Implement a Unit Waste Management Plan
05-2-7501 / Version 1
Effective Date Not Assigned

SECTION I. ADMINISTRATIVE DATA

All Courses Including This Lesson

Course Number	Version	Course Title
None		

Task(s) Taught(*) or Supported

Task Number	Task Title
Collective	
05-2-7501	Develop an Integrated Waste Management Plan
05-2-7502	React to a Hazardous Spill
05-2-7503	Implement Unit Hazardous Materials Management

Reinforced Task(s)

Task Number	Task Title
None	

Knowledge

Knowledge Id	Title	Taught	Required
None			

Skill

Skill Id	Title	Taught	Required
None			

Administrative/ Academic Hours

The administrative/academic hours required to teach this lesson are as follows:

Academic	Resident Hours / Methods		
Yes	0 hrs	0 mins	Lecture
Yes	1 hr	0 mins	Oral Presentation
Yes	0 hrs	0 mins	Test Review
Yes	0 hrs	0 mins	Test
Total Hours:	1 hr	0 mins	

Test Lesson Number

Hours	Lesson Number
None	

Prerequisite Lesson(s)

Lesson Number	Lesson Title
None	

Clearance Access

Security Level: Unclassified

Foreign Disclosure Restrictions

FD5. This product/publication has been reviewed by the training/educational developers in coordination with the Ft Leonard Wood FD authority. This product is releasable to students from all requesting foreign countries without restrictions.

References

Number	Title	Date	Additional Information
AR 200-1	ENVIRONMENTAL PROTECTION AND ENHANCEMENT	13 Dec 2007	
FM 3-34.5	ENVIRONMENTAL CONSIDERATIONS	16 Feb 2010	
FM 5-19	COMPOSITE RISK MANAGEMENT	21 Aug 2006	
TC 3-34.489	The Soldier and the Environment.	08 May 2001	
TM 38-410	STORAGE AND HANDLING OF HAZARDOUS MATERIALS {DLAM 4145.11; NAVSUP PUB 573; AFR 69-9; MCO 4450-12}	13 Jan 1999	

Student Study Assignment

None

Instructor Requirements

None

Additional Support Personnel Requirements

Name	Student Ratio	Qty	Man Hours
None			

Equipment Required for Instruction

ID - Name	Student Ratio	Instructor Ratio	Spt	Qty	Exp
None					

Materials Required

Instructor Materials:

None

Student Materials:

None

Classroom, Training Area, and Range Requirements

None

Ammunition Requirements

DODIC - Name	Exp	Student Ratio	Instruct Ratio	Spt Qty
None				

Instructional Guidance

NOTE: Before presenting this lesson, instructors must thoroughly prepare by studying this lesson and identified reference material.

None

Proponent Lesson Plan Approvals

Name	Rank	Position	Date
None			NO DATA

SECTION II. INTRODUCTION

Method of Instruction: Oral Presentation
Instr Type(I:S Ratio/Qty):
Time of Instruction: 1 hr
Instructional Strategy: Lecture

Motivator

Safe and efficient methods of waste disposal present many challenges. It is important for the health and well being of soldiers, civilians, and the environment to take considerations that will reduce the risk of harm from improper waste disposal.

Terminal Learning Objective

NOTE. Inform the students of the following Terminal Learning Objective requirements.

At the completion of this lesson, you [the student] will:

Action:	Develop an integrated waste management plan that provides safe methods of disposal for waste streams generated at a base camp.
Conditions:	As an element designing a base camp in a deployed environment, and given access to environmental guidance provided in the references.
Standards:	Design an integrated waste management plan that addresses the waste streams generated by the base camp.

Safety Requirements

Safety Requirements: None

Risk Assessment Level

None

Environmental Considerations

NOTE: Instructor should conduct a Risk Assessment to include Environmental Considerations IAW FM 3-34.5, Environmental Considerations {MCRP 4-11B}, and ensure students are briefed on hazards and control measures.

Environmental Considerations: Training entirely of an administrative nature, with little or no environmental impact. However, Instructor should conduct a Risk Assessment to include Environmental Considerations IAW FM 3-34.5, Environmental Considerations {MCRP 4-11B}, and ensure students are briefed on hazards and control measures.

Evaluation

NOTE: Describe how the student must demonstrate the accomplishment of the TLO. Refer student to the Student Evaluation Plan.

Instructional Lead-in

None

SECTION III. PRESENTATION

NOTE: Inform the students of the Enabling Learning Objective requirements.

A. ENABLING LEARNING OBJECTIVE

ACTION:	Describe the components of an integrated waste management plan.
CONDITIONS:	Given the components of an integrated waste management plan.
STANDARDS:	List the three primary waste streams addressed in the integrated waste management plan.

ELO A - LSA 1. Learning Step / Activity ELO A - LSA 1. Define integrated waste management

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 6

Meeting America's strategic objectives hinges on the Army's ability to promptly deploy forces at any time, in any environment, and against any adversary. Exploiting this expeditionary capability will often place units in an austere OE that lacks the necessary infrastructure to accommodate its generated waste. Haphazardly stockpiling or disposing of waste can spread disease and threaten human health, contaminate food and water sources, harm the environment, and negatively impact mission readiness. In support of the Army's commitment to environmental stewardship, and to minimize the harmful impacts of waste on Soldier health, the environment, and the mission, commanders at each echelon must ensure that waste management is incorporated throughout the operations process.

There is no easy solution to dealing with waste products. Every method of disposal is going to have negative effects to public health or the environment. Solutions to mitigate and control these harmful effects include the hierarchy of waste management, which is avoidance, or using alternative products, re-using, and methods of disposal.

Solid waste is any material or substance (solid or liquid) that is inherently waste-like by being no longer suitable for its originally intended purpose. Nonhazardous SW is any waste material that does not exhibit a hazardous characteristic and is generally recognized as garbage or general refuse. Nonhazardous SW includes items such as discarded paper, plastic, cardboard, wood, metal, glass, construction debris, and food waste. The primary components of a nonhazardous SW management system are: segregation, collection, transportation, recovery, and disposal.

Hazardous waste is any solid waste that is either listed as such in federal law or exhibits any of the four hazardous characteristics—ignitability, corrosive, reactivity, or toxicity (FM 3-34.5). Examples of common HW include used solvents, waste fuel filters, contaminated fuel, paint waste, non-punctured aerosol cans, and contaminated

soil from fuel spills.

Roughly 80 percent of all water used for purposes other than human consumption ends up as wastewater and will require treatment and disposal. The volume of wastewater alone presents a significant challenge, and depending on the source, it may contain suspended solids, organic material, biological organisms, and toxic chemicals that will require treatment prior to disposal.

Slide 7

As waste streams are analyzed and waste requirements are identified, waste management uses a 6-step process to develop a specific plan to meet the requirements for each type of waste. The six steps for developing a waste management plan are

Step 1: Analyze the situation.

Step 2: Develop preliminary waste estimates.

Step 3: Categorize waste requirements.

Step 4: Evaluate waste management capabilities.

Step 5: Generate solutions.

Step 6: Integrate waste management tasks into plans and orders.

Check on Learning: What are the three Priorities in the integrated waste management hierarchy?

Review Summary: None

ELO A - LSA 2. Learning Step / Activity ELO A - LSA 2. Describe the integrated waste management hierarchy

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 8

This is the hierarchy of waste management. Obviously, if a waste is not produced there will not be a need for disposal, which is why avoidance and reduction is the top of the hierarchy. Reuse and recycle involve finding a beneficial use for the product, rather than considering it a waste. Methods of disposal will need to be balanced in order to achieve an efficient disposal scheme.

Slide 9

Avoidance is NOT producing a waste stream. There are many ways in which waste streams can be avoided. Avoidance activities include items ranging from using refillable water bottles to rechargeable batteries. Assess your unit's activities to determine ways you can avoid creating waste.

Slide 10

Reduce the amount of waste you and your unit produce. Little things make a big

difference when incorporated collectively. Simple things like using a reusable coffee mug eliminates the logistical process of disposal. Other items such as rechargeable batteries can make a big difference.
Reuse of items can include everything form batteries, making simple repairs on broken items rather than purchasing new, or passing along items through the use of a Hazmart. Reusing materials such as wood pallets, batteries, or other materials that could serve as a beneficial product.

Recycle- Much of the waste stream a unit generates is recyclable. From plastic bottles, cans, to large scrap metal. If deployed, check with local nationals for recycling options for scrap metal. This could build relationships and provide a safe alternative to disposal. Check local guidance on the availability for recycling batteries. Many installations and base camps will have a DRMS nearby that can assist in the collection and recycling of these products.
Responsibility is important for every soldier. Use integrity when making decisions about waste and do the right thing. Finding an alternative option to disposal may not be the most convenient option, but it will assist in the sustainability for the Army's mission and protect the environment and health of our soldiers.

Slide 11

An example of reducing waste streams is using the process of composting. Composting is the controlled process of organic degradation or waste decomposition. It transforms a potential waste into a beneficial product.
In the process of waste decomposition, an array of micro-organisms and invertebrates consume the organics and convert them to humus, a soil amendment. In it's truest sense, composting is actually microbe farming, and like other types of farming, success has a lot to do with the farmer knowing how to make what he is raising thrive and grow.
Composting can be a simple process, but it is important that the microbes receive a balance of carbon and nitrogen to serve as the microbes energy source, oxygen, and moisture. The components affecting the composting process include the physical and chemical properties of the feedstock, moisture, oxygen, and temperature.

Slide 12

Composting processes are varied and numerous. The process spans a spectrum that is dependent upon the amount of material to be composted.
Pile composting consists of placing the feedstock in a heap or pile. This is the simplest form of composting and can be a slow process. Piles should be constructed to take advantage of natural air currents and convection currents form the heated waste. Static piles can be aerated using both passive and active systems. In a passive aerated static pile, the pile is constructed over a series of perforated pipes. As the compost heats up, hot air rises through the pile forcing outside air to move into the pipes and through the pile. With a force air system, air is forced through the pipes and into the pile using a fan or blower. A forced air system gives an operator more control over the composting process. Both pile composting and static pile can be managed by turning the pile. This will aerate the compost and will assist in providing a

homogenous mixture of nutrients and moisture throughout the pile. Depending upon the size of the pile, turning can be accomplished through the use of a pitchfork or front end loader.

Windrow composting consists of elongated piles. The windrows are most often managed by turning the feedstock on a routine basis. Turning the windrow improves the aeration and promotes mixing of the feedstock. The decomposition time is much quicker with managed windrows than in static piles. When turning a windrow, the operator should move the compost form the outside of the pile to the middle.

In-vessel/container system represents the highest level of process management available. A properly system can significantly reduce environmental concerns associated with composting waste. In-vessel composting can be performed through rotating drums, containers, silos, and anaerobic digesters. In-vessel systems are primarily used to accelerate the rapid decomposition phase of the composting process.

Slide 13

The last resort to managing waste is disposal. Although it should be considered the last resort, it is extremely important to ensure that the disposal is done in a safe manner that protects human health and the environment.

Check on Learning: What is the best management approach for collecting solid waste?

Review Summary: None

CHECK ON LEARNING (ELO A): What are the three Priorities in the integrated waste management hierarchy?

REVIEW SUMMARY(ELO A): A successful integrated waste management plan must first identify the types and amounts of waste, seek alternatives to disposal, then identify the disposal option that has the lowest of harm to human health and the environment.

B. ENABLING LEARNING OBJECTIVE

ACTION:	Describe the methods of disposal for non-hazardous solid waste
CONDITIONS:	Give various methods of disposal for soild waste.
STANDARDS:	Describe three methods of safely disposing non-hazardous solid waste.

ELO B - LSA 1. Learning Step / Activity ELO B - LSA 1. Solid waste collection and segregation

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 16

There is no one solution for managing waste streams. Managing for solid waste includes effective segregation of the waste streams and combining multiple types of disposal.

Source segregation is the preferred method of segregating wastes. This segregates the waste at the point of generation, rather than having to segregate it after it has been mixed with other types of waste. This will ultimately save time and space in the recycling/segregating area. The key to any successful integrated waste management is segregating the materials and ensure that each is properly disposed of.

Check on Learning: *Conduct check on learning.*

Review Summary: None

ELO B - LSA 2. Learning Step / Activity ELO B - LSA 2. Burial and Landfilling solid waste

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 17

When units are on the move or are stationary in a position for less than 1 week, or when established landfills are unavailable, nonhazardous SW should be buried in pits or trenches. Pits are preferred for overnight halts. A pit 4 feet square and 4 feet deep is suitable for 1 day for a unit of 100 individuals. The pit is filled to not more than 1 foot from the top, then covered, compacted, and mounded with 1 foot of earth. For stays greater than 2 days, a continuous trench is preferable since it can accommodate a larger amount of garbage and allows for a daily coverage of earth as the trench is extended. The trench is first dug about 2 feet wide, 4 feet deep, and long enough to accommodate the garbage for the first day. As in the pit method, the trench is filled to not more than 1 foot from the top; then covered, compacted, and mounded with 1 foot of earth. The trench is extended as required, and the excavated dirt is used to cover and mound the garbage already deposited. This procedure is repeated daily or as often as SW is dumped.

At a minimum, waste burial sites are located at least 100 meters from any natural water source used for cooking or drinking such as a stream, lake, or well. The waste burial site will also be at least 30 meters from kitchens and eating areas to minimize problems with insects, rodents, and odor.

When closing a waste burial site, place a rectangular sign on top of the site indicating the type of pit/trench, the date it was closed, and the unit designation if the situation allows. An 8-digit grid coordinate is recorded for each waste burial site and reported to higher headquarters. This information will be helpful in resolving disputes with landowners or HN governments and in performing any future remediation that may be required.

Slide 18

There have been some landfills developed within contingency operations, but the operation and maintenance of these landfills has not been maintained. Many of these landfills have caught on fire, and burned for weeks at a time. Problems associated with landfills include ground and surface water contamination, vectors, disease, and production of methane gas (a highly explosive gas).

A landfill is a much more complex process than digging a hole in the ground and burying the waste. There must be controls in places such as a compact impermeable liner (clay or geotextile fabric) that will reduce or eliminate leachate from infecting groundwater sources. Other design features include the type of landfill, and daily operations such as using a daily soil cover to reduce odors and vectors.

Typical trench landfill design. Each cell has 6 inches of daily cover applied at the end of the operational day. The daily cover is obtained from the backside of the trench and moved to the working face. The original trench earthen material is stock piled for the finial cover of the landfill closure, the finial slope should not exceed a 4:1 slope to reduce erosion. The slope will also need to be seeded with natural ground cover for the area.

Check on Learning: **Conduct check on learning.**

Review Summary: None

ELO B - LSA 3. Learning Step / Activity ELO B - LSA 3. Solid waste incinerators

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 19

The barrel incinerator will effectively handle the SW produced by a company-sized unit. This is an excellent dry trash incinerator, but wet material tends to disrupt proper draft and does not burn easily. A stack is made from an oil drum with both ends cut out or with one end cut out and the other end liberally punched with holes to admit draft air. Holes are punched through the sides of the drum and steel rods are inserted. The steel rods create a grate. The drum is set up on rocks, bricks, or other nonflammable material. A fire is built under the drum and the waste is added, one shovelful at a time, on top of the grate.

Running incinerators is difficult, as it may be difficult to operate and maintain. It also requires a sorting yard to ensure that no explosive items will be incinerated. Incinerators are good and that it reduces the amount of air pollution hazards for our fighting force.

Typical burn rates will be at 1500-1800 degrees F. depending on the feedstock for the incinerator. No waste that is over 25% wet should be burnt, as it will not process effectively in an incinerator or burn pit.

In addition, medical waste and hazardous waste incinerators may be available. These should be separate from the solid waste incinerator. The Center for Health Prevention and Preventive Medicine (CHPPM) deal with the regulated medical waste (RMW). Often, the destruction of the RMW will require assistance from either the engineers or environmental staff. Retrograding of medical waste may be required during the initial deployment, until a ½ ton medical burn incinerator can be obtained.

The placement of incinerators near the final sorting area simplifies the site and requires less transport of the waste. Medical incinerators may be located near the point of generation rather than the one stop waste disposal area.

Slide 20

Open-pit incinerators (also called air curtain incinerators) have been developed for controlled incineration of explosive wastes, wastes which would create an explosion hazard in a conventional, enclosed incinerator. They are also used for large items such as tree trunks and large animal carcasses.

Slide 21

Air Curtain Burners, also called FireBoxes, were designed principally as a pollution control device. The primary objective of an air curtain machine is to reduce the particulate matter (PM) or smoke, that results from burning waste. It is sometimes hard to visualize without seeing a machine in operation, but the machines do not burn anything, rather they control the results of something burning.

Slide 22

Additional disposal options include incineration. These photos show two 64 ton solid waste incinerators. Running incinerators is difficult, as a contract will need to be in place for the operation and maintenance, it also requires a sorting yard to ensure that no explosive items will be incinerated. Incinerators are good and that it reduces the amount of air pollution hazards for our fighting force.

Typical burn rates will be at 1500-1800 degrees F. depending on the feedstock for the incinerator.

No waste that is over 25% wet should be burnt, as it will not process effectively in an incinerator or burn pit. Segregation is extremely important in order prevent damaging the machinery.

Slide 23

This is a typical burn pit design. The design can vary depending on local conditions. Regardless of size of the burn pit, the siting and trade winds are two major factors that need to be taken into account. Burn pits should not be near billets, office areas, air strips or any area where the smoke will interfere or can cause any type of damage to personnel or equipment.

This photo shows an operational burn pit. What should be have been done to improve this burn pit? Look at the smoke, that is the normal direction of wind at this location. If the pit had been turned a bit, they could be burning against the back wall and covering the ash as required. The siting of this pit was in a good location and construction was done well with the soil type.

The functionality of the burn pit will be successful only if the all non-combustible

materials have been segregated from the waste. Waste that emits toxins when burned, such as plastic water bottles, should never be placed into the burn pit.

Check on Learning: Conduct check on learning.

Review Summary: None

CHECK ON LEARNING (ELO B): What is the best management approach for collecting solid waste?

REVIEW SUMMARY(ELO B): None

C. ENABLING LEARNING OBJECTIVE

ACTION:	Describe the methods of disposal for hazardous waste
CONDITIONS:	Given this lesson and associated references
STANDARDS:	Describe the processes involved in storing, transporting, and disposing hazardous waste

ELO C - LSA 1. Learning Step / Activity ELO C - LSA 1. Hazardous Waste Disposal

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 26

EPA defines hazardous waste in 40 CFR 261,

1. Meets the definition of one or more of the hazardous waste “characteristics”. The four characteristics are:

(a) Ignitable. Ignitable waste materials are liquids that have a flashpoint of less than 140 degrees F. or solids that catch fire easily and burn so rapidly that they create a serious health hazard.

(b) Corrosive. A corrosive is a liquid that has a pH value less than or equal to 2.0, or a pH value equal to of greater than 12.5. Corrosives will corrode a standard metal container.

(c) Reactive. Waste materials that are normally unstable, react violently with water, have explosive potential, or release poisonous gases, are reactive.

(d) Toxic. A waste is toxic if, when tested by an EPA-approved method, an extract from the waste contains specified concentrations of heavy metals or pesticides.

2. The waste is a “listed” hazardous waste (EPA has provided lists of specific wastes in the hazardous waste regulation).

Slide 27

Common ways HMs become HW include:

(1) The shelf life expires.
(2) By law the HM when discarded becomes a HW (often a listed waste).
(3) HM with characteristics is discarded.
(4) HM becomes unusable and must be discarded.
(5) HMs (or solid waste and HM) are mixed.
(6) HM becomes contaminated and can not be used for its' original purpose.

NOTE: The Material Safety Data Sheet for the original product should provide information to help answer questions. If in doubt, call your environmental office.

Slide 28

One method of avoiding hazardous waste is the creation of a hazmart facility. A fully functional and properly configured HAZMART will, among other things, provide quicker response for mission essential materials and a reduction in the hazardous material placed on the functional organizations. It should be noted, however, a new or remodeled facility is not a mandatory prerequisite to implementation of an HPP. The functional categories of the HAZMART are Control and Management, Regulated Distribution, Material Reuse and Recycling, and Reduction of Hazardous Waste

Site Requirements Recommendations:

- Locate facility within the Base Camp perimeter using the minimum fire separation distances
- Topography should be flat
- Co-locate with base camp waste management site
- Ensure proper access and egress for units
- Avoid excessive exposure from the elements when locating the building if possible
- Plan for customer parking and fire lanes
- Ensure secondary containment
- Provide water, sanitary sewer, electric
, telephone and fire alarm system

Slide 29

If available, you may need the safety equipment for each section of the design

Computer with database and barcode equipment

Telephone/radio

Intrinsically safe wiring/outlets

Shelved storage bays

Drum storage bays

Spill containment pits

Scales

Safety area and equipment

Fire suppression/extinguishers

Eyewash/Safety Shower

Grounding equipment

Spill Kits

Overpack equipment and materials

Crane Chain Lifting device (3000 lbs max)

Slide 30

Examples of items to check in container management are:

HM/HW container must have proper shipping name, in accordance with 49 CFR

HM/HW container must be labeled according to directives IAW your SOP or 49 CFR (default).

Use the original container, to the extent possible, to accumulate and transport HM/HW.

Containers must be labeled and marked properly so that personnel and emergency response personnel know what potential hazards exist.

Slide 31

Do not overfill any container. 90% capacity rule for thermal expansion. (General rule of thumb for headspace: leave 5 inches for a 55-gallon drum.)

Do not stack drums more than 2 high. When drums are stored on their sides bung holes for drums should be placed at 9 o'clock and 3 o'clock positions. If the bungs leak, then only 50% of the container will drain.

Flammable containers will not be stacked.

There must be at least 3 feet between rows of containers to permit aisle space.

Containers should be protected from the weather to avoid corrosion (if stored outside, cover); Store in approved cabinets, rooms and building; Containers must have lids and remain closed when not being filled.

Use empty containers from HM to accumulate the resultant HW; old markings and labels must be removed or painted to avoid confusion regarding contents. Containers should be turned in IAW SOP; ensure all documents pertaining to the contents have been annotated.

Slide 32

HM/HW deposited in containers must be compatible with the container and with each other. Do not mix wastes. Examples of segregated wastes include:

(1) Used oil and hydraulic fluids.

(2) Solvents.

(3) Paints and thinners.

(4) Acids.

Picture:

Ten vehicles were damaged in the parking lot of the hospital by a fire that started in the truck of a POV. The trunk contained two 5-gallon gas cans filled with gasoline. The Post Fire Department suspects that the fumes built up inside the closed truck and then were ignited by an electrical source (tail lights, brake lights, etc.). The gas containers did not have the lids on tight (see insert). They only had the spouts with caps, which would allow for leakage of vapors.

Fortunately, no one was injured. This incident could easily have caused serious injuries and much greater damage. This should call to our attention the facts that

gasoline and other fuels are extremely dangerous and that we must use great care when using, filling, transporting, or storing them.

Slide 33

The DLA Customer Handbook recommends these HW segregation categories for storage. Each category of waste should be separated from the others with secondary containment and a barrier (or adequate spacing).

Slide 34

Hazardous waste accumulation requirements include: Accumulation begins with the first drop of material in storage; practice good housekeeping to include segregation, secondary containment, adequate aisle space to provide unobstructed movement of personnel and fire/spill control equipment in an emergency; inspect weekly for leaks/deterioration of containers; annotate accumulation log with any deficiencies and corrections. By regulations, this must be accomplished weekly; accumulate by characteristics and separate like items by a dike, berm or wall in main accumulation areas.

Slide 35

HWAP must be formally designated and must meet Resource Conservation Recovery Act requirements. A hazardous waste accumulation point may be in a Motor Pool, Arms Room, hospital Labs and CBRN Room or all four locations. You still need to take care of each location and check periodically. General items to look for are: Containers cannot be larger than 55 gallons or 1 quart for acute hazardous waste; containers are located at or near the hazardous waste point of origination; containers are under control of the operator generating the waste; containers must be dated once first drop of waste is put in the container; full or one year limit containers must be turned into a permitted or temporary storage area within 72 hours.

Slide 36

Spill Drill

(1). The basic unit Spill Drill includes:

- Protect yourself
- Remove the spill source
- Envelope the spill
- Absorb/accumulate
- Containerize/cleanup
- Tell your supervisor or transmit a report

(2). Some units with unique hazardous materials on hand need a tailored plan to cover possible spills of those materials.

Slide 37

Land farming is a bioremediation technology. Contaminated soils are mixed with soil amendments such as soil bulking agents and nutrients, and then they are tilled into the earth. The material is periodically tilled for aeration. Contaminants are degraded, transformed, and immobilized by microbiological processes and by oxidation. Soil conditions are controlled to optimize the rate of contaminant degradation. Moisture

content, frequency of aeration, and pH are all conditions that may be controlled. Land Farming differs from composting because it actually incorporates contaminated soil into soil that is uncontaminated. Composting also generally takes place in aboveground piles.

Check on Learning: conduct check on learning

Review Summary: None

CHECK ON LEARNING (ELO C): What are a few of the general hazardous waste accumulation requirements?

REVIEW SUMMARY(ELO C): None

D. ENABLING LEARNING OBJECTIVE

ACTION:	Describe the methods of wastewater disposal
CONDITIONS:	Given this lesson and associated references
STANDARDS:	Describe options for waste water disposal from expedient methods to established base camps.

ELO D - LSA 1. Learning Step / Activity ELO D - LSA 1. Describe the process involved for managing wastewater

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 40

Water that contains dissolved or suspended waste materials. There are many threats to our health from wastewater that is not managed correctly. Discussed will be a general description of wastewater management options. As with other waste considerations, the siting of latrines and wastewater facilities plays an important role in safely managing the waste.

Slide 41

There are two general types of wastewater. Greywater, which comes from Showers, kitchens and laundries is reusable. Before grey water can be reused, you will need to check with preventive medicine to ensure it is safe. One method of reuse in grey water is a moisture additive for composting. For this to be efficient, the grey water evaporation ponds or storage tanks should be placed near the composting site if feasible.

Blackwater is water contaminated with human waste. It is not reusable and must be treated in a in lagoon, package plant, or facility capable of treating the waste.

Slide 42

Analyze the Situation

Beginning during mission analysis and continuing throughout the deployment, waste management planners attempt to gain a better understanding of where black water will be generated based on the array of forces. Knowing where forces will be positioned allows waste management planners to focus their analysis on determining the availability of existing toilet and treatment facilities in those areas, and the effects that the terrain (soil composition, surface configuration, and hydrology), and environmental and civil considerations will have on burning and burying human waste in those areas. Waste management planners must also focus on expected situations where units will be stationary for more than 72 hours, which is usually when field-expedient methods tend to become unsuitable for a specific location.

2. Develop and categorize requirements

Waste management planners develop preliminary black water requirements for each subordinate unit (one level down) and for each maneuver COA being developed. Preliminary black water requirements are based primarily on the number and gender of personnel within a unit. Planners then determine the black water requirements for each critical event or phase of the operation based on the
expected duration that a unit will be in a certain location using the categories shown in step 3. Waste management planners use the following planning factors to determine black water requirements:

One commode (along with a urinal if possible) for every 4 percent of males in the unit.

One commode for every 6 percent of females in the unit.

One Force Provider module generates 3,000 GPD of black water.

Slide 43

3. Evaluate Waste Management Capabilities

Waste management planners evaluate the available capabilities and resources (manpower, equipment, materials, and funding) for each subordinate unit (one level down) according to the proposed task organization for each COA being developed. The results of this evaluation will drive the generation of capability-based solutions in step 5

4. Generate Solutions

Waste management planners generate options that first try to take advantage of existing buildings with adequate toilet facilities and sewerage systems whenever possible without risking the mission. Commanders must decide if the added health benefits offset tactical considerations. When existing facilities and contractor support are not available, waste management planners generate capability-based solutions to meet the black water requirements for each subordinate unit (one level down). There may also be interim solutions, to include the temporary containment of black water in tanks and other large containers for treatment at a later time or for transportation to an approved treatment site elsewhere in the theater of operations.

Solutions must be feasible based on the availability of resources and subordinate unit capabilities, and suitable based on the risks to human health and the environment. PVNTMED personnel and the unit's field sanitation team are critical in determining the right type, location, number, and size of field latrines. When planning basic and enhanced black water management systems (waterborne sewerage systems), waste

management planners must coordinate with base camp planners and others involved in conducting BCDP, to include engineer units and contractors that will actually build the base camp.

5. Integrate Waste Management Tasks into Plans and Orders

Waste management planners coordinate and synchronize the supporting waste management tasks with other staff members and higher headquarters as necessary. The waste management tasks are then incorporated into plans and orders. Waste management tasks should be included in logistics rehearsals and back briefs to ensure subordinate units' plans are feasible and/or supportable by the higher headquarters.

Slide 44

In order to provide enough latrines in your planning process, you will need to calculate latrines at a ratio of 4% for males and 6% for female

Some very general construction standards for latrines are that they need to be at least 100 yards downwind from the dining facilities, 100 yards and down gradient from any surface water source, if possible. It is very important not to dig them into the ground water, as this will cause direct contamination.

They should also be 30 yards from the billeting areas, if outdoors, and from the unit area.

Digging a drainage ditch around the edges of the latrine, helps to ensure that storm water does not flow into the latrine are and carry off contamination.

CHPPM requires that hand washing devices be installed at all latrines for troop health.

Check on Learning: Conduct check on learning

Review Summary: None

ELO D - LSA 2. Learning Step / Activity ELO D - LSA 2. Expedient field methods for wastewater disposal

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 45

When fixed facilities are unavailable, units must use field-expedient methods to ensure proper sanitation. During short halts when units are on the move, Soldiers should use a commercially available disposable human waste bag (such as Brief Relief® bags) or a cat-hole latrine. When initially establishing a base camp, chemical latrines provided and serviced by contractors is the preferred option, followed by the use of deep pit latrines and urine soakage pits or burn-out latrines if unable to dig or the water table is shallow. Other options include mound, bored-hole, or pail latrines. Whenever possible, urinals should also be provided to prevent toilet seats from being soiled.

All training bivouac sites should have a port-a-jon or some other type of facility. If your bivouac site is in a CONOPS situation, then you can construct an area designed for

latrines. A straddle trench is easy to develop and to close after use.

Slide 46

The simplest of all human waste disposal devices is the cat-hole latrine (figure 4-8). This latrine is used by individuals on the move or stationary for 1 to 3 days when other established means are unavailable. A cat-hole latrine should be dug at least 1 foot wide and 1 foot deep. After use, the removed dirt is replaced and packed down.

Slide 47

The most common type of latrine for units that are stationary for 1 to 3 days is the straddle-trench (slit trench) latrine

The trench is dug 1-foot wide, 2 ½ feet deep, and 4 feet long, and will accommodate two people at the same time. There should be a straddle trench for every 4 percent of the unit's males and 6 percent of the unit's females. For example, a unit of 100 men and 50 women would require 4 trenches for men and 3 for women. Trenches are constructed parallel to one another and at least 2 feet apart. The removed earth is piled at the end of the trench and a shovel or paddle is provided so that individual Soldiers can promptly cover their excreta and toilet paper. Since there are no seats on this type of latrine, boards may be placed along both sides of the trench to provide better footing. Toilet paper should be placed on suitable holders and protected from inclement weather by a tin can or other covering.

Slide 48

The deep-pit latrine is used with a standard four-seat latrine box that is issued to or built by the unit. The four-seat box is 8 feet long, 2 1/2 feet wide at the base, and 18 inches high. A unit of 100 men requires two four-seat latrine boxes. The pit is dug 2 feet wide and 7 1/2 feet long, which allows 3 inches of earth to support the box on all sides. The depth of the pit depends on the estimated life span of the latrine. As a guide, a depth of 1 foot is allowed for each week of estimated use, plus 1 foot of depth for dirt cover when the latrine is closed. Rock or high groundwater levels may limit the depth of the pit, but it should be no more than 6 feet deep to reduce the risk of the walls caving in. Support may also be needed in some types of soil, in which case planking or other similar material should be used. Pack the earth tightly around the bottom edges of the box to seal any openings, and keep the lids closed and the latrine box clean to prevent fly breeding and reduce odors. If a fly problem exists, a residual pesticide can be used. The box and latrine seats should also be scrubbed daily with soap and water.

Slide 49

A bored-hole latrine consists of a hole that is about 18 inches in diameter and 15 to 20 feet deep that can be quickly emplaced with heavy equipment that has an auger attachment. The actual diameter of the hole is not critical and should be based on the largest size of auger that is available. The hole is covered by a one-hole latrine box using a metal drum with both ends removed that is sunk into the ground with a flyproof seat cover and lid that fits the top of the drum. If a drum is not available, construct a flyproof, wooden box that is 18 inches high.

Slide 50

The best device for urine disposal in the field is a urine soakage pit. The pit is dug 4 feet square and 4 feet deep and filled with an aggregate material. A border is placed along each edge so that each side of the soakage pit's surface is 5 feet long. The border should be 6 inches wide, 4 inches deep, and composed of small stones. Depending on available materials, use either pipe urinals or trough urinals with this pit. For the urine soakage pit to function properly, Soldiers must not be allowed to urinate on the surface of the pit. An optional feature is the ventilating shafts with screened openings that extend from about 8 inches above the pit to within 6 inches of the bottom of the pit. The funnels or trough must be cleaned daily with soap and water and the funnels replaced as necessary. Oil and grease must never be poured into the pit, as they will clog it. When a urine soakage pit is to be abandoned or it becomes clogged, it is sprayed with a residual insecticide and mounded over with a 2-foot covering of compacted earth.

Pipe urinals should be at least 1 inch in diameter and approximately 39 inches long and placed at each corner of the soakage pit and, if needed, on the sides halfway between the corners. The pipes are inserted at least 8 inches below the surface of the pit. A funnel of tar paper, sheet metal, or similar material is placed in the top of each pipe and covered with a screen. The upper rim of the funnel should extend about 30 inches above the ground surface.

Slide 51

The burn-out latrine is the preferred field-expedient method when the soil is hard, rocky, or frozen, making it difficult to dig. It is particularly suitable in jungles and other areas with high water tables. The planning factor for burn-out latrines is one seat per 8 percent of the males and one seat per 12 percent of the females in a unit. The design and construction of burn-out latrines will vary based on the availability of materials and construction capabilities (engineer units or contractors), and the desired degree of permanence that is suitable based on expected duration.

To fulfill immediate requirements, the most basic burn-out latrine can be constructed by placing a 55-gallon drum in the ground while leaving enough of the drum above the ground for a comfortable sitting height. The drum may be cut in half, making two latrines of less capacity. (Note: As a safety measure, drums should be filled with water before cutting to prevent igniting any residual fumes that could result in an explosion.) Place a wooden seat with a flyproof, self-closing lid on top of the drum. Weld handles to the sides of the drum, allowing two men to carry the drum with ease, because it must be moved before the contents are burned out. Have two sets of drums, if possible, so one set can be used while the other set is being burned out. Encourage male personnel to urinate in a urine disposal facility rather than a burn-out latrine because more fuel is required to waste with a higher liquid content.

Burn out the latrine daily by adding sufficient fuel to incinerate the fecal matter. Do not use highly volatile fuel because of its explosive nature. A mixture of 1 quart of motor gasoline (MOGAS) to 4 quarts of jet propulsion fuel grade 8 (JP-8) is effective but must be used with caution. Burn the contents again if they are not rendered dry and odorless in one burning. Any remaining ash should be buried.

Check on Learning: conduct check on learning

Review Summary: None

ELO D - LSA 3. Learning Step / Activity ELO D - LSA 3. Wastewater treatment systems

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 52

Sewage lagoons or oxidation ponds provide a means of treating and disposing both black and gray water; however, they require a significant land area with proper soil types to reduce the risk of groundwater contamination, adequate slope (1 to 2.5 percent) from the facilities to the lagoon to allow for water flow, and they cannot be used in arctic regions. The odor produced from anaerobic digestion can be a concern if not properly designed. Lagoons should be located downwind at least one-quarter mile and as far away from populated areas as possible. The increased length of the sewer collection system, compounded by the possible need for automatic lift stations, significantly increases the material cost and construction effort required for a complete system. Absorption from sewage lagoons into the surrounding soil must be minimized through compaction and/or the use of a clay or membrane liner. See table 4-8, page 4-28, for relative absorption rates in sewage lagoons. Most engineering units can construct simple holding ponds, but actual lagoons require civil engineering expertise that may be available through higher headquarters or reachback to USACE.

Slide 53

Anaerobic Lagoons

The word anaerobic means "without oxygen", which describes the conditions inside this type of lagoon. Anaerobic lagoons are most often used to treat animal wastes from dairies and pig farms, commercial or industrial wastes, or as the first treatment step in systems using two or more lagoons in a series.

Typically, anaerobic lagoons are designed to hold and treat wastewater from 20 to 150 days.* They are relatively deep (usually 8 to 15 feet) and work much like septic tanks. Inside an anaerobic lagoon, solids in the wastewater separate and settle into layers. The top layer consists of grease, scum, and other floating materials. If not preceded with septic tanks, the layer of sludge that settles at the bottom of an anaerobic lagoon eventually accumulates and must be removed. The wastewater that leaves an anaerobic lagoon will require further treatment.

Odor can be a problem with anaerobic lagoons. However, in many cases odor can be managed through a variety of methods, such as adding sodium nitrate, recirculating pond effluent, and through regular maintenance.

Aerobic Lagoons

Dissolved oxygen is present throughout much of the depth of aerobic lagoons. They tend to be much shallower than other lagoons, so sunlight and oxygen from air and wind can better penetrate the wastewater. In general, they are better suited for warm,

sunny climates, where they are less likely to freeze. Wastewater usually must remain in aerobic lagoons from 3 to 50 days to receive adequate treatment.*

Wastewater treatment takes place naturally in many aerobic lagoons with the aid of aerobic bacteria and algae. Because they are so shallow, their bottoms need to be paved or lined with materials that prevent weeds from growing in them.

Sometimes, the wastewater in aerobic lagoons needs to be mixed to allow sunlight to reach all of the algae and to keep it from forming a layer that blocks out the air and sun.

Facultative Lagoons Treat Wastewater Naturally

Like most natural environments, conditions inside facultative lagoons are always changing. Lagoons experience cycles due to variations in the weather, the composition of the wastewater, and other factors. In general, the wastewater in facultative lagoons naturally settles into three fairly distinct layers or zones. Different conditions exist in each zone, and wastewater treatment takes place in all three.

The top layer in a facultative lagoon is called the aerobic zone, because the majority of oxygen is present there. How deep the aerobic zone is depends on loading, climate, amount of sunlight and wind, and how much algae is in the water. The wastewater in this part of the lagoon receives oxygen from air, from algae, and from the agitation of the water surface (from wind and rain, for example). This zone also serves as a barrier for the odors from gases produced by the treatment processes occurring in the lower layers.

The anaerobic zone is the layer at the very bottom of the lagoon where no oxygen is present. This area includes a layer of sludge, which forms from the solids that settle out of the wastewater. Here, wastewater is treated by anaerobic bacteria, microscopic organisms, such as certain protozoa, and sludge worms, all of which thrive in anaerobic conditions.

Names for the middle layer include the facultative, intermediate, or aerobic-anaerobic zone. Both aerobic and anaerobic conditions exist in this layer in varying degrees. Depending on the specific conditions in any given part of this zone, different types of bacteria and other organisms are present that contribute to wastewater treatment.

Throughout facultative lagoons, physical, biological, and chemical processes take place that result in wastewater treatment. Many of these processes are interdependent. For example, on the surface, wind and sunlight play important roles. Surface agitation of any kind adds oxygen to the wastewater. For this reason, facultative lagoons are designed to make the best use of wind in the area.

The amount of wind the lagoon receives is not only important for the oxygen it contributes, but also because it affects the overall hydraulic flow pattern of the wastewater inside the lagoon, which is another physical factor that contributes to treatment.

Time is another important factor in treatment. Facultative lagoons are designed to hold the wastewater long enough for much of the solids in the wastewater to settle and for many disease-causing bacteria, parasites, and viruses to either die off or settle out. Time also allows treatment to reduce the overall organic strength of the wastewater, or its biochemical oxygen demand (BOD). In addition, some of the wastewater eventually

evaporates.

Sunlight is also extremely important to facultative lagoons because it contributes to the growth of green algae on the water surface. Because algae are plants, they require sunlight for photosynthesis. Oxygen is a byproduct of photosynthesis, and the presence of green algae contributes significantly to the amount of oxygen in the aerobic zone. The more warmth and light the sun provides, the more green algae and oxygen there is likely to be in the lagoon.

The oxygen in the aerobic zone makes conditions favorable for aerobic bacteria. Both aerobic and anaerobic bacteria are very important to the wastewater treatment process and to each other.

Bacteria treat wastewater by converting it into other substances. Aerobic bacteria convert wastes into carbon dioxide, ammonia, and phosphates, which, in turn, are used by the algae as food. Anaerobic bacteria convert substances in wastewater to gases, such as hydrogen sulfide, ammonia, and methane. Many of these by-products are then used as food by both the aerobic bacteria and algae in the layers above.

In addition, the sludge layer at the bottom of the lagoon is full of anaerobic bacteria, sludge worms, and other organisms, which provide treatment through digestion and prevent the sludge from quickly accumulating to the point where it needs to be removed. How often sludge must be removed from facultative lagoons varies depending on the climate, the individual lagoon design, and how well it is maintained. Sludge in all lagoons accumulates more quickly in cold than in warm temperatures. However, many facultative lagoons are designed to function well without sludge removal for 5 to 10 years or more.

Slide 54

Discharge Design: A Design Feature That Can Distinguish Lagoons Is How They Discharge Wastewater

Continuous Discharge Lagoons. These lagoons release wastewater continuously to a holding pond, so the rate of output roughly equals the rate of input. The hydraulic flow pattern in the lagoon is designed so the wastewater remains in the lagoon long enough to receive treatment before it reaches the outlet.

Controlled Discharge Lagoons. In these lagoons, wastewater is discharged in controlled amounts, usually once or twice per year. This method is common in cold climates where discharges typically occur after spring thaw and again in fall.

Slide 55

Discharge Design: A Design Feature That Can Distinguish Lagoons Is How They Discharge Wastewater

Complete Retention Lagoons. These lagoons are only practical in very dry climates where evaporation rate greatly exceeds rainfall amounts. Wastewater is never released from this type of lagoon. Instead it is allowed to evaporate.

Slide 56

In Series

When lagoons operate in series, more of the solid material in the wastewater, such as algae, has an opportunity to settle out before the effluent is disposed of. Sometimes serial treatment is necessary so the effluent from lagoon systems can meet local

requirements. Some lagoon systems are designed to use more cells during the summer months when algae growth is highest.

In Parallel

In parallel means that a system has more than one cell that is receiving wastewater at the same stage of treatment. This system design is particularly useful in cold climates or where lagoons are covered with ice for parts of the year. Because biological processes are involved, wastewater treatment slows down in cold temperatures, making treatment less efficient. Parallel cells are often used during winter months to handle extra loads.

Aerated Lagoons

Aerated lagoons are common in small communities. These systems use aerators to mix the contents of the pond and add oxygen to the wastewater. They are sometimes referred to as partial-mix or complete-mix lagoons depending on the extent of aeration. Partial-mix aerated lagoons are often anaerobic lagoons that have been adapted and upgraded to receive more wastewater.

With the exception of wind-driven designs, most aerators require energy to operate. However, energy costs are almost always considerably less than those for other mechanical treatment systems. Aeration makes treatment more efficient, which offsets energy costs in some cases. Aerated lagoons require less land area and shorter detention times.

**Exact detention times for wastewater in lagoons are based on factors such as the particular design, the amount of wastewater to be treated, and the level of treatment desired.*

Slide 57

Site Conditions

Certain site-related factors, such as the location of the water table and the composition of the soil, always must be considered when designing lagoon systems. Ideally, lagoons should be constructed in areas with clay or other soils that won't allow the wastewater to quickly percolate down through the lagoon bottom to the groundwater. Otherwise, lagoons must be artificially lined with clay, bentonite, plastic, rubber, concrete, or other materials to prevent groundwater pollution. Special linings usually increase system costs.

Most areas in the U.S. have laws concerning the siting of lagoons, including their distance from groundwater below, and their distance from dwellings. Lagoons also should be located downgrade and downwind from the billets, when possible, to avoid the extra cost of pumping the wastewater uphill and to prevent odors from becoming a nuisance.

The amount and predominant direction of wind at the site is another important factor, and helps to determine the lagoon's exact position. Any obstructions to wind or sunlight, such as trees or surrounding hillsides must be considered. Trees and weed growth around lagoons should be controlled for the same reasons. In addition, water from surface drainage or storm runoff should be kept out of lagoons, if necessary install diversion terraces or drains above the site.

Size and Shape

The exact dimensions of lagoons vary depending on the type of processes they use for treatment, the amount of wastewater that needs to be treated, the climate, and whether other lagoons or other types of treatment are also being used. The size and shape of lagoons is designed to maximize the amount of time the wastewater stays in the lagoon. Detention time is usually the most important factor in treatment.

In general, facultative lagoons require about one acre for every 200 people they serve. Aerated lagoons treat wastewater more efficiently, so they tend to require anywhere from one-third to one-tenth less land than facultative lagoons. Many partial-mix aerated lagoons are simply former facultative lagoons that have been adapted to receive more wastewater.

Lagoons can be round, square, or rectangular with rounded corners. Their length should not exceed three times their width, and their banks should have outside slopes of about three units horizontal to one unit vertical. This moderate slope makes the banks easier to mow and maintain. In systems that have dikes separating lagoon cells, dikes also should be easy to maintain. Interior bank and dike slopes are determined by the size and depth of the lagoon, potential wave action and other factors.

The bottoms of lagoons should be as flat and level as possible (except around the inlet) to facilitate the continuous flow of the wastewater. Keeping the corners of lagoons rounded also helps to maintain the overall hydraulic pattern in the lagoons and prevents dead spots in the flow, called short-circuiting, which can affect treatment.

Facultative lagoons are designed to hold wastewater anywhere from 20 to 150 days, depending on the discharge method and the exact size and depth of the lagoon. Aerated lagoons tend to require shorter detention times to treat the same amount of wastewater. In cold weather, however, biological treatment processes in all lagoons slow down, making longer detention times necessary.

Facultative lagoons are usually 3 to 8 feet deep, so they have enough surface area to support the algae growth needed, but are also deep enough to maintain anaerobic conditions at the bottom. Water depth in lagoons will vary, but a minimum level should always be maintained to prevent the bottom from drying out and to avoid odors.

Partial-mix aerated lagoons are often designed to be deeper than facultative lagoons to allow room for sludge to settle on the bottom and rest undisturbed by the turbulent conditions created by the aeration process.

Slide 58

These lagoons will service a camp population of 5000. Cost in TCMS is $336,083.

Slide 59

Read slide of advantages and disadvantages. Ask class after knowing this information, would you want to use a lagoon system?

Slide 60

The modern sewage treatment plant offers more efficient effluent management while providing effective wastewater treatment. Many plants will feature some form of preliminary treatment such as screening, grit or grease removal and primary sedimentation in advance of the biological treatment process. The TCMS Packaged

Plant costs $5,478,787.

Slide 61

Wastewater gravity flows or is pumped to a mechanical separator, typically a bar screen, where larger solids are removed. Water then flows into the equalization tank where the aeration process begins reducing contamination levels through the growth of microorganisms that literally consumes organic matter.

The equalization tank is designed to balance influent levels entering the plant. Wastewater from the tank then flows into the aeration chamber where the BOD, Suspended Solids, and Ammonia is reduced to design criteria levels through further and focused aeration. This aeration process creates a reaction called flocking. Flocking is the organic matter that has been consumed and reduced by the microorganisms and in a near weightless state through aeration process flows into the clarifier(s) where settling takes place.

The clarifiers are sized so as to allow enough retention time (typically 24 hours) for the flocking (aerated sludge or mixed liquor) to settle to the bottom of the clarifier's hopper style tanks where a small specified amount is continually removed and transported (air lifted) to the sludge holding tank. Further aeration and concentration through decant-siphoning takes place in the sludge holding tank. Water from the clarifier area continues to flow into the disinfection chamber where chlorination or UV treatment takes place. This disinfection is designed to kill remaining bacteria such as E.Coli.

The water at this point has reached design effluent levels, is visually clear, and odorless, and ready to be discharged.

Slide 62

Another way to treat black water is using conventional wastewater treatment facilities. Most of these are located off of the base, occasionally is some are located on the base. These types of facilities are expensive to construct. It is difficult to obtain personnel to ensure that these types of facilities are properly ran.

Slide 63

The goal of wastewater treatment is to produce a stream of water that is safe for return to the
environment. Usually the treatment consists of two basic stages, primary and secondary, along with a
process to dispose of the removed solids.

In primary treatment, the objective is to physically remove suspended solids from the wastewater. As
sewage enters the wastewater treatment plant, it flows through a screen which removes large objects
such as rags and sticks that can clog pipes or damage equipment. It then passes onto the grit chamber
where cinders, sand, and small stones can settle to the bottom. In some cases, comminutors are

used to cutup solids into a smaller size. After this preliminary treatment, the sewage contains organic
and inorganic matter along with other suspended solids as minute particles. Many of these solids can
be removed from sewage by treatment in a sedimentation tank. When the speed of the sewage flow
through one of these tanks is reduced, the suspended solids gradually sink to the bottom where they
form a mass of solids called primary sludge. This sludge is usually removed by pumping it to a sludge
digestion system.
After the effluent leaves the sedimentation tank in the primary stage of treatment, it flows to the
secondary treatment process which removes about 85 percent of the organic matter. This removal
is the result of the respiration and growth of the microorganisms present in the wastewater. The two
principal techniques are trickling filters and the activated sludge process.
A trickling filter is often a bed of stones from 3 to 6 feet deep through which sewage passes. More
recently, interlocking pieces of corrugated plastic or other synthetic media have also been used in
trickling beds. Microorganisms gather and multiply on these stones until they can consume most
of the organic matter in the sewage. The treated water trickles out through pipes in the bottom and
recirculates back to the head of the trickling filter or flows to another sedimentation tank to remove
excess settleable material.
In recent years, the trend has been towards the use of activated sludge instead of trickling filters. On
leaving the sedimentation tank in the primary stage, the wastewater flows to an aeration tank where
it is thoroughly mixed with air and return sludge and retained for several hours. During this time, the
microorganisms break down the organic matter into harmless by-products. From the aeration tank, the
sewage flows to a second sedimentation tank for removal of excess settleable material. The collected
sludge, now activated with millions of bacteria and other tiny organisms, can be returned to the
aeration tank or sent off to sludge conditioning and disposal.
The final step in any wastewater treatment system is generally disinfection – normally this is

accomplished through effluent chlorination. Disinfection will kill more than 99 percent of the harmful
pathogens in the effluent. Many states now require the removal of excess chlorine before discharging
to surface waters. Alternatives to chlorine disinfection, such as ultraviolet light, are also being used in
situations where chlorinated effluents can be harmful to fish and other aquatic life.

Check on Learning: conduct check on learning

Review Summary: None

CHECK ON LEARNING (ELO D): What are the three primary types of waste disposal systems?

REVIEW SUMMARY(ELO D): None

E. ENABLING LEARNING OBJECTIVE

ACTION:	Describe the layout of an integrated waste management plan
CONDITIONS:	Given this lesson and associated references
STANDARDS:	List the major planing and siting requirements for an integrated waste management plan

ELO E - LSA 1. Learning Step / Activity ELO E - LSA 1. Planning considerations

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 66

The most important component of the integrated waste management plan is the layout of the facility. The success of the integrated waste management plan is going to be the success of how well the materials are segregated Careful design planning should include the location of the following management schemes. Considerations need to involve prevailing wind direction, water sources, and location of living quarters. Waste facilities should always be down gradient and down wind of water source and living quarters. Other considerations include the terrain/topography, geology, neighboring communities/villages, and surrounding land usage.

Waste management planners evaluate the effects of terrain and weather on waste management operations. They review existing geospatial information (including environmental and biological hazards) on potential base camp areas, reinforced with onsite reconnaissance and infrastructure assessments whenever possible. Geospatial engineering support in the form of terrain analysis and tailored geospatial products should be requested through appropriate channels to help better understand and

visualize the effects of terrain (see Army Tactics, Techniques, and Procedures [ATTP] 3-34.80 for more information). Waste management planners focus on the following terrain characteristics:

Surface configuration and its effects on land use.

Soil composition and its effects on system design, performance, and construction.

Hydrology and the effects of surface and subsurface drainage on waste management operations.

Manmade features (such as roads and existing waste facilities) that can be used in conducting waste management operations.

Waste management planners consider the effects of weather on the design and performance capabilities of waste management systems. Weather information is normally prepared by staff weather officers and distributed through assistant chief of staff, intelligence/intelligence staff officer (S-2) tactical networks. The primary weather conditions that waste management planners should consider are

Temperature and Humidity. Extreme temperatures can affect the efficiency and effectiveness of waste management systems, decomposition, and vector reproduction. Hot and dry conditions favor evaporation, while extreme cold can impede digging and freeze water which affects the flow of wastewater through piping systems.

Precipitation. Rain and snow can affect road trafficability and impact the ability to transport waste. Heavy rainfall can render low-lying areas unusable, and stormwater runoff can cause containment systems to overflow and contaminate surrounding areas.

Wind. Prevailing wind direction is useful in positioning waste management system to help keep odors and toxic smoke and fumes away from troop billeting, work areas, and residential areas.

All waste disposal and storage areas should be down gradient and downwind from water sources, living areas, and DFAC by no less than 100 yards.

Check on Learning: conduct check on learning

Review Summary: None

ELO E - LSA 2. Learning Step / Activity ELO E - LSA 2. Integrated waste management plan layout

Method of Instruction: Lecture
Instr Type(I:S Ratio/Qty):
Time of Instruction: 0 hr 0 min
Instructional Strategy: Lecture
Media Type: PowerPoint Presentation
Security Classification: Unclassified

Slide 67

The most important component of the integrated waste management plan is the layout of the facility. The success of the integrated waste management plan is going to be the success of how well the materials are segregated Careful design planning should include the location of the following management schemes. Considerations need to involve prevailing wind direction, water sources, and location of living quarters. Waste

facilities should always be down gradient and down wind of water source and living quarters. Other considerations include the terrain/topography, geology, neighboring communities/villages, and surrounding land usage.

The next slides will walk through the areas of the one stop waste disposal area.

Slide 68

The first stop is the DRMS. If available, the DRMS will serve as a turn in location for any materials and equipment that are no longer needed. This service provides a safe way to dispose of excess property so it can be marketed for reuse, recycle, or safe disposal. This is placed at the entry of site for its accessibility and bulkiness of products. The DRMS will vary on what they accept, but can range from used batteries and Hazardous wastes to scrap metal.

If DRMS is not available at the location, segregate and stockpile materials to be transported to a facility that does.

Slide 69

This may require a large area to segregate all the materials. Materials such as scrap metal, wood, and plastic are examples of products than can be excluded from disposal.

Products that are compostable should be source segregated and delivered directly to the compost area. The alternative is to segregate organic wastes that are compostable at the recycling area and later delivered to the compost area.

Slide 70

The three most common methods for Solid Waste disposal are incinerators, landfills and burnpits. Each method has specific controls that must be in place to reduce the threat to soldiers health and the environment. As with other components of the integrated waste management plan, siting the waste disposal area is crucial for health protection and also operational efficiency.

Slide 71

The Hazmart is designed to offer a turn in for hazardous materials that are no longer needed by the unit. Other units can then procure these items rather than brining more products.

Slide 72

This area is designated for the storage and treatment of contaminated soils. Soil contaminated from a fuel spill or other type of contamination can be brought to this area where a process of remediation, such as land farming, will remove the contaminants. Once the soil has been remediated, it can be used as a daily cover for a landfill or for other uses such as building a berm, hector barrier fill, etc..

Slide 73

Waste should be sorted a final time before taken to the final disposal. Only combustible materials such as cardboard and paper should be disposed in a burn pit.

Slide 74

The three most common methods for Solid Waste disposal are burn pits, incinerators, and landfills. Each method has specific controls that must be in place to reduce the threat to soldiers health and the environment. As with other components of the integrated waste management plan, siting the waste disposal area is crucial for health

protection and also operational efficiency.

Check on Learning: *conduct check on learning*

Review Summary: None

CHECK ON LEARNING (ELO E): What are some planning considerations for the layout of an integrated waste management area?

REVIEW SUMMARY(ELO E): None

SECTION IV. SUMMARY

Method of Instruction:	Lecture
Instr Type(I:S Ratio/Qty):	None
Time of Instruction:	0
Instructional Strategy:	Lecture

Check on Learning

Conduct check on learning

Review/ Summary

Slide 76- Summary

By complying with environmental laws and regulations, we are not only protecting the environment, but also our troops and limited resources. Taking into account environmental impacts before and during mission activities we can reduce or eliminate some of those impacts. Those reductions can assist in expediting the time it will take to properly close the base camp and return our troops back to their families.

SECTION V. STUDENT EVALUATION

Testing Requirements	NOTE: Describe how the student must demonstrate the accomplishment of the TLO. Refer student to the Student Evaluation Plan.
Feedback Requirements	NOTE: Feedback is essential to effective learning. Schedule and provide feedback on the evaluation and any information to help answer students' questions about the test. Provide remedial training as needed.

Appendix A - Viewgraph Masters

Implement a Unit Waste Management Plan
05-2-7501 / Version 1

Sequence	Media Name	Media Type
None		

Appendix B - Test(s) and Test Solution(s)

PRACTICAL EXERCISE(S)/SOLUTION(S) FOR LESSON 05-2-7501 Version 1

Appendix D - Student Handouts

Implement a Unit Waste Management Plan
05-2-7501 / Version 1

Sequence	Media Name	Media Type
None		

Implement a Unit Waste Management Plan

05-2-7501 / Version 1

DRAFT

1. The importance of this lesson: (Why)

Develop an integrated waste management plan that provides safe methods of disposal for waste streams generated at a base camp.

2. What we want our Soldiers to Achieve: (Outcomes/Standard)

Design an integrated waste management plan that addresses the waste streams generated by the base camp.

3. Tasks to be taught

Task Number	Task Title	Task Type
05-2-7501	Develop an Integrated Waste Management Plan	Collective SUPPORTED
05-2-7502	React to a Hazardous Spill	Collective SUPPORTED
05-2-7503	Implement Unit Hazardous Materials Management	Collective SUPPORTED

Additional Non-Standard Tasks

None

4. References:

Reference Number	Reference Title	Date
AR 200-1	ENVIRONMENTAL PROTECTION AND ENHANCEMENT	13 Dec 2007
FM 3-34.5	ENVIRONMENTAL CONSIDERATIONS	16 Feb 2010
FM 5-19	COMPOSITE RISK MANAGEMENT	21 Aug 2006
TC 3-34.489	The Soldier and the Environment.	08 May 2001
TM 38-410	STORAGE AND HANDLING OF HAZARDOUS MATERIALS {DLAM 4145.11; NAVSUP PUB 573; AFR 69-9; MCO 4450-12}	13 Jan 1999

Additional Non-Standard References

None

5. Resources

TIME: Time of Instruction (Time not specified)

LAND: Classroom, Training Area, and Range Requirements

Id	Name
None	

AMMO: Ammunition Requirements

DODIC	Name
None	

MISC: Materiel Items and TADSS Requirements

Id	Name
None	

Additional Non-Standard Resources

None

6. A possible technique to achieve the outcome:

None

7. Conduct AAR with Soldier and Cadre.

None

NOTE: Before presenting this lesson, Instructors must be thoroughly prepared by studying the appropriate lesson plan and identified reference material.