO stock number. The markings should also be legible. If containers are damaged, suspect, have missing items then a discrepancy in shipment order, SF 361, will be initiated.

Storage. Items stored outdoors should have covers such as open sheds or tarpaulins. Chemicals must be given special consideration for storage. Gasoline, diesel fuel, or oil drums must be stacked butt to butt with the bung in a horizontal position. Antifreeze and battery acid are usually packed in rubber-type containers and must be given special consideration for stacking. Fire points should be marked and in the proper location.

Layout of Storage Facility. Allow enough space for work areas so receiving, packing, and crating can be accomplished. Allow enough space for materials, handling equipment, fire fighting equipment, and daily inspections for leaks and inventories. Drainage must be considered in outside storage areas. If inside storage is used, consideration must be given to the type of buildings, ventilation, lighting, bins and shelves. Dunnage such as pallets and runners for drums should be used when applicable.

LESSON 7

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. When can a special inventory of package POL be accomplished?
   A. The warehouse card and stock record card show a zero balance.
   B. A cut-off date has been established.
   C. Once the request for supplies is authorized.
   D. Once advance notice has been given to customers of a complete shutdown.

2. When is issue substitution of one unit pack for another common?
   A. With packaged products.
   B. With bulk products.
   C. With recycled products.
   D. With diesel products.

3. Who determines when a cyclic inventory should be done?
   A. First Sergeant.
   B. Platoon Sergeant.
   C. Accountable Officer.
   D. Squad Leader.

4. You are directing your section on how to issue packaged petroleum products. How would you issue packaged POL?
   A. Newest item first.
   B. Oldest item first.
   C. Substitute the item the customer requests.
   D. None of the above.

5. What should be done if containers are damaged, suspect, or have missing items?
   A. A stock locator card should be obtained.
   B. A discrepancy in shipment order should be initiated.
   C. A request for issue should be completed.
   D. A planograph should be made.

LESSON 8

DIRECT A PETROLEUM PILFERAGE CONTROL PROGRAM
Critical Task:
101-519-3156

OVERVIEW

Pilferage is one of the major causes for petroleum losses.

Lesson Description:

The soldier will become familiar with the factors to consider when establishing a security plan for a class III supply point.

Terminal Learning Objective:

Action: Identify the common types of pilferage. Identify the two types of pilferers and the control measures for each. Identify opportunities for pilferage and security hazards. Set up checkpoint inspections.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

Losses of government property will continue to increase unless preventative measures are taken. Some situations will require revamping of security systems while others may require only re-education of the facility personnel. The best method of loss prevention is to stop pilferage before it starts.

PART A - IDENTIFY THE COMMON TYPES OF PILFERAGE

Where need or desire exists and opportunity is presented, theft is almost sure to result. Pilferage, pilferer, and pilfer are used in the meaning of steal, theft, larceny, and similar terms. The protection of property, including the prevention of pilferage of government supplies and equipment, is one of the primary functions of military police and civil service security forces. Consider the following types of pilferage:

- Stolen items concealed on the person.
- Stolen items concealed in automobiles.
- Pilferage shipped and received through two or more people for fraud purposes.
- Fictitious invoices to remove property.
- Tanker trucks with false bottoms for the pilferage of product.
- Trash disposal and salvage disposal activities used to hide property.
- Items thrown over fences to be retrieved later.
- Pilferage planned with security personnel.
- Removal of items on vehicles belonging to outside contractors or vendors.

PART B - THE TWO TYPES OF PILFERERS

Casual Pilferers. Steal primarily because he/she is unable to resist the temptation of an unexpected opportunity and has little fear of detection.

- Usually little or no planning involved.
- Normally acts alone.
- Takes items for which he/she has no immediate need or foreseeable use.
- Takes items for family or friends for use around the home.
- The degree or risk involved in casual pilferage is normally slight, unless very large numbers of persons are involved.
- Casual pilferage occurs whenever the individual feels that the need or desire for a certain article and the opportunity to take it is provided by poor security measures. Casual pilferage is very serious if it becomes widespread, especially if the stolen items have a high cash or potential value. Casual pilferers are normally employees of the installation and usually are the most difficult to detect and apprehend.

Systematic Pilferers. Steals according to preconceived plan, and steals any and all types of supplies to sell for cash or to barter for other valuable or desirable commodities. Systematic pilferers:

- Steal for monetary gain, their acts are premeditated, and they may or may not be employees of the installation.
- Work with another person or well-organized groups.
- May work with cleaning team or even be in an advantageous position to locate or administratively control desired items or remove them from storage areas.
- May be a one-time occurrence.
- Such acts may extend over a period of months or years.
- Large quantities of supplies, with great value, may be lost to groups.

PART C - CONTROL MEASURES

Casual Pilferage. The most practical and effective method for controlling casual pilferage is through the use of psychological deterrents. One psychological deterrent is to search individuals and vehicles leaving the installation at unannounced times and places. When conducting spot searches, care must be taken to ensure that personnel are not demoralized nor their legal rights violated by oppressive physical controls or unethical security practices. An aggressive security education program is also important. All employees must realize that pilferage is morally wrong no matter how insignificant the value of the item taken. It is up to you to set a

proper example. All employees must be impressed with the fact that they have a responsibility to report any loss to property authorities. Inventory and control measures such as identification of all tools and equipment should be instituted to account for all material, supplies, and equipment. Don't lose sight of the fact though, that most employees are honest and disapprove of thievery.

Systematic Pilferage. Control measures must be taken to prevent systematic pilferage. In order to ensure effective pilferage control throughout the facility you must first eliminate potential thieves during the hiring procedure by careful screening and observation and by establishing customer identification. Inside the facility, you must establish an effective key control system and an effective package and material control system. It may be advisable to install mechanical and electrical devices including appropriate perimeter fencing, lighting, and parking facilities and effective pedestrian, railway, and vehicle gate security controls in order to establish security surveillance of all exits. The facility security can also be increased by establishing adequate security patrols to check buildings, grounds, perimeter, and likely locations that may be used for storage of pilfered items. Additionally, you may locate parking areas for private vehicles outside the perimeter fencing of the activity. In the event of a loss, investigate quickly and efficiently.

In all cases, develop local SOPs according to security requirements and implement SOPs as soon as possible to prevent pilferage at the facility.

PART D - IDENTIFY OPPORTUNITIES FOR PILFERAGE AND SECURITY HAZARDS

Opportunities for pilferage are present when supplies are being transported in trucks, trains, planes, or ships. The greatest vulnerability and the widest variety of opportunities occur at the various points where supplies are transferred from one means of transportation to another or from storage to transportation and vice versa. Monitor pump pressure gauges for fluctuation in normal operating pressure that may indicate pilferage in the pipeline.

Petroleum pipelines present a unique set of security problems. Establish pipeline patrols to look for loose flange belts and couplings on pipelines, holes dug under pipelines/hose lines, and holes cut into hose lines. Watch for sabotage by looking for open pipes or cut hose lines, fires, or explosive charges.

PART E - SET UP CHECKPOINT INSPECTIONS

An orderly system is a must at a checkpoint. Examine drivers, helpers, passengers, and vehicle contents. Establish a security log containing the date, operator's name, description of load, time entered, and time departed. Establish a seal log for all goods leaving the facility and verify seal number with shipping document and examine seals for signs of tampering.

LESSON 8

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. The protection of government supplies and equipment is one of the primary functions of the
   A. FBI.
   B. Military police.
   C. Civil service security forces.
   D. B and C.

2. A casual pilferer typically
   A. Spends a great deal of time planning the operation.
   B. Acts with others.
   C. Takes items for use around the home.
   D. Is easy to identify.

3. What is the most practical and effective method for controlling casual pilferage?
   A. Making a list of all tools in the facility.
   B. Annotate what tools are stored in each department of the facility.
   C. Using psychological deterrents.
   D. Locking all tools in a storeroom each night.

4. To control systematic pilferage, private vehicles should be
   A. Searched at random times.
   B. Parked outside the perimeter fencing.
   C. Kept under surveillance at all times.
   D. Logged in and out of the facility.

5. Pipeline patrols should be established in order to
   A. Prevent sabotage.
   B. Prevent pilferage.
   C. Check for leaks.
   D. All of the above.

LESSON 9

PETROLEUM MATH FOR THE NCO

OVERVIEW

Proficiency in basic mathematics is essential for a petroleum staff NCO when developing logistics operations involving the distribution of fuel.

Lesson Description:

This course is a refresher on the basic math skills that will be used on a regular basis in petroleum operations.

Terminal Learning Objective:

Action: Acquire knowledge on the proper procedures to add, subtract, multiply, and divide whole numbers, fractions, and mixed numbers; converting percentages to decimals; using a decimal as a multiplier; determining the area of a square, circle, and rectangle; calculating for an unknown in first degree equations; calculating circumference, diameter, and radius of a circle; finding the volume of a cube, box, and cylinder; and converting from one unit of measurement to another.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

As a petroleum manager, you can very easily be expected to be assigned to a brigade, division, corps, or higher staff. As the only expert on petroleum matters, you may be tasked to prepare staff papers or contribute to war plans involving fuel logistics, a working knowledge of petroleum mathematics is fundamentally important for the development of logistics operations involving the distribution of fuel to theater forces. Accordingly, it is essential that you develop a proficiency in basic mathematics.

PART A - WHOLE NUMBERS

Whole numbers are numbers that are not fractions i.e. 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10. They can be positive and negative. These are called Arabic numbers because they originated in the Middle East. Signs of mathematical operations tell you what to do with groups of numbers:

- + means to add
- - means to subtract
- x and ( ) mean to multiply
- / and ÷ mean to divide

Addition. Addition is the process of uniting two or more numbers or groups of objects of the same kind. The first step in the process is to arrange the numbers uniformly in vertical columns. The last digit to the right in each number should be in the vertical column. Add the numbers in the right hand column. If the sum contains more than one digit (10 or more), write the right hand digit under the column added, and add the remaining digit or digits to the left. For example, if the sum of the column is 43, write the 3 under the column and add the 4 to the sum of the digits in the next column.

Example: Add 8145, 234, 756
Arrange the numbers in vertical order first. Add and carry over digits.

```
   8145
    234
+ 756
Total/Sum  9135
```

Subtraction. Subtraction is the process of taking one number from another. It is the opposite of addition.

Example: Subtract 83 from 597

```
   597
 - 83
Difference  514
```

Multiplication. Multiplication is the process by which any given number may be added to itself any specified number of times. Used to shorten the process of addition.

Example: 232 X 2 = 464

```
   232
+ 232
   464
```

Division. Division is the method of finding out how many times one number is contained in another.
Example: 552 / 23 = 24

PART B - COMMON FRACTIONS

Measurements are seldom taken and given in whole numbers. Fractions become necessary if we are going to maintain any type of accuracy. Usually, the more accurate our measurements, the more fractions we will have to deal with.

A fraction consists of two parts, a numerator (top number) and a denominator (bottom number). A proper fraction is a fraction in which the numerator is less than the denominator. An improper fraction has a numerator larger than the denominator.

$$\text{Fraction} = \frac{\text{Numerator}}{\text{Denominator}}$$

When adding or subtracting fractions, the denominator in each fraction must always be the same number.

$$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$$

When denominators are not the same, the Least Common Denominator (LCD) must be found. One way to find the LCD is to multiply the denominators together.

$$\frac{1}{2} + \frac{1}{3} = 2 \times 3 = 6$$

Now change all denominators to 6. Multiply the first fraction by 3/3 (since 3/3 is the same as 1, it does not affect the value of the fraction).

$$\frac{3}{3} \times \frac{1}{2} = \frac{3}{6}$$

To change the second fraction to sixths, multiply the fraction by 2/2.

$$\frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$$

Now both denominators are equal and you can add the fractions.

$$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$$

Another way to find the LCD is to divide the smaller denominator into the larger one.

$$\frac{3}{4} + \frac{1}{8} = 8 \div 4 = 2$$

If the number divides evenly then the larger number is the LCD. For this problem, you now have to change all the denominators to 8.

$$\frac{3}{4} + \frac{1}{8} = \frac{6}{8} + \frac{1}{8} = \frac{7}{8}$$

To multiply a fraction, just multiply across (numerator times numerator; denominator times denominator).

$$\frac{3}{4} \times \frac{5}{7} = \frac{15}{28}$$

When multiplying many fractions, a method called cancellation can be used to simplify the process. Cancellation is simply the striking out or reduction of numerators and denominators by dividing.
To divide fractions, turn over the divisor and multiply. Use cancellation to speed up the process.

$$\frac{3}{16} \div \frac{9}{64} = \frac{3}{16} \times \frac{64}{9} = \frac{1}{1} \times \frac{4}{3} = \frac{4}{3} = 1\ 1/3$$

PART C - MIXED NUMBERS

A mixed number is a whole number and a fraction. To add or subtract mixed numbers you must first reduce them to improper fractions and find the LCD. To multiply mixed numbers reduce them to improper fractions and multiply.

Example: 1 1/8 + 3 3/8 = 4 4/8 = 4 1/2

PART D - DECIMAL FRACTIONS

To convert a fraction to a decimal divide the denominator into the numerator. The answer can be brought out to as many decimal places as accuracy requires.

Example: 1/4 = 1÷4 = .25

PART E - DECIMALS

Reading decimals. The figure to the right of the decimal point indicates the number of tenths. For example - .6 is the same as 6/10. The further to the right of the decimal, the smaller the fraction. Two figures to the right indicate hundredths; three means thousandths and so on.

Adding and subtracting decimals: when adding or subtracting decimals you must use the same method of adding whole numbers. All the numbers must be lined up in vertical columns, but the decimal points must be in a straight line.

Example: 875.3

$$\begin{array}{r} 875.3 \\ +\ \ 6.03 \\ \hline 881.33 \end{array}$$

Multiplying decimals: decimal fractions are multiplied the same way whole numbers are multiplied; however, once the product is found, you move the decimal point as many places from the right as there were in both the multiplicand and the multiplier.

Example: 18.6

$$\begin{array}{r} \times\ 5.27 \\ \hline 98.022 \end{array}$$

The number 18.6 has one decimal place and 5.27 has two. The total is three decimal places. The product 98022 must show those three decimal places. The correct answer is 98.022.

Dividing decimals: decimal fractions are divided the same way as whole numbers except one step must be done before any division is done. The first step is to move the decimal in the divisor over the number of spaces necessary to make it a whole number. Then move the decimal in the dividend the same number of spaces. Place the decimal point directly over the dividend and then divide.

For Example: 0.875 ÷ 0.5 = 1.75

Converting decimals to percents and percents to decimals: To convert a decimal to a percent just move the decimal over to the right two places and put the % sign after the number. To convert a percent to a decimal move the decimal point two places to the left and remove the % sign.

PART F - PERCENTAGES

To find the percentage of any number, change the percent to a decimal fraction and multiply by the number.

Example: 15% of 100. (The decimal fraction of 15% is .15) .15 x 100 = 15

Rate ÷ Base = Percentage. Base is a quantity of which a certain percent is desired. It is the starting point, the part that you want to break down. Rate is the amount or percent of the base you want.

Example: A fuel tank contains 130 bbls of fuel. 2.6 bbls is BS&W. What percent of the tank is BS&W?

130 = Base 2.6 = rate

$$\frac{2.6}{130} = 2\%$$

PART G - AREA

Area is the measurement of a surface expressed in square units. The top of your desk or the surface of the chalkboard are examples of area. We cannot state the length in meters and width in yards. There is no such measurement as meter yards. We must measure or convert all measurements to one unit of measurement. To convert units of measurements do the following:

- Square inches to square feet ÷ by 144
- Square inches to square yards ÷ by 1,296
- Square feet to square inches x by 144
- Square feet to square yards ÷ by 9
- Square yards to square feet x by 9
- Square yards to square inches x by 1,296

Before using the formulas below you must make sure that all measurements are in the same unit.

- Rectangle

A = L X W L = A ÷ W W = A ÷ L

- Square

A = length of side X length of side = length of side^2 (same as a rectangle, but all sides are equal)

- Circle

Diameter - straight line passing through center of circle and stopping at the circumference. Circumference ÷ Pi or 2 x radius.
Radius - line from center of circle to its circumference.
Circumference - perimeter of a circle. Pi x diameter.
Pi = Circumference ÷ Diameter or 3.14159. Pi is a constant, it never changes.
Area = Pi x $Radius^2$

PART H - VOLUME

Volume is how much something will hold. Area will not hold anything, only cover it. Volume is expressed in cubic units. All measurements must be in the same units before you begin using any of the formulas listed below.

- Volume of a box= Length x Width x Height.
- Volume of a cube= Side x Side x Side= $Side^3$. (same as a box, but all sides are equal)
- Volume of a Cylinder= area of the base x height. Since the base of cylinders are round, we will need to use the formula for the area of a circle - Pi x R^2 x H.
- Conversion: cubic feet to gallons - 1 cubic ft = 7.48 gal. Gallons to barrels - 1 bbl = 42 gal.

PART I - CALCULATING FOR AN UNKNOWN IN FIRST DEGREE EQUATIONS

The last objective we want to cover is to calculate the unknown value in the equations by calculating velocity of flow in a pipeline when given the other two values in the formula.

An equation is no more than a statement that says "what's on the right side is the same as what's on the left side."
Q = the volumetric flow rate, measured in cubic ft/sec
V = the velocity of flow, measured in ft/sec
A = the cross sectioned area of the pipe, measured in square feet.

$Q = VA$ and $V = \frac{Q}{A}$

If A = .2245 ft^2 and Q = 1.2246 cubic ft/sec, what is the velocity of flow in ft/sec?
We have both Q and A and must solve for V as follows:

$V = \frac{Q}{A}$

$V = \frac{1.2246 \text{ cubic ft/sec}}{.2245 \text{ sq ft.}}$

V = 5.45 ft/sec (round off to the 100th)
We can then anticipate product moving through the pipeline at a speed of 5.45 ft/sec.

LESSON 9

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. What is the mathematical operation of multiplication used for?
   A. The opposite of addition.
   B. To unite two or more numbers or groups of objects of the same kind.
   C. To find out how many times one number is contained in another.
   D. To shorten the process of addition.

2. What should you do before you add or subtract mixed numbers?
   A. Reduce them to improper fractions and find the LCD.
   B. Change all of the denominators.
   C. Move the decimal over to the right two places.
   D. Change all of the multiplicands.

3. What is the first step in dividing decimals?
   A. Move the decimal over to the right two places.
   B. Divide the denominator into the numerator.
   C. Move the decimal in the divisor over the number of spaces necessary to make it a whole number.
   D. Move the decimal point as many places from the right as there were in both the multiplicand and the multiplier.

4. What should you do before using a formula to determine area?
   A. Multiply the length times the width.
   B. Make sure that all measurements are in the same unit.
   C. Make sure that the decimals are converted to percents.
   D. Multiply the area of the base times the height.

5. Which of the following is the measurement of how much something will hold?
   A. Volume.
   B. Area.
   C. Pi.
   D. Circumference.

LESSON 10

QUALITY SURVEILLANCE OPERATIONS

OVERVIEW

Quality surveillance operations include conducting tests and interpreting recorded test results in relation to the 77F mission during petroleum laboratory operations and quality surveillance programs.

Lesson Description:

During this block of instruction we will discuss quality surveillance operations and programs, petroleum laboratory operations, conducting tests and interpreting recorded test results in relation to the 77F mission, fire and safety precautions, and environmental considerations.

Terminal Learning Objective:

Action: Acquire knowledge on identifying required types of tests by petroleum product, determining the required quality surveillance procedures and selecting the appropriate test kit, reviewing DA Form 2077 (Petroleum Products Laboratory Analysis Report) to determine the condition of tested petroleum products and disposition of off-specification products, and observing safety precautions and identifying environmental considerations.

Condition: Given subcourse QM 5092.

Standards: The soldier must score a minimum of 70 percent on the end of subcourse examination.

INTRODUCTION

It is estimated that 60 percent of the supplies entering a theater of operations will be petroleum products. The quality surveillance mission is to maintain the quality of these products from point of origin to point of use.

PART A - QUALITY SURVEILLANCE OPERATIONS

Quality surveillance is a group of measures to be utilized to determine and maintain the quality of government-owned petroleum and related products so such products are suitable for use. (Aggregate does not equal whole; total considered with reference to its parts.)

Quality Surveillance Programs. Quality Surveillance SOP is a vigilant quality surveillance program implemented by properly trained personnel necessary to protect the original product quality.

Conus.

- Army Petroleum Center (APC). United States Army Petroleum Center conducts Quality Surveillance of Army owned petroleum products at CONUS depots, commercial terminals, and installations. APC is responsible for developing, coordinating, and monitoring the CONUS Quality Surveillance program.
- APC (WEST). All the states on the west of the demarcation line are served by this office located at the Defense Depot, Tracy, CA.
- APC (EAST). All the states on the east of the demarcation line are served by this office located at the New Cumberland Army Depot, New Cumberland, PA.
- Other CONUS facilities. These facilities have a limited Quality Surveillance capability. (Fort Hood, TX; Fort Lee, VA; Fort Campbell, KY; Fort Bragg, NC; Fort Stewart, GA; and Fort Rucker, AL.)

Overseas. The Joint Petroleum Office (JPO) ensures that an adequate Quality Surveillance program is maintained within the command.

Others. Others responsible for Quality Surveillance include services having physical possession of the product and the individuals actually in contact with the product.

SOP Requirements. To be able to maintain a Quality Surveillance program and be effective, you have to have at least minimum requirements such as:

- Sampling.
- Testing.
- Storage and handling.
- Packing and marking.
- Loading and shipping. Records and reports.
- Calibration of equipment.

Quality Surveillance Procedures. To keep products on specification and prevent contamination, follow these procedures:

- Make sure the product name and grade are stenciled on storage tanks, tank compartments, vehicle manhole covers, pipelines, valves, loading racks, control valves, and servicing units.
- When loading and unloading petroleum make sure the product being loaded or unloaded is the same as the product in the receiving tank.
- Make sure a filter separator is installed in each aviation fuel line between the storage tank and loading point. Take a sample to check the effectiveness of the filter/separator after the elements have been changed and every 30 days.
- Always use operational filter/separators when dispensing fuel.
- Never carry mixed loads of fuel in multicompartment tank vehicles. Convert tankers from one fuel to the other using the appropriate procedures.
- Each day a tank vehicle is used, recirculate the fuel in the tanker for 3 to 5 minutes. Then take a visual fuel sample and observe it for color brightness and clarity. Also, if used for aviation refueling, an Aqua-Glo test must be performed. Do not use the tanker if the fuel is contaminated.

- After loading and before discharging a tank vehicle, gage the tank for water. If any water is found, drain it immediately through the gravity discharge outlet. In addition, drain the water from the manual water drain valve.
- Do not carry foreign objects in pockets or clothing when working around petroleum tanks. Keep tools away from tank openings.
- Keep hoses in storage compartments when not in use. Do not remove dust caps or plugs from nozzles until they are ready for use.

Contaminants. Contamination may consist of solid foreign matter, free or emulsified water, mixed fuels or grades of fuel, or all of these.

- Foreign matter can enter fuel from a number of sources such as tanks, pipes, hoses and pumps, and also from people. The foreign matter found most often consists of bits of rust, paint, metal, rubber, lint, dust, and sand. Rust is probably the most common of these. Sediment is the general term applied to solid contaminants.
- Water is one of the most common contaminants. It can get into fuel through leaks and condensation. Dissolved water in fuel is like vaporized moisture in the air. Fresh or salt water may be present in small droplets that produce a cloud effect, in larger droplets that cling to the sides of containers, in very large amounts that settle to the bottom in a separate layer, or in emulsions. Emulsions usually occur when fuel droplets become suspended in water. This may happen when fuel is agitated in the presence of water, as when it passes through a pump. The heavier the fuel, the longer the emulsion may last.
- Mixed fuels or grades of fuels can be as serious as any other form of contamination. Different kinds of fuel must be stored in separate tanks and pumped one at a time so that fuels will not mix in lines, filter/separators, pumps, and refuelers. Be sure to mark all systems (fixed and mobile) to show what type of fuel each is handling at the time. Mixed fuels or grades are hard to detect without testing. Only people with a great deal of experience notice the slight changes in color or odor.

PART B - PETROLEUM LABORATORY OPERATIONS

Laboratory tests ensure fuels meet specifications, identify unknown products, detect contamination, verify unfavorable field tests, and provide the basis for disposition of unacceptable fuel. Laboratory tests include, but are not limited to, distillation, gravity, corrosion, water tolerance, particulate matter, freeze point, vapor pressure, gum content, tetraethyl lead, and sulfur.

Types of tests.

- Type “A” test - complete specification tests.
- Type “B-1” test - partial analysis comprising the checking of principal characteristics most likely to have been affected in the course of moving the product (contamination).
- Type ”B-2” test - partial analysis to verify characteristics susceptible to deterioration because of age.
- Type “B-3” test - partial analysis for contamination in particular for controlling the re-injection of pipeline interface products (contamination in the pipeline).
- Type “C” test - specific gravity, color and appearance, including visible sediment and water (visual).

DA Form 2077(Petroleum Laboratory Analysis Report). Review petroleum laboratory analysis reports to determine the condition of tested petroleum product. DA 2077 (refer to Figure 10-1) is used by the laboratory to indicate all test results on that given product and the disposition of the product.

- Sample number - extracted from sample tag.
- Laboratory report number - lab personnel assigned this number.
- Product nomenclature and type - extracted from sample tag.
- Specification number - extracted from sample tag.
- Sample submitted by - extracted from sample tag.
- Amount product sample represents - extracted from sample tag.
- Manufacturer or supplier of product - extracted from sample tag.
- Source of sample - extracted from sample tag.
- Sample tag - extracted from sample tag.
- Contract number - extracted from sample tag.
- Federal Stock Number - extracted from sample tag.

- Date sample taken - extracted from sample tag.
- Qual number - extracted from sample tag.
- Batch number - extracted from sample tag.
- Fill date - extracted from sample tag.
- Delivery date - extracted from sample tag.
- Blocks 1 through 62 - data extracted from specifications.
- Remarks block - fuel disposition.
- Date forward, signature, title - NCOIC or OIC of lab.

PART C - CONDUCTING TESTS AND INTERPRETING RESULTS

There are several ways to check for product contamination in the field. Product temperature and gravity, visual checks, particulate contamination by color and the Aqua Glo test all provide clues to product contamination.

- Temperature and Gravity. When a shipment arrives at a Class III facility, take the temperature and API gravity of the product. Determine the API gravity of the product. Gravity indicates uniformity of fuel more reliably than its quality. If the API gravity is out of range of that of the expected product, or if the difference at the same temperature is greater than 1/2 degree, do not unload the product until it is laboratory tested, as it may be contaminated.
- Visual checks. Look at the product carefully each time a transporter is loaded or unloaded. Proper color in a fuel indicates freshness and uniformity but not quality. When the color is off, it does not necessarily mean the product is off specification. However, it may show contamination or deterioration that may merit further investigation. If the fuel is cloudy or hazy, it probably contains undissolved water.
- Particulate contamination. Particulate contamination may be determined using the color method in a field environment. Samples are checked against a color standard to determine if a product is suitable for use. This method does not replace the requirement to have active filter/separators checked every 30 days by a laboratory.
- Aqua-Glo. The Aqua-Glo measures water in parts per million (PPM). Test results in excess of 10 PPM indicate aviation fuel is not suitable for Army or Air Force use. Aviation fuel used in Navy and Marine Corps equipment may not exceed 5 PPM.

PART D - FIRE AND SAFETY PRECAUTIONS

Follow these precautions during any gaging operation:

- Never conduct gaging operations in an electrical storm.
- Ensure soldiers doing the gaging check to see that the tank vehicles and tanks being gaged are properly bonded and grounded. Before starting gaging operations, they should ground themselves by touching their bare hands to the tank shell being gaged.
- Ensure supervisors do a safety risk assessment on whether soldiers should wear field gear during gaging operations. Although field gear can fall off and contaminate fuel and possibly create static electricity discharges, these factors should be balanced against the fact that a soldier could be severely injured from falling off tank vehicles or possibly injured due to the tactical situation (sniper fire, riots during contingency operations). In forward areas on tank vehicles, soldiers should wear full field gear, since the danger from related injuries is high and explosion and contamination dangers are relatively low. For operations on large fixed tanks in rear or garrison areas, soldiers should remove all loose uniform and field gear items that may potentially fall into the tank, since injury risks are relatively low, but the results of a static electricity discharge or fuel contamination are large.
- Open all hatches from the upwind side to allow the wind to blow vapors away from the gager. Avoid breathing vapors and fumes. Never allow soldiers to conduct gaging operations or any other petroleum operation alone. Train soldiers to recognize the symptoms of excess vapor inhalation and the steps to take if someone is overcome with petroleum vapors.
- Stand on the gaging platform, if the tank has one. Avoid standing on the roof.
- Keep the tape in a tape and bob against the rim of the gaging hatch at all times to avoid buildup of static electricity. Wipe the tape clean and dry after each use.

PETROLEUM PRODUCTS LABORATORY ANALYSIS REPORT For use of this form, see FM 10-67-2; The proponent agency is TRADOC		SAMPLE NO.	LAB REPORT NO.
PRODUCT NOMENCLATURE AND TYPE			SPEC. NO.
SAMPLE SUBMITTED BY *(Installation)*			AMT PROD SAMPLE REPRESENTS
MANUFACTURER OR SUPPLIER OF PRODUCT			SOURCE OF SAMPLE *(Truck, Tank, Aircraft, etc.)*
SAMPLE TAKEN BY *(Name)*	CONTRACT NO.	ITEM NO.	FSN	DATE SAMPLE TAKEN
QUAL NO.	BATCH NO.	FILL DATE	DLVR DATE	DATE SAMPLE REC
NAME AND LOCATION OF LABORATORY		☐ FUEL BULK STORAGE ☐ FUEL PACKAGED ☐ ALLIED PRODUCTS ☐ FILTER EFFECTIVENESS ☐ QUALIFICATION CONTRACT ☐ ROUTINE SURVEILLANCE ☐ PROCUREMENT ORIGIN ☐ PROCUREMENT ☐ SPECIAL ☐ DEPOT	DATE TESTS STARTED DATE TESTS COMPL

TEST	SPEC/ QUAL	RESULT	TEST	SPEC/ QUAL	RESULT
1. GRAVITY °API/SP GR 60°/60°F TOP			27. WATER AND SEDIMENT % VOL MAX		
a. MID			28. FSII % VOL TOP		
b. BOT			*a.* MID		
c. AVG			*b.* BOT		
2. APPEARANCE/WORKMANSHIP			*c.* AVG		
3. COLOR VISUAL			29. PARTICULATE CONTAMINANT MGS/GAL		
a. HELLIGE *(Colorimeter)*			30. THERMAL STABILITY INCHES HG		
b. ASTM MAX/SAYB MIN			*a.* PREHEATER RATING		
c. SAYB AFTER HEAT MIN			31. SULFIDES *(Tank Water BTMS)*		
4. ODOR			32. WATER SEPAROMETER INDEX MIN		
5. DISTILLATION 1BP °F			33. % ASH PLAIN/SULF MAX		
a. 10 % REC - ~~EVAP~~ AT °F			34. % LEAD		
b. 50 % REC - ~~EVAP~~ AT °F			35. % PHOSPHORUS		
c. 90 % REC - ~~EVAP~~ AT °F			36. % CHLORINE		
d. % REC - EVAP AT °F			37. BURNING TEST *(16 hrs)*		
e. FBP/~~DRY~~ PT °F			38. KIN CS/SSU AT °F		
f. % RECOVERED			*a.* KIN CS/SSU AT °F		
g. % LOSS			*b.* KIN CS/SSU AT °F		
h. % RESIDUE Max			*c.* KIN CS/SSU AT °F		
i. 10% + 50% EVAP °F MIN			*d.* SSF AT °F		
6. ENGINE RATING O.N. MOTOR METHOD			*e.* VISCOSITY INDEX MIN at 40 degrees C		
a. ON RESEARCH METHOD			39. EVAP LOSS % MAX		
b. LMR AVIATION METHOD			40. PRECIPITATION NO MAX		
c. RMR SUPER CH METHOD			41. SEPARATION % MAX		
d. CETANE NUMBER/INDEX MIN			42. ACID NO/BASE NO MAX		
7. RVP *(PSI)*			43. CHANNEL PT °F MAX		
8. GUM EXISTENT MG/100 ML MAX			44. SAPONIFICATION NO MAX		
GUM *(Wash)* MG/100 ML MAX			45. DIELECTRIC STRENGTH KV MIN		
GUM POTENTIAL MG/100 ML MAX			46. FOAM SEQ 1. MLS MAX *(TND/STAB)*		
PRECIPITATE MG/100 ML MAX			*a.* SEQ 2. MLS MAX *(TND/STAB)*		
9. TEL/TML *(ML/GM/GAL)* MAX			*b.* SEQ 3. MLS MAX *(TND/STAB)*		
10. OXIDATION STABILITY MINUTESMin			47. PENETRATION UNWORKED 77°F		
11. DR TEST/MERC S% MAX			*a.* PENETRATION WORKED 77°F		
12. SULFUR BY LAMP BOMB % MAX			48. DROP PT/MELT PT °F MIN		
13. FREEZING PT °F			49. CORR AND OXIDATION STAB		
14. CORROSION COPPER STRIP 3 hr @ 122 degreesF			50. SWELLING SYN RUBBER %		
15. AROMATICS % VOL MAX			51. LOW TEMP STABILITY		
16. OLEFINS % VOL MAX			52. SALT SPRAY TEST		
17. SMOKE POINT MM MIN			53. WORK STABILITY		
18. SMOKE VOLAT INDEX MIN			54. WATER STABILITY		
19. ANILINE PT °F/ANILINE GRAV PROD MIN			55. THICKENER TYPE		
20. FLASH/FIRE POINT °F MIN			56. THICKENER CONTENT %		
21. CLOUD POINT °F MAX			57. CORROSION PROTECTION		
22. POUR POINT °F MAX			58. REMOVAL		
23. WATER REACT INTERFACE RATING MAX			59. APPARENT VISC AT °F		
a. VOLUME CHANGE MAX			*a.* SHEAR RATE POISES		
24. CARBON RESIDUE % WT MAX			60. SED CONTAM. MILLIPOE, MG/L, MAX		
25. WATER % VOL MAX			61. EFFECTIVENESS OF FILTRATION min		
25. SEDIMENT % VOL MAX			62. OTHER *(Specify)* Sediment Volume		

REMARKS		
DATE FORWARDED	SIGNATURE	TITLE

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Figure 10-1, DA Form 2077.

PART E - ENVIRONMENTAL CONSIDERATIONS

Actual and potential oil spills regardless of size are of great concern to environmental protection authorities and to everyone involved in petroleum operations. Prevention should be the first line of defense against oil spills.

Army policy, as well as federal law, requires units to prevent spills of oil and hazardous substances and to provide prompt response to contain and clean up such spills. These laws, regulations, and policies prohibit any discharge of oil or hazardous substance from installations, vehicles, aircraft, and watercraft into the environment without a discharge permit.

Installation requirements dictate a unit's spill-prevention and -response planning for the units within their confines. During deployments, the deployment order directs spill-prevention and -response procedures. During contingency operations or combat, spill prevention and -response procedures are defined by HN or theater guidance and the unit SOP. Typical unit-level responsibilities include the following:

- Ensuring that the unit SOP complies with the Installation spill contingency plan (ISCP).
- Providing adequate facilities for storing and handling POL products and hazardous substances.
- Implementing safety and security measures in areas where spills are likely--maintenance areas, fuel points, supply facilities, and accumulation points.
- Appointing a trained spill coordinator and spill-response team.
- Conducting periodic spill-response drills.
- Maintaining adequate equipment and supplies for spill response.
- Posting telephone numbers of the installation's spill response agencies.

Unit Environmental Self-Assessment questions include:

- Is the unit spill-prevention plan present? Is it understood and being followed?
- Are oil, fuel, battery acid, hydraulic oil, or other HM spills properly reported?
- Does the unit enforce prohibitions against discharging pollutants on the ground or along fence lines?
- Are small oil spills cleaned up promptly and effectively?
- Are drip pans used under vehicles/equipment and spigots of POL product barrels where spills are likely to occur?
- Is contaminated soil properly disposed of at a designated authorized disposal area?

LESSON 10

PRACTICE EXERCISE

The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you complete the exercise, check your answers with the answer key at the end of this subcourse. If you answer any items incorrectly, go back to the part of the lesson that contains the information involved and study again.

1. Which of the following petroleum laboratory tests is a partial analysis to verify characteristics susceptible to deterioration because of age?
   A. Type “C” test.
   B. Type “B-1” test.
   C. Type “A” test.
   D. Type “B-2” test.

2. Which of the following is probably the most common type of foreign matter that causes contamination in fuel?
   A. Dust.
   B. Lint.
   C. Rust.
   D. Rubber.

3. When checking for product contamination in the field, how is particulate contamination determined?
   A. Using the historical data method.
   B. Using the color method.
   C. Using the temperature method.
   D. Using the Aqua-Glo test.

4. When conducting Quality Surveillance operations, under what circumstances should a soldier wear full field gear?
   A. For operations on large fixed tanks in rear or garrison areas.
   B. In forward areas on tank vehicles.
   C. When conducting operations in an electrical storm.
   D. All of the above.

5. What is the first line of defense against oil spills?
   A. Prevention.
   B. Booms.
   C. Absorbents.
   D. Reporting.

Section I

GLOSSARY

Acronyms and Abbreviations

ACCP	Army correspondence course program
AAR	after action report
ABFDS	Ariel bulk fuel delivery system
AIPD	Army institute for professional development
API	American Petroleum Institute
ATC	air traffic control, air traffic controller
ASTM	American Society for Testing and Materials
AVGAS	aviation gasoline
AVN BDE	aviation brigade
C	Celsius
CAB	combat aviation brigade
CMMC	Corps Material Management Center
COMMZ	communications zone
CONUS	continental United States
COSCOM	Corps Support Command
DA	Department of the Army
DD	Department of Defense
DF	diesel fuel
DFM	Diesel Fuel Marine
DFSC	Defense Fuel Supply Center
DISCOM	Division Support Command
DETC	Distance education and training council
DLA	Defense Logistics Agency
DMMC	Division Material Management Center
DOT	Department of Transportation
DS	direct support
EPA	Environmental Protection Agency
F	Fahrenheit
FARE	Forward Area Refueling Equipment
FFCA	Federal Facilities Compliance Act
FM	field manual
FSB	Forward Support Battalion
FSII	fuel system icing inhibitor
FSSP	Fuel System Supply Point
gal	gallon(s)
GPM	gallons per minute
GS	general support
HAZMAT	hazardous material
HEMTT	heavy expanded mobility tactical truck
HDBK	handbook
HM	hazardous material
HMIS	hazardous material information system
HN	host nation
HW	hazardous waste
IAW	in accordance with
ISCP	Installation Spill Contingency Plan
JP	jet propulsion
JPO	Joint Petroleum Office
LCD	lowest common denominator
LIN	line item number
MBPAS	monthly bulk petroleum accounting summary
MIL	military
MOGAS	motor gasoline
MOPP	mission-oriented protective posture
MOS	military occupational specialty
MSB	Main Support Battalion
MSDS	Material Safety Data Sheet
NATO	North Atlantic Treaty Organization
NCO	noncommissioned officer
NCOIC	noncommissioned officer in charge
NSN	national stock number
OPFOR	opposing forces
PMCS	preventive maintenance checks and services
POL	petroleum, oils, lubricants
ppm	parts per million
QS	quality surveillance
RCRA	Resource Conservation and Recovery Act
RQ	required quantity
S4	Supply Officer (US Army)
S&S	supply and services
SF	standard form
SOP	standard operating procedure
SPCC	Spill Control and Countermeasures Plan
STANAG	Standardization Agreement
STD	standard
TM	technical manual
TMMC	Theater Material Management Center
TOE	tables of organization and equipment
TPU	tank and pump unit
US	United States (of America)

Section II.

Terms

Additive an agent used for improving existing characteristics or for imparting new characteristics to certain petroleum products.

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.

Aqua-Glo test A test to detect water in fuel supplies.

Appearance refers to the visual examination of fuels. The terms used to describe appearance are clear and bright, hazy and cloudy.

Aviation fuels (AVFUELS) those refined petroleum products specifically formulated and blended for use in aircraft engines, both jet engines and piston (reciprocating) engines. AVGAS (below) is an aviation fuel.

Aviation gasoline (AVGAS) A hydrocarbon fuel for use in reciprocating piston-type aircraft engines. AVGAS is characterized by high vapor pressure and distillation range and high tetraethyl lead content. It is procured by the military under specification MIL-G-5572.

Bonding Electrically connecting units of containers before operations begin in order equalize any static potential that might exist and to provide a continuous path for any static potential that might be generated after operations begin.

Bottom loading Refers to the loading of a railway tank car or tank vehicle through the bottom outlet. Bottom loading reduces loss through vapor formation.

Burner fuel oil A fuel oil used under boilers and in furnaces to generate power or heat. Under Federal Specification (FS) W-F-815, it is produced in six grades: FS No. 1, FS No. 2, FS No. 4, FS No. 5 (Light) FS No. 5 (Heavy), and FS No. 6. Under specification MIL-F-859, one grade, Navy special, is produced.

Class III (POL) Petroleum fuels: lubricants, hydraulic and insulating oils, preservatives, liquid and compressed gases, chemical products, coolants, deicing and antifreeze compounds, together with Components and additives of such products and coal.

Class III A (Air) Petroleum and chemical products used in support of aircraft.

Class III W (Ground) Petroleum and chemical products and solid fuels used in support of ground and marine equipment.

Clear and bright Clear is the absence of visible solids, a cloud, a haze, an emulsion, or free water in the product. Bright is the sparkle of clean, dry product in transmitted light.

Compression ignition In a diesel engine the heat of compression ignites the fuel, in contrast to the spark ignition in a gasoline engine.

Contaminant A foreign substance in a product.

Contaminated product A product in which one or more grades or types of products have been inadvertently mixed, or a product containing foreign matter, such as dust, dirt, rust water, or emulsions.

Corrosion Rusting; a gradual eating away or oxidation such, as the action of moist air on steel, and the more rapid chemical action of acid on metal or steel.

Flash point The lowest temperature at which a liquid petroleum product gives off vapor in sufficient concentration to ignite (that is, flash) on application of a flame under specified conditions.

Ground products Refined petroleum products normally intended for use in administrative, combat, and tactical vehicles, materials-handling equipment, special-purpose vehicles, and stationary power and heating equipment.

Innage tape and bob A steel measuring tape connected by a harness snap to the eye of cone-tipped bob. Used to measure the distance from the bottom of the tank to the liquid level of product in a tank or gage pipe.

Joint Petroleum Office (JPO) An office established by the Joint Chiefs of Staff with petroleum logistics responsibilities in a unified command in oversea areas.

Off-specification product A product which fails to meet one or more of the physical, chemical, or performance requirements of the specification.

Petroleum measurement tables ASTM-IP tables provided for the calculation of quantities of petroleum and its products under the required conditions in any of three systems of measurements. Tables are provided for the reduction of gravity and volume to standard states over normal operating ranges, for calculation of weight-volume relationship, and for interconversion of a wide variety of commercially useful unit's (ASTM Method D 1250).

POL Petroleum, Oils, and Lubricants. Included are petroleum fuels, lubricants, hydraulic and insulating oils, temporary protectives, liquid and compressed gases, chemical products, liquid coolants, deicing and antifreeze compounds, together with components and additives of such products.

Quality surveillance The measures taken to ensure that petroleum products which have been accepted by the government as being of the required quality are still of the required quality when delivered to the user. QS includes watching over and caring for products during all storage and handling operations, adhering to handling methods and procedures designed to protect quality, and examining and testing of products in storage and on change of custody.

Sediment and water Solids and aqueous solutions which may be present in an oil and which may be left to settle or which may be separated more rapidly by a centrifuge.

Specific gravity the ratio of the weight of any quantity of matter, a petroleum product for example, to the weight of an equal quantity of water; usually determined by use of a hydrometer.

volatile Tending to evaporate or vaporize readily; volatility is the extent to which a liquid vaporizes or the ease with which it turns to vapor.

volume correction The correction of measured quantity of product, determined by gaging at observed temperature and gravity and reference to a gage table, to net quantity of product at 60° F (16°C) after deducting bottom water and sediment.

water contamination Water present in a fuel in any form; includes dissolved water similar to moisture in the air, entrained water suspended in the form of minute droplets, and free water.

Lesson 1 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	D. Part A
2.	B. Part B
3.	C. Part B
4.	C. Part C
5.	A. Part C

Lesson 2 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	D. Part A
2.	D. Part C
3.	B. Part G
4.	B. Part I
5.	D. Part J

Lesson 3 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	C. Part A
2.	A. Part B
3.	A. Part B
4.	D. Part B
5.	B. Part B

Lesson 4 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	A. Part A
2.	C. Part A
3.	D. Part C
4.	D. Part E
5.	B. Part D

Lesson 5 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	B. Part A
2.	D. Part B
3.	A. Part C
4.	C. Part D
5.	D. Part E

Lesson 6 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	B. Part A
2.	D. Part B
3.	C. Part C
4.	B. Part D
5.	D. Part F

Lesson 7 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	A. Part B
2.	A. Part B
3.	C. Part C
4.	B. Part C
5.	B. Part D

Lesson 8 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	D. Part A
2.	C. Part B
3.	C. Part C
4.	B. Part C
5.	D. Part D

Lesson 9 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	D. Part A
2.	A. Part C
3.	C. Part E
4.	B. Part G
5.	A. Part H

Lesson 10 Practice Exercise Answer Key and Feedback

Item	Correct Answer and Feedback
1.	D. Part B
2.	C. Part A
3.	B. Part C
4.	B. Part D
5.	A. Part E