MCI 57.14a

MARINE CORPS INSTITUTE

NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) RECONNAISSANCE AND CONTAMINATION AVOIDANCE

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WASHINGTON, DC

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IN REPLY REFER TO:

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MCI 57.14a NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) RECONNAISSANCE AND CONTAMINATION AVOIDANCE

1. Purpose. MCI course 57.14a, Nuclear, Biological, and Chemical (NBC) Reconnaissance and Contamination Avoidance, provides instruction to all Marines having duties that may require operating in a contaminated environment.

2. Scope. MCI 57.14a addresses ITS 5711.2.2, 5711.2.3, and 5711.2.6 found in MCO 1510.71A. It also provides the individual with a non-57XX MOS with enough information to make the Marine an asset to the unit's NBC defense teams.

3. Applicability. This course is intended for instructional purposes only. It is designed for Marines in the ranks of private through gunnery sergeant in any MOS who are or may be assigned to monitor/survey teams as a collateral duty and privates through staff sergeants in the MOS of 5711.

4. Recommendations. Comments and recommendations on the contents of this course text are invited and will aid in subsequent course revisions. Please complete the course evaluation questionnaire located at the end of the text and return it to

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NUCLEAR, BIOLOGICAL, AND CHEMICAL
(NBC) RECONNAISSANCE AND CONTAMINATION AVOIDANCE

CONTENTS

CONTENTS--cont'd

STUDENT INFORMATION

TITLE & NUMBER:	NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) RECONNAISSANCE AND CONTAMINATION AVOIDANCE MCI 57.14a
STUDY HOURS:	8 hours
COURSE MATERIALS:	Text
REVIEW AGENCY:	Marine Corps Detachment, United States Army Military Police and Chemical School, Fort McClellan, AL 36205-7435
RRC:	2 Reserve Retirement Credits
ACE:	Not applicable to civilian training/education.
ASSISTANCE:	For administrative assistance, have your training officer or NCO use the Unit Activity Report (UAR) or MCI Hotline: DSN 288-4175 or commercial (202) 433-4175. Marines worldwide may call toll free 1-800-MCI-USMC. For assistance concerning course content matters, call the instructor at DSN 288-3611 ext. 140 or commercial (202) 433-3611 ext. 140.

STUDY GUIDE

Congratulations on your enrollment in a distance training course from the Occupational Specialty Department of the Marine Corps Institute (MCI). Since 1920, the Marine Corps Institute has been helping tens of thousands of hard-charging Marines, like you, improve their technical job performance skills through distance training. By enrolling in this course, you have shown a desire to improve the skills you have and master new skills to enhance your job performance.

The distance training course you have chosen, MCI course 57.14a, Nuclear, Biological, and Chemical (NBC) Reconnaissance and Contamination Avoidance, provides instruction to all Marines in MOS 57XX and those Marines who may be assigned to a unit NBC team. The information includes preparation for NBC reconnaissance operations, conducting radiological, biological, and chemical monitor/survey missions as well as general familiarization with all equipment required to complete your monitor/survey mission.

Because you have chosen to learn at a distance by enrolling in this MCI course, your professional traits are evident and we know

YOU ARE PROPERLY MOTIVATED. You made a positive decision to get training on your own. Self-motivation is perhaps the most important force in learning or achieving anything. Doing whatever is necessary to learn is MOTIVATION. You have it!

YOU SEEK TO IMPROVE YOURSELF. You enrolled to improve those skills you already possess and learn new skills. When you improve yourself, you improve the Corps!

YOU HAVE THE INITIATIVE TO ACT. By acting on your own, you have shown you are a self-starter, willing to reach out for opportunities to learn and grow.

YOU ACCEPT CHALLENGES. You have self-confidence and believe in your ability to acquire knowledge and skills. You have the self-confidence to set goals and the ability to achieve them, enabling you to meet every challenge.

YOU ARE ABLE TO SET AND ACCOMPLISH PRACTICAL GOALS. You are willing to commit time, effort, and the resources necessary to set and accomplish your goals. These professional traits will help you successfully complete this distance training course.

BEGINNING YOUR COURSE

Before you actually begin this course of study, read the Student Information page. If you find any course materials missing, notify your training officer or training NCO. If you have all the required materials, you are ready to begin.

To begin your course of study, familiarize yourself with the structure of the course text. One way to do this is to read the Table of Contents. Notice the Table of Contents covers specific areas of study and the order in which they are presented. You will find the text divided into several study units and a review lesson. Each study unit is comprised of two or more lessons, lesson or unit exercises, exercise solutions and references.

LEAFING THROUGH THE TEXT

Leaf through the text and look at the figures and tables. Read a few lesson exercise items (questions) to get an idea of the type of items in the course. If the course has additional study aids, such as a handbook or a plotting board, familiarize yourself with them.

THE FIRST STUDY UNIT

Turn to the first page of Study Unit 1. On this page, you will find an introduction to the study unit and generally the first study unit lesson. Study unit lessons contain learning objectives, lesson text, and exercises.

READING THE LEARNING OBJECTIVES

Learning objectives describe in concise terms what the successful learner, you, will be able to do as a result of mastering the content of the lesson text. Read the objectives for each lesson and then read the lesson text. As you read the lesson text, make notes on the points you feel are important.

COMPLETING THE EXERCISES

To determine your mastery of the learning objectives and text, complete the exercises developed for you. Exercises may be contained in a lesson, at the end of a lesson, or at the end of a study unit. Without referring to the text, complete the exercise items and then check your responses against those provided.

CONTINUING TO MARCH

Continue on to the next lesson, repeating the above process until you have completed all lessons in the study unit. Follow the same procedure for each study unit in the course.

SEEKING ASSISTANCE

If you have problems with the text or exercise items that you cannot resolve, ask your training officer or training NCO for assistance. If they cannot help you, request assistance from your MCI distance training instructor by completing the Content Assistance Request Form located at the back of the course.

THE REVIEW LESSON EXAM

When you have finished all the study units, complete the review lesson exam located at the end of the course text. Try to complete the review lesson exam without referring to the text. For those items you are unsure of, restudy the text. When you have finished the review lesson exam and are satisfied with your responses, check your responses against the answer key provided with your course materials.

PREPARING FOR THE FINAL EXAM

To prepare for your final exam, you must review what you learned in the course. The following suggestions will help make the review interesting and challenging.

CHALLENGE YOURSELF. Try to recall the entire learning sequence without referring to the text. Can you do it? Now look back at the text to see if you have left anything out. This review should be interesting. Undoubtedly, you'll find you were not able to recall everything. But with a little effort you'll be able to recall a great deal of the information.

USE UNUSED MINUTES. Use your spare moments to review. Read your notes or a part of a study unit, rework exercise items, review again; you can do many of these things during the unused minutes of every day.

APPLY WHAT YOU HAVE LEARNED. It is always best to use the skill or knowledge you've learned as soon as possible. If it isn't possible to actually use the skill or knowledge, at least try to imagine a situation in which you would apply this learning. For example, make up and solve your own problems. Or, better still, make up and solve problems that use most of the elements of a study unit.

USE THE "SHAKEDOWN CRUISE" TECHNIQUE. Ask another Marine to lend a hand by asking you questions about the course. Choose a particular study unit and let your buddy "fire away."

MAKE REVIEWS FUN AND BENEFICIAL. Reviews are good habits that enhance learning. They don't have to be long and tedious. In fact, some learners find short reviews conducted more often prove more beneficial.

TACKLING THE FINAL EXAM

When you have completed your study of the course material and are confident with the results attained on your review lesson(s), take the sealed envelope marked "**FINAL EXAM**" to your unit training NCO or training officer. Your training NCO or officer will administer the final exam and return the exam and answer sheet to MCI for grading. Before taking your final exam, read the directions on the generic DP-37 answer sheet carefully and complete all requested information.

COMPLETING YOUR COURSE

The sooner you complete your course, the sooner you can better yourself by applying what you've learned! HOWEVER--you do have 12 months from the date of enrollment to complete this course. In addition, you may be granted one 6-month extension if approved by your commanding officer. If you need an extension, please complete the Student Request/Inquiry form (MCI-R11) located at the back of the course, and deliver it to your training officer or training NCO.

GRADUATING!

As a graduate of this distance training course and as a dedicated Marine, your job performance skills will improve, benefiting you, your unit, and the Marine Corps.

Semper Fi!

STUDY UNIT 1

FUNDAMENTALS OF NBC RECONNAISSANCE OPERATIONS

Introduction. Nuclear, Biological, and Chemical (NBC) weapons are a special class of weapons beyond the scope of conventional warfare. NBC warfare is an escalation over conventional warfare because it causes mass casualties far more severe than conventional weapons. Enemy use of NBC weapons should not stop other combat operations. As a member of an NBC monitor/survey team, you provide critical support throughout your area of responsibility.

As a monitor/survey team member, you may have been assigned this job as an additional duty. Your team may consist of personnel who, like yourself, have other duties and have been assigned this as an additional duty. Your NBC officer and NBC noncommissioned officers (NCOs) are probably not 5702s or 5711s and have also been assigned to NBC as an additional duty. Therefore, all of you have to be well-trained and proficient in your additional duties. A monitor/survey team leader from a non-57XX military occupation specialty (MOS) who doesn't take NBC seriously can hurt both himself and his fellow team members.

Before you can perform a monitor/survey mission, you need to understand the fundamentals of NBC reconnaissance operations. These fundamentals include how to

- Prepare for your missions.
- Recognize and react to different types of NBC attacks.
- Cross and mark contaminated areas.
- Report monitor/survey findings.

Proficiency in these skills is necessary for you to succeed in an NBC environment.

Lesson 1. PREPARING FOR NBC MONITOR/SURVEY MISSIONS

LEARNING OBJECTIVES

1. Identify the basic responsibilities of the NBC officer and unit commander in supporting monitor/survey operations.

2. Identify the acronym used to plan and prepare for an NBC mission.

3. Identify the acronym used to write an operation order for an NBC mission.

This lesson covers the basics of preparing you for an NBC mission: mission statements, responsibilities, factors to address, and some tips to help you successfully complete your mission.

1101. **NBC Officer and Unit Commander's Duties**

Before sending a team out on a mission, your NBC officer and unit commander will have to perform the following:

- Determine team requirements.
- Assign a unit or team to conduct the mission.
- Provide the team with all relevant information.

    - What type of contamination is suspected?
    - What information needs to be collected?
    - What type of equipment will be needed?
    - What might the specific dangers be?

- Provide the team adequate time to prepare.
- Provide equipment necessary to conduct the mission.

Note: All your NBC equipment, such as detection devices and protective equipment, will come from your NBC specialists. They know what you need and will supply it. Your duty is to ensure that you and your team know how to use the equipment properly.

- Provide miscellaneous support.
- Review the team leader's plan and preparations.

As you can see, the NBC officer and unit commander have many responsibilities to help you and your team complete the mission. Without looking back, can you recall how many responsibilities the NBC officer and the unit commander have to consider to help your team complete the mission?

If you said seven, you are on the right track. If you had trouble, you should review the previous paragraph.

1102. **Planning and Preparing for an NBC Monitor/Survey Mission**

Your NBC officer will make available all information to help you plan your mission. To prepare for your mission, use the standard troop leading steps. The acronym BAMCIS represents the first letter of each step.

B - Begin the planning
A - Arrange the reconnaissance
M - Make the reconnaissance
C - Complete the plan
I - Issue the order
S - Supervise

a. Begin the planning. You should begin by estimating the situation. You may recall how to do this using the acronym METT-TSL.

The letter	Stands for	Means
M	Mission	• The mission assigned to your team • How it relates to the mission of the commander who is sending the patrol
E	Enemy	What is known or suspected of the enemy's • Presence • Capabilities • Habits and characteristics • Tactics
T	Terrain and weather	The environment can be friendly or hostile including • Ground • Vegetation • Drainage • Weather • Visibility
T	Troops	• Friendly situation • Available support
T	Time	Constraints and impact of time on preparation and mission accomplishment
S	Space	• Size of the area of operation (AO) • How the size affects the ability of your higher headquarters to support your mission
L	Logistics	Supplies and equipment to complete your mission

After you have estimated the situation, prepare and issue a warning order. A warning order should include

- **Situation**. A brief summary of enemy and friendly situations.
- **Mission**. State the mission.
- **General Instructions**. Include a time line and a list of all individual and unit gear.
- **Special Instructions**. Who does what to prepare for the mission.

You can use the form shown on page 3-13-25 of the Marine Battle Skills Training (MBST) Book 3.

b. Arrange for and make reconnaissance. Then complete your estimate. Now that you have an understanding of the commander's intent and have studied the situation, you need to make a recon of the area. What does it mean to make reconnaissance? It means to check the area of your mission before you depart. If you cannot physically check the area, you can probably rely on air observation (i.e., maps and photos).

- Study the terrain and possible routes.

- Determine likely areas for ambushes and for heavy concentrations of NBC contaminants.

Below is a brief list of factors you should consider.

(1) Routes to the objective area

(2) Return routes

(3) Meteorological data

(4) NBC reports

(5) Reports of enemy activities within the area

(6) Possible use of enemy air, mortars, or artillery

c. Complete the plan. Once you have considered all these factors, work with your NBC specialists to complete the plan.

When you have completed your plan, you can use the acronym SMEAC to help prepare your operation order. SMEAC stands for

- Situation
- Mission
- Execution
- Administration and Logistics
- Command and Signal

SMEAC is shown in the example Operation Order on the next two pages.

OPERATION ORDER

(1) Situation

E Enemy (SALUTE)

S Size
A Activity
L Location
U Unit
T Time
E Equipment

F Friendly (HASSAD)

H Higher headquarters (your higher headquarters' mission)
A Adjacent friendly units (units operating in the same area)
S Support (units that are supporting your mission)
S Security (who will provide security)
A Attachments (personnel attached to your team from other units)
D Detachments (personnel from your unit presently detached to other units)

(2) Mission

- When
- Who
- What
- Where
- Why

(3) Execution

(a) Commander's intent.

(b) Concepts of operations.

- Scheme of maneuver
- Fire support plan

(c) Task the general patrol organization and assign responsibilities if you know them at this point.

(d) Coordinating instructions.

1. Any changes to the time line given in the warning order

2. Location of departure, reentry points of friendly lines, and actions to take upon the team's return

3. Details on routes and alternate routes to and from your objective area

4. Final preparation positions and actions to take at these positions

5. Actions to take in danger areas if the enemy is contacted

6. Details not covered elsewhere on actions in the objective area

7. Estimated time needed for debriefing on return

(4) Administration and Logistics

(a) Individual protective equipment, weapons, detection equipment, water, and medications

(b) Vehicles and emergency decontamination equipment (if chemical)

(c) Special equipment needed (wire cutters, demolition, radios, flashlights, infrared equipment, and binoculars) and distribution of equipment during the mission

(d) Restricted or prohibited items

(5) Command and Signal

(a) Designation of the assistant patrol leader and his role in preparation

(b) Designation of navigators and radio operators (if required)

(c) Special signals to be used

Remember, as a team leader, you must work closely with the NBC specialists in your unit who will provide you with a great deal of information. In most cases, your monitor/survey team usually has preselected departure and return routes and other checkpoints that you'll incorporate into your plan.

d. Issue the order. Once you have completed your plan and your team's initial preparations have progressed to a point where you can issue the order, you should do so. Check the team's progress in obtaining necessary equipment.

Your directions must be clear and concise so your team members understand. Usually, every NBC team member has been assigned a specific function before the mission; however, make sure all new members understand their jobs. Remember, because their jobs are additional duties, there may be some confusion.

e. Supervise. The last step is to supervise.

(1) Inspection. You must inspect equipment, especially NBC detection and protective equipment. Your team members and security personnel should rehearse their functions before leaving on the mission.

(a) During inspections, you should check protective clothing and equipment to make sure that all is complete and correct. Check for the following:

- Do **NOT** take letters and papers that could provide information to the enemy on the mission!
- Correct identification tags.
- Prescribed NBC equipment, weapons, and ammo.
- Unnecessary equipment and excess weight.
- Loose gear and noise (have the Marines jump up and down a few times to ensure there is no unnecessary noise).

(b) Question each team member to ensure everyone knows the following:

- The mission, planned routes, and the fire support plan
- Their individual task--what they are to do and when they are to act
- What other team member's tasks are
- Challenges and passwords, codes, call signs, frequencies, reporting times, and similar details

Just before you go out on your mission, inspect again! Nothing is worse than getting into a contaminated area and finding that your equipment doesn't work or that you can't establish communications.

(2) Rehearsals. Before leaving on your mission, it's also a good idea to have **several** rehearsals to ensure everyone knows what his job is.

Why? NBC monitor/survey missions are often repetitious. They involve performing similar tests over and over again. Rehearsals keep everyone sharp, avoid confusion, and prevent delays in the contaminated area.

- An effective method of rehearsal is to talk the team through each phase of the mission. Describe each team member's actions and functions until everyone feels comfortable with his duties. Rehearsing should cut down on the amount of time in the contaminated area and help the team make a timely report of its findings when it gets back to the rear.

- Remember, your team moves more slowly in protective clothing, especially if the weather is hot. Take this into consideration; rehearse as realistically as possible.

(3) Final instructions. When you're satisfied with your team's performance

- Adjust your plan. Issue final instructions to your team members.

- Inspect one final time to ensure everyone carries the proper equipment and that nothing has been left behind.

Do you remember the acronym used to recall the format for the operation order? That's right! SMEAC. Can you also define what each letter in the acronym means? SMEAC stands for

- Situation
- Mission
- Execution
- Administration and Logistics
- Command and Signal

Look back and refresh your memory if you had trouble remembering. Let's continue. Now that you've created and issued the order and inspected and rehearsed your team, is the team ready to depart on its mission? What's the last thing you should do before leaving? That's right! **Inspect one last time to ensure everyone carries the proper equipment and nothing has been left behind**.

Lesson Summary. In this lesson you covered the NBC officer and unit commander's duties pertaining to the monitor/survey mission and what you need to do to plan for them. If you feel comfortable with the material presented, test yourself with the following lesson exercise. In the next lesson you'll learn how to recognize and react to a nuclear attack.

Lesson 1 Exercise: Complete items 1 through 3 by performing the action required. Check your responses against those listed at the end of the lesson.

1. What responsibilities must your NBC officers and unit commanders meet before sending you out on a mission?

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

   g. _____

2. You're ready to leave on your mission. You followed the steps in the acronym BAMCIS to ensure you completed all the necessary steps of preparation. List the individual steps of BAMCIS.

   a. B - _____

   b. A - _____

   c. M - _____

   d. C - _____

   e. I - _____

   f. S - _____

3. List the basic sections of an operation order using SMEAC.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

Lesson 1 Exercise Solutions

			Reference
1.	a.	Determine team requirements	1101
	b.	Assign a unit or team to conduct the mission	
	c.	Provide the team with all relevant information	
	d.	Provide the team with adequate time to prepare	
	e.	Provide equipment necessary to conduct the mission	
	f.	Provide miscellaneous support	
	g.	Review the team leader's plan and preparations	
2.	a.	Begin the planning	1102
	b.	Arrange the reconnaissance	
	c.	Make the reconnaissance	
	d.	Complete the plan	
	e.	Issue the order	
	f.	Supervise	
3.	a.	Situation	1102
	b.	Mission	
	c.	Execution	
	d.	Administration and logistics	
	e.	Command and signal	

Lesson 2. RECOGNIZING AND REACTING TO A NUCLEAR ATTACK

LEARNING OBJECTIVES

1. Identify the indicators that would tell you a nuclear attack has occurred.

2. Identify the proper reaction to a nuclear attack when no warning is given.

3. Identify defensive measures to take against a nuclear attack when a warning is given.

4. State the length of time to remain in the immediate action (protective) posture.

5. Name the four means of nuclear weapons employment.

1201. Nuclear Attack Indicators

A nuclear attack probably will come without warning.

- The first indication will be a very intense light.

- Heat and initial nuclear radiation comes with the light, and the blast follows within seconds.

There is very little time to take protective action. As a monitor/survey team member, you should know that one of the greatest battlefield hazards is nuclear fallout. This fallout could spread great distances from the center of the attack.

With this in mind, here are the six indicators of nuclear explosions.

a. Brilliant flash of light. Nuclear explosions always create a brilliant flash of light that

- Is caused by the enormous amount of heat generated at the center of the explosion
- Appears as a huge ball of fire
- Looked at directly will cause serious eye damage

b. Massive explosion. Everyone knows that nuclear explosions

- Are larger than conventional explosions
- Produce far more energy per pound than conventional explosives

c. High winds. Nuclear explosions are accompanied by high winds. This phenomenon is also referred to as the "blast effect" and causes approximately 50 percent of the damage associated with nuclear explosions. The high winds move outward from the location of the attack, ground zero, at **7 to 8 times the speed of sound!**

There are two phases to a nuclear explosion:

- Compression Phase. The extreme intensity of the blast raises the atmospheric pressure (normally 14.7 pounds per square inch (psi) at sea level) by about 10 psi. This effect is known as an **overpressure,** or the **compression phase** as in the first two graphics in fig 1-1.

- Negative Phase. As the fireball burns, it consumes so much oxygen that it sucks air in and creates an **underpressure,** or the **negative phase**. The initial blast wave reverses direction, adding to the explosive force and destructive effect (fig 1-1).

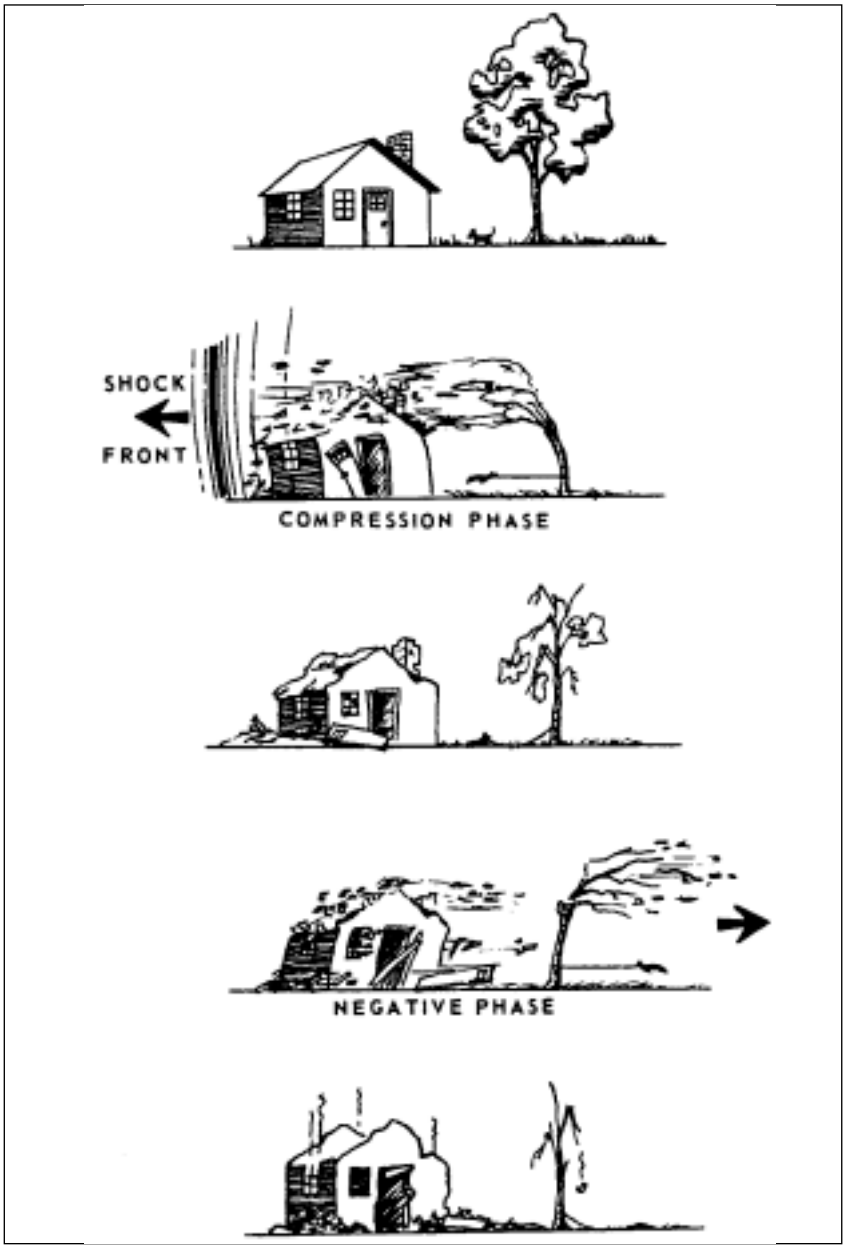


Fig 1-1. Blast waves.

d. Mushroom cloud. **Nuclear detonations do have one characteristic that is not readily associated with conventional weapons--they usually produce a "mushroom" cloud.** Highly visible in daylight, this cloud gives you a clue about the type of the burst (fig 1-2).

- If the mushroom cloud stem is white or light gray, the device exploded high enough above the ground that it could not pick up much dirt. This detonation is called a low airburst and produces very little fallout. The low airburst produces a large mushroom-like cloud but no distinctive stem connecting the cloud to the ground.

- If the cloud stem is dark and dirty, the device exploded on or close to the ground. This type of detonation is a surface burst, one that produces lots of nuclear fallout. The fallout is radioactive material.

- Subsurface bursts normally do not produce a large mushroom cloud because the explosion occurs beneath the surface. They produce a large contaminated area, above and below the surface.

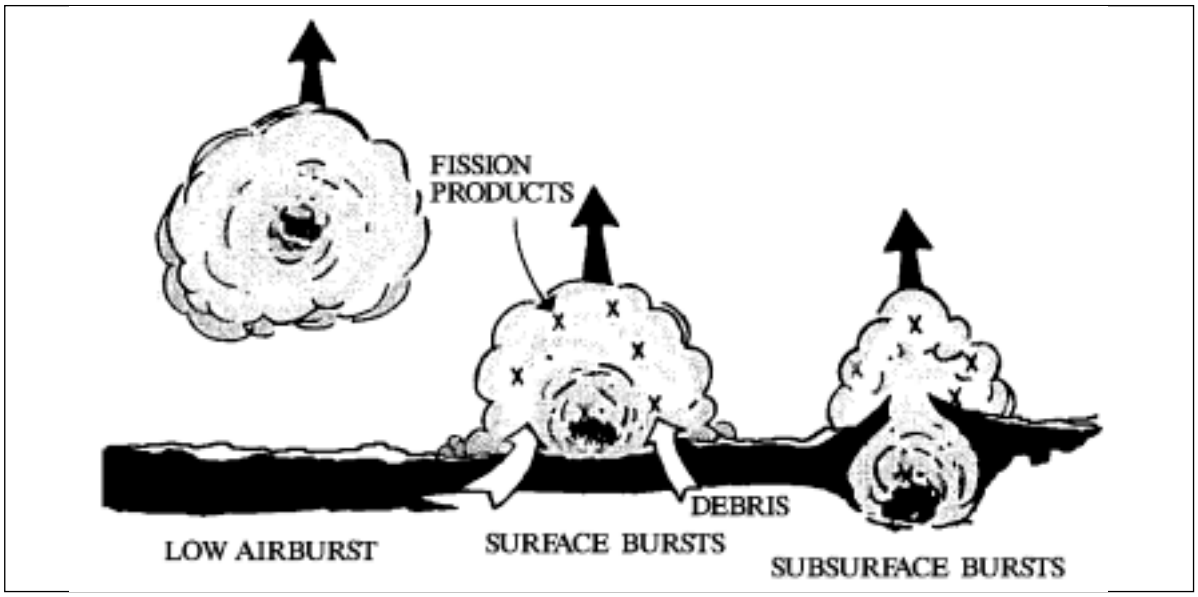


Fig 1-2. Types of bursts.

e. Radiation. The last indicator is a positive reading on your detection devices. As a member of a monitor/survey team, you are responsible for monitoring your RADIAC instruments and reporting your findings according to your unit's standing operating procedure (SOP). You will learn how to operate the various types of RADIACs in the next study unit.

Now, review. What are the indicators for a nuclear attack? Your response should have been as follows: a brilliant flash of light, a massive explosion, high winds, a mushroom cloud, and radiation.

f. Casualties.

(1) Blast waves cause casualties in two ways--directly and indirectly.

- Direct casualties result from the exposure of the body to the overloading or crushing effect that the quick rise in air pressure exerts. Most injuries occur in gas filled organs such as the lungs and stomach; many of the injured will have ruptured eardrums. Although the human body is quite resilient, this sudden and violent increase in air pressure is more than it can take.

- Indirect casualties result when missiles or debris hit the body or from the displacement of the whole body. Collapsing structures or debris also bury people. Since indirect casualties are similar to those caused by conventional explosions, they may not be valid indicators of a nuclear explosion.

(2) Casualties from radiation poisoning should be expected also. Depending on the amount of radiation absorbed into the body, the symptoms may range from nausea, to hair loss, to bleeding gums, or to death.

Can you recall the two types of casualties caused by high winds or blast? That's right! Direct and indirect.

1202. Defensive Measures for a Nuclear Attack Without Warning

As soon as you realize that a nuclear attack has occurred, you must take **IMMEDIATE** protective action to ensure your survival! The faster you react, the better your chances will be!

The first indication you'll get will be the brilliant flash of light from the explosion. The flash, the heat from the explosion, and the initial burst of radioactivity all travel at the speed of light.

a. If you are caught in the OPEN with no warning, you should (fig 1-3)

(1) Drop face down to the ground immediately. A large rock, log, or depression in the earth will give you some protection. Don't waste time looking around for it! If it's not in front of you, forget it! JUST DROP!

(2) Place your weapon under your body.

(3) Cover as much exposed skin as possible by putting your hands under your body.

(4) Close your eyes and remain calm during the attack.

(5) After the blast waves, check yourself and others for injuries. Check your weapon for damage and continue your mission.

Fig 1-3. Immediate action in the open.

b. If you're in a fighting position when the detonation occurs, you should

(1) Position yourself to get the maximum protection possible by curling up in a fetal position on your **back** with your knees drawn up to your chest. Cover your face with your hands and place your weapon against a wall or lay it next to you as shown in figure 1-4 as the BEST position.

(2) The FAIR and GOOD positions shown in figure 1-4 offer some protection from the affects of the nuclear detonation but do not provide the same impact protection as the BEST position.

(3) Cover exposed skin and keep your helmet on.

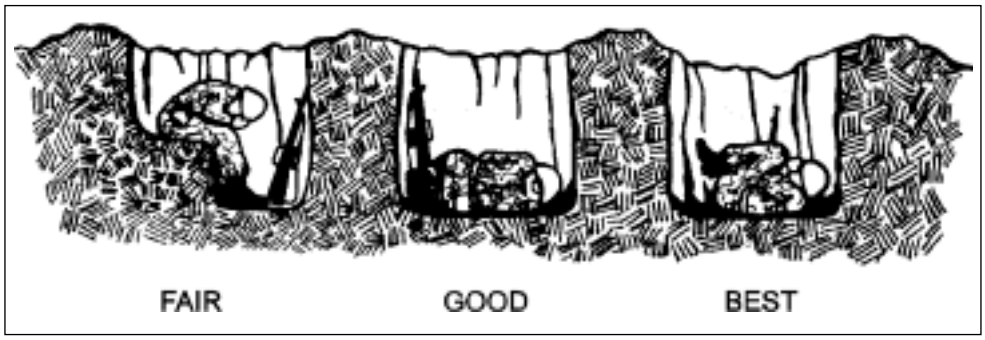


Fig 1-4. Immediate action in a fighting position.

c. If you are in a vehicle, you are fortunate. Vehicles provide you with more protection (shielding) than you would have if you were out in the open, and some vehicles provide more protection than others. Vehicles such as tanks and amphibious assault vehicles (AAVs) have better shielding properties than high mobility multipurpose wheeled vehicles (HMMWVs) and 5-ton trucks.

If a nuclear attack occurs while you are using a vehicle, you should

(1) Stop the vehicle.

(2) Close all hatches and windows.

(3) Drop to the lowest part of the vehicle, such as the floorboards.

(4) Close your eyes and cover exposed skin.

1203. Defensive Measures for a Nuclear Attack With Warning

If you receive advance warning of a nuclear attack, prepare as quickly as possible. Tanks, bunkers, and buildings are good protection against a nuclear attack because they provide you with shielding properties that block the weapon's effects. Time permitting, you can place your vehicle over a ditch, culvert, or fighting hole and then to get into it. This strategy is especially useful when you're in HMMWVs or other light vehicles. Heavy vehicles such as tanks and AAVs provide you with natural protection from the blast and fallout. Close and fasten the hatches and remain inside the vehicle. When circumstances permit, always use your vehicle to shield other troops, your team, or yourself (fig 1-5). Remember, get as low to the ground as possible, in or out of the vehicle, assume a good protective posture, and exercise common sense.

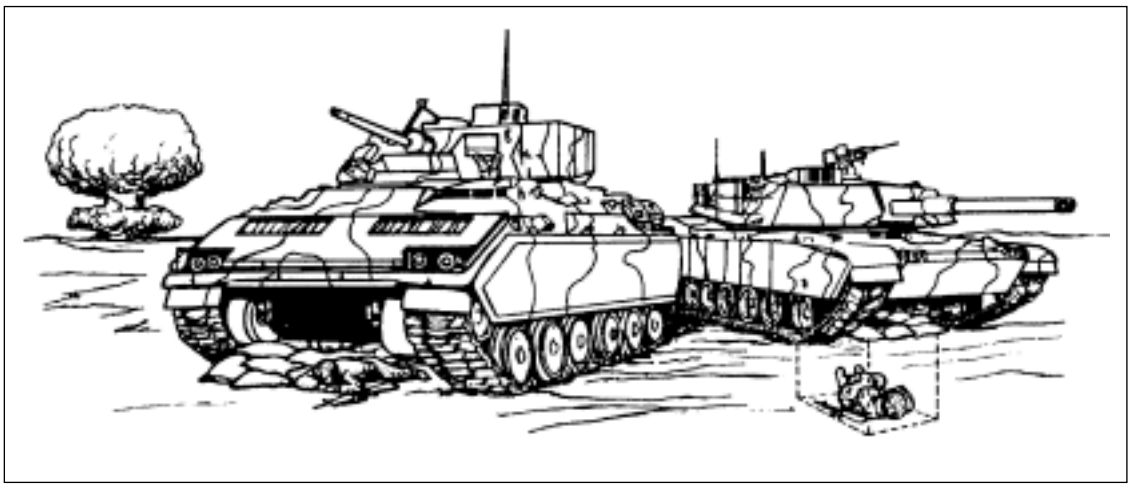


Fig 1-5. Action with armored vehicles.

Check yourself on the important information we've just covered regarding the best defensive postures.

If you're in the open with no warning of an attack, what do you do? Right! Drop flat, close your eyes, and cover all exposed skin. If you're in a fighting position, cover up and go into a fetal position. If you're in a vehicle, use it for shielding. Remember, stay as low as possible, whether in a vehicle or on the ground.

Do you recall what to do with your weapon if you are caught in the open during a nuclear attack? If you said place it under your body, you are correct. Placing it under your body keeps debris out of your weapon and keeps it from possibly being blown away.

1204. Length of Time in Protective Posture

During a nuclear attack, remain in your immediate action protective posture for at least 90 seconds or until all debris stops falling. Of course, common sense tells you that if objects are still flying around after 90 seconds, you shouldn't get up. Re-establish contact with your unit and continue your survey mission. The enemy is counting on their nuclear device to thoroughly disrupt your operations, including your survey mission. You can counter this by remaining calm, staying off the radio unless absolutely necessary, and doing what Marines are taught to do: accomplish the mission no matter what!

1205. Methods of Employing Nuclear Weapons

You should be aware of the various methods of employing nuclear weapons. Knowing how the enemy can employ nuclear weapons may eliminate part of the enemy's element of surprise. In a tactical nuclear exchange, every second counts! Keep in mind that the enemy can employ nuclear devices in a number of different ways such as:

a. Artillery. Massed artillery fire has traditionally played an important role in ground operations. With the refinement of nuclear weapons, nuclear artillery ammunition has greatly increased in its range and threat, not to mention destructive capabilities. Most 152mm artillery and larger pieces are believed to be nuclear capable.

b. Rockets. Massive rocket barrages are a significant portion of the enemy's attack doctrine. Mounted on trailers or trucks to increase their mobility, their multiple rocket launchers are capable of both nuclear and chemical attacks. The launchers range in size from 4 to 40 tubes.

c. Missiles. Either ground or aircraft-launched missiles come in a variety of sizes, both with and without multiple warheads. Today's weapons include a new generation of "smart bombs" that see their way to the target and then detonate. Of course, with nuclear weapons you only have to be close to the target!

d. Aircraft. With the refinement of nuclear weapons, even the smallest conventional aircraft may be armed with a nuclear weapon. Today's aircraft deliver a variety of tactical nuclear weapons to the battlefield.

Can you recall three of the four primary types of nuclear weapons employment? If you said artillery, rockets, missiles, or aircraft, you're correct. If you didn't, review paragraph 1205.

Lesson Summary: In this lesson you learned the indicators of a nuclear attack, the appropriate immediate action with and without any warning, the amount of time to remain in a protective posture, and the four main means of employment for nuclear weapons. In the next lesson you will learn how to react to a chemical or a biological attack.

- -

Lesson 2 Exercise: Complete items 1 through 8 by performing the action required. Check your responses against those listed at the end of this lesson.

1. What indicators tell you that a nuclear attack has occurred?

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

2. You're out in the open and have just seen a brilliant light, heard a huge blast, and felt high winds. What are you going to do?

   _____

   _____

3. If you are in a fighting position when a nuclear attack occurs, what should you do?

   _____

   _____

4. If you are in a vehicle when a nuclear attack occurs, what should you do?

   _____

   _____

5. Tanks, bunkers, and buildings are good protection against a nuclear attack because they provide you with _____ properties that block the weapon's effects.

6. Following the employment of a nuclear weapon, for at least how many seconds should you remain in a protective position?

   a. 45
   b. 60
   c. 90
   d. 120

7. Following a nuclear attack, you should check yourself and other team members for injuries, re-establish communications with your unit, and most importantly,

   _____

8. List the four primary means of employment of a nuclear weapon.

   a. _____

   b. _____

   c. _____

   d. _____

Lesson 2 Exercise Solutions

			Reference
1.	a.	Brilliant flash of light	1201
	b.	Massive explosion	
	c.	High winds	
	d.	Mushroom cloud	
	e.	Radiation	
	f.	Casualties	
2.	Drop flat, close eyes, cover skin, place weapon under body, and check for injuries		1202
3.	Assume a fetal position, cover skin		1202
4.	Stop vehicle, close hatches, get in lowest part of vehicle, cover skin and close eyes		1202
5.	shielding		1203
6.	c.		1204
7.	accomplish the mission		1204
8.	a.	Artillery	1205
	b.	Rockets	
	c	Missiles	
	d.	Aircraft	

Lesson 3. RECOGNIZING AND REACTING TO A BIOLOGICAL OR CHEMICAL ATTACK

LEARNING OBJECTIVES

1. List the seven indicators that will alert you to a chemical or biological attack.

2. List the pre-attack defensive measures that you would take to prepare for an enemy biological or chemical attack.

3. List the methods the enemy uses to employ chemical and biological agents.

1301. Attack Indicators

You will have little or no warning if an enemy uses NBC weapons. You will have to take proper immediate action to survive. The attack may involve aircraft spray, tanks, bombs, bomblets, rockets, missiles, artillery, or mortars! It's a good bet the enemy contaminates large areas quickly. As a monitor/survey team member, you will have to determine the extent of contamination and report your findings, in addition to other enemy activity that you may observe, to your unit.

Attack indicators are anything out of the ordinary that is happening around you and your team. Some indicators are obvious, while recognizing others requires some training. The following is a list of biological and chemical attack indicators:

- Low flying enemy aircraft flying perpendicularly to the wind direction.

- Bombs that don't explode. They "pop," fizzle, hiss, or just lie on the ground and appear to do nothing.

- Unidentified smoke or mist.

- An increase in sick, dead, or dying animals.

- Positive readings on your chemical detection equipment, such as alarms or detector paper.

- Unexplained symptoms that appear in or on your body. These include blisters, welts, and unexplainable illnesses.

- An unusual or unexplained increase in the number of insects.

Be alert for anything that doesn't seem right or looks out of place and could be cause for alarm. There are three standard ways to "sound the alarm," to alert others in your area of operations that a chemical/biological attack has occurred: hand and arm signals (visual), general alarms sent over communication equipment, and local alarms that might include such things as a bell ringing (fig 1-6).

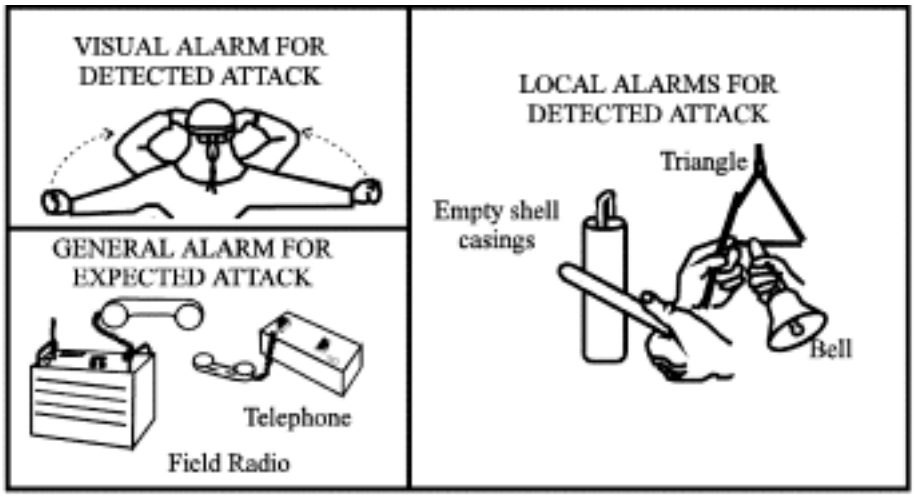


Fig 1-6. Alarms.

Ready to recap? What are the biological and chemical attack indicators? You should have said low flying enemy aircraft flying perpendicularly to the wind direction; bombs that don't explode; unidentified smoke or mist; an increase in sick, dead, or dying animals; positive readings on chemical detection equipment or alarms; symptoms that appear on your body; or unexplained increase in the number of insects.

1302. Pre-attack Defensive Measures

a. Personal health maintenance. You already know that all Marines must adhere to good personal health standards. This is especially important in an NBC environment. By maintaining good personal health, you reduce your chances of becoming a casualty. Your body will be strong and able to fight off diseases. You will be able to withstand longer periods of time in protective equipment.

One way to ward off disease--either naturally occurring or from a biological attack--is to keep your body as clean as possible. Maintain personal hygiene even more in the field than in garrison.

- Pay particular attention to the hairy portions of your body and any exposed skin.
- Treat all cuts, nicks, or scrapes immediately with soap and water at a minimum. After cleaning the wound, apply appropriate first aid treatments.

- **NEVER** use a chemical decontamination kit to clean a wound; the chemicals in the kit are caustic and will create more problems for you or the casualty than the contamination itself.

b. Immunizations. Immunizations also reduce the chances of Marines becoming a biological agent casualty. Many diseases that were once common in the United States have now been wiped out. However, in many foreign countries, many of these diseases are still common; therefore, proper immunizations are essential. If you're going into an area where a specific disease is common, make sure you get the additional immunizations you'll need to protect yourself.

c. Maintaining area cleanliness. Trash and food can attract animals that may be infested with fleas, lice, and ticks. These can be carriers of biological agents, not to mention rabies! Since it's an extra effort, many Marines in the field neglect to use sanitation facilities properly. Don't let that happen to your unit.

d. Overhead cover. You can reduce the effects of some biological and chemical agents by putting an additional layer or barrier between you and the contamination. Cover doesn't have to be elaborate. Any additional barrier between you and the agents, particularly those disseminated as aerosols and sprays, will help.

e. Protective equipment. The single most important action that you can take before any type of NBC attack is to learn how to properly use your NBC defensive equipment. Your mask will save your life if you know how to use it properly! You must act properly to avoid death! You should take approximately 8 minutes or less to don all of your mission oriented protective posture (MOPP) **gear.**

- A chemical or biological attack can happen anytime, without warning, allowing you little time to react. One breath of a nerve agent can kill.

- As a monitor/survey team member, you should be in your protective equipment at a MOPP level equivalent to the threat before you actually come into contact with possible contamination. At some point, no matter at what MOPP level you are operating, you will have to don all of your protective equipment when an attack occurs. Don your equipment when your team's detection devices announce contact with contamination.

Last but not least, you should be physically fit. When you are fit, your body will fight off disease better, and you will be less susceptible to heat-related injuries caused from wearing MOPP gear.

What are the defensive measures that you should take to help prepare for an NBC attack? That's right! Maintain good health standards, use overhead cover, maintain area cleanliness, use your NBC defensive equipment properly, and obtain the additional immunizations needed to protect yourself where diseases are common.

1303. Means of Employing Chemical and Biological Agents

To properly react to a chemical or biological attack, you must understand some of the ways that these weapons may be employed. This will make you aware that an attack is taking place and help you in preparing an NBC-1 report to send to your unit.

Chemical agents may be employed by

- Aircraft equipped with spray tanks and aerosol generators; flying perpendicular to the wind direction.
- Mines filled with chemical agents.
- Bombs and bomblets. They are munitions that do not explode. Instead, they burst open.
- Artillery.

Although they're actually living organisms, many biological agents are employed in ways similar to chemical agents. Here is how they are delivered.

- Aircraft equipped with spray tanks and aerosol generators; flying perpendicular to the wind direction.
- Insect vectors infected with biological agents.
- Sabotage, an intentional contamination of water and food sources.

Insect vectors and sabotage are two means of employing biological agents. Always be alert for sabotage! Remember, biological agents are living organisms, and a large, violent explosion will reduce their effectiveness.

Now without looking back at the text, can you remember the three primary ways that biological agents are employed? If you said aircraft spray, vectors, and sabotage; congratulations! You're on the ball! These weapons usually won't explode or have a reduced impact or explosion. Remember, biological agents are living organisms, and a large, violent explosion will reduce their effectiveness. Chemical weapons, on the other hand, use a reduced explosion to gain the desired type of coverage. A high explosion would turn the chemical agent into a vapor and blow it over a large area where it could dissipate too rapidly to be effective.

Lesson Summary. In this lesson you learned the indicators of chemical and biological agents. These indicators will help you identify a possible chemical/biological attack. However, your mission will have to go on after the attack ends. Since the residual effects of agents may be long-lasting, you will have to use enough protection to permit you to continue your mission. You will learn how to do this in later lessons.

Lesson 3 Exercise: Complete items 1 through 4 by performing the actions required. Check your responses against those listed at the end of this lesson.

1. List the seven indicators of a chemical or biological attack.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

   g. _____

2. List five measures you can take for pre-attack chemical defense.

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

3. What are the primary ways chemical agents may be employed?

   a. _____

   b. _____

   c. _____

   d. _____

4. What are the primary ways biological agents may be employed?

   a. _____

   b. _____

   c. _____

Lesson 3 Exercise Solutions

			Reference
1.	a.	Low flying enemy aircraft flying perpendicular to wind direction	1301
	b.	Bombs that don't explode. They "pop," fizzle, hiss, or just lie there and do nothing.	
	c.	Unidentified smoke or mist	
	d.	An increase in sick, dead or dying animals	
	e.	A positive reading on your chemical detection equipment, such as alarms or detector paper	
	f.	Symptoms that appear on your body	
	g.	An unusual or unexplained increase in the number of insects	
2.	a.	Maintain current immunizations	1302
	b.	Maintain area cleanliness	
	c.	Ensure overhead cover	
	d.	Use protective equipment properly	
3.	a.	Aircraft equipped with spray tanks and aerosol generators; flying perpendicular to the wind direction	1303
	b.	Mines filled with chemical agents	
	c.	Bombs and bomblets	
	d.	Artillery	
4.	a.	Aircraft equipped with spray tanks and aerosol generators; flying perpendicular to the wind direction	1303
	b.	Insect vectors	
	c.	Sabotage	

Lesson 4. CROSSING CONTAMINATED AREAS

LEARNING OBJECTIVES

1. List the steps before, during, and after crossing areas contaminated by radiological fallout.

2. List the correct techniques for crossing areas contaminated by biological and/or chemical agents.

Your unit commander needs area surveys for detailed information on the size of a contaminated area. As a rule, radiological surveys allow you to record the intensity of the contamination. Chemical contamination cannot be measured in intensity. Therefore, as a monitor/survey team member, it's your job to measure the contaminated area and find clean routes through it.

As a monitor/survey team conducting the mission, your unit needs to determine

- The general location of the contamination
- If there was a nuclear, biological, or chemical attack
- What type of agent you can expect
- How the agent was employed

Why do you think it's a good idea to know how the agent was delivered? Keep in mind variables such as wind speed, wind direction, and temperature gradient. You can determine how large the contaminated area is by knowing the type of munitions employed to deliver the chemical agent. Since different weapons have different bursting radii, the size of the contaminated area depends on the size of the weapon.

1401. Crossing Radiologically Contaminated Areas

The greatest problem usually associated with radiological hazards is determining the

- Intensity of the hazard
- Length of time that a team may be allowed to stay in the hazardous area

If the radiation level is low enough, you can remain in place for a long time. Unlike some chemical agents, radiological hazards can't be seen, tasted, smelled, or felt. Detection with RADIAC instruments is the only way to monitor these hazards. Don't be fooled because everything looks OK--it probably isn't! Before you and your team leave for your mission, you'll be given the equipment you need to survey radiation levels. **You will be given a "turn-back" dose rate, that, once reached, will tell you to exit the contaminated area and report to headquarters with your findings.**

Table 1-1 shows the steps to follow before, during, and after crossing a contaminated area

Table 1-1. Steps Before, During, and After Crossing a Contaminated Area

BEFORE	DURING	AFTER
(1) Ensure all of your RADIAC instruments work properly.	(1) Use the shortest route possible.	Buddy up and brush each other off once your mission is accomplished to remove excess dust particles. These particles may contain radioactive fallout.
(2) Sandbag the vehicle to increase shielding.	(2) Cross the area as quickly as possible.	
(3) Close windows and hatches to help keep radioactive dust particles out.	(3) Avoid unnecessary contact with surfaces you think are contaiminated. Do not stir up dust needlessly.	

1402. **Crossing Chemically and Biologically Contaminated Areas**

In the last two lessons you learned how to recognize and react to an NBC attack. Now, you will see how to cross contaminated areas. You'll cover chemical and biological crossings together because Marines use similar protective measures for both. The agents and physiological effects are quite different, but crossing either type of contaminated area is quite similar with one exception. Can you think of that exception? If you said we have to exclude considering transmission by insect vectors, you're absolutely correct. The enemy has no control over where insect vectors are likely to travel.

Most chemical and biological agents are dispersed at ground level or are released from aircraft at low altitudes. As a rule, the enemy would like to affect an area approximately 2 meters or 6 feet high. Why? The average height of a Marine is less than 6 feet tall.

When biological and chemical agents are dropped from an aircraft, what does that tell you about the agents themselves? If something is heavier than air, it will fall to the ground. As a rule, when agents are heavier than air they stay low near the ground, seek out low places like fighting holes and follow terrain features such as creek beds and valleys. However, not all chemical and biological agents are heavier than air.

The way to avoid unnecessary exposure is to seek higher ground. As a monitor/survey team member, your mission is to find contamination; in most cases, this is easy to do. Also, having a basic understanding of how agents act is invaluable. For instance, chemical agents move in the direction of the wind. Chemical agents generally move at the same rate of speed as the wind and

follow ground contours of terrain. Such knowledge helps you assess the chemical threat and allows you to avoid areas of chemical concentration during your survey missions.
Let's take a look at this. How often have you been in the field, seen some CS (tear gas) thrown on a unit, and watched Marines run downwind from the gas? In these situations, you learn the hard way to move upwind, never downwind, of chemical contamination.

- If you're in the field and high winds are present, how long do you think it will take to disperse the agent? You're right if you said not long at all. In fact, most chemical agents are used when wind speeds are low. Why? Low wind speeds keep the agents from dispersing too rapidly and losing their effectiveness.

- Remember, most agents are heavier than air and follow terrain features. This also means that they can flow into and around obstacles such as buildings, trees, and your vehicle! Uneven terrain only disperses the contaminant; it does not eliminate the chemical threat to you and your team (fig 1-7).

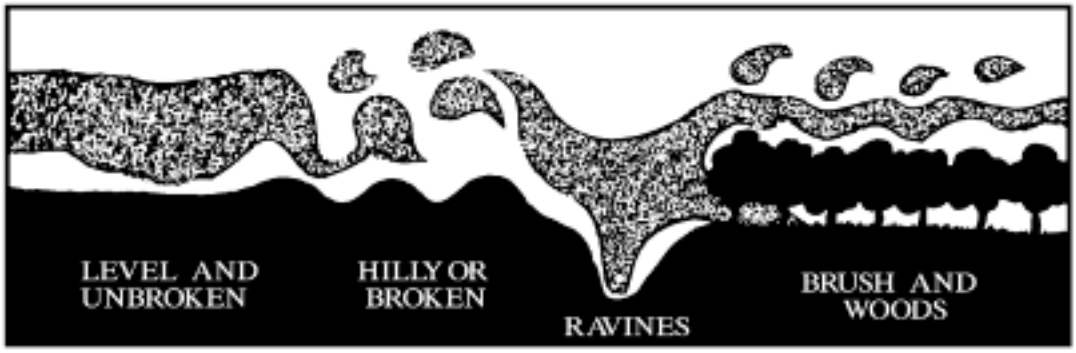


Fig 1-7. Agents flowing around obstacles.

Crossing a chemically or biologically contaminated area is much the same as crossing one that is radiologically contaminated. Of course, you should limit exposure and move as quickly as possible through the contaminated area. Remember that your MOPP gear will be hot and will slow your efforts to complete your mission. Additional precautions to take when crossing a contaminated area are listed below:

- Follow established routes, preferably the shortest and fastest your mission will allow. Deviating from assigned routes could keep medivac or extraction personnel from finding you in an emergency.

- Ensure detection equipment functions properly and that your biological sampling kit (BSK) is properly stocked.

- Don necessary protective equipment to prevent contamination.

- Attach M8 and M9 tape to exterior of overgarments.

- Move upwind of contamination.

- Avoid gullies, trenches, ravines, cellars, and other low-lying areas where agents may collect.

- Avoid contaminated vegetation, suspicious liquids, and pools of water; they can break down your overgarment and spread contamination. Heavy vegetation collects contamination and presents more of a hazard than open, bare terrain.

- Avoid unnecessary contact with contaminated surfaces. Avoid kicking up dust; some agents are dispersed as powders.

- Buddy up and remove any dust and report discoloration of M8 or M9 tape.

Remember to use common sense whenever you cross a contaminated area! Be proficient with your detection/sampling equipment to limit your exposure to the contaminated area. Record and report your findings. The more time you spend in a contaminated area, the greater your risk of becoming contaminated.

Lesson Summary: In this lesson you learned the correct techniques for crossing areas contaminated by radiological, biological and chemical agents. In the next lesson you will learn about the North Atlantic Treaty Organization (NATO) NBC markers and how to use them to mark contaminated areas.

Lesson 4 Exercise: Complete items 1 and 2 by performing the actions required. Check your responses against those listed at the end of this lesson.

1. What steps do you take before, during, and after crossing an area contaminated by fallout?

   BEFORE

   _____

   _____

   _____

   DURING

   _____

   _____

   _____

   AFTER

   _____

2. What precautions must you take when crossing chemically and biologically contaminated areas?

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

   g. _____

   h. _____

   i. _____

Lesson 4 Exercise Solutions

			Reference
1.		BEFORE	
		Ensure all RADIC instruments function properly	1401
		Sandbag the vehicle to increase shielding	
		Close windows and hatches	
		DURING	
		Use the shortest possible route	
		Cross the area as quickly as possible	
		Avoid contact with suspected surfaces	
		AFTER	
		Buddy up to remove dust particles	
2.	a.	Follow shortest allowable established route	1402
	b.	Ensure detection equipment functions properly and BSK is stocked	
	c.	Don protective gear	
	d.	Attach M8 and M9 to exterior of overgarment	
	e.	Move upwind of contamination	
	f.	Avoid low-lying areas where agents settle	
	g.	Avoid heavy vegetation and suspicious liquids	
	h.	Avoid unnecessary contact with contaminated surfaces and kicking up dust	
	i.	Buddy up to remove dust	

Lesson 5. MARKING CONTAMINATED AREAS

LEARNING OBJECTIVES

1. Identify NATO NBC markers.

2. Identify the proper marking procedures for standard NBC contamination markers.

1501. Using Contamination Markers

Part of your mission is to mark contaminated areas once you have tested and reported them. Use contamination markers to partition off areas that have been surveyed and found to be contaminated. You can also use these markers to designate areas where contaminated equipment or gear has been buried or abandoned.

Occasionally, you may have to mark areas with more than one type of marker because multiple hazards may exist in the same area. Mark these areas by placing appropriate signs near each other. Let's look at an example. An area is contaminated with both a radiological and a chemical hazard. What would you do? That's right. Simply place the two markers near each other.

1502. Identifying Contamination Markers

The signs that you'll use for marking contaminated areas are standard in color and size throughout NATO. Standard markers allow U.S. forces to easily recognize and specify the type of hazard.

- The marker shape is a triangle that measures 20cm X 20cm X 28cm. The triangle is inverted, meaning the point is always down.

- Its background color indicates the type of hazard that you might encounter.

- Place markers so they face away from the contamination. That way, if you should come across one from the front, you'll know what type of hazard is present behind it. Coming across one from the rear means that you have just passed through the contaminated area, much like finding yourself in a minefield.

a. Chemical. The most common marker is the chemical contamination marker. Use the chemical marker (fig 1-8) to mark chemically contaminated areas. It can be emplaced by any unit with detection capabilities. Chemical agents are easy to detect and identify. Other friendly units and your team may emplace markers when you have completed detection and identification. Biological and radiological markers can't be used until specific tests using RADIAC meters or results from medical labs have shown that contamination is present.

Fig 1-8. Chemical contamination marker.

You will need to write certain data on the front of each marker you place; this will help others who come across the marker to properly evaluate the situation. As a rule, you should provide as much data as possible for the next unit. At a minimum, place the following information on the front of the marker:

- Name of agent (if known)
- Date and time of detection
- Unit

b. Biological. The second NATO marker is the biological contamination marker (fig 1-9). You'll probably see this marker around medical or research facilities where biological contaminants can easily be found. Don't rule out seeing them in the field, though. There is evidence that many countries now have the knowledge necessary to manufacture large quantities of biological agents.

Fig 1-9. Biological contamination marker.

When marking a biological contamination, place the following information on the front of the marker:

- Name of agent (if known)
- Date and time of detection
- Unit

c. Nuclear. Use this marker to designate areas contaminated with nuclear radiation (fig 1-10). Members of a survey team conducting a radiological survey place these markers. Specific readings, telling how much radiation is present, are necessary to determine the best location for the contamination markers. Remember you can use these markers for other areas such as disposal sites and equipment that has been so highly contaminated that they have been abandoned.

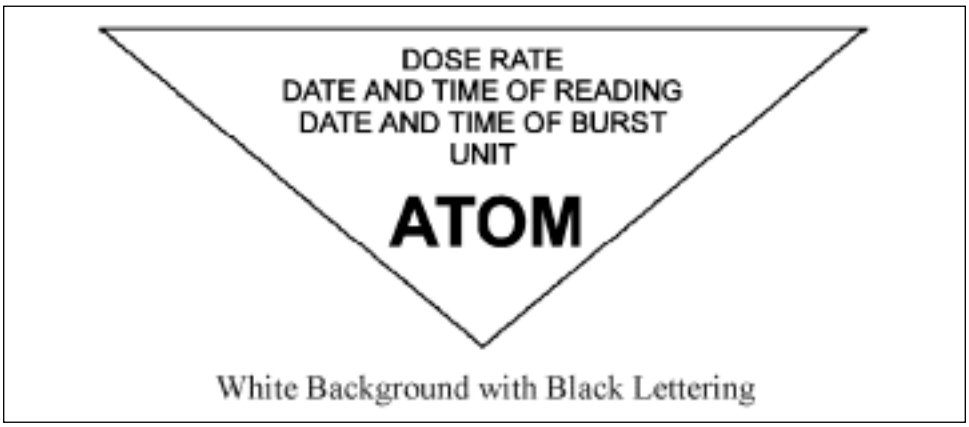


Fig 1-10. Radiological contamination markers.

As a monitor/survey team member, you'll need to determine the following:

- Dose rate
- Date and time of reading
- Date and time of burst (if known)
- Unit

Look at an example. A unit came across a nuclear contamination marker. The information on the marker said that the attack had occurred more than 30 days ago. By calculating the decay rate and determining the total dose of radiation, the unit decided it could move through the area. Why? Because the radiation level had dropped to an acceptable level during the 30-day period.

You've often seen contamination signs, usually during MBST testing, with such lettering as "RAD," "NUC," "CHEM," or "BUG." Don't be fooled by imitations; settle only for the designations "ATOM," "BIO," and "GAS."

1503. Using the NBC Marking Kit

In the old days of NBC, all-day working parties made triangles that measured 20cm X 20cm X 28cm from sheets of plywood. Other Marines scratched their heads and wondered aloud, as Marines often do, "What are these for?" You know what came next. Painting the triangles; some white, some yellow, and some blue. Now we have an NBC marking kit that does all this.

The marking kit (fig 1-11) is simple to use. It has everything you need to mark a contaminated area--flags, ribbons, crayons, mounting stakes, and a carrying container. Contamination markers are made of cellophane and rolled onto spools.

- To dispense a marker, simply unroll it and tear it off along the perforation.
- Use the mounting stakes to place a marker at waist height.
- Use the yellow ribbon to tie the markers to trees.
- Place the cellophane between markers to better identify a contaminated area.
- Use the red crayons to write applicable hazard data on the front.

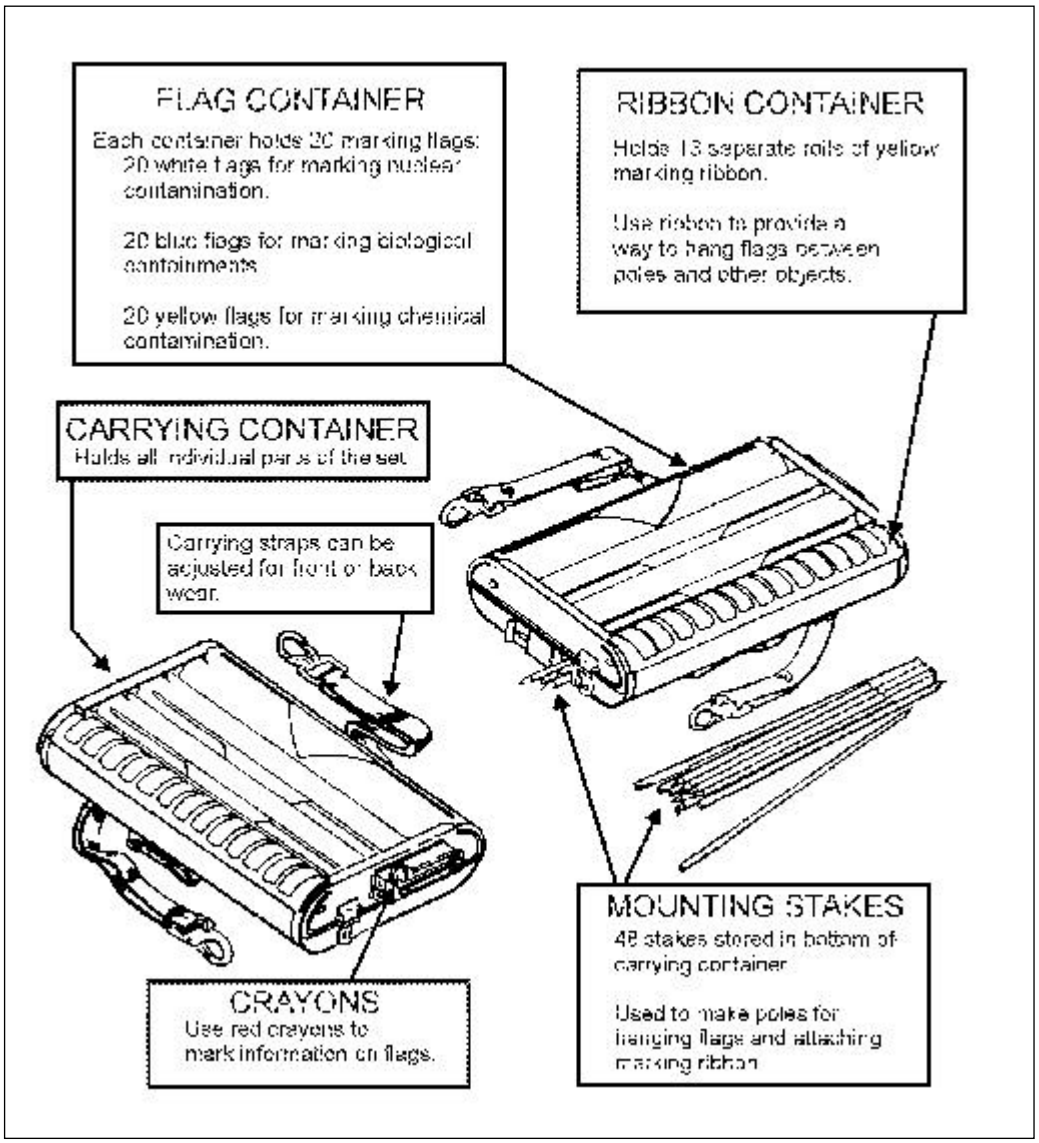


Fig 1-11. NBC marking kit.

1504. Marking Procedures

a. Importance of marking. Marking an area warns friendly troops of contamination hazards, but you've got to place the signs where they'll most likely be seen. Without good markings, unprotected Marines may walk into a contaminated area and become casualties.

b. Placement. As a rule, the individuals who find the contamination mark the area. As a monitor/survey team member, you might expect to find a lot of contamination, and you're absolutely right. **Place markers along the area where you find contamination, with adjacent markers (left or right) within easy eyeball distance of each other and facing away from the contamination; about 25 to 100 feet apart at the most depending on the terrain.** Usually a small unit will recon or patrol through an area, find contamination the hard way by stumbling over it, and call it in. The small unit will then mark the location. Your team will be sent to mark and determine the extent of the hazard.

c. Directions of markers. Are you clear about what direction markers should face in relation to the contamination? And where you must place the detection information? If you said facing away from the actual contamination, with pertinent information on the front of the marker, then you were correct. If not, review the material in paragraph 1503. By now you should be feeling quite comfortable about crossing and marking contaminated areas. It's simple if you and your team follow the guidelines outlined here and exercise common sense.

Lesson Summary: In this lesson you learned the importance, placement, and direction of markers used to mark a contaminated area. In the next lesson you will cover procedures for reporting monitor surveys.

- -

Lesson 5 Exercise: Complete items 1 through 5 by performing the action required. Check your responses against those listed at the end of this lesson.

1. When positioning a contamination marker, ensure the marker is

    a. facing the contamination and easily visible.
    b. at head height with the required information.
    c. easily visible at 200 meter intervals.
    d. facing away from contamination, about 25 to 100 feet apart.

2. You've come across an area of nuclear contamination. The marker you'll use to mark it will have a

    a. blue background, red lettering, designation NUC.
    b. red background, yellow lettering, designation RAD.
    c. black background, white lettering, designation ATOM.
    d. white background, black lettering, designation ATOM.

3. Your equipment has verified chemical contamination. The marker you'll use to mark it will have a

   a. white background, black lettering, designation CHEM.
   b. yellow background, red lettering, designation GAS.
   c. blue background, red lettering, designation CHEM.
   d. red background, yellow lettering, designation GAS.

4. A biological contamination marker can best be described as a

   a. blue triangle with the word "BIO" printed in red.
   b. red triangle with the word "BIO" printed in white.
   c. red triangle with the word "BIO" printed in blue.
   d. yellow triangle with the word "BIO" printed in red.

5. What information is required on the standard NBC marker?

   a. Date of detection and agent
   b. Agent, unit, name, and means of delivery
   c. Date of employment, agent, and means of detection
   d. Date of detection, agent, unit, and dose rate

Lesson 5 Exercise Solutions

		Reference
1.	d.	1502
2.	d.	1502
3.	b.	1502
4.	a.	1502
5.	d.	1502

Lesson 6. REPORTING MONITOR/SURVEY FINDINGS

LEARNING OBJECTIVES

1. List the advantages of the three methods of reporting NBC attacks.

2. State in writing the purposes of the NBC-1 and NBC-4 and spot reports prepared by a monitor/survey team.

3. Identify the landing zone (LZ) brief.

4. Identify the purpose of the field message book.

5. Identify the four message priorities to determine the order of transmission.

Once your team has detected the presence of NBC agents--whether nuclear, biological, or chemical--you must report their presence to the appropriate headquarters, using one of several reports. You'll learn about these reports and their formats in this lesson. You must also know how to properly relay these reports to your headquarters. Let's take a look at that first.

1601. Methods of Reporting

As a monitor/survey team member, you have several ways to communicate. Your specific situation dictates what form of communication to use. Using a field phone for a route survey might be out of the question, but for a monitoring mission at a known location it could be ideal.

a. Radio. The most common and fastest method of reporting your findings is by a tactical radio net. Remember, you must exercise proper communications security anytime you talk on a radio.

- Always assume that the enemy is listening to your conversation and can fix your position rapidly.

- Never transmit your location without the use of encryption devices and codes.

You must always understand and master the equipment that you use; never allow the equipment to master you. MCI 25.30g, VHF Field Radio Equipment, will teach you the use of radio equipment and prowords, encryption devices, and other communications materials.

b. Field phone. A more reliable means of transmitting NBC reports is by a field phone. However, this method lacks mobility. For certain monitoring missions, it may be ideal, but remember, in most situations, you will be away from your unit and not have access to a field phone. If a field phone is available, use it! It is more secure than a radio.

c. Messenger. Although the most secure method of reporting is messenger, there are certain drawbacks to using one. Using a messenger takes extra time. For example, if you have a report such as the NBC-1, Observer's Report, that you need to get to the rear quickly where its information will be processed into usable data, using a radio or field phone would be a better means of communication. You may wish to use a messenger when you have some NBC reports that do not have to be sent to the rear so rapidly. Using a messenger also protects your location. Your team won't run the risk of exposing itself through enemy electronic surveillance.

Using a messenger takes time and decreases the team members your team has available. This is a consideration because, as a rule, on monitor/survey missions, you'll have as few personnel as possible. Minimizing personnel on the mission decreases the logistical burden of transportation and exposes fewer personnel to possible contamination.

1602. Types of Reports

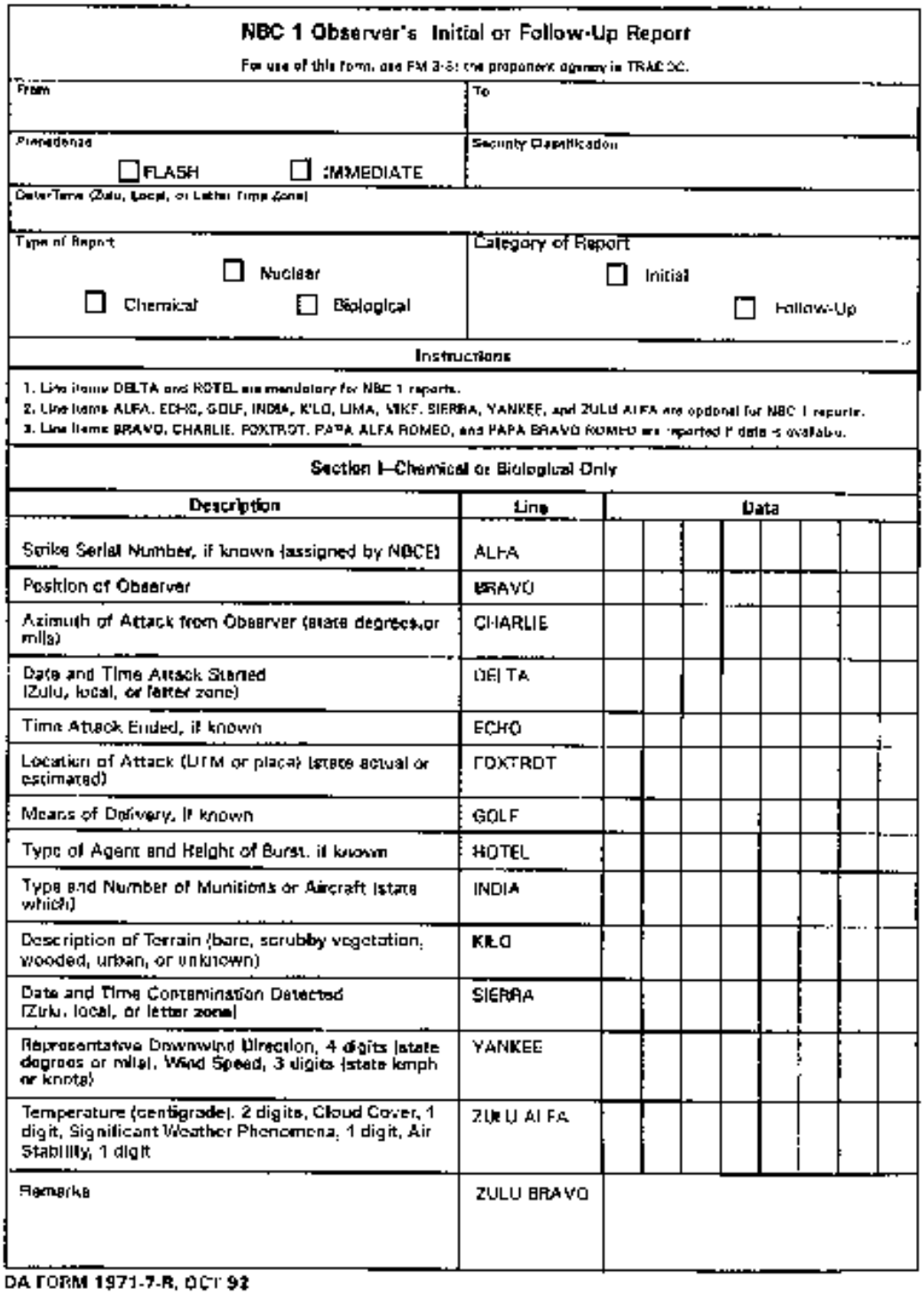
As a monitor/survey team member, you will use several types of messages. Your job is to report any enemy activity that you may encounter so that a "special reception" may be planned for them. In this instance, consider your team a NBC recon team. You should report anything that's out of the ordinary, especially information on the enemy.

While some units may require you to write your own report using a field message book, others will provide you with reproduced copies of DA Forms 1971-7-R through 1971-10-R to expedite and ensure all applicable line items have been completed.

a. NBC-1 (*Observer's Report*). Use the NBC-1 report when your team has come under an NBC attack. Remember to

- Use the proper format when transmitting any report.
- Take a GTA 3-6-8, *NBC Warning and Reporting System Card*, or copies of Form 1971-7-R on your mission if you or your team are unfamiliar with necessary line items (fig 1-12).

b. NBC-4 (*Reconnaissance, Monitoring, and Survey Results Report*). This is probably **the** report that your team will use most often. It details the types and extent of contamination found (figs 1-13 and 1-14).



NBC 1 Observer's Initial or Follow-Up Report

For use of this form, see FM 3-3; the proponent agency is TRADOC.

From	To
Precedence: ☐ FLASH ☐ IMMEDIATE	Security Classification
Date/Time (Zulu, local, or letter time zone)	
Type of Report: ☐ Nuclear ☐ Chemical ☐ Biological	Category of Report: ☐ Initial ☐ Follow-Up

Instructions

1. Line items DELTA and HOTEL are mandatory for NBC 1 reports.
2. Line items ALFA, ECHO, GOLF, INDIA, KILO, LIMA, MIKE, SIERRA, YANKEE, and ZULU ALFA are optional for NBC 1 reports.
3. Line items BRAVO, CHARLIE, FOXTROT, PAPA ALFA ROMEO, and PAPA BRAVO ROMEO are reported if data is available.

Section I—Chemical or Biological Only

Description	Line	Data
Strike Serial Number, if known (assigned by NBCE)	ALFA	
Position of Observer	BRAVO	
Azimuth of Attack from Observer (state degrees or mils)	CHARLIE	
Date and Time Attack Started (Zulu, local, or letter zone)	DELTA	
Time Attack Ended, if known	ECHO	
Location of Attack (UTM or place) (state actual or estimated)	FOXTROT	
Means of Delivery, if known	GOLF	
Type of Agent and Height of Burst, if known	HOTEL	
Type and Number of Munitions or Aircraft (state which)	INDIA	
Description of Terrain (bare, scrubby vegetation, wooded, urban, or unknown)	KILO	
Date and Time Contamination Detected (Zulu, local, or letter zone)	SIERRA	
Representative Downwind Direction, 4 digits (state degrees or mils), Wind Speed, 3 digits (state kmph or knots)	YANKEE	
Temperature (centigrade), 2 digits, Cloud Cover, 1 digit, Significant Weather Phenomena, 1 digit, Air Stability, 1 digit	ZULU ALFA	
Remarks	ZULU BRAVO	

DA FORM 1971-7-R, OCT 93

Fig 1-12. Sample DA Form 1971-7-R.

NBC 4 Radiation Dose Rate Measurements or Chemical/Biological Areas of Contamination

For use of this form, see FM 3-3; the proponent agency is TRADOC.

From	To
Precedence: IMMEDIATE	Security Classification
Date-Time (Zulu, Local, or Letter Time Zone)	
Type of Report: ☐ Nuclear ☐ Chemical ☐ Biological	Category of Report: ☐ Initial ☐ Follow-Up

Instructions

1. Line items QUEBEC, ROMEO, and SIERRA may be repeated as often as necessary.
2. Line items HOTEL, QUEBEC, ROMEO, and SIERRA are mandatory for NBC 4 reports.
3. Line items ALFA and KILO are optional for NBC 4 reports.

Section I--Chemical or Biological Only

Description	Line	Data
Strike Serial Number (assigned by NBCC)	ALFA	
Type of Agent	HOTEL	
Description of Terrain (bare, scrubby vegetation, wooded, urban, unknown)	KILO	
Location of Reading (UTM) (state whether test was air or liquid)	QUEBEC	
Date and Time of Reading (Zulu, local, or letter zone)	SIERRA	
Type of Agent	HOTEL	
Description of Terrain (bare, scrubby vegetation, wooded, urban, unknown)	KILO	
Location of Reading (UTM) (state whether test was air or liquid)	QUEBEC	
Date and Time of Reading (Zulu, local, or letter zone)	SIERRA	
Type of Agent	HOTEL	
Description of Terrain (bare, scrubby vegetation, wooded, urban, unknown)	KILO	
Location of Reading (UTM) (state whether test was air or liquid)	QUEBEC	
Date and Time of Reading (Zulu, local, or letter zone)	SIERRA	
Remarks	ZULU BRAVO	

DA FORM 1971-10-R, OCT 92

Fig 1-13. DA Form 1971-10-R (Front).

Section II--Nuclear Only		
Description	**Line**	**Data**
Strike Serial Number (assigned by NBCC)	ALFA	
Crater Diameter (meters) if known	KILO	
Location of Reading (UTM)	QUEBEC	
Dose Rate (cGyph) (the words "Initial," "Peak," "Increasing," or "Decreasing" may be added)	ROMEO	
Data and Time of Reading (Zulu, local, or letter zone)	SIERRA	
Location of Reading (UTM)	QUEBEC	
Dose Rate (cGyph) (the words "Initial," "Peak," "Increasing," or "Decreasing" may be added)	ROMEO	
Date and Time of Reading (Zulu, local, or letter zone)	SIERRA	
Location of Reading (UTM)	QUEBEC	
Dose Rate (cGyph) (the words "Initial," "Peak," "Increasing," or "Decreasing" may be added)	ROMEO	
Date and Time of Reading (Zulu, local, or letter zone)	SIERRA	
Remarks	ZULU BRAVO	

REVERSE, DA FORM 1971-10-R, OCT 92

Fig 1-14. DA Form 1971-10-R (Reverse).

c. Spot report (SPOTREP). Use these initial reports to inform your command that something, usually a casualty, has happened. Use this report only as a guide for reporting all available information on w h a t happened, where , why , how , when, and to whom it happened. The following spot report format (fig 1-15) shows you how to arrange your report information and what the report will sound like when it's transmitted. Spot reports may vary from unit to unit, so your unit's spot report may not be exactly the same as this. Consult your unit's SOP for the exact format.

Spot Report

Spot Report # _____

A. Call sign or reporting unit
B. Date-time-group
C. Position
   1. Friendly position (encoded). DO NOT encode friendly positions following contact with the enemy or when the enemy knows your position.
   2. Enemy positions (do not encode)
D. Incident (what happened)
E. Action (action taken or being taken)
F. Friendly KIA (CASREP must follow)
G. Friendly WIA (CASREP must follow)
H. Friendly MIA (rank, initials, last four of SSN, circumstances when last seen)
I. Enemy KIA (confirmed only)
J. Enemy captured
K. Suspects detained (number and type)
L. Weapons captured
M. Number and type of equipment and documents captured or destroyed

Fig 1-15. Spot report format.

1603. Landing Zone (LZ) Brief

You may need helicopters to land where you conduct a reconnaissance. If there is an emergency requiring your team to be extracted from the contaminated area, your mission may be terminated. Your team may be responsible for calling the helicopters in when conducting a point survey.

A landing zone (LZ) brief (fig 1-16) is required each time a helicopter lands in your LZ. The size of the LZ and the height of the obstacles around it may severely limit the type of aircraft that can land. Tactical tips that may prove helpful in assisting the aircraft into and out of the LZ and handling casualties at an LZ are listed below.

- Prepare your brief before the helicopter arrives.
- Stage equipment and personnel before the helicopter arrives.
- Prepare to load any casualties before the helicopter arrives. Place seriously injured Marines nearest the door of the aircraft. Team members should be ready to load.
- Be prepared to mark the LZ.
- Shield the strobe lights from enemy view by placing them inside a helmet or an M-203 grenade launcher.
- If the helicopter receives fire while in the approach, describe the type of fire to the pilot and what direction it is coming from. Give the aircraft commander an accurate picture of your situation on the ground.

Do not use the clock method to establish direction. The aircraft has a compass, so use cardinal directions (north, south, east, west) in your messages.

LZ Brief

1. Size of the LZ (diameter or length and width)
2. Obstacles in the LZ
3. Best approach (compass heading)
4. Wind direction and speed
5. Direction of enemy fire
6. Obstacles in the approach
7. Cleared to fire in _____ direction _____ distance
8. Distance of perimeter from the LZ
9. Location nearest friendly position to LZ
10. Last enemy fire at time and type
11. Direction of last enemy fire
12. Position of enemy automatic weapons
13. LZ will be marked with _____
14. Remain on this channel with LZ control until mission is completed

(Add or delete information as necessary such as chemical agents used and the extent of contamination.)

Fig 1-16. LZ brief.

Now, check yourself on your understanding of the required monitor/survey team reports. Match each of the reports in column 1 with its function in column 2.

Column 1		Report	Column 2	Function
___	1.	NBC-1	a	Provide information needed for helicopter landings
___	2.	NBC-4	b.	Provide periodic updates of team's activities
___	3.	SPOTREP	c.	Report an NBC attack
___	4.	LZ brief	d.	Make an initial report of occurrences
			e.	Give details of the type and extent of contamination

Your answers should be

1. c.
2. e.
3. d.
4. a.

1604. **Field Message Book**

a. Purpose. Use the field message book, NAVMC 694 (Rev 7-70) for drafting field messages at the regimental level and below. This pocket-sized yellow message book contains 75 message blanks and is an excellent aid to preparing small unit communications. The message book is easy to understand and contains plain and simple instructions for use.

b. Contents. You'll find the phonetic alphabet printed on the front cover. Inside the front cover, you'll find instructions for preparing field messages, a precedence table, and a classification table. An insert (the back cover of the book) when placed under the message forms, allows you to make the desired number of copies. The message forms are printed on pressure sensitive paper so that you can make several copies without carbon paper.

Note: If you and your team are provided with applicable DA Forms, use them to transmit your message traffic. However, in certain instances, such as situation or spot reports, you'll need a field message book.

c. Importance of security. As a monitor/survey team member, you'll send message traffic as a result of your mission. You should always do the following:

- Write out your messages whenever possible so that once you're on the radio, you can be brief.

- Deny the enemy the opportunity to pinpoint your location by locking onto your signal.

1605. Message Priorities

Whenever any message is sent, establish a priority. Most NBC reports are sent either immediate or priority, with one exception--the NBC-1. Always send the NBC-1 FLASH. Take a look at the following definitions. As a survey specialist, you need to know proper message priorities for transmitting your messages.

- **FLASH** As fast as humanly possible, but in any case, not more than 10 minutes

- **Immediate** As fast as possible after all FLASH traffic, but not more than 30 minutes

- **Priority** As fast as possible after all higher precedence traffic, but not more than 3 hours

- **Routine** As fast as possible after all higher precedence traffic, but less than 6 hours

Transmitting message traffic is an important part of your mission. Nothing is gained when your team gathers information in a contaminated area if you cannot effectively relay that information back to your command. An even worse scenario is when you gather information and attempt to relay it, and the enemy finds your position using electronic surveillance. The results are not worth repeating, are they?

Can you recall at which priority an NBC-1 report is sent? That's right, FLASH precedence! What about routine NBC data that you and your team collect? At what precedence is it sent? If you said routine, take a look back to the top of the page. Most NBC reports are sent immediate or priority.

Lesson Summary: In this lesson you learned the methods of reporting NBC attacks. You learned the purpose of those reports specific to the monitor/survey mission, the purpose of the field message book, and the four priorities of the transmission order.

Lesson 6 Exercise: Complete items 1 through 7 by performing the actions required. Check your responses against those listed at the end of this study unit.

1. List the advantages of each of the three methods of reporting an NBC attack.

   a. _____

   b. _____

   c. _____

2. What is the purpose of the NBC-1 report?

   _____

3. What is the purpose of the NBC-4 report?

   _____

4. What is the purpose of the SPOTREP?

   _____

5. When must you prepare an LZ brief?

   _____

6. What is the purpose of the field message book?

   _____

7. Under which precedence priority is an NBC-1 message sent?

   a. Routine
   b. FLASH
   c. Priority
   d. Immediate

UNIT SUMMARY

In this study unit you learned how to prepare for and conduct an NBC mission and how to recognize and react to nuclear, biological, and chemical attacks. You also learned how to mark and cross contaminated areas. Finally, you found out how to report your monitor/survey findings to the headquarters requiring the information. In the next study unit you will study how to conduct a radiological monitor/survey mission.

Lesson 6 Exercise Solutions

		Reference
1.	a. Radio is fastest b. Field phone is more secure than radio c. Messenger is most secure	1601
2.	An observer's report that specifically addresses the monitor/survey findings of an NBC attack	1602
3.	Reports results of reconnaissance monitoring and survey; details the type and extent of contamination	1602
4.	To inform your unit that something has happened; usually associated with casualty reporting	1602
5.	Each time a helicopter lands in your landing zone	1603
6.	For drafting field messages at the regimental level and below	1604
7.	b.	1605

STUDY UNIT 2

CONDUCTING A RADIOLOGICAL MONITOR/SURVEY MISSIO

Introduction. Since you cannot see radiation with the naked eye, you must take special considerations to ensure safety and survivability in an NBC environment.

In this study unit you'll discuss

- The purpose of radiological monitor/survey operations
- Certain tactical considerations
- Operations of RADIAC instruments
- Conducting both a radiological monitoring and survey mission
- Recording and reporting of radiological data

Lesson 1. RADIOLOGICAL MONITOR/SURVEY MISSION: PURPOSE AND DESCRIPTION

LEARNING OBJECTIVE

State the purpose for conducting radiological monitoring/survey operations.

Imagine that a nuclear detonation has occurred several miles away. Over the tops of trees you see the billowing mushroom cloud off in the distance. Your team is waiting for the call to activate. What can you expect? What's going to require your team to act? To answer these questions and others, read on.

Once a detonation has occurred, many things happen. First and foremost, there may be a great deal of confusion and chaos. Report to your unit NBC control center as soon as possible.

Units in the field will send the control center the NBC-1 Observer Reports, providing the control center with information about the attack. The control center

- Collects, analyzes, and plots the results from these reports.

- Uses this information to estimate the contamination direction, speed of travel, and the areas affected to complete an NBC-2 report that is dispatched to affected personnel. The control center uses this estimate to warn personnel of suspected areas of contamination.

2101. Radiological Monitor/Survey Operations

NBC-1 reports completed by the initial observer(s) allow the NBC control center to determine the approximate location of the contamination. Remember, this is only an estimate. You need additional information to get a more accurate view of the situation. As part of a radiological monitor/survey operations team, you'll be assigned a mission with instructions on where to look to find the missing pieces of the puzzle.

Your team has been activated and you have your mission. Your purpose is to

- Locate and determine the intensity of the contamination.
- Record its levels on an NBC-4 report.

In providing this information to the control center, you help the unit commander to make a more precise decision about the welfare of his troops. He bases this decision on operational commitments, previous exposure to radiological contamination, and the mission.

Can you recall the purpose of radiological monitor/survey operations? Right, the purpose is to locate and determine the extent of radiological contamination.

2102. Responsibilities of the Designated Observers

Every unit is responsible for observing, recording, and reporting NBC attacks, but not every unit will automatically send in an NBC-1 report. Only selected units, known as "designated observers" will provide an NBC-1 Observer's Report. If every unit sent in an NBC-1 report, the control center would be swamped with too many reports. Allowing uncontrolled submission of NBC reports would certainly tie radio nets up, consume a lot of time, and keep the control center from disseminating information.

The control center selects designated observers based on

- Location
- Relation to the contamination
- Availability of the detection equipment

These units are directed to prepare NBC-1 reports whenever a nuclear attack occurs.
What do we call a unit that is responsible for providing information whenever nuclear attacks occur? Did you say designated observer? If so, you're on a roll!

What if it were a chemical or biological attack? Are the same designated observers used? Because of the difficulty in detecting attacks, it is the responsibility of all units and individuals to report these kinds of attacks.

Lesson Summary: In this lesson you learned why your team has to conduct a radiological survey and what the designated observer's responsibilities are in a radiological monitor/survey mission. In the next lesson you will learn about various RADIAC instruments used to detect, measure, and indicate radiation levels.

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Lesson 2. USING RADIAC INSTRUMENTS

LEARNING OBJECTIVES

1. Define the acronym RADIAC instruments.

2. Identify the common units of measurement that indicate intensities of radiation.

3. Use the correct method and unit to calculate the total dose rate given the dose rate and time of exposure.

4. Identify the common instruments the Marine Corps uses to measure, detect, and indicate radiation levels.

2201. Define RADIAC Instruments

a. RADIAC instruments. Since you cannot measure nuclear radiation with any of your physical senses, a device has been developed to tell you when radiation is present. The device used to detect and measure nuclear radiation is called a RADIAC instrument.

b. Definition. The term RADIAC was derived from the first letters of the words that indicate the functions of these instruments.

- RA - RAdiation
- D - Detection
- I - Indication
- A - And
- C - Computation

2202. RADIC Instrument Units of Measurement

There are many units of measurement indicating levels of intensity. However, the only units of measurement that you are likely to encounter during your mission are listed below:

a. RAD is the abbreviated term for **R**adiation **A**bsorbed **D**ose. It is a measure of the total amount of radiation received. Since a RAD is a large amount of radiation, you state the measurement in RADs when you intend to measure a large amount of radiation.

b. Millirad (MRAD) is equal to one one-thousandth of a RAD. You use this unit to measure a small amount of radiation.

c. Roentgen is a unit of measurement for gamma radiation. It is used only by the military and may also be found on some RADIAC instruments. While one roentgen is not exactly equal to one RAD, you can use numbers stated in the two units interchangeably.

d. Centigray. The centigray is the basic System International (SI) unit for measuring radiation. Adopting this unit has changed the basic unit for combat radiation dosimetry from the RAD to the centigray (cGy). STANAG 2957 states that all NATO documents will reflect the new unit centigray or cGy followed by RAD in brackets like this: 100 cGy [RAD].

Note: For scientific and technical reasons, we measure nuclear radiation in a variety of units, including the roentgen (R), radiation absorbed does (RAD), and centigray (cGy). The relation between these units is as follows:

1 RAD	=	1 cGy (centigray)
1 MRAD	=	1/1000 RAD or 1 uGy (microgray)
1 R/HR	=	1 cGy/HR or 1 centigray per hour
1 MRAD/HR	=	1 uGy/HR or 1 microgray per hour

Why are these relations so important? Because some instruments, the older models for example, measure in roentgens while others measure in RADs. The newer instruments measure in cGy. The point of this is to let you know there are several units of measurement you can use. For practical purposes, you should consider them to be interchangeable to the extent specified above.

What is the Standard International unit of measurement for radioactivity? If you said the centigray (cGy), you're correct!

2203. Calculate the Total Dose Rate

a. Nuclear radiation causes damage to living tissue. The more radiation that you receive, the more tissue is damaged. Radiation also decays over a period of time; therefore, it is necessary to measure radiation in different ways.

(1) Dose is the amount of radiation you received or could receive over a given period of time. It is also referred to as the total dose.

(2) The dose rate is the rate of speed at which you receive radiation.

Radiation is measured in two ways: Can you recall what these two ways are? Right, they are the dose rate--the rate at which radiation is being received, and dose, the total accumulated radiation that has been received.

b. The relationship between dose and dose rate is expressed in the formula below:

DOSE RATE x TIME = TOTAL DOSE

Now that you understand what total dose is, let's take a look at calculating total dose using an example problem. **To determine total dose, simply multiply dose rate by the length of time spent in the area.**

Here's an example: Your team is on a mission and has received 10 cGy per hour for 0.5 hour. What is your total dose? If you said 5cGy, you're right!

c. Dose rate measure. Since dose rate is a function of radiation level and time of exposure, the unit of measure must include both. You may see units of measure exposed as centigray per hour (cGy/HR) or microgray per hour (uGy/HR). You want to measure high intensities with the larger unit of measurement, and low intensitites with the smallest unit of measurement. The RADIAC instrument will tell you when to use which measurement.

(1) Use centigray per hour (cGy/HR) to indicate HIGH INTENSITIES of radiation.

(2) Use microgray per hour (uGy/HR) to measure LOW INTENSITIES of radiation.

2204. Describe RADIAC Instruments

a. Principles of operation. You have to understand how RADIAC instruments work because you need to troubleshoot and diagnose malfunctions. You have already seen that speed in reporting information to the control center can save lives in a nuclear environment; therefore, you must know how to collect the information quickly and correctly.

- RADIAC instruments operate on a very simple principle, the electrical collection of ions.

- Radiation in the form of gamma rays enters a gas filled chamber. The chamber has two internal parts, a copper cylinder charged negatively and a positively charged rigid wire running through the center of the cylinder. The voltage between the wire and the cylinder is slightly below the voltage required to ionize the gas. When radiation passes between the cylinder and the wire, it ionizes the gas allowing current to create a potential difference (voltage) across a resistor in the counter's internal circuitry.

- The counter amplifies this voltage to make the radiation's presence known as a deflection of a meter or an addition to the total numerical reading on a counter.

Can you recall what operating principle is used by RADIAC instruments? If you said, "the electrical collection of ions," you're correct. Read on! If you were wrong, review this section before continuing.

b. RADIAC instruments.

Note: Over the years, the number of RADIAC instruments has grown considerably. It is a good idea for you to be familiar with all of them. However, since there is a large variety of RADIACs, you may have difficulty operating and learning maintenance procedures for each of the RADIACs.

(1) IM 143/PD dosimeter. This self-reading dosimetric device (fig 2-1) looks like a pencil or pen. Wear it clipped to your pocket.

- The IM 143/PD is a simple piece of equipment to maintain and operate. Once it's charged, you simply put it into your pocket and take a look at it from time to time through the eyepiece to determine your team's accumulated dose.

- The IM-143/PD measures **total dose**.

(a) To operate IM-143/PD dosimeter, you read the dosimeter by holding the RADIAC meter up to a source of light and looking into the eyepiece.

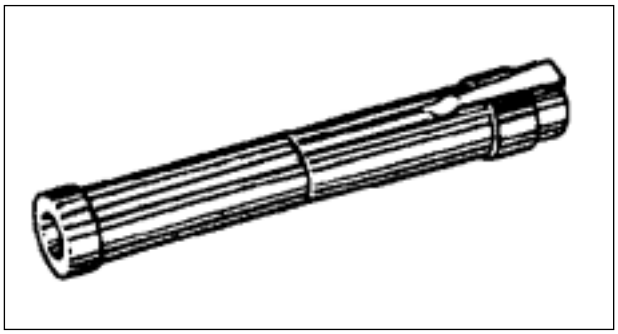


Fig 2-1. IM-143/PD dosimeter.

(b) Characteristics

1. Tactical, self-reading, high-dose pocket dosimeter

2. Range of 0 to 600 cGy (600 RADS) full scale (fig 2-2).

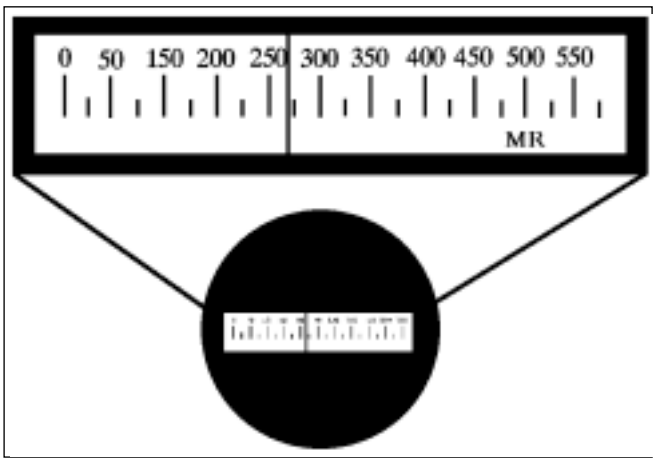


Fig 2-2. Range scale of the IM-143/PD.

(2) PP-4276/PD RADIAC detector charger. Use this instrument to

- Charge dosimeters. A small electric charge is needed to measure radiation.

- Zero dosimeters. To get an accurate reading, you must reset the scale to 0 before each mission (fig 2-2).

The time required to charge an IM-143/PD is approximately 10 seconds. The PP-4276/PD charges immediately, but placing the hairline across the scale is difficult.

(3) AN/VDR-2. The AN/VDR-2 was designed to replace the IM-174 series, AN/PDR-27, and IM-143/PD. You can use it to measure low and high intensities of radiation for area surveys, monitoring of personnel and equipment, and reporting total doses to team personnel (fig 2-3).

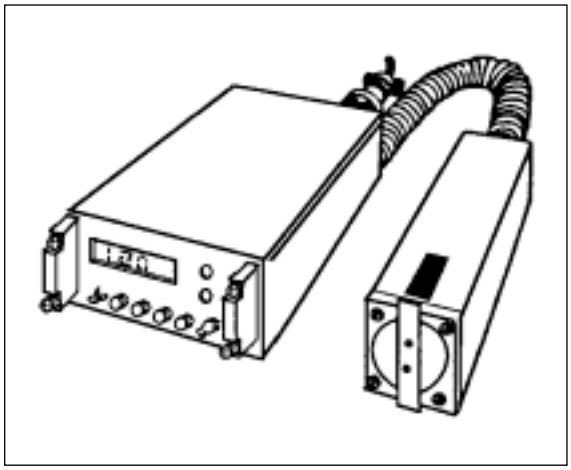


Fig 2-3. AN/VDR-2.

Older models of RADIAC meters operated on the principle of "electrical collection of ions" and the AN/VDR-2 is no exception. In replacing all previous instruments, the AN/VDR-2 has the following advantages:

(a) The display panel shows dose rate and total dose levels, alarm set levels, battery condition, and test indicators.

(b) It calculates total dose and alarms when the turn-back dose has been exceeded.

(c) It has an audible or visual alarm when dose rate or dose alarm set points have been exceeded.

(d) It is portable and you can mount it in a vehicle.

Lesson Summary. In this lesson you studied the correct letters used to describe the functions of RADIAC instruments. You learned the method for calculating the total dose and the common units of measurement indicating intensities of radiation. You learned about instruments the Marine Corps uses to measure, detect, and indicate radiation levels. In the next lesson you will learn how to conduct, record, and report radiological monitoring information.

Lesson 3. CONDUCTING, RECORDING, AND REPORTING RADIOLOGICAL MONITORING OPERATIONS

LEARNING OBJECTIVES

1. Identify the importance of radiological monitoring.
2. Define the two types of radiological monitoring.
3. Identify the two monitoring techniques.
4. Given inside and outside dose rate readings, calculate the correlation factor (CF).
5. Identify the required radiological monitoring measuring equipment.
6. Identify two types of radiological monitoring reports.

Radiological monitoring is the process by which you, as a monitor/survey team member, monitor for radiation in your area of responsibility. In a nutshell, the NBC control center will alert your team to use special equipment. Your team monitors the hazard intensity and reports the findings. Radiological monitoring has certain advantages over conducting surveys. One advantage is that monitoring drastically reduces the chances of exposure to the hazard. Conduct monitoring from within hardened protective shelters, as opposed to a survey where your team must drive into or through the hazard area. Take a brief look at what monitoring is.

2301. Importance of Radiological Monitoring

Use monitoring to determine the presence and intensity of the residual radiation. You do monitoring while stationary, at your unit's current location, instead of in the constant movement of a survey. Perform monitoring as part of the normal intelligence gathering activities associated with a unit moving into or out of an area. It provides commanders with early warning and other useful information to units at all levels.

Once an NBC-3 report has been received by a unit with monitoring capabilities, it becomes the duty of that unit to monitor the levels of radiation, record, and report the findings to the NBC control center for further evaluation.

These monitoring activities are important for several reasons. They can

- Limit the exposure of personnel to radiation by determining radiation levels
- Identify peak dose rates
- Predict the arrival of fallout to other areas

Now that you have a basic understanding of what radiological monitoring is, let's look at the types of monitoring that your team may be required to perform.

2302. Types of Monitoring

a. Periodic monitoring. The purpose of periodically monitoring your unit or assigned area for radiation is to ensure the area is not contaminated and to warn your commander when contamination arrives.

(1) You should routinely monitor at a designated point a minimum of once during each one-hour period for the arrival of, the rise in, or the fall of radiation.

(2) Your NBC officer will provide you with specific times to monitor so that all associated units will monitor at the same time.

b. Continuous monitoring. Surveillance monitoring for radiation is non-stop. Generally you perform it in your unit's area of responsibility, route of march, or travel. Continuous monitoring requires your team to have the survey meter with you and turned on at all times. Your situation will dictate how often you take readings. For example, once fallout begins, take readings more often than if your unit is simply notified that fallout may occur.

You will initiate continuous monitoring

(1) When your unit receives a fallout warning (NBC-3 report)

(2) When your unit commander orders it

(3) Following a nuclear burst; either sighted, heard, or reported

(4) When the unit is moving

(5) During reconnaissance and other patrol activity

(6) When you detect more than 1 cGy/HR during periodic monitoring

You'll discontinue your team's monitoring efforts only on orders from higher headquarters or when dose rates fall below 1 cGy/HR, unless your unit is on the move.

Without looking back at the text, can you recall what the two types of monitoring are? If you said periodic and continuous, you're correct. Keep it up!

2303. Monitoring Techniques

Monitoring techniques will vary. Factors which influence your technique include the following:

- Ground dose rate
- Your unit's operational or tactical considerations
- Your unit's accumulated dose
- Type of survey meter
- Whether you're stationary or moving

Obviously, you want minimal exposure to radiation. The technique you use for monitoring must provide sufficient information to allow your control center to calculate the ground dose rate at your location.

a. Indirect technique. Conduct indirect monitoring from within shelters or fortifications. The indirect technique will expose your team to less radiation. To perform indirect monitoring you

(1) Stand in the center of the room.

(2) Obtain the highest reading using your RADIAC meter

.

(3) Record that reading.

This technique reduces your exposure to radiation. To take readings from a shielded position, you must obtain at least one outside reading to provide enough data to determine a correlation factor (CF) for your shelter.

b. Direct technique. The direct technique of determining ground dose rate is the most simple and accurate of the two monitoring techniques. Determine the unshielded (outside) dose rate by

- Standing at the desired location
- Reading your instrument

To take a reading you should

(1) Stand at least 10 meters away from buildings, other large structures, or objects that could shield your reading.

(2) Hold the RADIAC meter at waist level and rotate 360^0.

(3) Record the highest reading that you observed.

When these procedures will not work, you can take additional readings at points of interest. If a road or trail runs through a narrow cut of operational interest, take readings both in the cut and in the open near the cut. In cities or towns, take readings standing in the middle of streets or in street intersections. Safety considerations will preclude the direct determination of ground dose rates:

(1) When your team is in low dose rate areas

(2) While monitoring for the initial detection of contamination

(3) When obtaining correlation factor data

(4) When walking through a contaminated area on foot

What are the two radiological monitoring techniques? If you said indirect techniques and direct techniques, you are correct.

2304. Calculating the Correlation Factor (CF)

All monitoring reports that your team makes, excluding those you take using the direct technique, must include the correlation factor (CF). Shielded dose rates (those taken inside) can be normalized or converted to outside ground dose rate readings. To calculate the CF, you or a team member must

- Take a reading outside following the procedures prescribed in the direct technique.
- Take one inside usually within 3 minutes of each other.
- Divide the outside dose rate by the inside dose rate reading to obtain the CF.
- Round off your answer to the nearest whole number if your CF results in a fraction.

CF Formula:

$$\frac{\text{Outside Dose Rate (OD)}}{\text{Inside Dose Rate (ID)}} = \text{CF}$$

Note: If you cannot take outside readings because of high radiation levels, record an inside reading, and in your monitoring report, describe the structure you are in.

Calculate a correlation factor in the following way: imagine that your monitoring team is located in an open front shelter dug into the side of a hill. Since there's no published CF for this type of shelter, you must determine the CF for the structure to aid the control center in normalizing the dose rate readings. Following the completion of fallout, your team begins monitoring.

As the team leader, you direct an outside reading. Follow this reading by an inside dose rate reading. Your team member determines that a reading of 2 cGy/HR exists in the center of the shelter and a 10 cGy/HR reading exists approximately 15 meters outside the shelter. You should order him to return immediately to avoid unnecessary exposure. The two dose rate readings were made within 3 minutes of each other; thus the correlation factor data for this shelter is

Inside dose rate (ID) = 2 cGy/HR

Outside ground dose rate (OD) = 10 cGy/HR

$$\text{Correlation factor (CF)} = \frac{\text{OD}}{\text{ID}}$$

$$\text{Compute} = \frac{10 \text{ cGy/HR}}{2 \text{ cGy/HR}}$$

Answer = 5

Again, divide the larger number (the outside dose rate reading) by the smaller number (the inside dose rate reading). The answer will be your correlation factor. The formula is quite easy, so try your hand at one.

Your team crawls to an underground bunker several feet under the surface when a nuclear detonation occurs. You monitor the rise of radiation from inside the bunker and at 3 cGy/HR you take an outside dose rate reading. The outside dose rate is 80 cGy/HR. What is the correlation factor?

Outside Dose Rate (OD) = _____cGy/HR

Inside Dose Rate (ID) = _____cGy/HR

Correlation Factor (CF) = _____

What's your answer? If you said that 27 is the CF, Great! You're right on the money. Did you remember to round off to the nearest whole number? You would report 26.6 as 27.

2305. Using the Required Radiological Monitoring Equipment

You need the following materials/equipment to monitor:

a. Radiological survey meter. Select a survey meter that can measure large amounts of radiation. An example would be the AN/VDR-2. You may use other types of RADIACs.

b. Wristwatch. Recording the time that you take a reading is an essential part of a monitoring report. Use any wristwatch that can be read to the nearest minute.

c. Radiological data sheet. Use DA Form 1971-R (Radiological Data Sheet-Monitoring and Point Technique) and DA Form 1971-1-R (Radiological Data Sheet-Route Technique or Course Leg Technique) for recording data. These forms are reproduced locally.

d. Maps of the area that you must monitor.

e. Communications equipment.

2306. Report Radiological Monitoring Data

In Study Unit 1, you learned about the various reports that your team uses in conjunction with your mission. During monitoring operations, additional reports may be necessary. The NBC control center or your unit's SOP usually directs the use of these reports. Monitoring reports may also be required.

a. Submit automatic reports. These reports provide the minimum essential monitoring information for warning, survey planning, and for hazard evaluation purposes. Submit reports through the chain of command to the NBC control center. Two reports you may have to submit are **contact** and **peak dose rate reports.**

(1) Contact reports

- Avoid casualties and radiological hazards to troops by warning units of approaching fallout or of previously undetected contamination.
- To be meaningful, these warnings must be based on information from units and other monitoring teams like yours that initially have contact with the hazard.
- Know the area where fallout is arriving. Observe the change in its perimeter as the area expands downwind from ground zero. This is necessary for survey control, traffic control, and other activities.

Submit contact reports with an IMMEDIATE precedence whenever an initial ground dose rate of 1 cgy/hr or more is detected in your area. These reports provide the basis for issuing fallout and contaminated area warnings throughout the major command.

(2) Peak dose rate report. At locations receiving fallout, the dose rate will steadily rise until it reaches a peak and will then decrease as the contamination level decays. Exercise caution when reporting the peak dose rate because in some cases the dose rate may fluctuate for a short time before beginning a constant decrease.

You should report when

- The radiation peaks and then begins a steady decline down the scale.
- The meter goes off the scale.
- The meter comes back on the scale.

Can you recall the two types of automatic reports? Of course, contact and peak dose rate. Remember, use good common sense. It is not necessary for you to remain in the area until the meter comes back on the scale. However, if you are in the area when the meter does come back on the scale, simply record and report the time.

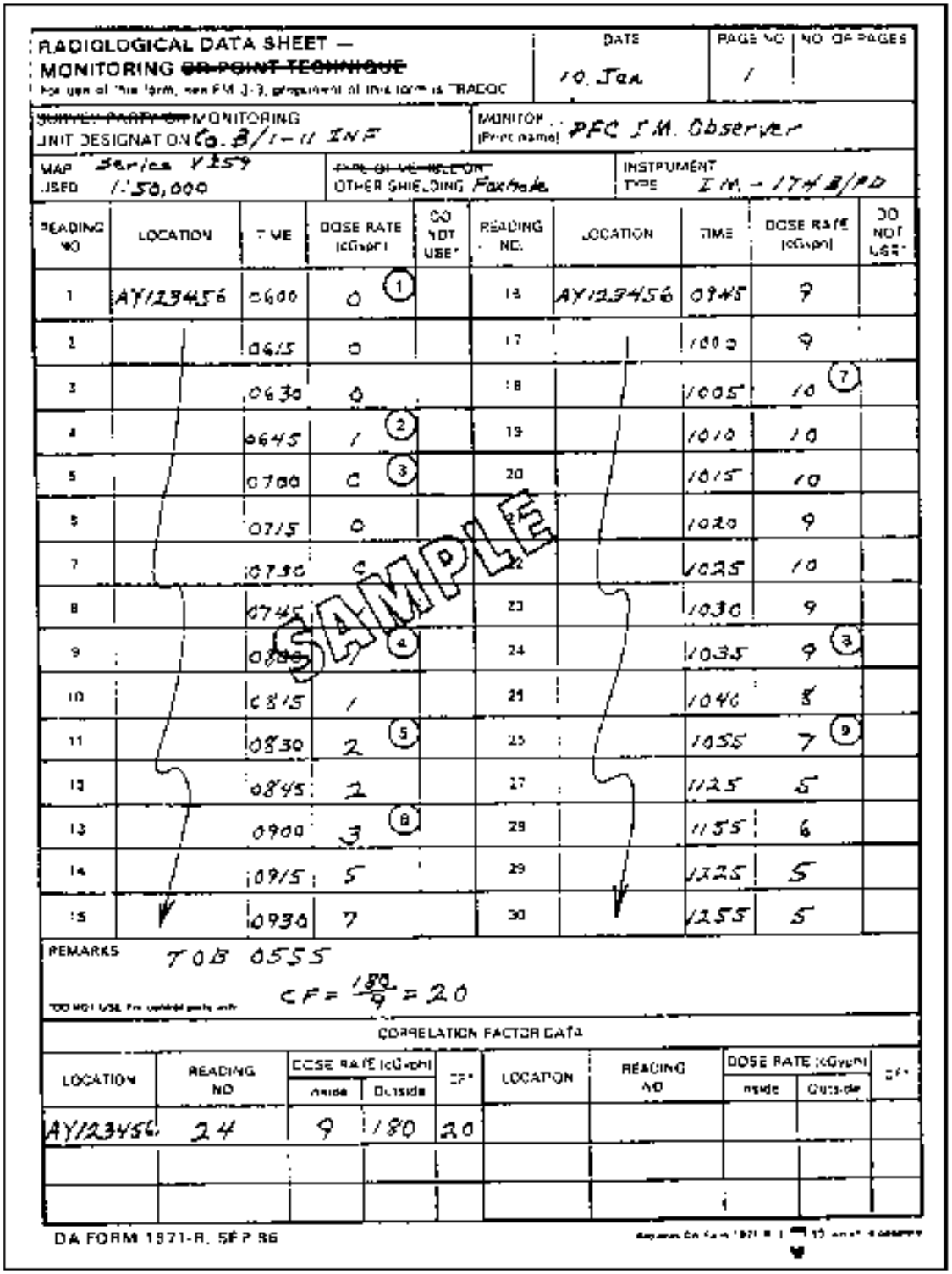
b. Submit special reports. Requirements for these reports are established in unit directives, SOPs, or other standing instructions. These instructions should include the report basis, precedence, format, and reporting procedures. Your unit's mission, radiation status, and similar considerations will determine the criteria for these reports. A special report could require you to report when dose rate readings reach a specific value.

2307. Radiological Monitoring Reports

The radiological data sheet, known as the Radiological Data Sheet-Monitoring or Point Technique DA Form 1971-R (fig 2-4), is designed to record monitoring data you obtained in automatic and special reports. Headings provided at the top of the form are self-explanatory. When using the form,

- Line through any heading that is not applicable to your situation.

- Use the REMARKS block to provide any additional information that may be of value to the control center such as the time of burst and computations you may have made.



RADIOLOGICAL DATA SHEET — MONITORING ~~SR POINT TECHNIQUE~~

For use of this form, see FM 3-3; proponent of this form is TRADOC

DATE: 10 Jan | PAGE NO: 1 | NO OF PAGES:

~~SURVEY PARTY~~ MONITORING UNIT DESIGNATION: Co. B/1-11 INF

MONITOR (Print name): PFC I.M. Observer

MAP USED: Series V 1509 1:50,000

~~TYPE OF PROTECTION~~ OTHER SHIELDING: Foxhole

INSTRUMENT TYPE: I.M.-174 B/PD

READING NO	LOCATION	TIME	DOSE RATE (cGy/hr)	DO NOT USE*	READING NO.	LOCATION	TIME	DOSE RATE (cGy/hr)	DO NOT USE*
1	AY123456	0600	0 (1)		16	AY123456	0945	9	
2		0615	0		17		1000	9	
3		0630	0		18		1005	10 (7)	
4		0645	1 (2)		19		1010	10	
5		0700	0 (3)		20		1015	10	
6		0715	0		21		1020	9	
7		0730	0		22		1025	10	
8		0745	0		23		1030	9	
9		0800	0 (4)		24		1035	9 (8)	
10		0815	1		25		1040	8	
11		0830	2 (5)		25		1055	7 (9)	
12		0845	2		27		1125	5	
13		0900	3 (6)		28		1155	6	
14		0915	5		29		1225	5	
15		0930	7		30		1255	5	

SAMPLE

REMARKS: TOB 0555

CF = 180/9 = 20

*DO NOT USE for updated graphic only

CORRELATION FACTOR DATA

LOCATION	READING NO	DOSE RATE (cGy/hr) Inside	DOSE RATE (cGy/hr) Outside	CF*	LOCATION	READING NO	DOSE RATE (cGy/hr) Inside	DOSE RATE (cGy/hr) Outside	CF*
AY123456	24	9	180	20					

DA FORM 1971-R, SEP 86

Fig 2-4. Completed DA Form 1971-R for Monitoring.

Lesson Summary: In Lesson 3 you learned the basics of the radiological monitor/survey. You learned the importance of radiological monitoring, its advantages, how to calculate a correlation factor, and the correct equipment to take on a survey mission. Last, you learned the two types of monitoring reports and saw an example of how you should record the data you would collect during radiological operations. In the next lesson you will learn about conducting, recording, and reporting radiological survey operations.

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Lesson 4. CONDUCTING, RECORDING, AND REPORTING RADIOLOGICAL SURVEY OPERATIONS

LEARNING OBJECTIVES

1. Identify the personnel requirements for conducting ground and aerial survey parties.
2. Describe the organization of a radiological survey operation, including the two types of parties, composition, and functions of each.
3. Identify the control methods that a survey party uses to report survey results.
4. Calculate the turn-back dose rate and the turn-back dose.
5. Identify the equipment necessary to conduct a survey party.
6. Describe the two types of aerial surveys.
7. Describe the guidance of the aerial survey party.
8. Record and report aerial radiological survey data.
9. Identify the three techniques used to conduct ground surveys.
10. Obtain the dose rate readings of ground surveys.
11. Identify the report used to record ground survey data.
12. Calculate the Air-Ground Correlation Factor.

A radiological survey is the directed effort to determine the extent and intensity of contamination. These surveys provide general information about contamination for immediate operations and detailed information on which future operations are to be based. Surveys require a lot of resources (i.e., time, coordination, and personnel) that must be diverted from other missions.

If no operations are planned in the affected area, you may not have to conduct a survey. However, if there's even a remote chance that your unit may need the affected area in the future, conduct a survey as soon as possible. Since radiation decays, it's important to conduct the survey as soon as possible to obtain more accurate readings and a better overall picture of the hazards.

Remember **NEVER** conduct a survey unless you're directed to do so. This limits your exposure to possible radiological hazards. Perhaps a different survey team may already be conducting a survey of the suspected area. There may be sufficient units in the vicinity to get a good idea of the hazard through the use of monitoring.

2401. Personnel Requirements for Survey Parties

As you learned earlier in Lesson 1, all NBC related personnel and equipment are drawn from the company/battery or battalion. NBC teams are subordinate to the authority directing the survey. Reconnaissance units can perform aerial or ground surveys as a priority mission when required.

Note: Use any powered vehicle to conduct a ground survey. All vehicles have approximately the same area coverage capability (between 15 and 40 square kilometers per hour per vehicle). Coverage capability depends on the degree of detail required, the road net, and trafficability of the contaminated area.

a. Determine the number of ground survey parties. The number of survey parties required at any one time depends on the situation, terrain, available time, desired detail, and other factors.

b. Select the personnel of aerial survey parties. Consider the same factors that influence ground surveys in selecting the number of parties required for an aerial survey. Select monitors for the aerial surveys from units normally located near an aircraft landing area to reduce the time in getting the survey team briefed and airborne. Primary sources for monitors are

(1) Aerial observers who regularly fly reconnaissance and surveillance missions

(2) Reconnaissance and tracked vehicle units

(3) Other units with trained monitors

2402. Organization of the Radiological Survey Party

The survey is generally performed by a group made up of a control center and one or more survey parties. In many Marine Corps units, the control center acts as headquarters overseeing the operations. Survey operations may be conducted either by Marines on the ground, on foot, and in vehicles or in the air, using fixed or rotor wing aircraft.

The table below describes the composition, functions, and locations of the control and survey parties:

Table 2-1 Control and Survey Parties

Type of Party	Composition	Function	Location
Control center	NBC officer, NBC NCO, and control center team	Collects, screens, and disseminates NBC data, directs NBC operations	Battalion or higher level
Survey party	Monitor, recorder, and security personnel	Conducts the survey and reports to the control center	Company, battery

At the division level and higher echelons, monitoring reports may not provide sufficient information for evaluating contaminated areas. Surveys may be necessary to provide essential information. Because personnel are required to conduct and support the survey, you'll be diverted from your primary duty. Conduct surveys when essential information cannot be obtained from monitoring reports.

2403. Survey Control Methods

a. Centralized control method. The primary method of survey control is a centralized operation. Your survey party collects and reports radiological data directly to the control center. The control center forwards data up the chain of command. Headquarters, usually your parent unit, screens data your team provides.

b. Decentralized control method. The alternate method of survey control is a decentralized operation directed through command channels and controlled by a subordinate command. The subordinate command furnishes radiological data to the commander who ordered the survey.

Can you recall the two types of surveys just discussed? Right! Centralized and decentralized.

2404. Calculate Turn-Back Dose Rate and Turn-Back Dose

a. Obtain an operation exposure guide (OEG). The commander who ordered the survey compiles an OEG for nuclear radiation. When the commander does not provide the OEG, your unit commander and the control center have to calculate turn-back dose rates, the turn-back dose for each survey team, and provide you with an OEG.

b. Calculate the turn-back dose rate.

Rtb = Turn-back dose rate

$$Rtb = \frac{2 \times OEG \times speed}{distance}$$

OEG = Operation exposure guide

Speed = The speed at which the survey party will travel

Distance = The distance the survey party will travel inside the fallout pattern (derived from a fallout prediction plot if no better information is available)

(1) If your survey party encounters the turn-back dose rate, immediately leave the fallout area. Use the same route you used to enter it, unless instructed otherwise.

(2) If the dose rate decreases as your party moves ahead, continue to perform your mission along the assigned route.

c. Use the operation exposure guide (OEG) for the aerial survey. Use of the OEG by the aerial survey party requires judgment by the senior pilot. If the dose received is approaching the OEG, the pilot must decide whether to fly the remaining course legs at a greater height above ground or to abort the remainder of the mission. The monitor will keep the pilot informed of the dose received during the mission.

(1) Importance of fallout timing. When most contaminated particles in a radioactive cloud rise to considerable heights, the fallout occurs over a very large area and it may last for an extended period of time. A survey completed before fallout would be inaccurate because contaminants would still be suspended in the air. **For this reason, conduct radiological surveys only after the completion of fallout.**

(2) Control center coordination. Whenever practical, your control center coordinates the activities of your survey team with units located in the area to be surveyed. If the control center cannot coordinate because of lack of communications or other causes, your team will be informed that the survey has not been coordinated. You'll then be directed to coordinate with other units in the area.

2405. Materials/Equipment for Survey Parties

Survey parties need the following to accomplish their mission:

a. RADIAC meter(s). Use for measuring dose rates in contaminated areas.

b. Dosimeter. Use a dosimeter, such as an IM-143/PD, for purposes of radiation exposure control. The instruments should be properly calibrated or checked before use.

c. Forms. Use DA Form 1971-1-R, Radiological Data Sheet--Route or Course Leg Technique, and DA Form 1971-R, Radiological Data Sheet--Monitoring or Point Technique for recording information collected during the survey. (Local reproduction of these forms is authorized.)

d. Watch. Wear a watch to time survey readings. For aerial survey, use a stopwatch or a watch with a sweep-second hand to time the interval between readings.

e. Communications equipment. Carry necessary equipment for accomplishing reporting procedures.

f. Maps. Obtain maps of the land areas to be surveyed.

2406. Aerial Radiological Surveys

Obtain the radiological contamination information. Use the RADIAC meters in rotary-wing or fixed-wing aircraft to obtain radiological contamination information. Since aerial surveys are conducted rapidly and at a distance from the radioactive source, the aerial survey party would be exposed to less nuclear radiation than a ground survey party conducting a ground survey over the same area.

a. Aerial survey techniques. The techniques used to conduct detailed aerial surveys include the following points:

(1) **Route**. The pilot flies between two checkpoints, following the route of some predominant terrain feature, such as a road that connects the two checkpoints (heavy dashed lines).

(2) **Course leg**. The pilot flies a straight line course (a course leg) between two checkpoints (thin dashed lines).

(3) **Point**. This determines the ground dose rate at points of operational concern. Use it to obtain more precise data at those points.

b. Planning aerial surveys. Use a checkpoint overlay to plan a survey. After you establish survey requirements, the control center selects a series of course legs, routes, and points where data will furnish sufficient ground dose rate information to evaluate the contaminated area. Figure 2-5 shows an overlay plan for an aerial survey. Use this overlay over a map of the area you want to survey to obtain the checkpoint coordinates. Figure 2-6 illustrates a division area with selected checkpoints. Here are two types of aerial surveys.

(1) Detailed aerial survey. Since simplified aerial survey information and monitoring reports don't normally provide sufficient information for the preparation of the detailed radiological contamination overlay, a detailed aerial survey is usually required. Battlefield conditions or the operational situation may preclude the preparation of the detailed radiological contamination overlay, and a simplified radiological contamination overlay may then be needed to satisfy the commander's requirements. A simplified aerial survey will normally be required to complete the overlay.

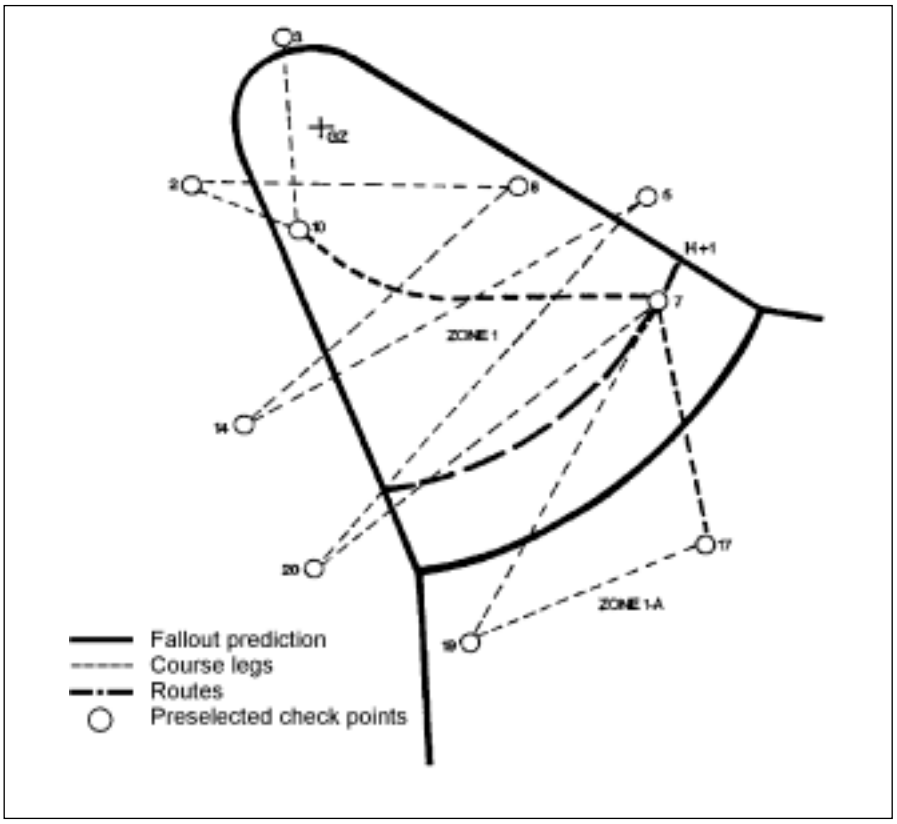

Fig 2-5. Fallout prediction and aerial survey overlay.

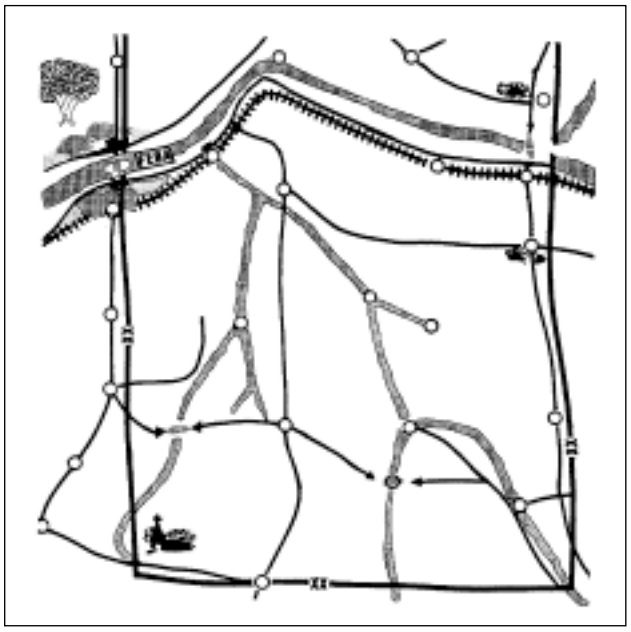

Fig 2-6. Division area showing preselected points.

(2) Simplified aerial surveys. Use the simplified aerial survey to provide the minimum essential information for evaluating the hazard. Determine the outer limits of the area of militarily significant contamination, including dose rates in the most heavily contaminated parts of the area, and dose rates at points of operational interest. Perform the simplified survey and provide the information to the control center as soon as possible after contamination is on the ground.

Note: The procedure to obtain dose rate information between checkpoints is the same procedure used for all aerial surveys discussed below. When dose rate information from either technique is processed, the result is a series of ground dose rates spaced at equal intervals along the flight path.

There are three techniques for simplified aerial surveys.

(a) Course leg technique. The course leg technique requires your aerial survey team to fly a straight line course (course leg) between two checkpoints. The pilot maintains as nearly as possible

- Constant height above the ground
- Constant ground speed
- Straight flight direction between the starting and ending checkpoints of course leg

1. The pilot locates the starting checkpoint of a course leg to be flown; he either

- Locates the end checkpoint
- Determines the azimuth of the course leg

2. The pilot will fly the aircraft on the proper course to pass over the initial checkpoint on a straight path to the end checkpoint. When on course, he will alert you and give you the height above ground. Shortly before reaching the initial checkpoint, you'll record the time and height above the ground before each course leg to assure proper operation.

3. The pilot commands "mark" when the aircraft is directly over the starting checkpoint.

   - Read the survey meter.
   - Record the dose rate.
   - Begin timing preselected time intervals.

4. You'll read the survey meter and record the dose rate at each preselected time interval (for example, every 15 seconds).

5. The pilot again will alert you when the aircraft approaches the end checkpoint. When the aircraft is directly over the end checkpoint, the pilot commands "mark." You'll then read and record the final dose rate for the course leg.

(b) Point technique. Procedures for using the point technique vary according to the situation. When the situation permits, the aircraft lands near the point of interest and you'll dismount the aircraft, proceed to the selected point, and take the reading by using normal ground monitoring procedures.

(c) Simplified aerial surveys. The techniques of conducting simplified aerial surveys are the same as those for detailed aerial surveys with the following exceptions:

1. The simplified survey requires less time and effort than other surveys. As an example, you'll take fewer readings or fewer numbers of course legs to obtain the survey results.

2. The simplified survey may cover only those parts of the contaminated area that are of immediate operational concern.

3. The control center plans only the general area where the simplified survey will be conducted. After arriving over the area, the survey party selects the check points, routes, and course legs.

c. Advantages of aerial surveys.

(1) Speed and flexibility are the greatest advantages of aerial surveys. Speed and flexibility make aerial surveys advantageous over large, unoccupied areas, enemy occupied areas, and over areas not easily accessible to ground troops.

(2) Aerial surveys can be used over areas that have dose rates unacceptably dangerous to ground survey parties.

(3) Survey party members are exposed to lower radiation doses and minimum requirements are necessary for equipment, personnel, and communications.

d. Disadvantages of aerial surveys.

(1) Dose rate readings are not as accurate as those obtained by ground surveys.

(2) Dose rates for specific points on the ground are not provided by aerial surveys.

What are the greatest advantages of an aerial survey? If you said speed and flexibility, you're right. Remember your readings won't be as accurate as those of a ground survey, but your team is exposed to less radiation over a shorter period of time.

What are the two types of aerial surveys? If you said simplified and detailed, you are correct. If you were wrong, then review paragraph 2406 before you continue.

2407. Guidance for the Aerial Survey Party

a. Plan the aerial survey. The control center that plans the aerial survey may not be completely familiar with the survey area, the current tactical plans, or the operational situation that exists there. However, the control center has access to the latest information available to the headquarters conducting the survey and provides guidance to the survey party at the briefing. In addition to information about the contaminated area, the control center provides

(1) Detailed information to the aerial survey party with the identification of the course legs or routes to be flown

(2) Tentative survey height

(3) Approximate time periods during which groups of the course legs or routes are to be flown

(4) Your survey party with an OEG, turn-back dose, and turn-back dose rate

b. Determine the following factors. The aerial survey party will determine

(1) The actual height above ground to fly each course leg or route

(2) The ground speed for each course leg or route

(3) The direction of flight for each course leg or route

(4) The locations for determining AGCF data

(5) The time intervals between readings

(6) Whether to delay the flight of a particular course leg or route

c. Guide the survey party in determining the factors. Weigh the tactical, operational, and weather conditions existing at the time of survey and the dose condition to your survey team against the following factors:

(1) The slower the aircraft speed and the shorter the time interval between readings, the more accurate the results will be.

(2) Remember survey data obtained at heights of more than 500 feet above the ground is unreliable. A height of 190 to 200 feet is considered optimum.

(3) Select the combination of ground speed and reading time interval so that the ground distance between readings is not more than 500 meters. For increased plotting accuracy, make at least 10 readings between checkpoints.

2408. Record and Report Aerial Radiological Data

a. Record the aerial radiological data. There are two kinds of radiological data sheets for recording data that your team has obtained. Here is how they are used:

(1) Record data obtained by the point technique on the DA Form 1971-R. A blank form is shown in figure 2-7.

(2) Record data obtained using the route or course leg technique on the DA Form 1971-1-R, Radiological Data Sheet--Monitoring or Point Technique. A blank form is shown in figure 2-8.

b. Completing the form.

(1) Headings are self-explanatory.

(2) When you use either form, you line out any heading not applicable to your situation.

(3) Space is provided for the control center to enter the air-ground correlation factor and normalized readings.

(4) The REMARKS block is provided for any additional information that will be of value to the control center. The control center also uses this block to enter time of nuclear burst and computations of the air-ground correlation factor. Figures 2-7 and 2-8 illustrate radiological data sheets.

RADIOLOGICAL DATA SHEET- **MONITORING OR POINT TECHNIQUE** For use of this form, see FM 3-3-1; the proponent agency is TRADOC	DATE	PAGE NO.	NO. OF PAGES
SURVEY PARTY OR MONITORING UNIT DESIGNATION	MONITOR (Print name)		
MAP USED	TYPE OF VEHICLE OR OTHER SHIELDING	INSTRUMENT TYPE	

READING NO.	LOCATION	TIME	DOSE RATE (cGy/hr)	DO NOT USE*	READING NO.	LOCATION	TIME	DOSE RATE (cGy/hr)	DO NOT USE*
1					16				
2					17				
3					18				
4					19				
5					20				
6					21				
7					22				
8					23				
9					24				
10					25				
11					26				
12					27				
13					28				
14					29				
15					30				

REMARKS

* DO NOT USE. For control party only

CORRELATION FACTOR DATA

LOCATION	READING NO.	DOSE RATE (cGy/hr)		CF*	LOCATION	READING NO.	DOSE RATE (cGy/hr)		CF*
		INSIDE	OUTSIDE				INSIDE	OUTSIDE	

DA FORM 1971-R, SEP 94 EDITION OF SEP 80 IS OBSOLETE

Fig 2-7. Blank DA Form 1971-R for Monitoring or Point Technique.

**RADIOLOGICAL DATA SHEET-
ROUTE OR COURSE LEG TECHNIQUE
(Ground and Aerial Survey)**
For use of this form see FM-3-3-1; the proponent agency is TRADOC

RADIOLOGICAL DATA SHEET- ROUTE OR COURSE LEG TECHNIQUE (Ground and Aerial Survey)	DATE	PAGE NO.	NO. OF PAGES
SURVEY PARTY DESIGNATION	MONITOR (Print Name)		
MAP USED	AIRCRAFT OR VEHICLE TYPE	INSTRUMENT TYPE	

ROUTE OR COURSE LEG DESIGNATION			
TIME AT START OF LEG OR ROUTE			
TIME ROUTE COMPLETED (Signed) OR SURVEY HEIGHT (Air)*			
DISTANCE OR TIME INTERVAL USED			

REMARKS

*Times [illegible]

** DO NOT USE. For control party only.

READING NO.	DOSE RATE (cGyph)	DO NOT USE**	READING NO.	DOSE RATE (cGyph)	DO NOT USE	READING NO.	DOSE RATE (cGyph)	DO NOT USE
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
17			17			17		
18			18			18		
19			19			19		
20			20			20		

AIR-GROUND OR VEHICLE CORRELATION FACTOR DATA

LOCATION	HEIGHT (feet) AIR ONLY	DOSE RATE (cGyph)		CFM
		INSIDE AIR	OUTSIDE GROUND	

DA FORM 1971-1-R, SEP 84 — EDITION OF SEP 85 OBSOLETE

Fig 2-8. Blank DA Form 1971-1-R for Course Leg Technique.

c. Report the survey data. Deliver the survey data that your team has collected to the control center at the completion of each aircraft mission by physical drop, radio, or telephone. If communications equipment is available, you may transmit the data by radio directly to the control center as you conduct the survey.

2409. Conducting Ground Surveys

a. Special considerations. Teams using wheeled or tracked vehicles normally prefer ground radiological surveys that are not limited solely to the use of vehicles. Radiological information can also be obtained by personnel on foot. You should take certain factors into consideration when conducting a ground survey:

(1) The possibility of high radiation doses to personnel; conduct foot surveys only under special circumstances.

(2) Use armored vehicles to reduce doses received by personnel whenever possible.

(3) A ground survey lacks the speed and flexibility of an aerial survey.

(4) A ground survey places a larger load on communications facilities.

(5) It requires diverting more personnel and equipment from their original mission.

b. Advantages. Ground surveys do have certain advantages over aerial surveys. They

(1) Are independent of weather conditions

(2) Can be conducted at night

(3) Provide more accurate information than an aerial survey

Using regularly assigned personnel and equipment, any unit can perform ground surveys within its area of responsibility.

c. Ground survey techniques. The three techniques used to conduct a ground survey are the point, route, and preselected dose rate.

(1) Point technique. When using the point technique you can

- Determine the ground dose rate at a selected point of the particular operational concern.

- Obtain the reading by dismounting from the vehicle and taking a direct ground dose rate reading. For accuracy, this method is preferred.

Note: When obtaining the dose rate reading, you should move at least 10 meters away from the vehicle. This procedure prevents undue shielding of the radiation field by the vehicle or your body.

- If the dose rate is taken inside the vehicle, the normalized ground dose rate will be calculated by the control center using a correlation factor obtained by your team.

When obtaining dose rate reading, what does moving away from the vehicle prevent? If you said shielding, you're correct.

(2) Route technique. When using the route technique, you can take dose rate readings inside the vehicle at selected distance intervals between checkpoints along the designated route. The control center determines ground dose rates by using a correlation factor. Most surveys will be route techniques.

(3) Preselected dose rate technique. When using this technique, take the preselected dose rates along your assigned routes. Use this technique only for survey of fallout contamination more than 48 hours after the nuclear explosion (H + 48 hours) or contamination where the decay is very slow. You can directly plot dose rates and locations without further processing.

2410. Obtain the Dose Rate Readings of Ground Surveys

Take dose rate readings during a ground survey by using the route technique.

a. Obtain normal readings. To obtain normal readings, take readings from inside the vehicle, hold the survey meter in a vertical position, and sit in the assistant driver's seat.

(1) The driver measures a distance using the odometer along the route. The control center usually determines this distance.

(2) The driver will state "mark" at the proper interval and you'll obtain the reading.

(3) Record the reading on DA Form 1971-1-R.

b. Obtain vehicle correlation factor (CF) data. Use this data for converting the reported readings taken from inside the vehicle to ground dose rates outside the vehicle. Your team provides data for the vehicle CF that consists of a set of two **accurate** readings taken at the same location.

(1) Take the first reading inside the vehicle. Take all subsequent inside readings reported for the survey with the meter held in the same position.

(2) Take the outside reading immediately, as a normal ground reading, at the same location as the first reading with the vehicle pulled away at least 10 meters.

(3) Take one or two additional sets (inside/outside) of readings at different locations so that the control center can use an average vehicle correlation factor.

(4) Divide outside dose rate by inside dose rate to obtain CF (OD/ID = CF). To obtain outside ground dose rate, see paragraph 2304.

(5) Obtain new data if these conditions change significantly or if your survey meter or vehicle type is changed.

2411. Recording and Reporting Ground Survey Data

a. Use the correct recording form. Use the radiological data sheet (fig 2-7) for recording data that your survey team obtains.

(1) Record data obtained using the route technique on DA Form 1971-1-R.

(2) Record data obtained using the point or preselected dose rate technique on DA Form 1971-R.

b. Use the correct reporting procedures. Report data obtained from ground surveys to the control center of the authority directing the survey as rapidly as possible without screening or evaluation by intermediate headquarters. Use the communication methods in the order presented below to report your data:

(1) Report by radio direct to the control center.

(2) Report by radio to the nearest area communications center and then to the control center.

(3) Proceed to the nearest unit and use its facilities to report through the area communications center to the authority directing the survey.

(4) Proceed to the nearest area communications center and report directly by any available means to the control party.

(5) Physically deliver data to the control center.

c. Use your unit SOP. Your unit SOP or survey team briefing gives more precise information on reporting and recording survey data. Radiological survey information has intelligence value to the enemy. Your unit has proper security procedures for reporting this data. For example, the unit SOP may require that location coordinates be encoded.

2412. **Calculate Air-Ground Correlation Factors**

a. Definition. An air-ground correlation factor (AGCF) is required for calculation of ground dose rates from aerial dose rates taken in an aircraft during a survey. The AGCF is the ratio of a ground dose rate reading to an aerial reading taken at the survey height over the same point on the ground.

b. Techniques. The two techniques for obtaining the AGCF include the preferred and alternative methods.

(1) Preferred method. The preferred method in obtaining an AGCF is to directly determinate the ground and aerial dose rates during the survey. Calculate the AGCF by using the formula shown below:

Ground dose rate	=	20 cGy/HR
Aerial dose rate (60-meter survey height)	=	5 cGy/HR
Air-ground	=	ground dose rate / aerial dose rate
Aerial Dose Rate		
Calculate	=	20 cGy/HR / 5 cGy/HR
Answer	=	4

- Multiply the reading taken in the aircraft at a survey height of 60 meters by the AGCF.

- Estimate the 1-meter reading. The procedure for determining the ground dose rate reading involves landing at the selected point.

- Proceed to that point and take the ground dose rate reading, using normal monitoring procedures.

- Obtain the AGCF data, if possible, for each two to four course legs or routes flown.

The sites for obtaining AGCF data should be selected to approximate average foliage and ground surface conditions in the contaminated area.

(2) Accuracy of this AGCF data as to position, height above ground, and dose rate is of primary importance. New data must be obtained when

- Survey height changes by 15 meters or more
- Ground foliage or average ground surface conditions change
- Aircraft or the survey meter changes
- Weather conditions change drastically during monitoring

(3) Alternative method. When tactical situations, terrain conditions, high radiation dose rates, or other factors do not permit using the preferred technique, the AGCFs shown in table 2-1 are used. To estimate a ground dose rate, multiply the aerial dose rate obtained by the correlation factor from table 2-1 for the type of aircraft and the height above ground at which the reading was taken. For example, while flying at a 150 meter survey height in a UH-1, a reading 10 cGy/HR is obtained; the AGCF for a UH-1 at a height of 150 meters is 8.2.

Ground dose rate	=	Aerial dose rate X Air-ground CF
	=	10 cGy/HR X 8.2
	=	82 cGy/HR

Practice: Given the following information calculate the ground dose rate:

Aerial dose rate	AGCF	Ground dose rate
50 cGy/HR	2	
15 cGy/HR	4	

Answers:

50 cGy/HR X 2 = 100 cGy/HR

15 cGy/HR X 4 = 60 cGy/HR

Table 2-1. Air Ground Correlation Factors[1]

Height above ground	Height above ground	Aircraft / UH-1
Meters	Feet	AGCF
30	100	2.2
60	200	3.2
90	300	4.5
120	400	6.2
150	500	8.2
300[2]	1,000[2]	29.0
600[2]	2,000[2]	300.0
900[2]	3,000[2]	2,600.0

1 The figures have been rounded to two significant digits for practical use.
[2] The use of the AGCF with readings taken at these heights will result in approximation of ground dose rates.

Using the preferred method, find the AGCF given the following dose rates: ground dose rate = 50 and the aerial dose rate = 10.

If your answer is 5 cGy/HR you are correct, if not, review the section on calculating AGCF before completing the unit review.

Study Unit 2 Exercise: Complete items 1 through 34 by performing the action required. Check your responses against those listed at the end of this study unit.

1. The control center will assign certain units, known as _____ to report nuclear attacks and avoid possible confusion and duplication of effort.

2. What does RADIAC mean?

   RA - _____

   D - _____

   I - _____

   A - _____

   C - _____

3. What are the units of measurement used to indicate the intensities of radiation?

   a. _____ c. _____

   b. _____ d. _____

4. Because radiation causes damage to tissue, it is necessary to measure radiation in different ways. What are the two means used to measure radiation?

   a. _____ b. _____

5. The amount of radiation received or that could be received over a period of time is referred to as _____.

6. Your team is driving through an area where the contamination is quite old. You remain in the area for 1.5 hours and the dose rate is 50 cGy/HR. What is the total dose?

   _____

7. What is the IM-143/PD used to measure?

   a. Dose rate c. Total dose
   b. OEG d. Beta radiation

8. RADIAC instruments operate on the principle of _____.

9. What is the personnel self-reading RADIAC instrument used in conjunction with the PP-4276/PD RADIAC detector charger?

_____

10. What is the purpose of the PP-4276/PD RADIAC detector charger?

_____

11. Which RADIAC instrument is used to measure high and low intensities of radiation to include total dose and replace the IM 174/PD and the AN/PDR-27?

_____

12. List three of the most important reasons to conduct radiological monitoring operations.

a. _____

b. _____

c. _____

13. Monitoring is used to determine the _____ of residual radiological hazards.

a. presence and intensity
b. type and presence
c. extent and intensity
d. presence and type

14. What are the two types of monitoring?

a. _____

b. _____

15. List three of the six reasons why a unit would switch from periodic to continuous monitoring.

a. _____

b. _____

c. _____

16. What are the two monitoring techniques?

    a. _____

    b. _____

17. From the following information, determine the correlation factor (CF).

    ID = 2 cGy/HR OD = 10 cGy/HR CF = _____

18. State the equipment necessary to conduct monitoring operations.

    a. _____

    b. _____

    c. _____

    d. _____

    e. _____

19. What two automatic reports are you required to submit in conjunction with radiological monitoring?

    a. _____ b. _____

20. What is the form used to record monitoring results?

    _____

21. When choosing personnel for aerial survey parties, the primary sources for monitoring are

    a. _____

    b. _____

    c. _____

22. The survey is generally performed by a group made up of a _____ and one or more _____.

23. During which control method does your survey party collect radiological data and report it directly to the control center?

_____

24. Calculate the turn-back dose rate.

OEG = 50 Distance = 30 km Speed = 30 kmph

_____

25. List the minimum equipment necessary to conduct an aerial survey mission.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

26. What are the two types of aerial radiological surveys?

a. _____

b. _____

27. What factors must the aerial survey party determine to accomplish its mission?

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

28. What form would you use when performing an aerial survey using the route technique?

_____

29. What are the three ground survey techniques used for ground survey?

a. _____

b. _____

c. _____

30. List two of the three primary advantages of a ground survey over an aerial survey.

a. _____

b. _____

31. How do you normalize dose rate readings taken from inside a moving vehicle to outside readings?

_____

32. DA Form _____ is used to record data obtained during the route survey technique.

33. Define AGCF.

_____

_____

_____

33. Using table 2-1, calculate the ground dose rate.

Aerial dose rate = 50 Height above ground = 30 meters.

Ground dose rate = _____

UNIT SUMMARY

In this study unit you explored the basic fundamentals in conducting a radiological monitor/survey mission, including the purpose of radiological monitoring and survey. You learned about various RADIAC instruments and their uses and how to conduct, record, and report your team's radiological monitoring and survey results.

Once you feel comfortable with the knowledge in conducting a radiological monitor/survey mission, you should turn your attention to conducting a biological survey mission, your next study unit.

Study Unit 2 Exercise Solutions

		References
1.	designated observers	2102
2.	RAdiation Detection Indication And Computation	2201
3.	a. RAD b. MRAD c. Roentgen d. cGy	2202
4.	a. dose rate b. dose	2203
5.	total dose	2203
6.	75 cGy/HR	2203
7.	c.	2203
8.	electrical collection of ions	2204
9.	IM-143/PD	2204
10.	to charge dosimetric devices such as the IM-143/PD	2204
11.	AN/VDR-2	2204
12.	a. Limit exposure to personnel by determining the radiation level b. Identify peak dose rates c. Predict the arrival of fallout to other areas	2301
13.	a.	2301
14.	a. periodic b. continuous	2302

		Reference
15.	(Any three of the following are correct.)	
	a. When an NBC 3 report is received	2302
	b. When ordered by your unit commander	
	c. After a nuclear burst has been sighted, heard, or reported	
	d. When your unit is moving	
	e. During recon or other patrol activity	
	f. When you detect radiation above 1 cGy/HR during periodic monitoring	
16.	a. Direct	2303
	b. Indirect	
17.	CF = 5	2304
18.	a. Radiological Survey Meter	2305
	b. Wristwatch	
	d. Radiological data sheet	
	c. Maps	
	e. Communications equipment	
19.	a. Contact	2306
	b. Peak dose rate	
20.	DA Form 1971-R, Radiological Data Sheet - Monitoring or Point Technique	2307
21.	a. Aerial observers who regularly fly reconnaissance and surveillnce missions	2401
	b. Reconnaissance and tracked vehicle units	
	c. Other units with trained monitors	
22.	control center, survey parties	2402
23.	Centralized method	2403
24.	100 cGy/HR	2404
25.	a. RADIAC meters	2405
	b. Dosimeter	
	c. DA Form 1971-1-R and DA Form 1971-R	
	d. Wristwatch	
	e. Communications equipment	
	f. Maps	
26.	a. Detailed	2406
	b. Simplified	
27.	a. Actual height above ground to fly each course leg or route	2407
	b. The ground speed for each course leg or route	
	c. The direction of flight for each course leg or route	
	d. The location for determining AGCF data	
	e. The time intervals between readings	
	f. Whether to delay the flight of a particular course leg or route	2408

		Reference
28.	DA Form 1971-1-R for Course Leg Technique	
29.	a. Point technique	2409
	b. Route technique	
	c. Preselected dose rate technique	
30.	(Any two of the following three answers)	2409
	a. independent of weather conditions	
	b. can be conducted at night	
	c. provided more accurate information	
31.	Data is normalized using a CF	2410
32.	1971-1-R	2411
33.	The ratio of a ground dose rate reading to an aerial reading taken at the survey height over the same point on the ground	2412
34.	110 cGy/HR	2412

STUDY UNIT 3

CONDUCTING A BIOLOGICAL MONITOR/SURVEY MISSION

Introduction. Biological agents are difficult to detect. You can't see, taste, feel, or hear them. An attack is almost impossible to detect with current technology. In fact, you may not know an attack has occurred for days or even a few weeks because of the incubation periods for various diseases. For this reason, you must be especially alert for attack indicators, take appropriate samples, and process them according to your unit SOP. You will cover biological agents in this study unit.

Lesson 1. CHARACTERISTICS OF BIOLOGICAL AGENTS

LEARNING OBJECTIVES

1. Identify the characteristics of biological agents.

2. Identify factors affecting biological agent survivability.

3101. Characteristics

You learned in Study Unit 1 how the enemy uses chemical and biological agents. There are some differences between the two types of agents.

- Chemical agents react spontaneously when employed.

- Biological agents usually require an incubation period. The incubation period allows the agent to breed and spread before detection occurs. Take a look below at other characteristics.

Biological agents are

- Extremely difficult to detect
- Infectious and virulent
- Stable in storage
- Economical to produce in large quantities
- Easily and effectively employed
- Mostly stable in their employed form and have a slow decay rate
- Virulent to the degree that only a small amount is required to affect a large population

Note: The ***infectious*** and ***virulent*** characteristics of biological agents are the two common characteristics that affect you most.

What do you think are the key points to remember about biological agents? If you said they are infectious and virulent, you're correct. In fact, until symptoms begin to appear, your unit won't know that they've been infected unless you have been sampling for early detection.

3102. Survivability

a. Effects. Biological agents, as living organisms, are susceptible to weather changes. The predominant effects are covered below:

(1) Temperature. Extremely high or cold temperatures prevent growth of microorganisms. Most agents will be employed when temperatures are in the 70^{o} to 85^{o} range.

(2) Temperature gradient. When considering the employment of biological agents, air stability is crucial. For example, when surface temperatures are warmer than the surrounding air, the warmer air will rise and disseminate the agent rapidly. Good air stability is important.

(3) Wind. High winds disseminate biological agents over a larger area, dilute them, and reduce concentration levels, thus reducing their effectiveness.

(4) Sunlight. Ultraviolet radiation from the sun can kill biological organisms over time.

(5) Relative humidity. Moisture in the air provides a medium to help transport and feed microorganisms.

b. Mission protection. You learned in Study Unit 1 that physical fitness, immunizations, pest control, and other factors are important in the defense against biological agents, but what about during your mission? What type of protection is necessary? Let's take a look.

(1) Your field protective mask, the M-17 or M-40 series, is the single most important piece of equipment when dealing with NBC hazards. It will protect you from most biological organisms by preventing inhalation of microorganisms and providing a "shield" against insect vectors.

(2) The uniform, including gloves, provides protection against insect vectors. Usually, your team will use MOPP gear when you encounter a chemical hazard. This suit provides greater protection from biological contamination than your utility uniform.

Lesson Summary: In this lesson you learned about the characteristics of biological agents, and the factors in nature that affect the biological agent's chances of survival. If you are confident that you do not have any questions, continue on with Lesson 2 where you will learn how to conduct a biological sampling mission. If you need more time to study, do that now before continuing.

- -

Lesson 2. BIOLOGICAL SAMPLING

LEARNING OBJECTIVES

1. State the purpose of biological sampling.
2. Identify the locations from which to take biological samples.
3. Identify the methods to decontaminate biological sampling instruments.
4. Recognize the methods to report biological sampling data.

3201. Purpose of Biological Sampling

Why sample? Your team samples for biological agents because the samples aid in identifying the agent. Even though you can't identify an agent, medical personnel can. Sampling is particularly useful in

- Confirming that an attack has taken place
- Determining the proper therapy for personnel exposed to the agent
- Estimating the possible number and type of casualties
- Determining the time-to-casualties if the time of attack is known
- Evaluating the enemy's biological capability

Note: Obtain many samples relatively free of any outside contaminant that may kill the suspected biological agent (for example, petroleum products).

3202. Sampling Sources

When you are assigned to a biological sampling mission, you should sample from areas or items likely to be contaminated, and avoid those areas that will reduce the effectiveness of your sampling. Remember from the first study unit, always exercise common sense. If you see something that looks out of the ordinary, it probably is. There are three types of samples that you specifically want to take: surface, solid, and liquid.

a. Most effective places to sample from are

(1) Oily substances

(2) Gelatinous masses

(3) Water or other liquids

(4) Fragments of munitions

(5) Dead animals and/or fish

(6) Moisture from vegetation and equipment

b. Least effective places to sample from are

(1) Sheltered by obstructions

(2) Exposed to direct sunlight

(3) Subject to high temperatures

Use good, common sense. For example, don't sample from the hood of a vehicle that has been left running or sitting in the sun. The heat would kill the agent almost immediately. Concentrate your efforts on oily substances, water, and liquids which may act as a collection point that masses the microorganisms.

Now you know where to sample, right? But, what do you use to collect samples? As you learned earlier, your NBC specialist will provide you with all necessary equipment. The biological sampling kit (BSK) is usually manufactured locally and consists of an ammo can painted blue with biological sampling kit in red letters. Procure the contents locally from your station's medical community.

3203. Contents of the Biological Sampling Kit

These items are used in taking samples and recording sample data. They are included in a storage/transport container.

- Specimen cups
- Culture tubes (with and without liquid medium)
- Pipette (eyedropper)
- Forceps (tweezers)
- Iris scissors
- Isopropyl Alcohol
- Biological sampling cards (BSC)
- Grease pencils

3204. Procedures for Taking Samples

a. Differences between chemical and biological attacks. Unlike a radiological or chemical survey mission, you can't determine the extent of contamination on a biological sampling mission. Your team will be given a series of coordinates and directed to sample for suspected biological agents.

You observe an enemy aircraft spraying a suspicious liquid. Your team dons its protective equipment and prepares to identify the contamination. Initially, your team will test for a chemical hazard. Why? Unless the attack is obviously biological, your team should attempt to identify any chemical threat first. Your team's ability to specifically identify a chemical agent within minutes and relay the test results by an NBC-1 report is critical in warning unprotected troops downwind of the contamination. Once you've determined the tests are negative for chemical hazard, then assume the worst and take several biological samples. Report your team's findings and forward the samples according to your unit's SOP.

b. Sampling types. When conducting a biological sampling mission, the three types of samples that you can take are surface, solid, and liquid. Here are the procedures respectively.

(1) Surface samples

(a) Select a biological culture tube with a transport medium and peel it open.

(b) Remove the cap with attached cotton swab.

1. Holding the cap between the thumb and forefinger, rotate the swab on the suspected contamination using a "Z" pattern.

2. Cover an area about 9 to 12 square inches.

(c) Return the swab to the tube, replace cap, and turn sample upside down. Crush the ampoule above the swab to release the medium. Swab tip should be saturated.

(d) Complete the biological sampling card with the appropriate information. Once you return to your unit, your NBC specialist will forward the sample to the nearest medical facility for testing.

(2) Liquid samples

(a) Using a plastic specimen cup, obtain at least 100 cubic centimeters of suspected contamination, and secure the lid.

(b) Complete a BSC and once you return to your unit, your NBC specialist will forward the sample to the nearest medical facility.

(3) Solid samples

(a) Select the sample (bomb fragments, leaves, bugs, or a part of a dead animal).

(b) Using the forceps, obtain a small sample. Put it in a culture tube or, if necessary, use a specimen cup.

(c) Complete a BSC to accompany the sample.

What three types of samples will you take when performing a biological sampling mission? That's right! Surface, liquid, and solid.

3205. Decontaminating Sampling Instruments

Once you use the necessary instrument, you have to decontaminate it. The decontamination process reduces the possibility of spreading the contamination. Nothing could be more detrimental than a team's failure to sterilize their instruments, move to another area and commence taking new samples with contaminated sampling instruments. Your team's sampling results will show that an otherwise uncontaminated area is contaminated. Look over the decon steps below and commit them to memory.

a. Keep all instruments separate until they can be decontaminated.

b. Do not place any instruments back into the BSK.

c. Place contaminated instruments in alcohol for 3 minutes, minimum.

d. Air dry instruments, don't wipe, and then place them back into the sampling kit. Why do you think it's important to air dry the instruments instead of drying them off with a towel? That's right, contamination is everywhere, including the towel. So, if you use a towel, it'll contaminate your instruments.

Can you recall the minimum length of time required to decontaminate your instruments when using alcohol? You should have said 3 minutes. If you didn't, look back at the text and review the information.

You've learned where to take a sample, types of samples to take, sampling procedures, and the decontamination process of your equipment. You've covered all the procedures for biological sampling, except filling out the BSC and reporting the information you have collected.

3206. Recording and Reporting Biological Sampling Data

a. BSC (included in your BSK).

- Fill one out for **EVERY** sample taken.
- Ensure that it accompanies the sample back to your unit.
- **Do not mix the cards and samples together**. It could get confusing if you have ten samples and ten cards and then attempt to match them up later.
- Tape or rubber band the card to the sample. The cards in your kit are blank. Most units will print the format on one side and provide spaces for entering data on the reverse. An example of the information found on the front of a BSC is shown in figure 3-1.

* 1. Name, rank, SSN and unit.

* 2. Type of sample (surface, solid, liquid).

* 3. Location where sample was taken.

* 4. Time and date that sample was taken.

* 5. Weather conditions (rain, overcast, temperature, etc.).

6. Terrain features.

* 7. Sample number ___ of ___ samples taken.

* 8. Indications of a biological attack.

9. Any other pertinent information.

Note: * Denotes mandatory entry.

Fig 3-1. Sample biological sampling card information.

b. Reporting NBC attacks. In Study Unit 1, you learned the proper procedures for reporting your team's monitor/survey findings.

- In most cases while on a biological sampling mission you won't have a lot to report because you won't be able to determine the extent and type of the biological contamination.

- You are required to send reports as your situation changes. However, you may still need to send an NBC-1 Biological Report. Your job is to report suspected contamination.

Below you'll find a few examples of biological NBC reports (table 3-1). For the definition of line items and other examples, refer to the GTA 3-6-5 card. Remember, your reports could contain more or less information than these examples.

Table 3-1. Example biological reports

NBC-1 Follow-up (indicating biological)	NBC-3 (suspect biological)
A 001	A 001
B LB200300 Act	D 200430Z
D 200430Z	F LB200300 to LB 208304
E 200435Z	G Aerial spray
F LB200300Act	H Unknown-Suspect biological
G Aerial Spray	PA LB216298, LB203290
H Unknown	Y 0270 Deg. 015 kmph
ZB M8 and M256 negative/unmasked personnel and cattle paralyzed and dying.	ZA 6158-0
	ZB Line PA is maximum casualty area.

Lesson Summary: In Lesson 2, you learned a lot of information. Take a moment and review what you learned. You learned the purpose of the biological sample, the appropriate locations to look for biological samples, as well as places to avoid. You learned the proper procedures for collecting biological samples, the way to keep your equipment from being contaminated and how to record and report your findings during your biological monitor/survey mission. Next is your study unit exercise--good luck!

Study Unit 3 Exercise: Complete items 1 through 8 by performing the action required. Check your responses against those listed at the end of this study unit.

1. Biological agents are cheap to reproduce, easily disseminated, and remain stable in storage. What common characteristics of biological agents affect you most?

   Biological agents are _____and_____.

2. There are five factors that influence agent survivability: temperature gradient, wind, and relative humidity. List the other two.

   a. _____ b. _____

3. What is the purpose of biological sampling?

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

4. The most effecive places to sample from are

   a. _____

   b. _____

   c. _____

   d. _____

   e. _____

   f. _____

5. What are the three types of samples that you'll take when sampling?

   a. _____

   b. _____

   c. _____

6. List the steps for decontaminating sampling instruments.

   a. _____

   b. _____

   c. _____

   d. _____

7. Accompanying every biological sample is a _____.

8. What two reports are submitted for suspected biological contamination?

   a. _____ b. _____

UNIT SUMMARY

In this study unit you learned about the characteristics of biological agents, the why, where and how of sampling for biological agents, and how to record and report your biological agent sampling data. In the next study unit you will learn about conducting a chemical monitor/survey mission.

Study Unit 3 Exercise Solutions

			Reference
1.		Infectious and virulent	3101
2.		sunlight and temperature	3102
3.	a.	Confirms that an attack took place	3201
	b.	Determines the proper therapy for personnel exposed	
	c.	Estimates the possible number and type of casualties	
	d.	Determines the time-to-casualties if the time of attack is known	
	e.	Evaluates the enemy's biological capability	
4.	a.	Oily substances	3202
	b.	Gelatinous masses	
	c.	Water or other liquids	
	d.	Fragments of munitions	
	e.	Dead animals and/or fish	
	f.	Moisture from vegetation and equipment	
5.	a.	Surface	3204
	b.	Liquid	
	c.	Solid	
6.	a.	Keep all instruments separate until they are decontaminated.	3205
	b.	Do not place any instruments back inside the BSK.	
	c.	Place contaminated instruments in alcohol for at least 3 minutes.	
	d.	Air dry and replace instruments in BSK.	
7.		biological sampling card (BSC)	3206
8.	a.	NBC-1	3206
	b.	NBC-3	

STUDY UNIT 4

CHEMICAL MONITOR/SURVEY MISSION, CHEMICAL AGENT DETECTION, AND DETECTION EQUIPMENT

Introduction. To conduct a chemical monitor/survey mission, your team must have a complete understanding of

- What chemical agents are
- How they're used
- Possible effects to your team

In this study unit, you'll learn the types of surveys, equipment and procedures when conducting a chemical survey mission. You will also learn what you can do before entering a contaminated area to increase your performance.

It is important for you to review the material contained in MCI course 57.1, NBC Individual Survival Measures, or Books 2 and 3 of the MBST to familiarize yourself with other information necessary in accomplishing your mission, such as

- Chemical agent self and first aid
- Personnel decontamination procedures
- Equipment decontamination procedures
- MOPP gear exchange procedures

Lesson 1. CONDUCTING A CHEMICAL MONITOR/SURVEY MISSION

LEARNING OBJECTIVES

1. State the purpose for conducting a chemical monitor/survey mission.

2. Identify the chemical survey procedures.

3. Identify the chemical hazard recording procedures.

4. Identify the effects of prolonged wearing of MOPP gear.

4101. Purpose of Chemical Surveys

a. Chemical surveys. Conduct chemical surveys to determine the hazards in a particular area before your unit moves through the area. Your team's job is to determine if any chemical agents are present and to identify them. The survey techniques used for chemical surveys are quite similar to those for radiological surveys, with a couple of exceptions.

(1) Because chemical agents are heavier than air and designed to be surface-employed, no aerial survey can be performed.

(2) Unlike a radiological survey that determines the extent and intensity of the hazard, **a chemical survey can only determine the extent, not the intensity, of the hazard.**

What is the primary difference between a radiological and chemical survey? If you said that a radiological survey can determine the extent **and** intensity, while a chemical survey can only determine the extent of the contamination, you are correct!

b. Survey procedures. All units will use surveys to determine the location of chemical hazards. Survey procedures are the same no matter who does them. In conducting a chemical survey, your mission is to find the boundary and/or routes for your unit around or through the contamination. Your team should determine the following:

(1) Are chemical agents present?

(2) If there is an agent present, what type is it?

(3) Where/when was the chemical agent first detected?

(4) What are the agent's boundaries?

(5) Are there any clean routes through the contamination?

4102. Leading a Chemical Survey Team

a. Inspection. As you have learned in Study Unit 2, you have to perform a preoperational check and inspect detection equipment before departing on any mission. At a minimum, you should inspect the following:

(1) Your M256A1 kits, ensuring they are serviceable and complete

(2) The M8 and M9 detector papers, ensuring they are serviceable

(3) Your chemical agent monitor (CAM), ensuring it is serviceable

(4) The communications gear, ensuring it is operational

Perform a preoperational check to ensure all equipment is working properly. Nothing could be worse than making your team get into MOPP gear, drive into the contaminated area, and then realize that you forgot batteries for the equipment or that it simply doesn't work.

b. Survey team briefing. Take notes during the survey team briefing, ensuring you understand all the following points:

(1) Operational situation

(2) Contamination situation

(3) Mission

(4) Concept of operation

(5) Specific assignment of each team if more than one team will be involved

(6) Coordinating instructions, including

(a) Whether contaminated area will be marked

(b) The time of departure and return

(c) Where the decontamination will be accomplished

(d) Where and when the debriefing will take place and by whom

(7) Administration and logistics (equipment and forms)

(8) Command and signal. This should contain data reporting procedures such as

(a) Communications/electronics operating instructions (CEOI)

(b) Call signs

(c) Codes to be used

(d) Reporting times

(e) Primary and alternate frequencies

(f) Location of control team

4103. Types of Chemical Surveys

a. Chemical surveys are similar to radiological surveys. In fact, they are executed in much the same way. The difference is that your team is looking for chemical contamination instead of radiological contamination. The exception, as noted earlier, is that no aerial survey is conducted because chemical agents hug the ground.

b. Types of surveys. The three types of chemical surveys are **point**, **route**, and **area**. The characteristics of these surveys are the same as for radiological surveys. If you feel that you might need to refresh your memory, return to Study Unit 2.

c. Perform a point survey.

(1) Proceed to the point you need to survey.

(2) Perform test(s) with available equipment. Detect and identify chemical agent(s) present.

Note: When conducting test(s), always use the most expedient method. For example, if a suspicious liquid is present, test it. If no liquids are present, use the CAM or M256A1.

(3) Perform test as often as required.

(4) Record findings on DA Form 1971-2-R (fig 4-1), and (if required by survey plan or briefing) transmit results to the control team.

(5) Return to the control center for debriefing.

(6) When necessary, conduct decontamination procedures.

d. Perform a route survey.

(1) Proceed to the start point(s) on the predetermined route according to your chemical survey plan or briefing.

(2) Your team will proceed along the route and take readings at predetermined intervals or until you encounter contamination. Normally, a team consists of a **minimum** of three people: a radio operator, security person, and a driver.

(3) Test for the presence of contamination at all locations identified in the chemical survey plan or in the briefing.

Note: When you conduct a chemical survey, you should place the M8A1 chemical alarm or CAM (when provided) in a strategic location within the vehicle to sample the air while moving. Once a hazard has been detected, your team should perform additional tests and report the findings to your control center (table 4-1).

(4) Record your teams findings on DA Form 1971-2-R, and transmit the results to your control center when required by the survey.

(5) Return to the control center for debriefing.

(6) If necessary, conduct decontamination procedures.

e. Perform an area survey.

WARNINGS: When you make contact with contamination,

- **Use the most expedient means available to identify the agent. For example, if liquid droplets are present, use M8 paper.**
- **Conduct additional tests using other detection devices such as an M256A1 chemical detector kit. Identify the chemical agent.**
- **Use other detection equipment to determine the extent of the contamination.**

(1) Proceed to the perimeter of the suspected hazard area as shown by your survey plan's overlay.

Note: Your team will proceed from an assigned starting point toward the center to the target, using a CAM to determine contact at predetermined intervals.

(2) Test for the presence of contamination at all locations identified in the chemical survey plan or in the briefing.

Table 4-1. Instructions for Completing the Chemical Data Sheet

Steps	Actions
1	Cross out the technique that is not used (fig 4-1).
2	Write in six- or eight-digit coordinate along with the time when the sample was taken. Specify whether the time is local or Zulu (fig 4-1).
3	Select the detector type that was used to identify the chemical agent (fig 4-1).

CHEMICAL DATA SHEET — (1)
MONITORING ~~OR SURVEY~~

DATE: 7 DEC 90 | PAGE NO: 1 | NO. OF PAGES: 1

UNIT: A Co 1/8
MONITOR OR SURVEY TEAM NUMBER: RBS
MAP USED: QUANTICO, VA.
MONITOR OR SURVEY TEAM MEMBER (Print Name): PFC I. M. GADD

LOCATION/TIME OF TEST OR INDICATION	TYPE OF DETECTOR USED (3) PAPER	ALARM	KIT	AGENT DETECTED
NV521678/100600Z (2)			✓	Nerve
NV521676/100625Z	✓			V.
NV521674/100636Z	✓			V.
NV521672/100647Z	✓			V.
NV521670/100715Z	✓			V.

SAMPLE

REMARKS

DA FORM 1971-2-R, SEP 86

Fig 4-1. Completed DA Form 1971-2-R, Chemical Data Sheet, Monitoring.

Note: Remember, use the most expedient method available when conducting tests. The M256A1 takes approximately 15 minutes to complete, M8 or M9 just seconds, and the reaction time of the CAM is immediate. Other means of detecting chemical agents are available. If other detection devices are used, then redesignate an unused column and change it to the appropriate detection device.

(3) Take tests every 200 meters (or at intervals established in the survey plan or briefing) until the hazard reacts with detector paper or until each team member comes within 200 meters of the center of attack.

Note: What is the prescribed interval for taking readings? Right, 200 meters. But, keep in mind that this a rule of thumb and if the interval is different it will be covered in your chemical survey plan. Depending on the type of agent, most survey plans allow using a CAM until you've made contact.

(4) Record findings on DA Form 1971-2-R and transmit results to the control team if required by survey plan or briefing.

Note: If yours is the only survey team, repeat the procedure above for each sector until you complete the whole survey.

(5) Return to the control center for debriefing.

(6) If necessary, conduct decontamination procedures.

4104. Effects of Wearing MOPP Gear

When you conduct a chemical survey mission, your team may be in MOPP gear for extended periods of time. MOPP gear and other equipment are a serious hindrance and you should take steps to reduce adverse effects.

Consider the adverse effects of wearing MOPP gear for a long time.

a. Physical effects.

(1) Elevated body temperatures decrease your performance.

(2) You dehydrate rapidly.

Note: When in MOPP 4, you can lose up to one quart of fluid per hour.

(3) Wearing the mask narrows your field of vision.

(4) Wearing the hood impairs hearing.

(5) Wearing the mask makes speaking difficult.

b. Psychological effects.

(1) Claustrophobia

(2) Disorientation

(3) Distortion of body sensations

(4) Confusion

c. Adverse effects. Minimize the adverse effects before operating in a chemical environment by doing the following:

(1) Keep physically fit. This will

- Increase your endurance
- Decrease stress when wearing the MOPP gear

(2) Drink plenty of fluids.

d. Actions to take in a chemical environment.

(1) Plan for tasks to take longer than otherwise to accomplish.

(2) Conserve your energy whenever possible.

(3) Increase your water intake to avoid dehydration and a possible heat injury.

(4) Speak slowly.

(5) Hold the radio handset close to the voicemitter when using radios.

(6) Repeat orders to ensure they are understood.

(7) Wear MOPP gear over underwear in hot weather.

Besides being in good physical condition, what do you think is the single most important thing that you can do for yourself before executing your chemical survey mission? If you said drink plenty of fluids or hydrate yourself, you're right.

Lesson Summary. In this lesson you've learned how to conduct a chemical survey, including the purpose and types of chemical surveys, the adverse affects of wearing MOPP gear, and how to record your team's findings. Now that you have a good understanding of how to go about conducting a survey, let's look at the equipment that is going to help your team accomplish its mission.

- -

Lesson 2. CHEMICAL AGENT DETECTING AND DETECTION EQUIPMENT

LEARNING OBJECTIVES

1. Identify detection procedures.

2. Identify the two methods used to detect and identify chemical agents.

3. Identify chemical agents detected.

a. Mission. All units are responsible for the chemical reconnaissance of their own front, flanks, routes, and alternate routes of approach. Your unit or the control center will direct your team to conduct a chemical monitor/survey mission (often referred to as a chemical reconnaissance). Determine the best means of passage through an area whenever a chemical hazard is encountered unexpectedly.

b. Checking hazard areas. You can check hazard areas of suspected contamination with any of the following equipment:

(1) M8--chemical agent detector paper

(2) M9--chemical agent detector tape

(3) M256A1--chemical agent detector kit

(4) Chemical agent monitor (CAM)

CAUTION: When in a suspected contaminated area, always wear protective clothing (MOPP4).

4201. Detection Procedures

a. Common sense. Whenever your team is on a survey mission, you have to exercise common sense. For example, suppose you are moving along a survey route taking readings at prescribed intervals in search of contamination. You cross an area of dark liquid sprayed along the road. Stop and take a reading! Identify and report boundaries even if the area isn't at a prescribed interval.

b. Low areas. Your team should pay special attention to shell craters, low-lying patches of woods, defiles, ravines, stream beds, areas covered with underbrush, and other spots favorable to contamination by a persistent chemical agent. These agents tend to seek low-lying areas. Woods, defiles, and high grasses tend to stop them.

c. Report findings. When you locate chemical contamination, use the NBC-4 report to record your team's findings as quickly as possible. When directed, mark the area with a chemical contamination marker, especially if you consider it necessary to protect friendly units from crossing or occupying the contaminated area.

d. Contaminated areas. Your team will gather required information for areas known to be or suspected of recently being contaminated.

(1) For areas of known contamination, report

(a) Type of agent used and date, if known

(b) Location and extent of contamination

(c) Possible routes for troops and vehicles upwind or downwind of the contaminated area and whether masking will be required on these routes

(d) Feasibility of preparing a road or of using any established warnings of contamination

(e) Requirements for marking a contaminated area or establishing warnings of contamination

(2) For areas recently contaminated with chemical agents, report

(a) Limits of the hazard area

(b) Location of uncontaminated areas

(c) Information such as date of contamination, type of terrain, vegetation, and weather

4202. Methods of Detecting and Identifying Chemical Contamination

There are two methods for the detection and identification of chemical agents: subjective and objective. The objective is more reliable.

a. Subjective. Detection by one of your five physical senses: sight, hearing, taste, touch, and smell. Use this method of detection only as a warning of the presence of an agent, to be followed by immediate masking.

b. Objective. Detection and identification by an external physical or chemical aid such as M8 paper and M9 tape, M256A1, and the CAM. These items sample the molecular structure of air or indicate a chemical agent's presence when the agent chemically reacts with these treated papers or test reagents.

One method of detection is preferred over the other, can you recall which one? That's right! Objective. Do you think that it's possible to use subjective detection? Certainly. What if your team encounters a chemical agent, a casualty, or sick and dying animals? They can aid you in determining what chemical agent(s) are present.

Use the chemical detection equipment in the next section to familiarize yourself with the types and purpose of detection equipment.

4203. Chemical Detection Equipment

a. M8 chemical detection paper.

(1) M8 chemical detector paper (figs 4-2 through 4-4) is a blotter-like paper, impregnated with chemicals used to detect liquid contamination, specifically to indicate the possible presence of liquid blister and nerve agents (these agents are disseminated as a liquid). You should use M8 or M9 on suspected surfaces, such as puddles, small drops, or barely visible droplets.

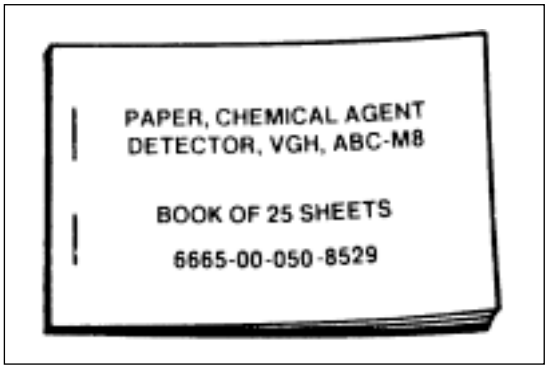

Fig 4-2. M8 paper.

(2) Test for liquid chemical agents (table 4-2).

Note: You may receive M8 paper with your field protective mask or as a SL-3 component of the M256A1 chemical agent detector kit.

Table 4-2. Instructions for Using M8 Paper

Steps	Actions
1	Remove and open M8 paper from M256A1 kit or mask carrier, discard plastic bag.
2	Test the liquid. • Tear out a sheet of M8 paper (sheets are perforated; use one segment). • Expose M8 paper to suspected liquid agent.
3	Compare any color changes on the paper with the colors shown inside the cover of the book of M8 paper. Use color readings to determine the type of chemical agent present.

Note: Ensure that you hold the M8 paper in the down position to prevent liquid contaminates from running onto your protective glove (fig 4-3). Blot, do not rub, the M8 on suspected contamination.

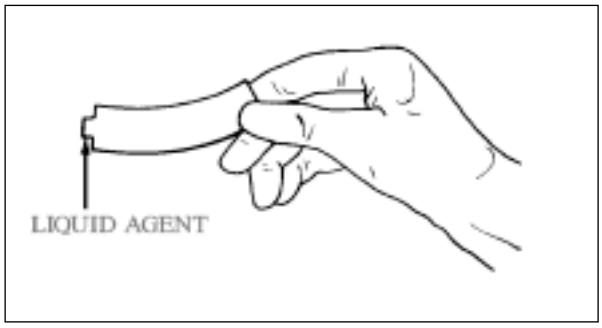

Fig 4-3. Contamination drips down.

- Yellow/gold indicates presence of a G series nerve agent.
- Dark green indicates the presence of a V series nerve agent.
- Pink-red indicates the presence of an H series blister agent.

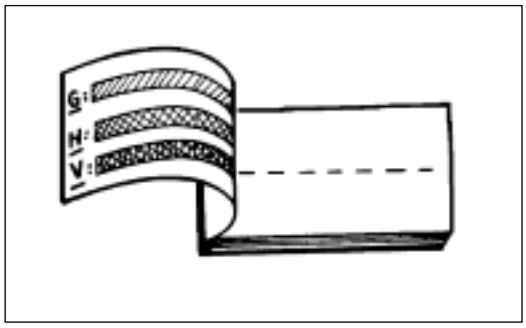

Fig 4-4. M8 inside cover.

What color do you think M8 paper would change if you sample an H series blister agent? Of course, pinkish to red depending on the strength of the agent.

Note: Some decontaminants and petroleum products will produce false positive tests on M8 paper. In an area where decontaminants have been used, confirm positive results by additional tests using M256A1 or CAM.

Occasionally, decontaminants will produce false indications when you use the M256A1. When you suspect this is happening, test the decontaminant itself.

WARNING: Never assume that an area is not contaminated. When in doubt, retest the area and report the findings.

b. M9 chemical detector tape. (See table 4-3.)

(1) The M9 detector tape (fig 4-5) consists of a roll of detector tape 2 inches wide by 30 feet long in a dispenser with a resealable plastic bag. The adhesive-backed detector tape contains a detector dye suspended in the paper. When droplets of a liquid chemical agent touch it, the detector produces a contrasting color change from green to pink or red.

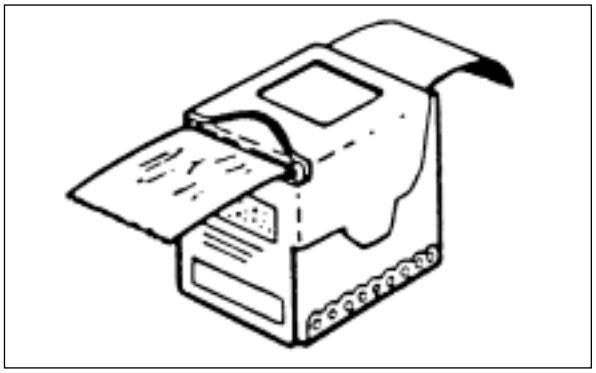

Fig 4-5. M9 detector tape.

For visual warning, wear bands of M9 tape around the wrist, upper arm, ankle and areas routinely exposed on vehicles, equipment, and terrain surfaces. Do this for monitoring liquid chemical contamination. Use it to indicate the presence of liquid agent contamination.

(2) Use M9 detector tape.

Note: M9 tape is not designed to specifically identify chemical agents. Its purpose is to detect their presence.

Table 4-3. Instructions for Using M9 Tape

Steps	Actions
1	Open package of M9 tape.
2	Unroll small portion of detector tape.
3	Blot, do not rub, the M9 tape on the suspected liquid.
4	Observe for color change.

Note: Like M8 paper, M9 tape changes colors when in contact with a chemical agent. However, when in contact with contamination, it can appear as a light pink color to a reddish brown or violet color, signifying a chemical agent is present. It **will not** identify specific chemical agents.

c. Purpose and features of M256/M256A1 chemical agent detector kit (fig 4-6).

(1) The purpose of the M256A1 kit is to detect and classify chemical agents in liquid or vapor form. The kit detects the presence of nerve, blood, and blister agents within 15 minutes. The kit

- Is easy to carry and simple to operate
- Contains 12 sampler detectors and M8 paper
- Includes a carrying case with straps
- Has a set of operational instruction cards

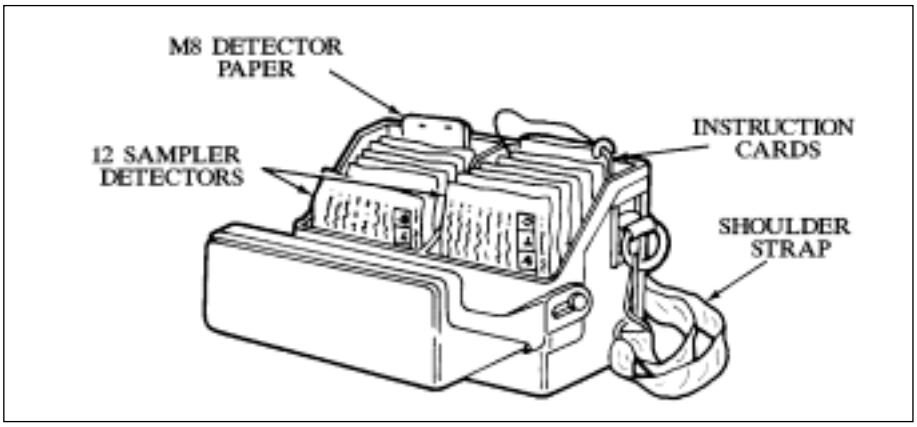

Fig 4-6. M256/M256A1 chemical detector kit.

(2) The 12 sampler-detectors (fig 4-7) mentioned earlier consist of the following:

- Six glass ampoules each filled with chemical reagents (No. 1)
- Three test spots (No. 2)
- A hinged chemical heater (No. 3)
- Hinged protective strips (No. 4)
- Rubbing tabs (No. 5)

Note: You'll find instructions printed on the outside of each sampler-detector protective bag and a set of instruction cards attached to the inside of the case.

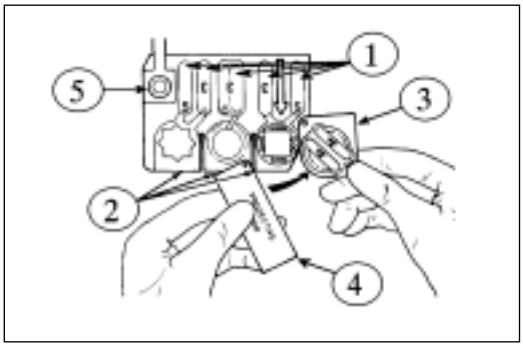

Fig 4-7. Sampler detector.

(3) Sampler-detectors detect the following chemical agents:

(a) Blister Agent Detection.

- To detect mustard (H & HD) and phosgene oxime (CX), use the square test spot with the blister reagent ampoules and the chemical heater.

- To detect lewisite (L), use the lewisite detecting tablet and the lewisite tablet rubbing tab.

- Formed channels in plastic sheets direct the flow of reagents from the finger-crushable ampoules to wet the test spots at the time of testing. **Safe/danger observations are printed on the reverse of each sampler-detector.**

(b) Blood agent detection. To detect cyanogen chloride (CK), use the circular test spot with the blood agent ampoules.

(c) Nerve agent detection. To detect nerve agents (G & V), use the star-shaped test spot with the nerve agent ampoules.

In liquid form, the M8 can detect and identify chemical agents, but the M9 will only detect them. In what forms can the M256A1 detect and identify chemical agents? Right, both liquid (using the vapors from the liquid) and vapor form.

d. Using the M256A1 chemical agent detector kit.

(1) Do not use this kit if you are color blind or cannot see colors correctly. Color comparisons are used during tests. A wrong reading of results might cause removal of protective equipment while toxic agents are present.

(2) To avoid inaccurate test results, open the sampler detector bag and conduct tests while facing into the wind. This will keep the vapors of your equipment and clothing from causing inaccurate test results.

(3) Avoid sampling in smoke or smoke screens.

(4) Do not use an outdated sampler detector because it may give inaccurate test results.

(5) Do not expose the sampler detector to any type of moisture. (This can cause inaccurate test results.)

(6) Protect the sampler-detector kit during exposure from excessive moisture, such as rain or dew.

(7) Before breaking glass ampoules, place heater pads on each side of the sampler detector, covering the ampoules to be broken. (These pads will prevent pieces of glass shards from cutting or puncturing protective gloves and hands.)

(8) Avoid contact with venting vapors when conducting tests.

(9) Do not touch sampler detector test spots. (Dirt and oil from gloves will give inaccurate test results.)

Note: Do not use the red lens of a flashlight when performing tests at night. Wear a watch and observe wait times (10 minutes, 5 minutes, etc.).

e. Prepare the M256A1 kit for use.

(1) Ready the kit.

(a) Put the shoulder strap over your head and one shoulder.

(b) Adjust the shoulder strap; the kit will hang at waist level.

(2) Fasten the kit to the belt, hooking the waist belt-attachment strap to belt (fig 4-8).

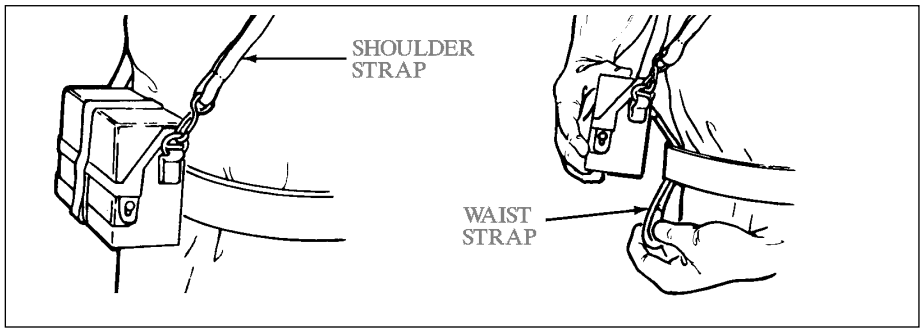

Fig 4-8. Belt attachment.

(3) Open the kit.

(a) Pull the strap away from the fastener strip.

(b) Grasp the case top, and pull it up while pulling it away from your body (fig 4-9).

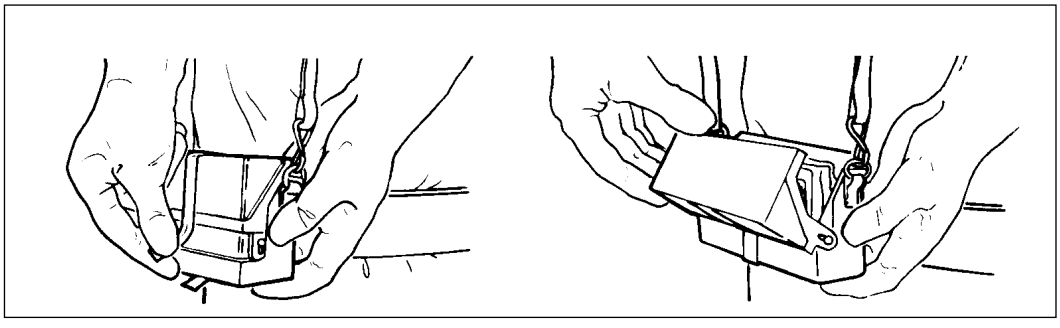

Fig 4-9. Opening detector kit.

(c) Take out the instruction cards and read both sides.

(d) Take out a sampler detector and read both sides of the sampler detector bag.

- Observe all warnings.
- Tear the protective bag along the line marked by arrows (fig 4-10).
- Carefully pull out the sampler detector, and save the bag for reference to instructions.

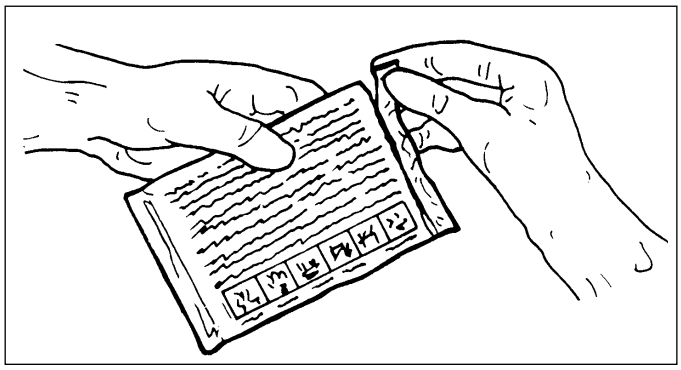

Fig 4-10. Sampler in protective bag.

f. Test for toxic vapors.

(1) Observe all warnings.

(2) Swing out the heater; remove and save the two loose pads (fig 4-11).

(a) Save the pads under the hinged heater.

(b) Swing the heater back into place.

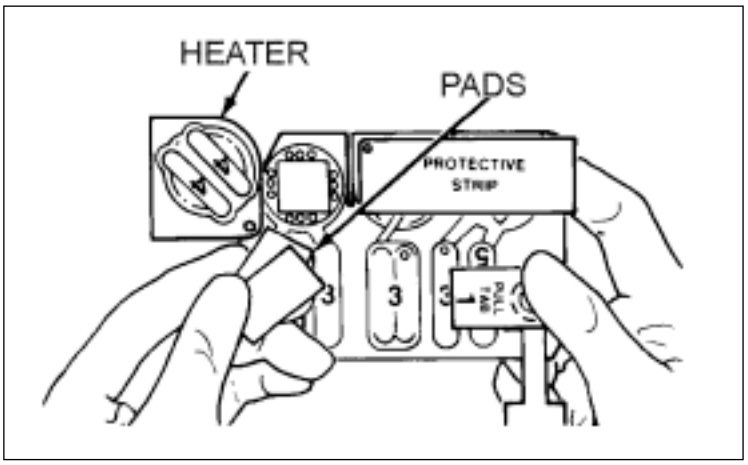

Fig 4-11. Removing heater pads.

(3) Remove the pull tab marked number 1 by pulling upward to expose the lewisite detecting tablet (fig 4-12).

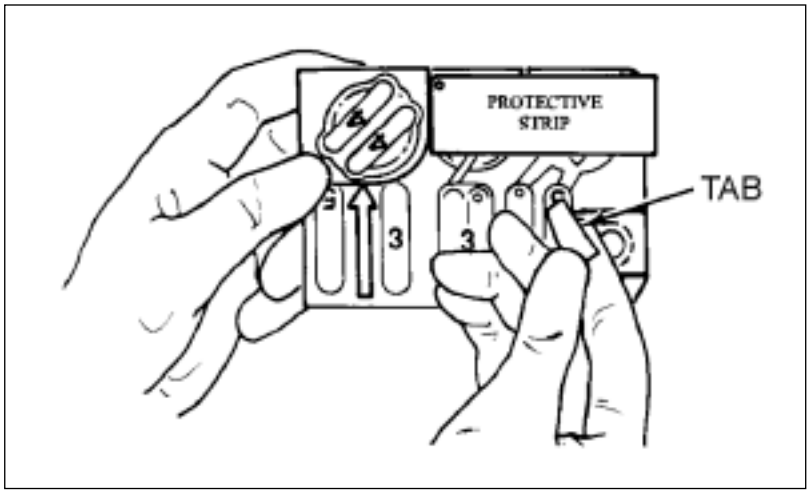

Fig 4-12. Removing tab-1.

(4) Mark the lewisite rubbing tab.

(a) Bend the tab over the lewisite detecting tablet.

(b) Rub the upper half of the tab until a mark is visible (fig 4-13).

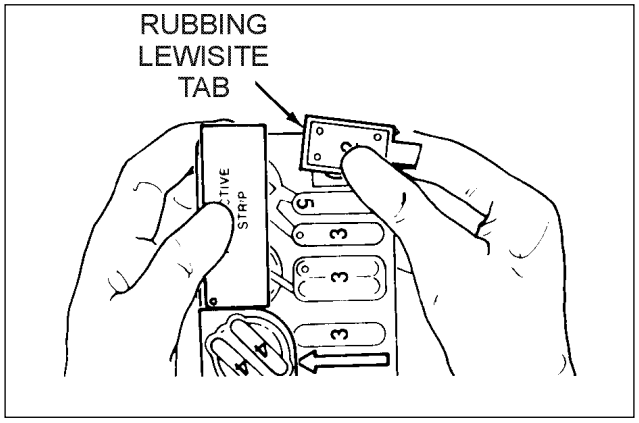

Fig 4-13. Rubbing lewisite tablet.

(5) Hold the sampler detector with the test spots or arrow pointing up.

(6) Using the heater pads, crush four ampoules in the three center pockets marked number 3 (fig 4-14).

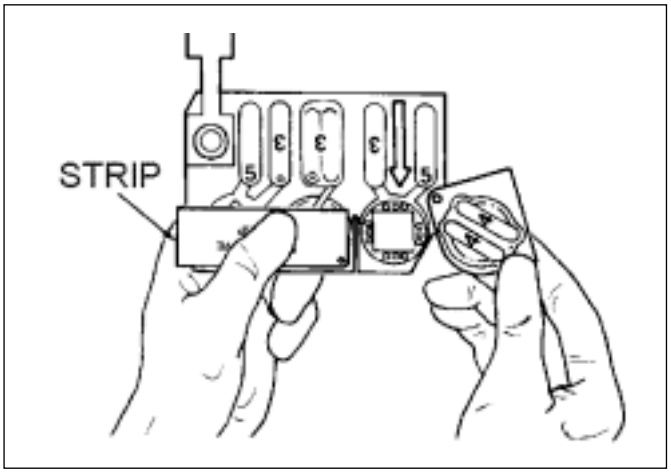

Fig 4-14. Crushing center ampoules.

Note: Nerve agent spots may be difficult to wet with solutions as the kit ages. Work solutions into the spot carefully while pressing the protective strip over the nerve agent spot.

(7) Turn the sampler detector upside down and verify wetting of test spots.

(8) Hold the sampler detector with the test spots or arrow pointing down.

(9) Using the heater pads, squeeze the ampoules to force liquid through the formed channels (fig 4-15).

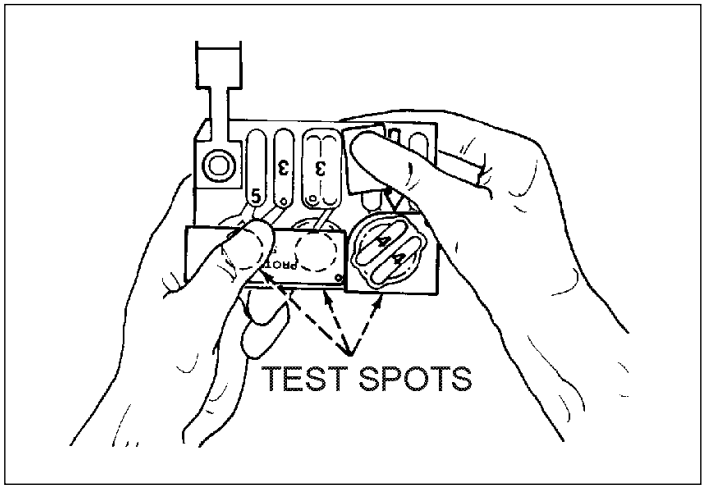

Fig 4-15. Squeezing center ampoules.

(10) Put your thumb on the protective strip over the middle of the test spot.

(11) Swing the heater away from the test spot (fig 4-16).

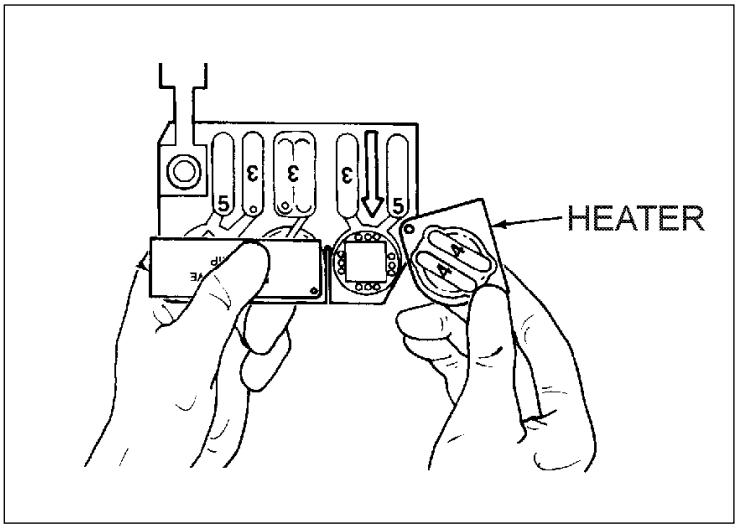

Fig 4-16. Swinging heater ampoules away.

<u>WARNINGS</u>: Avoid hot vapors that may burn you when crushing heater ampoules.

Face into the wind.

Hold the sampler detector down and to one side while the vapors are venting.

(a) Activate the first heater ampoule marked number 4.

(b) Use the heater pads, crush one green ampoule, and swing the heater immediately over the test spot (fig 4-17).

(c) Hold the sampler detector to one side when venting to avoid vapors.

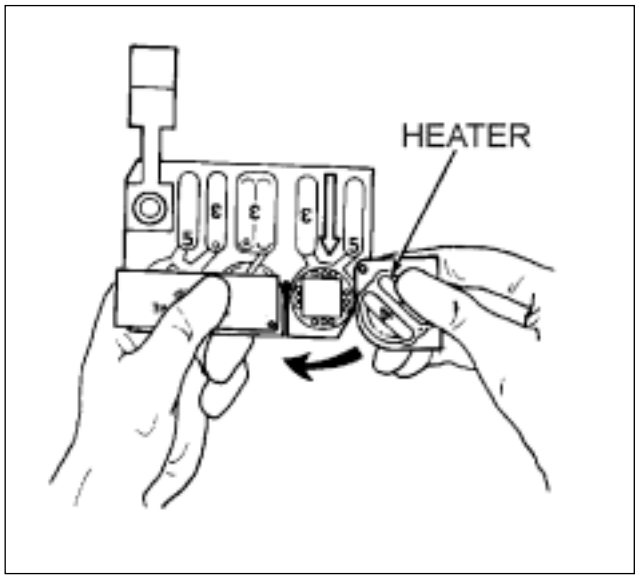

Fig 4-17. Replacing heater ampoules.

(12) After 2 minutes, swing the heater away from the test spot, and swing the protective strip away from the test spots.

<u>WARNING</u>: Do not hold the sampler detector in direct sunlight while exposing the test spots. You may not be able to obtain accurate test results.

(13) Expose the test spots to air for 10 minutes.

<u>Note</u>: Hold the sampler detector by the hinged protective strip.

(14) After 10 minutes, activate the second heater ampoule marked number 4 (fig 4-18).

(a) Crush the second green ampoule, being sure to use the heater pads.

(b) Swing the heater immediately over the test spot.

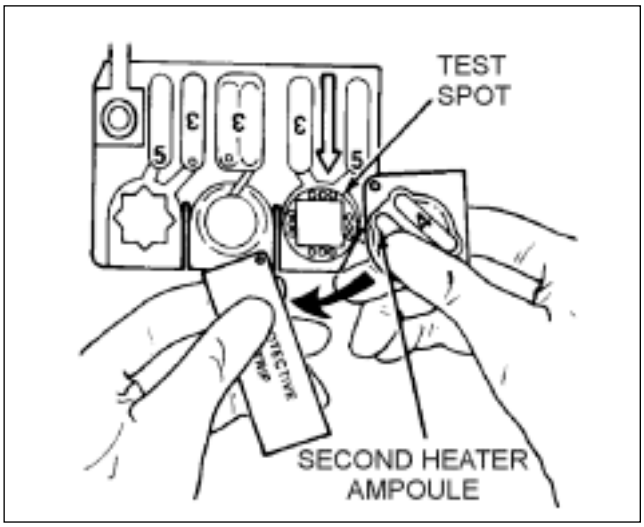

Fig 4-18. Crushing second heater ampoule.

(15) After 1 minute, swing the heater away from the test spot.

(16) Hold the sampler detector with the test spots or arrows pointing down.

(17) Using the heater pads, crush the remaining ampoules marked number 5. Be sure to wet the test spots by squeezing the ampoules to force the liquid onto the test spots (fig 4-19).

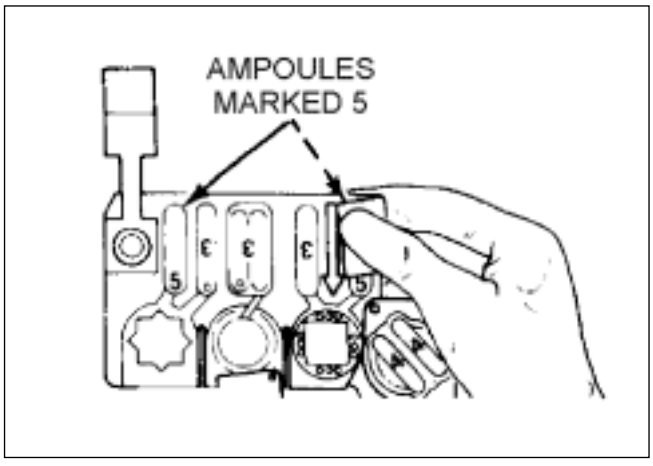

Fig 4-19. Crushing number 5 ampoules.

(18) Rerub the lewisite detecting tablet.

(a) Bend the tab over the lewisite detecting tablet.

(b) Rub the bottom half of the tab until a mark is visible (fig 4-20).

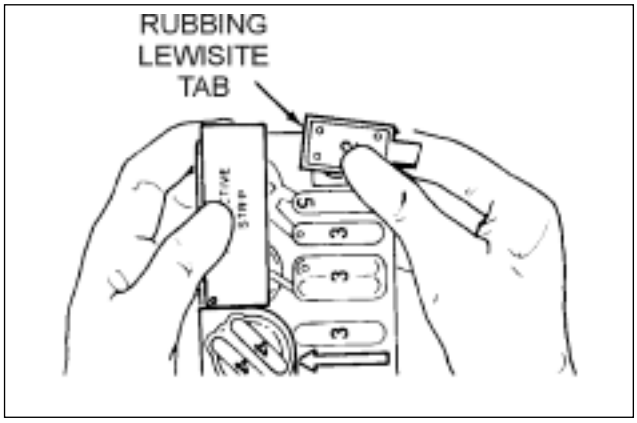

Fig 4-20. Rubbing lewisite tablet again.

(c) Compare the colors to determine whether conditions are dangerous or safe.

(19) Turn the sampler detector over to the reverse side, and compare the colors of the test spots with those shown on the sampler detector (fig 4-21).

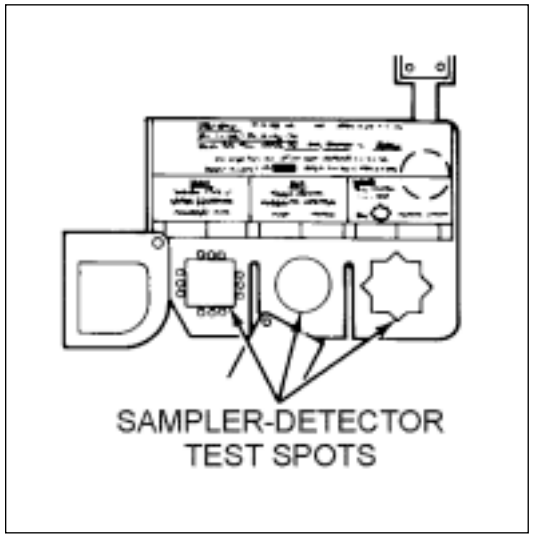

Fig 4-21. Front side of sampler-detector.

(20) Look for a change in the color of the rub marks on the lewisite detecting tab.

Notes: Compare the blood agent (round spot) and the lewisite (rubbing tab) tests after 10 minutes of exposure time. Blister agents (H and CX) develop color immediately after all the ampoules are broken. Nerve agents require a waiting period of 3 minutes.

- If no color develops with the M256A1 kit, a positive nerve test is indicated. Disregard any small blue or blue-green areas under the plastic rim of the nerve agent spot.

- Look at the rub marks on the lewisite tablet, rubbing the tab closely. At low concentrations, the change may be slight. Compare it with the second rub mark before judging.

- Yellow and orange sometimes occur on a blood agent spot when no agent is present. Pink or blue must be present to indicate blood agents. Consider any combination of colors or a rainbow effect, pink or blue, as a positive blood agent test.

If the blood agent is indicated, repeat the testing for toxic agent vapors using a fresh sampler-detector for blood agent only. If a blood agent is not indicated the second time, the blood agent is not present. If there is a positive indication on the second attempt, then a blood agent is present.

Before you dispose of the sampler-detector, contact the OIC for disposal instructions consistent with the local unit's NBC SOP. Each sampler-detector contains 2.6 mg of mercuric cyanide. Consider it hazardous waste.

g. Chemical agent monitor (CAM).

(1) Description. The CAM is a portable, hand held instrument designed to determine and to indicate the hazard from nerve or blister agent vapor present in the air (figs 4-22 to 4-23). Use the CAM to search out clean areas; to search for and to locate contamination on personnel, equipment, ship's structures, aircraft and land vehicles, buildings and terrain; and to monitor for the effectiveness of decontamination.

Table 4-4. Description of the CAM

No.	Name	Description
1	Carrying case assembly	Provides stowage for all equipment. (See fig 4-22.)
2	CAM	(See fig 4-22.)
3	Carrying harness assembly	Attaches to CAM and is placed over shoulder to support the CAM while being carried. Contains pockets for confidence sample, spare battery, and filtered nozzle package assemblies. (See fig 4-22.)
4	Filtered nozzle package assembly	Contains four packages of six each filter-nozzle standoffs, which keep dust out of the CAM. (See fig 4-22.)
5	Spare battery	One battery housed in carrying harness pocket. (See fig 4-22.)
6	Large handle strap	Snaps to the rear handle of the CAM. (See fig 4-22.)
7	Small handle strap	Snaps to front handle of the CAM. (See fig 4-22.)
8	Confidence sample	Contains simulates used to test the ability of the CAM to detect nerve and blister agent vapors. The end with the cross-sections marked "G" contains nerve agent simulant. The end with three longitudinal ribs, marked "H," contains blister agent simulant. (See fig 4-22.)
9	Sealed nozzle protective cap	Houses a spare nozzle protective cap assembly. The nozzle protective assembly cleans the air circulating inside the CAM. (See fig 4-22.)
10	Nozzle protective assembly	Protects nozzle assembly and ensures that clean air is sampled when CAM is started. (See fig 4-23.)
11	Nozzle assembly	Receives chemical agent vapors through an analysis by the CAM. (See fig 4-23.)
12	Lithium battery	Powers CAM. (See fig 4-23.)
13	Battery cap	Provides access to the battery compartment and holds battery in place. (See fig 4-23.)
14	Environmental cap	Protects electrical connector and provides a temporary storage place for the nozzle protective cap assembly when CAM is in operation. (See fig 4-23.)

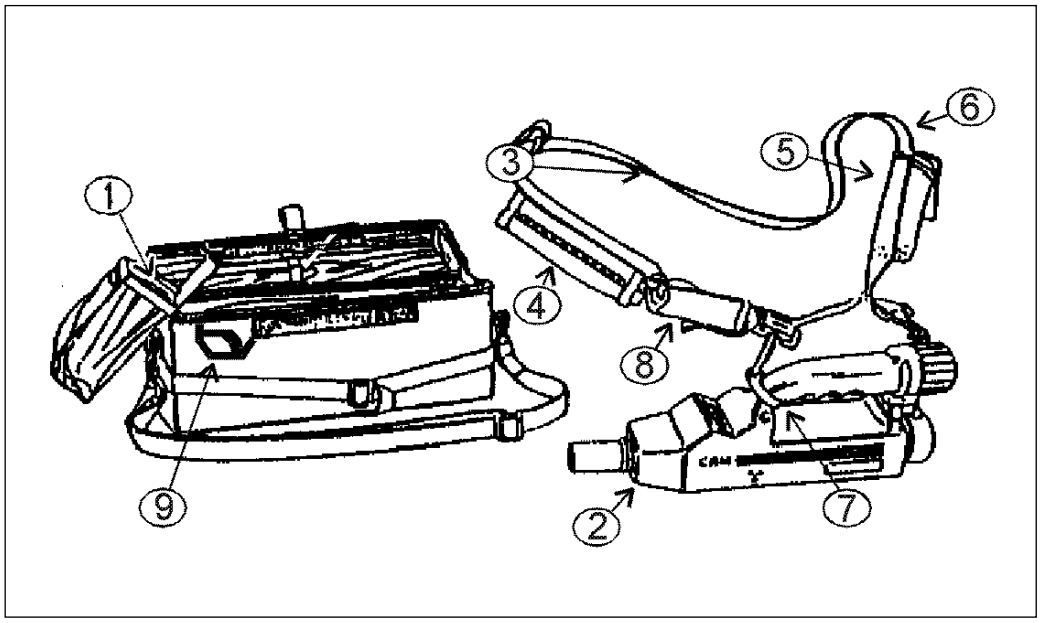

Fig 4-22. CAM and accessories.

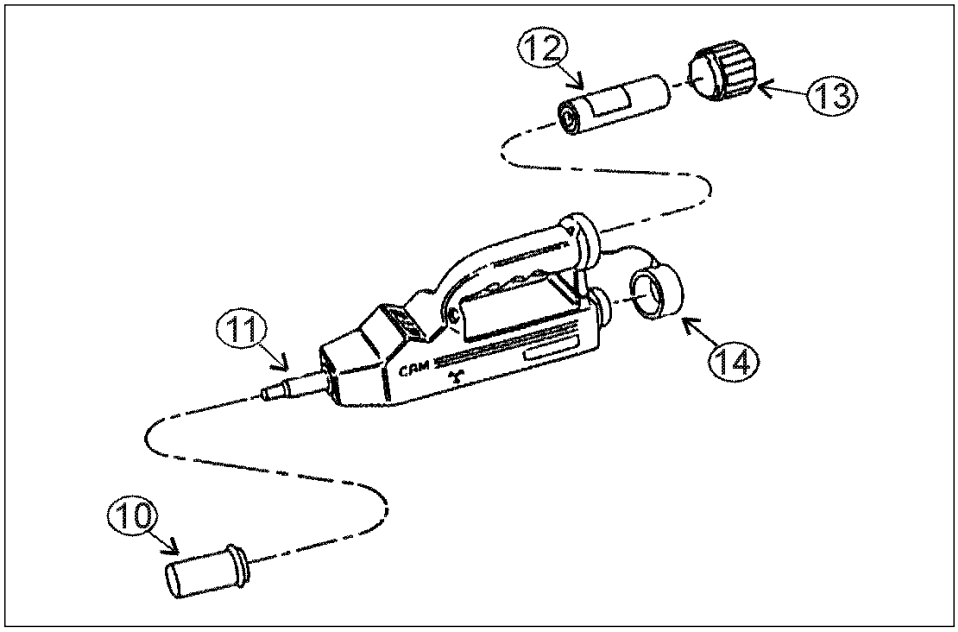

Fig 4-23. CAM assembly.

(2) Function.

(a) The CAM detects and discriminates between vapors of nerve and blister agents and displays the relative concentration. The CAM is strictly a post-attack monitoring/surveying instrument. The CAM is a vapor monitor and can only reflect conditions at the front of the nozzle assembly. It is a point monitor only and cannot give a realistic assessment of the vapor hazard over an area from one position.

(b) It is necessary to move the CAM around the area carrying out a complete reconnaissance if you want a proper assessment of the vapor hazard in the area. (Any assessment will probably be made in conjunction with other detection methods.)

(3) Readings. When investigating the contamination of persons, objects, vehicles, aircraft, or equipment, first establish what general vapor hazard exists around the suspected contamination. If a higher than the background level is indicated, then the object is contaminated. If the reading is the same as the background, then the object may be contaminated, or the CAM may merely be recording the background vapor hazard. Be careful when assessing the contamination of an object from the information indicated on the CAM display.

Warning: Do not switch the CAM off for end of mission or storage if it displays bars.

Note: In cold weather, liquid contaminants may not release sufficient vapor to produce a reading on the CAM.

Lesson Summary. In Lesson 2 you found that there is a variety of detection devices at your disposal to help you accomplish your mission, including the M8 and M9, M256A1, and CAM. You can learn about the operating procedures, battery installation (if applicable), and how to maintain equipment issued through your unit's NBC library.

- -

Study Unit 4 Exercise: Complete items 1 through 13 by performing the action required. Check your responses against those listed at the end of this study unit.

1. Unlike radiological surveys, chemical surveys can only determine the _____ of the hazard.

2. List the three types of chemical surveys.

   a. _____

   b. _____

   c. _____

3. What form is used to record chemical monitor/survey data?

   _____

4. During your brief, no guidance concerning interval was given. When performing an area survey, at what interval should you test for contamination?

   _____

5. Before executing a chemical survey, what is the single most important thing that you can do for yourself physically?

   _____

6. List three physical effects of wearing MOPP gear for long periods of time.

   a. _____

   b. _____

   c. _____

7. What two methods are available for the detection and identification of chemical agents?

   a. _____

   b. _____

8. What liquid chemical agents are detected by the M8 paper?

   _____ and _____

9. What color change occurs when the M9 tape is exposed to liquid chemical droplets?

   _____

10. How many sampler-detectors are contained in the M256A1 kit?

    _____

11. The M256 chemical agent detector will detect _____, _____ and _____ agents in vapor form.

12. The CAM detects and discriminates between vapors of _____ and _____ agents.

13. The CAM is used to search out clean areas, to search for and to locate contamination on personnel, equipment, ship's structures, aircraft, and land vehicles, buildings and terrain; and _____.

UNIT SUMMARY

In Study Unit 4 you learned what a chemical survey is, how to conduct a chemical survey, detection and identification equipment available to you, and pretreatments available in combating chemical agent effects. Armed with this knowledge, you should feel comfortable in completing any assigned chemical survey mission. Remember, it's important that you seek additional information to become proficient in all facets of your mission.

Study Unit 4 Exercise Solutions

		References
1.	extent	4101
2.	point, route, and area	4103
3.	DA Form 1971-2-R	4103
4.	200 meters	4103
5.	drink lots of water/hydrate yourself	4104
6.	a. elevated body temperatures	4104
	b. rapid dehydration	
	c. mask will narrow your field of vision	
	d. wearing the hood impairs your hearing	
	e. wearing the mask makes speech difficult	
7.	a. subjective	4202
	b. objective	
8.	G and V series nerve agents, and H series blister agents	4203
9.	pink or red	4203
10.	12	4203
11.	blister, blood, and nerve agents	4203
12.	nerve, blister	4203
13.	monitor for effectiveness of decontamination	4203

NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) RECONNAISSANCE AND CONTAMINATION AVOIDANCE

REVIEW LESSON EXAMINATION

INSTRUCTIONS: The purpose of the review lesson is to prepare you for your final examination. We recommend that you try to complete your review lesson without referring to the text, but for those items (questions) you are unsure of, restudy the text. When you have finished your review lesson and are satisfied with your responses, check your responses against the answers provided at the end of this review lesson examination.

Select the ONE answer which BEST completes the statement or answers the item. For multiple-choice items circle your response. For matching items place the letter of your response in the space provided.

1. For NBC operations, who determines the team requirements and provides adequate time, necessary skills, and equipment for your team?

   a. Company commander
   b. Squad leader
   c. NBC officer
   d. Admin chief

2. As a monitor/survey team leader, the acronym BAMCIS will aid you in preparing for your mission. The letter "A" stands for "arrange reconnaissance." What information are you likely to study?

   a. Enemy troop activities
   b. Terrain, proposed routes, and NBC reports
   c. Situation and tactical maps
   d. Likely avenues of approach and NBC reports

3. Refer to the six troop leading steps. In what paragraph are you likely to perform pre-operational checks, inspect troops, and check equipment?

   a. **S**upervise
   b. **B**egin the plan
   c. **I**ssue the order
   d. **C**omplete the plan

4. Select the acronym that best identifies an operation order.

   a. SMEAC
   b. BAMCIS
   c. METT-T
   d. SALUTE

5. What is your first indication that a nuclear attack has occurred?

   a. Large dark mushroom cloud
   b. Brilliant flash and intense heat
   c. Loud explosion and shock waves
   d. Positive readings on M256 kit

6. What is the first step in performing immediate action when you are caught in the open during a nuclear attack?

   a. Cover all exposed skin
   b. Avoid looking into the flash
   c. Drop face down to the ground
   d. Seek immediate overhead cover

7. What defensive measures can you take for a nuclear attack when given a warning?

   a. Close your eyes and cover skin ground
   b. Place your weapon under your body
   c. Drop immediately, with your face to the ground
   d. Place your vehicle over a ditch and get in it

8. Following the employment of a nuclear weapon, how long should you remain on the ground?

   a. 30 seconds
   b. 45 seconds
   c. 60 seconds
   d. 90 seconds

9. List the primary means of delivery for a nuclear weapon.

   a. Artillery, rockets, and infantryman
   b. Rockets, motors, aircraft, and artillery
   c. Grenades, mortars, missiles, and aircraft
   d. Missiles, aircraft, artillery, and rockets

10. What are the three methods used to employ chemical agents?

    a. Mines, aircraft, and artillery
    b. Artillery, AT-4, and mines
    c. Bombs, rockets/missles, and tanks
    d. Artillery, bomblets, and grenades

11. List three indicators that alert you that a chemical or biological attack has occurred.

    a._____ b. _____ c. _____

12. As a pre-attack measure against biological agents, you should ensure that your team performs good hygiene, maintains a high state of physical fitness, and above all ensure that

    a. your team has had chow.
    b. all detection equipment has fresh batteries.
    c. your team lubricated their weapons.
    d. their immunizations are current.

13. What protective measures can you take to protect yourself during a biological or chemical attack?

    a. Don all your MOPP gear.
    b. Wear protective equipment, such as helmet and mask.
    c. Seek protective shelter.
    d. Get in the MOPP level equal to the threat.

14. When crossing radiologically contaminated terrain, it is important to

    a. use the shortest route.
    b. monitor radiation levels.
    c. open windows to increase ventilation.
    d. wear field protective mask to avoid particle inhalation.

15. Before crossing a radiologically contaminated area, instruct your team to sandbag the vehicle. This protects against mines, boobytraps, and

    a. large caliber indirect fire weapons.
    b. stabilizes the vehicle for accurate radiation detection.
    c. allows for more accurate readings.
    d. increases vehicle shielding.

16. When crossing a chemically contaminated area, you should attempt to avoid

    a. low lying areas.
    b. using high ground.
    c. trails and paths.
    d. moving upwind.

17. When positioning a contamination marker, ensure the marker is

    a. facing contamination, visible, and 50 to 200 feet apart.
    b. head level, facing away from contamination, 35 to 50 feet apart.
    c. easily visible from 200 feet away.
    d. facing away from contamination, about 25 to 100 feet apart.

18. Biological contamination markers can best be described as a

    a. blue triangle with the "BIO" written in red.
    b. red triangle with "GAS" written in blue.
    c. blue triangle with "GAS" written in red.
    d. yellow triangle with "BIO" written in red.

19. What information is required to be written on a radiological contamination marker?

    a. Dose rate, means of delivery, and time of burst
    b. Date and time of burst, dose rate, and vehicle CF
    c. Date and time of detection
    d. Date of detection, dose rate, and date and time of burst

20. Which of the following three methods is recommended for reporting findings on NBC attacks?

    a. Radio, field phone, messenger
    b. Field phone, messenger, written report
    c. Messenger, face to face report, radio
    d. Written report, field phone, radio

21. Which of the following methods is the most secure means for reporting NBC attacks?

    a. Messenger
    b. Situation report
    c. Field phone
    d. Spot report

22. Which report specifically addresses your monitor/survey findings?

    a. NBC-1
    b. NBC-2
    c. NBC-3
    d. NBC-4

23. In reference to message priorities, what precedence is an NBC-1 report sent?

    a. Routine
    b. FLASH
    c. Priority 2
    d. ASAP

24. The correct purpose for conducting a radiological survey is to

a. locate and determine the intensity of contamination.
b. locate and record the location of the explosion.
c. locate and calculate the correlation factor.
d. take protective action and evacuate casualties.

25. To avoid confusion and duplicate reports, the control center will assign special units to report nuclear attacks. These units are known as_____ .

a. NUDET teams
b. designated reporters
c. NUC recorders
d. designated observers

26. The acronym RAD means to measure _____.

a. dose rate
b. total amount of radiation received
c. RAD dose
d. low intensity radiation

27. What are the correct letters to indicate the function of RADIAC instruments?

a. RAD
b. RAM
c. ROENTGEN
d. RA

28. What is the correct method and unit of measure to calculate dose rate?

a. RAD
b. RAD/HR
c. cGy/HR
d. RAM

29. The amount of radiation received over a period of time is referred to as?

a. Dose rate
b. RAD/HR
c. Total dose
d. cGy/HR

30. Your team is driving through an area where the contamination is days old. You remain in the area 1.5 hours and the dose rate is 50 cGy/HR. Calculate the total dose.

a. 34 cGy/HR
b. 50 cGy/HR
c. 75 cGy/HR
d. 150 cGy/HR

31. Use the IM-143/PD to measure _____.

a. total exposure
b. dose rate
c. total dose
d. beta radiation

32. Use the PP-4276/PD in conjunction with the IM-143/PD to _____ and _____ the dosimeter.

a. illuminate, calibrate
b. zero, calibrate
c. repair, charge
d. zero, charge

33. Select the RADIAC instrument that measures high intensity, low intensity, and total dose radiation.

a. IM-143/PD
b. AN/VDR-2
c. AN/PDR-75
d. PP-4276

34. What are the two types of monitoring?

a. Timed and random
b. Dose rate and total dose
c. Periodic and intermittent
d. Periodic and continuous

35. What are the two types of monitoring techniques?

a. Shielded and unshielded
b. Direct and indirect
c. Inside and outside
d. Total dose and dose rate

36. Provided the following information, determine the correlation factor (CF).

ID = 2 cGy/HR OD = 10 cGy/HR

a. .2
b. .5
c. 5
d. 20

37. Which of the following radiological monitoring equipment do you use to measure low and high intensities of radiation?

a. AN/VDR-2
b. PP 4276
c. AN/PDR-75
d. IM-143/PD

38. What two automatic reports are you required to submit in conjunction with radiological monitoring?

a. General and contact dose rate
b. NBC-3 and NBC-4
c. Direct and indirect dose rates
d. Contact and peak dose rate

39. Which form is used to record monitoring results?

a. DA Form 1971-R
b. DA Form 1971-1-R
c. DA Form 1971-2-R
d. STANAG 1007-1-R

40. Which of the following best describes the factors for determining the number of personnel required to conduct ground and aerial surveys?

a. Situation, terrain, and available time
b. Terrain, available personnel, and nature of survey
c. Situation, available equipment, and terrain
d. Available personnel, available time, and terrain

41. The survey is generally performed by a group made up of a _____and one or more _____.

a. control center, survey parties
b. NBC officer, NBC NCOs
c. team, NBC NCOs
d. control party, commanding officers

42. What are the two control methods that a survey party uses to report survey results?

a. Direct and indirect methods
b. Centralized and decentralized methods
c. Consolidated and individualized methods
d. Detailed and simplified methods

43. Calculate the turn-back dose rate given the following information:

OEG = 50 DISTANCE = 30 KM SPEED = 30 KMPH

a. 50 cGy/HR
b. 75 cGy/HR
c. 90 cGy/HR
d. 100 cGy/HR

44. Which of the following best describes the equipment requirements for the survey party?

a. RADIAC meters, dosimeters, watches, and DA Form 1971-1-R
b. RADIAC meters, dosimeters, rifles, sandbags, and DA Form 1971-1-1-R
c. Situation, available equipment, and terrain maps
d. Available security personnel, RADIAC meters, and dosimeters

45. What are the two types of aerial radiological surveys?

a. Shielded and unshielded
b. Preselected and random
c. Direct and indirect
d. Detailed and simplified

46. What are the three survey techniques used for a detailed aerial survey?

a. Route, course leg, and point
b. Point, turn-back dose rate, and route
c. Course leg, preselected dose rate, and point
d. Preselected dose rate, point, and leg

47. According to the guidance of the survey party, the _____ the aircraft speed and the_____ the time interval between readings, the more _____ the results will be.

a. faster, longer, accurate
b. slower, shorter, accurate
c. faster, shorter, inaccurate
d. slower, longer, accurate

48. What form would you use when performing a ground survey using a route technique?

a. DA Form 1971-R
b. DA Form 1971-1-R
c. DA Form 1971-2-R
d. DA Form 1971-R-1

49. What are the three survey techniques used for a ground survey?

a. Point, vehicular, and route
b. Route, point, and preselected dose rate
c. Course leg, preselected dose, and point
d. Preselected dose rate, turn-back dose, and point

50. When obtaining a radiation level reading from a vehicle, you should

a. maintain steady speed, observe the meters, and record a high reading.
b. exit at least 10 meters, turn 360 degrees, and record the highest reading.
c. exit the vehicle at least 25 meters and take a high reading.
d. exit vehicle at least 10 meters and charge your dosimeter.

51. During a ground survey, how would you obtain the dose rate reading?

a. Take readings in the vehicle in a vertical position to the driver's seat.
b. Take readings in the vehicle and later convert them to a ground dose rate.
c. Taking the reading with the survey party consistently in the same place.
d. Taking dose rate reading during a ground survey by mounted personnel.

52. What term is used to describe the relationship of air dose rates and ground dose rates?

a. Altitude Ground Correction Factor
b. Atomic Gas Correction Factor
c. Air-Ground Correlation Factor
d. Air-Ground Containment Factor

53. How would you obtain the AGCF?

a. The numerical difference of two simultaneous readings in one area
b. The transmission factor of an aircraft during unstable flight
c. The ratio of a ground dose rate reading to an aerial dose rate reading
d. Readings taken in the air, on the ground, at the same time and vehicle

54. Biological agents are economical to produce, easily disseminated, and remain stable in storage. What characteristic is common only to biological agents?

a. Difficult to store
b. Infectious and virulent
c. Decay slowly and are stable
d. Affordable and easily disseminated

55. Which weather factor does **not** reduce biological agent concentration levels?

a. Sunlight
b. Relative humidity
c. Temperature gradient
d. Rain

56. Which of the following best describes the purpose of biological sampling?

a. Confirming an attack
b. Determining treatment
c. Estimating possible casualty population
d. Aid in identification of agent

57. What type of biological samples can be taken?

a. Interior and exterior
b. Liquid, solid, and soil
c. Solid, liquid, and surface
d. Waste, liquid, and solid

58. You are to obtain a surface sample using a culture tube with a transport medium. What pattern should you use and how large an area should you use to take your sample?

a. Square, 9 to 18 inches
b. S pattern, 9 to 12 square inches
c. Z pattern, 9 to 12 square inches
d. Circular, 9 to 12 square inches

59. Once a biological sample has been taken, it is important to remember to decontaminate used equipment with _____ for _____ minutes.

a. hot soapy water, 4
b. alcohol, 3
c. bleach and water solution, 5
d. DS-2, 3

60. Which of the following forms can only be used for reporting biological sampling?

a. DA Form 1971-6-R
b. SITREP
c. NBC-4 report
d. Biological sampling card

61. Unlike radiological surveys, chemical surveys can only determine the _____ of the hazard.

a. intensity
b. extent
c. position
d. persistency

62. The purpose for conducting a chemical monitor/survey mission is to determine the _____ in a particular area.

a. location of hazards
b. intensity of hazards
c. type of hazards
d. amount of hazard area

63. What are the important actions that the survey team should take in preparation for a chemical survey mission?

a. Perform preventive maintenance (PM) checks and study SOP
b. Attend the survey party briefing
c. Check and inspect the detection equipment and attend survey party briefing
d. Study commander's guide and perform PM checks on detection equipment

64. List the three types of chemical surveys.

a. Point, route, and area
b. Area, route, and preselected
c. Preselected, area, and point
d. Detailed, simplified, and preselected

65. Before executing a chemical survey, what is perhaps the single most important thing that you can do for yourself physically?

a. Get lots of rest
b. Eat prior to mission
c. Drink plenty of water
d. Take good notes at the team brief

66. You are a chemical survey team leader and must take into consideration the many variables that affect an individual's performance. One of these factors may be the

a. elevated body temperature.
b. types of agents encountered.
c. time of last rest period/meal.
d. length of time in protective equipment.

67. What two methods are available for the detection and identification of chemical agents?

a. Subjective and objective
b. Preselected and route
c. Direct and indirect
d. Detailed and simplified

68. What liquid chemical agents are detected by the M8 paper?

a. Blood, blister, and nerve
b. "H" series blister, blood, and nerve
c. Lewisite, "G" and "V" series nerve
d. "G" and "V" series nerve and "H" blister

(LAST PAGE OF THE REVIEW LESSON)

Review Lesson Solutions

		References
1.	c.	1102
2.	b.	1102
3.	a.	1102
4.	a.	1102
5.	b.	1201
6.	c.	1202
7.	d.	1203
8.	d.	1204
9.	d.	1205
10.	a.	1303
11.	Any three of the following are correct: An alarm Low flying aircraft flying perpendicular to wind direction Bombs that do not explode Unidentified smoke or mist An increase in sick, dead, or dying animals Blisters and welts Increase in number of insects	1301
12.	d.	1302
13.	a.	1304
14.	a.	1401
15.	d.	1401
16.	a.	1402
17.	d.	1501
18.	a.	1502
19.	d.	1502
20.	a.	1601
21.	a.	1601
22.	d.	1602
23.	b.	1605
24.	a.	2101
25.	d.	2102
26.	b.	2201
27.	a.	2202
28.	c.	2203
29.	c.	2203
30.	c.	2203
31.	c.	2204
32.	d.	2204
33.	b.	2204
34.	d.	2302

		Reference
35.	b.	2303
36.	c.	2304
37.	a.	2305
38.	d.	2306
39.	a.	2307
40.	a.	2401
41.	a.	2402
42.	b.	2403
43.	d.	2404
44.	a.	2405
45.	d.	2406
46.	a.	2406
47.	b.	2407
48.	b.	2408
49.	b.	2409
50.	b.	2409
51.	b.	2410
52.	c.	2412
53.	c.	2412
54.	b.	3101
55.	d.	3102
56.	d.	3201
57.	c.	3202
58.	c.	3204
59.	b.	3205
60.	d.	3206
61.	a.	4101
62.	b.	4101
63.	c.	4102
64.	a.	4103
65.	c.	4104
66.	a.	4104
67	a.	4202
68.	d.	4203

BIBLIOGRAPHY

SOURCE MATERIALS

C-77-260-000/MB-001 Operator's Manual Chemical Agent Monitor

FMFM 7-11-H Field Behavior of NBC Agents (Including Smoke and Incendiaries)

FMFM 11-17 Chemical and Biological Contamination Avoidance

FMFM 11-20 NBC Reconnaissance

NAVELEX 0969-130-8010 TM for charger, RADIAC Detector

TM 3-6665-307-10 Operator's Manual for the Chemical Agent Detector Kit

TM 3-6665-311-10 Paper, Chemical Agent Detector : M9

TM 11-6665-251-10 RADIAC Set AN/VDR-2

MARINE CORPS INSTITUTE
COURSE CONTENT ASSISTANCE REQUEST
MCI 57.14a NUCLEAR, BIOLOGICAL, AND CHEMICAL (NBC) RECONNAISSANCE AND CONTAMINATION AVOIDANCE

Use this form for questions you have about this course. Write out your question(s) and refer to the study unit, lesson exercise item, or the review lesson exam item you are having a problem with. Before mailing, fold the form and staple it so that MCI's address is showing. Additional sheets may be attached to this side of the form. Your question(s) will be answered promptly by the Distance Training Instructor responsible for this course.

NAME	RANK	MOS

COMPLETE MILITARY ADDRESS (INCLUDING RUC IF KNOWN)

TELEPHONE NUMBER

DSN COMMERCIAL (Area Code)

YOUR QUESTION:

INSTRUCTOR'S RESPONSE:

MARINE CORPS INSTITUTE
COURSE EVALUATION QUESTIONNAIRE
MCI 57.14a Nuclear, Biological, and Chemical (NBC) Reconnaissance and Contaimination Avoidance

Directions:

This questionnaire is extremely important to the Marine Corps Institute. The course you have just completed has undergone extensive development and revision. As an integral part of the continued success of this course, YOUR HELP IS NEEDED. By completing this questionnaire, your responses may result in a need to review the course.

Please take five minutes to complete the questionnaire and return it to MCI in the self-addressed envelope provided with your course materials. Additional comment sheets may be attached to this questionnaire. If you want to be contacted by the course instructor, please provide your name, rank, and phone number. Regardless of whether you want to be contacted or not, please enter your primary military occupational specialty (MOS).

Information About YOU:

Name (Optional)	Rank	MOS

Telephone Number (Optional)	
DSN	Commercial (Area Code)

Information About the COURSE:

1. How long did it take you to complete this course including the review lesson examination?
   ___ Less than three hours
   ___ Three to six hours
   ___ Seven to ten hours
   ___ Eleven to fourteen hours
   If more than fifteen hours enter number of hours here: _____

2. Were the learning objectives stated at the beginning of each lesson clear? (Circle your response)

   a. Yes b. No

   If you circled "NO" please list below the study unit and lesson number for those unclear objectives.

MARINE CORPS INSTITUTE
COURSE EVALUATION QUESTIONNAIRE

Information About the COURSE (continued):

3. Did the figures, that is illustrations, photographs, tables, charts, etc., clearly support the information/text within the lesson? (Circle your response)

   a. Yes b. No

   If you circled "NO" please list the figure or table number(s) below.
   _____ _____ _____ _____ _____ _____ _____ _____

4. Did the exercise at the end of a lesson or study unit test your skills and knowledge gained by studying the lesson? (Circle your response)

   a. Yes b. No

   If "NO" please list the exercise question/item number, the lesson number, and the study unit number below. (Attach additional sheet, if necessary)

Question Number	Lesson Number	Study Unit Number
_____	_____	_____

5. When you read the lesson the first time, did it make sense to you? (Circle your response)

   a. Yes b. No

   If "NO" please list the lesson number and/or paragraph number below.
   _____ _____ _____ _____ _____ _____ _____ _____

6. Would you recommend that a revision be made to any portion of this course? (Circle your response)

   a. Yes b. No

   If "YES", is your recommendation based on (check all that apply):

   ___ Outdated procedures or process. Enter Study Unit Nos. ____
   ___ Outdated equipment or material. Enter Study Unit Nos. ____
   ___ Information not accurate. Enter Study Unit Nos. ____
   ___ Other (Please describe)

7. Comments: Please attach separate sheet.

MARINE CORPS INSTITUTE--STUDENT REQUEST/INQUIRY-MCI - R-11 (3/96)

MCI 57.14a
Nuclear, Biological, and Chemical (NBC) Reconnaissance and Contamination Avoidance DATE:_____

SECTION 1. STUDENT IDENTIFICATION

INSTRUCTIONS: Print or type clearly:
(Section 1. Information is needed by MCI to act/respond to input provided in Section 2.)

RANK	FIRST NAME MI. LAST NAME	MOS	RUC	SOCIAL SECURITY NO.

MILITARY ADDRESS (INCLUDE ZIP CODE) (Reservists may use civilian address)

SECTION 2. STUDENT REQUEST/INQUIRY

INSTRUCTIONS: Complete only those sections requiring an action/response from MCI.

	FROM:	**TO**:
CHANGE	NAME:	NAME:
	RANK:	RANK:
	SSN:	SSN:
	RUC:	RUC:

The following materials are needed:

Lessons:
Manual:
Answer Sheets:

Others:

Final Exam Overdue:
Lesson sent to MCI on _____

Missing Diploma or Completion Certificate:
The course or program was completed
(day) _____ (month) _____ (year) _____

Exam sent to MCI on _____

Request Extension _____

(Students are only eligible for one extension prior to their Course Completion Date (CDD))

Request Reenrollment _____

(Students are only eligible for reenrollment once and only after their CDD. If already reenrolled and disenrolled, a new enrollment must be requested)

Request New Enrollment _____

OTHER Requested Action:

AUTHORITY: Title 5, USC, Sec. 301. Use of your Social Security Number is authorized by Executive Order 9397 of 22 Nov 43.
PRINCIPAL PURPOSE: The Student Request/Inquiry is used to transmit information concerning student participation in MCI courses.

ROUTINE USES: This information is used by MCI personnel to research student inquiries. In some cases information contained therein is used to update individual student records maintained by the Marine Corps Institute.

MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION: Disclosure is voluntary. Failure to provide information may result in the provision of incomplete service to your inquiry. Failure to provide your Social Security Number will delay the processing of your request/inquiry .

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