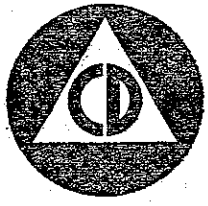
SM–11.21.1
MAY 1963

RADIOLOGICAL MONITORING STUDENT WORKBOOK



DEPARTMENT OF DEFENSE

OFFICE OF CIVIL DEFENSE

CONTENTS

NOTE TO THE INSTRUCTOR

This Student Workbook includes the necessary materials needed by each student during the conduct of the Radiological Monitoring course. It also includes an examination, and a Certificate, which should be removed from the Workbook before it is issued to a student. All pages are perforated for easy removal.

Quantities of this Student Workbook should be requested through the local or State Office of Civil Defense.

LESSON PLAN TITLES AND SCOPES

RADIOLOGICAL MONITORING

PART I—Training required to provide the basic fundamentals of radiological monitoring.

Unit 1

Hours

INTRODUCTION—Lesson Plan No. 1 ..... .25

Welcome; scope, purpose, sequence and length of the course; standards of instruction; general concepts of radiological defense; and students' potential contribution as radiological monitors.

NUCLEAR WEAPONS EFFECTS—Lesson Plan No. 2 ..... 1.25

Radioactivity; types of nuclear radiation; effects of nuclear weapons with emphasis on fallout; terminology, to include dose, dose rate, and roentgen.

OPERATION PROSPECT (Exercise)—Lesson Plan No. 3 5

Practical exercise in locating simulated contaminated areas, using the CD V–700.

Unit 2

CIVIL DEFENSE RADIOLOGICAL INSTRUMENTS—Lesson Plan No. 4 ..... 2.0

Types of instruments; elementary theory of operation; battery installation, operational check, operating characteristics, care and maintenance, uses and limitations with particular emphasis on reading of the instruments.

Unit 3

INSTRUMENT FAMILIARIZATION (Exercise)—Lesson Plan No. 5 5

Familiarization with the CD V–700 to include use of range switch, conversion of meter readings to measured dose rates.

RADIOLOGICAL MONITORING TECHNIQUES—Lesson Plan No. 6 ..... 1.5

Types and techniques of monitoring to include area, food, water, personnel, and monitoring from public shelters and fallout monitoring stations.

Unit 4

PROTECTIVE MEASURES—Lesson Plan No. 7 5

Radiation hazards; individual and collective protective actions; typical fallout shelters; protection of food, water, and equipment; and exposure limits.

AREA MONITORING (Exercise)—Lesson Plan No. 8 ..... .75

Practical small area monitoring experience, using the CD V–700.

MONITORING OPERATIONS—Lesson Plan No. 9 ..... .75

Peacetime, shelter, and fallout monitoring station operations, and monitoring in support of emergency operations.

PART II—Additional training needed by the monitor to enable him to provide the radiological defense guidance required by shelter managers or heads of emergency operating crews when they are not under the supervision of a control center.

	Hours
Unit 5	
EFFECTS OF FALLOUT AND RADIATION EXPOSURE GUIDANCE—Lesson Plan No. 10	1.5
Biomedical aspects of nuclear radiation to include the radiation syndrome, biological variability and repair, and required medical care; emergency exposure criteria, and guidance for independent shelter operations.	
DECONTAMINATION—Lesson Plan No. 11	.5
Principles of food, water, equipment and personnel decontamination.	
Unit 6	
DOSE AND DOSE RATE CALCULATIONS—Lesson Plan No. 12	1.0
Use of nomograms for computing dose, dose rate, and entry time.	
RADIATION PROTECTION (Exercise)—Lesson Plan No. 13	1.0
Practical exercise demonstrating the relationship of time and shielding as radiation protective measures, use of dosimeters for taking dose rate measurements, and determination of protective factors.	
Unit 7	
STANDING OPERATING PROCEDURES—Lesson Plan No. 14	.5
Specific and detailed radiological defense operational procedures outlined in the local SOP. These procedures will vary with each locality and level of government.	
STUDENT PROFICIENCY (Exercise)—Lesson Plan No. 15	1.5
Practical exercise in using the CD V–700, with emphasis on verifying the accuracy of readings.	
Unit 8	
COURSE REVIEW—Lesson Plan No. 16	1.0
Review of all course materials and clarification of student concepts and questions.	
COURSE EXAMINATION—Lesson Plan No. 17	1.0
Written examination to determine student understanding of radiological concepts, techniques, and terminology, and a graded practical exercise to determine student proficiency in typical situations involving the use of radiological equipment.	
Total	16.0

PART III—Subsequent training by the local Radef staff required to maintain an acceptable level of competence.

Unit 9	
REFRESHER TRAINING—Lesson Plan No. 18	2.0
Structured periodic review to maintain monitors at an acceptable level of proficiency.	

RADIATION EXPOSURE RECORD

Name _____

Age _____ Date of Birth _____

Social Security Number _____ Dosimeter Serial No. _____

Date	Initial Reading	Final Reading	Dose

Date _____ Total Exposure _____

Signature _____

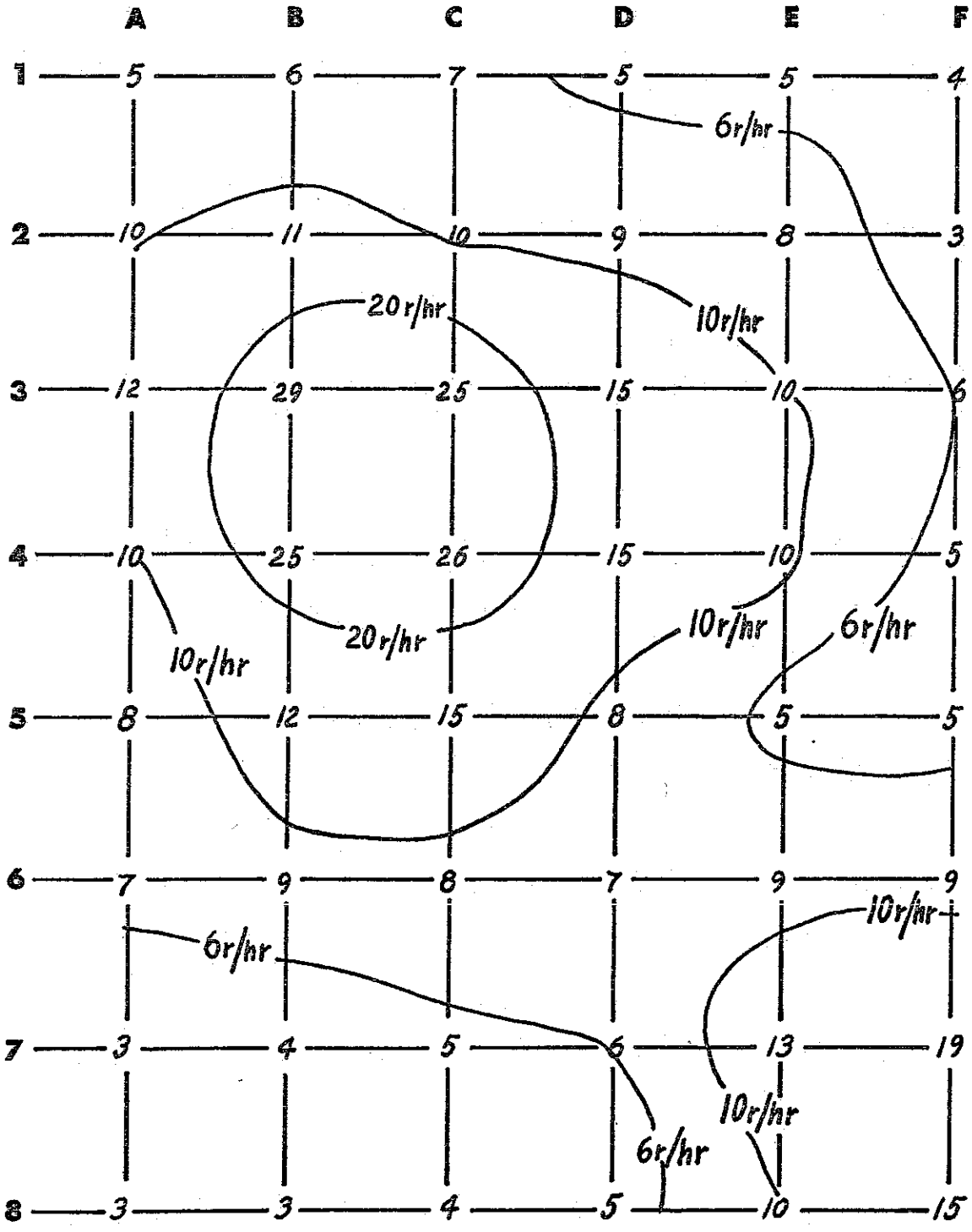
WORKSHEET FOR
OPERATION PROSPECT EXERCISE

SOURCE	LOCATION OF SOURCE
0	(Base of fire hydrant)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

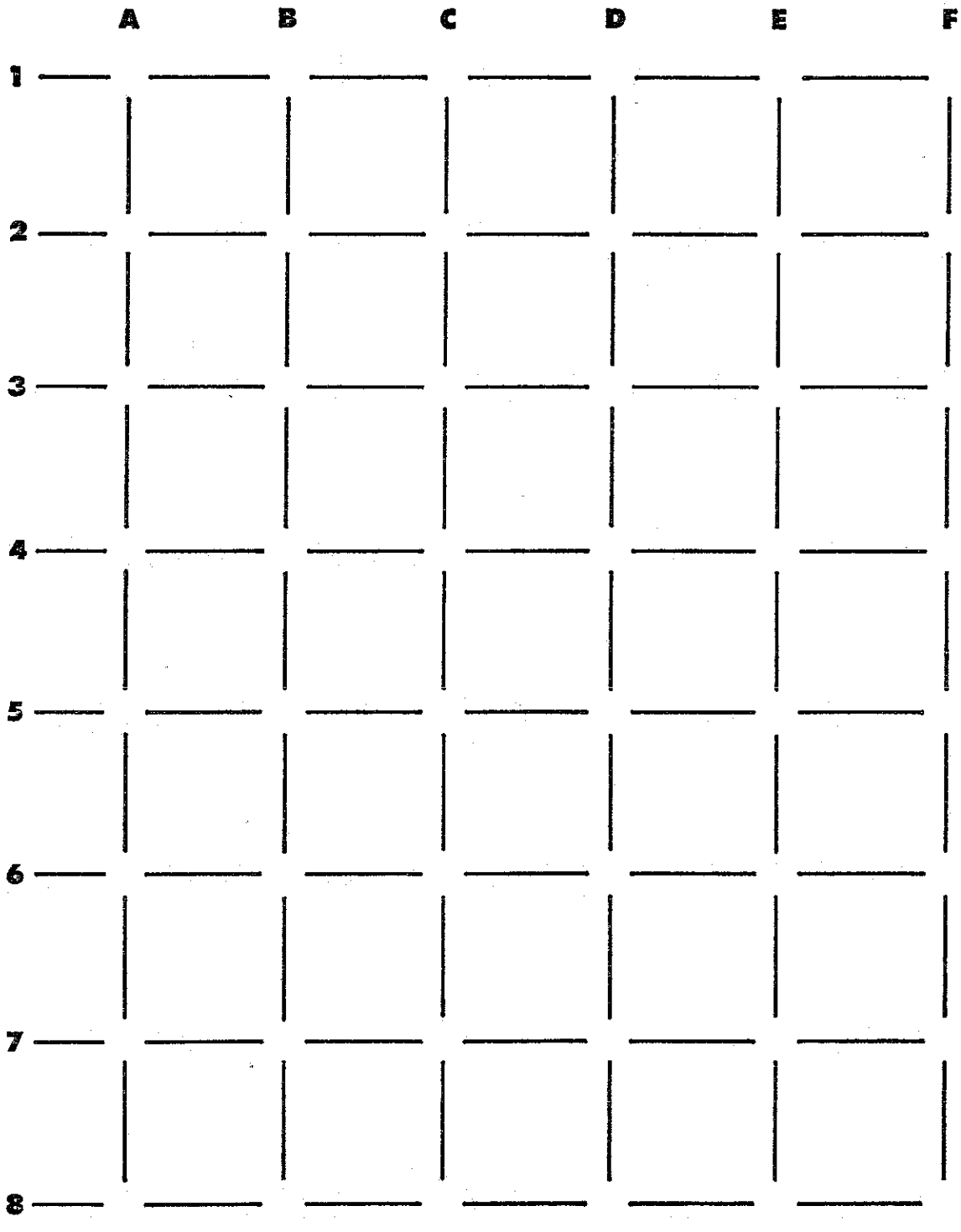
WORKSHEET FOR INSTRUMENT FAMILIARIZATION EXERCISE

DISTANCE (FEET)	RANGE	×	METER READING	=	MEASURED DOSE RATE (mr/hr)
1		×		=	
2		×		=	
3		×		=	
4		×		=	
5		×		=	
6		×		=	
8		×		=	
10		×		=	
12		×		=	
14		×		=	
16		×		=	
18		×		=	
20		×		=	
		×		=	
		×		=	
		×		=	
		×		=	
		×		=	

SAMPLE WORKSHEET
FOR
AREA MONITORING EXERCISE



WORK SHEET
FOR
AREA MONITORING EXERCISE



DOSE AND DOSE RATE PROBLEMS

Dose Rate Problems

1. If the dose rate at one hour after burst is 40 r/hr, what will be the dose rate at 2, 4, 6, 8, and 10 hours?
2. If the dose rate at H+1 is 100 r/hr, what will be the dose rate at 2, 4, and 10 hours?
3. If the dose rate at H+1 is 350 r/hr, what will be the dose rate at 5, 8, and 12 hours?
4. If the dose rate at H+6 was 45 r/hr, what would be the dose rate at 1, 9, 12, and 15 hours?
5. If the dose rate at H+12 was 80 r/hr, what would be the dose rate at 1, 16 and 24 hours?
6. If the dose rate at H+20 was 10 r/hr, what would be the dose rate at 1, 20, 25, and 32 hours?
7. If the dose rate at H+30 is 10 r/hr, when would the dose rate be 7 r/hr?
8. At H+20 days the dose rate in an area is 3 r/hr. What will be the dose rate at H+25 days?
9. In a sheltered area with a protection factor of 100, the dose rate is 10 r/hr at H+10. What will be the unsheltered dose rate at H+18?
10. In a sheltered area with a protection factor of 1,000, the dose rate at H+24 is 15 r/hr. What will be the dose rate in the shelter at H+40?

Dose Problems

11. If the dose rate at H+1 was 200 r/hr, what would be the dose of a monitor if he entered the area at H+12 and stayed 4 hours?
12. If the dose rate at H+1 was 50 r/hr, what would be the dose of a monitor if he stayed in this area from H+5 to H+8?
13. If the dose rate at H+1 was 500 r/hr, what would be the total dose of a monitor who remained in this area for a 1.5 hour period beginning at H+12?
14. What would be a monitor's dose if he entered an area at H+6 and left at H+8? At the time of entry, the dose rate was 15 r/hr.
15. Firemen must put out a fire in an area where the dose rate was 50 r/hr at H+7. What will be their mission dose if it takes 6 hours to fight the fire and they start their mission at H+12?
16. Vital medical supplies must be moved to a shelter area. The task will require 30 minutes. If the worker enters the area at H+6 when the dose rate is 200 r/hr, what dose will he receive?
17. An individual left a shelter at H+6 on a mission to a nearby shelter but never arrived at the other shelter. At H+30 a rescue team found him unconscious in the contaminated area outside the original shelter. At that time, the dose rate was 14 r/hr. What dose was received by the unconscious individual?
18. A rescue team entered a contaminated area at H+12 and accomplished a task in 4 hours. What was their dose if the dose rate at time of *exit* was 12 r/hr?
19. No water is available in a shelter. There is a safe supply nearby. It is a 45-minute walk *to the water* and the mission will begin at H+10. If the dose rate at H+7 was 30 r/hr, what dose will be received in obtaining the water for the shelter?
20. What is the dose received in a shelter from H+18 to H+24, if the unsheltered dose rate at H+16 is 120 r/hr and the shelter protection factor is 200?

Entry Time Problems

21. If the dose rate in an area was 300 r/hr at H+1, when can a monitor enter the area for a 3-hour stay and receive less than 50 r?

22. A monitor must stay in an area for 1 hour. The dose rate in this area at H+1 was 150 r/hr. He must limit his dose to 15 r. When can he enter?

23. In order to keep a monitor's dose below 20 r for a stay time of 2 hours, what is the earliest possible entry time into an area where the dose rate was 120 r/hr at H+1?

24. If the dose rate in an area is 5 r/hr at H+20 and an individual must stay there 3 hours, what is the earliest time he can enter and not exceed a dose of 10 r?

25. A mission dose is set at 35 r. The dose rate in the area was 18 r/hr at H+15. When can workers enter this area for a 3-hour period?

26. The task of removing valuable equipment which is located in a contaminated area will require 3 hours. The mission dose is set at 50 r and the dose rate at H+9 was 50 r/hr. When can the salvage crew enter the area?

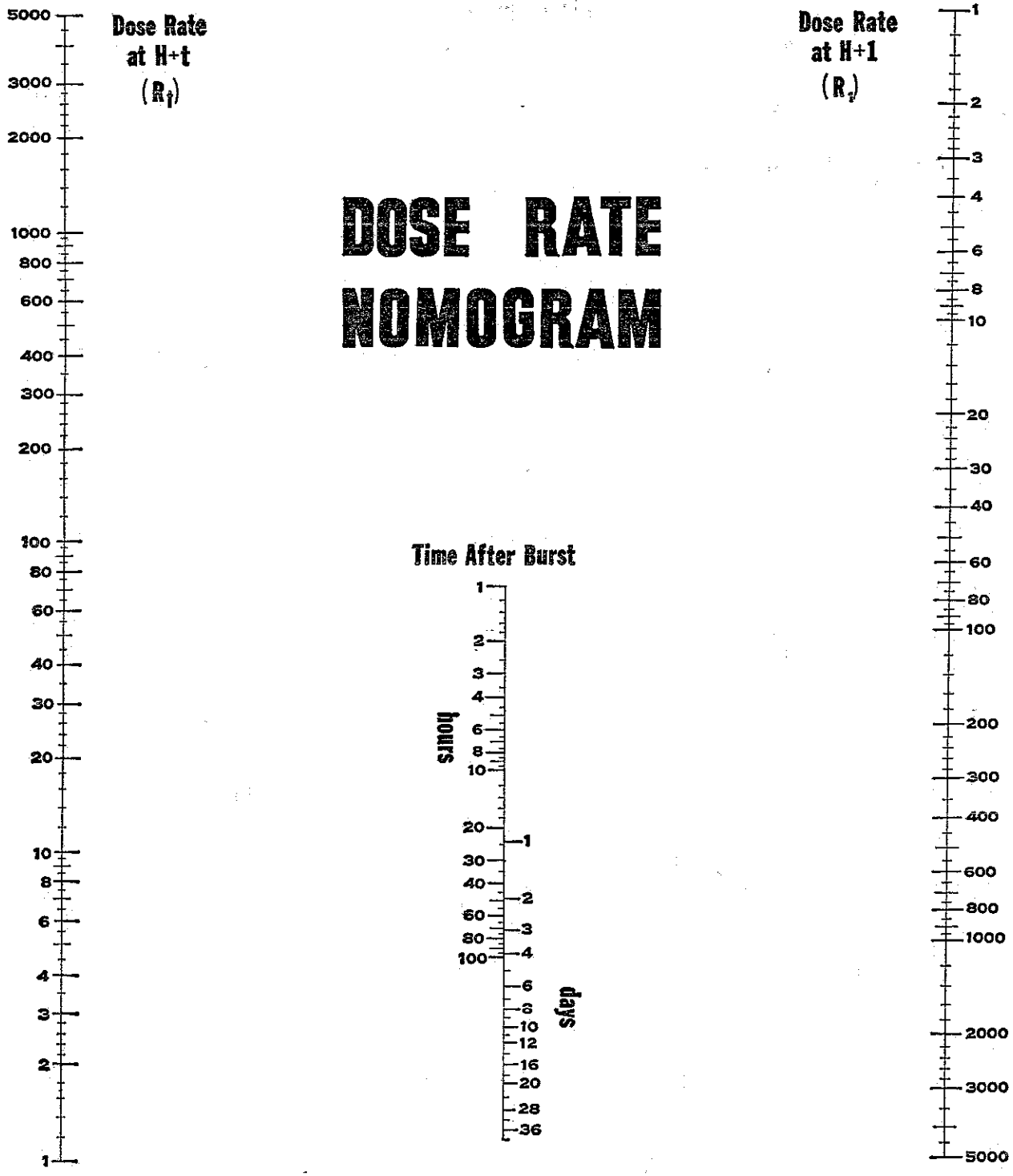
27. A monitor must make a survey of an area which will require 2 hours. The mission dose is set at 35 r and the dose rate in the area was 18 r/hr at H+1 day. When will the monitor be able to enter the area?

28. People want to move from an improvised shelter to a community shelter. At H+6 the route to be traveled had an average dose rate of 85 r/hr. The trip will take 2 hours and the mission dose is 50 r. When can they leave?

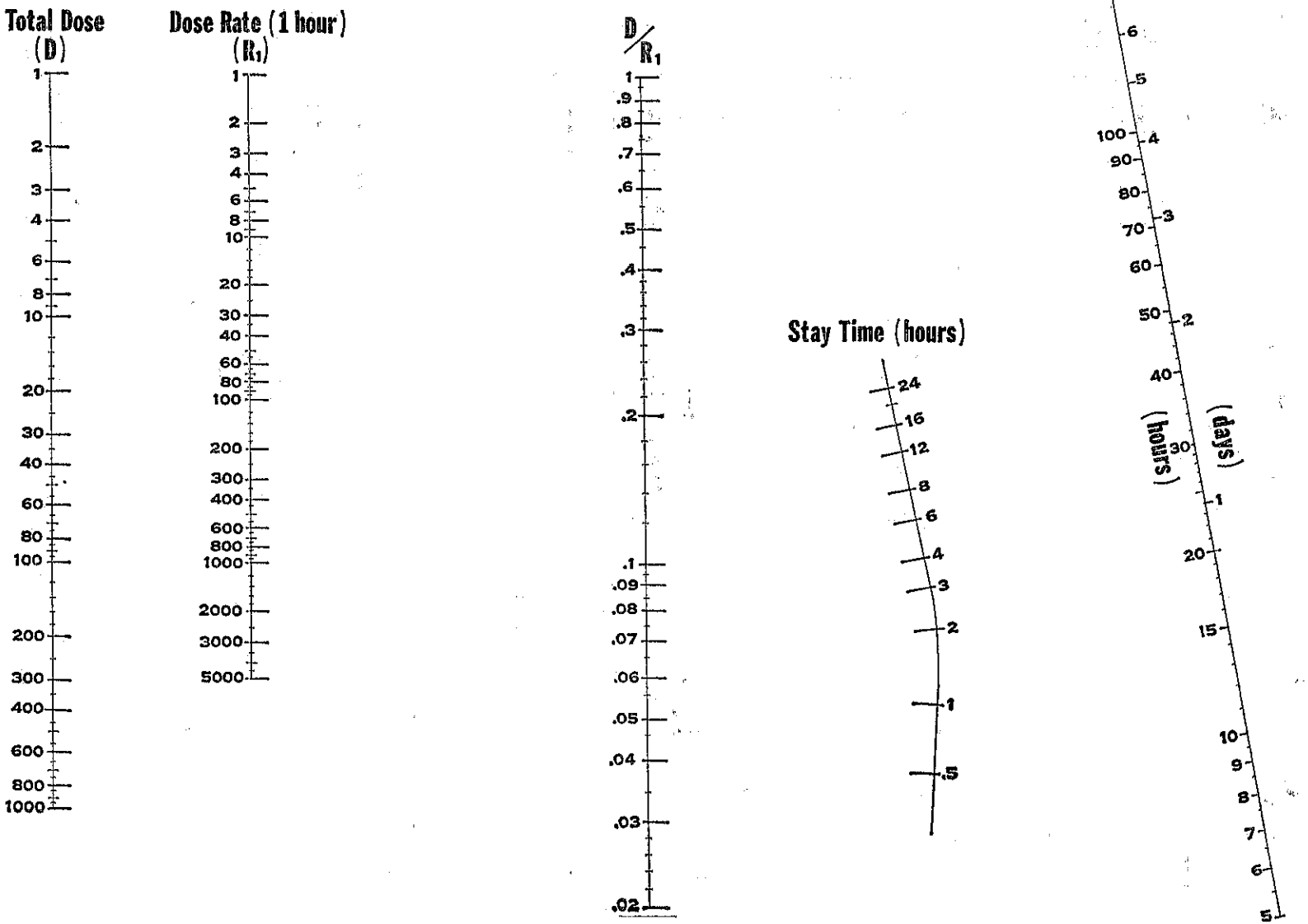
29. A supply of drugs must be delivered as soon as possible to a shelter. The drive takes 3 hours. The average dose rate along the route to be followed was 125 r/hr at H+4. The mission dose is 75 r. What is the earliest time that the drugs can arrive at the shelter?

30. A shelter with a protection factor of 500 is running low on food. The nearest supply would require 1 hour round trip travel to obtain it. The average dose rate over the route to be traveled was 60 r/hr at H+7. The mission dose is set at 50 r. When can the mission be started to obtain the food?

DOSE RATE NOMOGRAM



ENTRY TIME - STAY TIME TOTAL DOSE NOMOGRAM



WORKSHEET FOR RADIATION PROTECTION EXERCISE

STATION A

TIME	DOSIMETER READINGS	AVERAGE READING	SURVEY METER READING

STATION B

SHIELDING MATERIAL	DOSIMETER READINGS	AVERAGE READING	% REDUCTION

STATION C AND D

Inside dose rate (Station C)=
Outside dose rate (Station D)=
Protection factor=

WORKSHEET FOR STUDENT PROFICIENCY EXERCISE

DISTANCE (FEET)	1ST DOSE RATE MEASUREMENT mr/hr	CALCULATED DOSE RATE mr/hr	2ND DOSE RATE MEASUREMENT mr/hr
1			
2			
3			
4			
5			
6			
8			
10			
12			
14			
16			
18			
20			

(For use by those local organizations which do not have certificates)

This is to certify that

_____

Has successfully completed the course

RADIOLOGICAL MONITORING

Conducted by

_____

On

_____

_____	_____
INSTRUCTOR	AUTHORIZING OFFICIAL
_____	_____
INSTRUCTOR	TITLE

U.S. GOVERNMENT PRINTING OFFICE:1963