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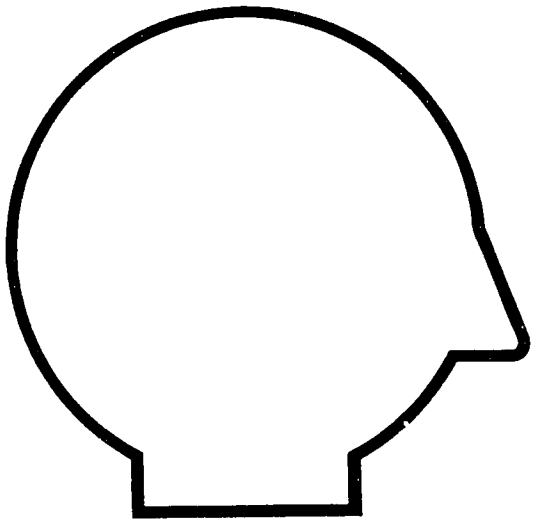
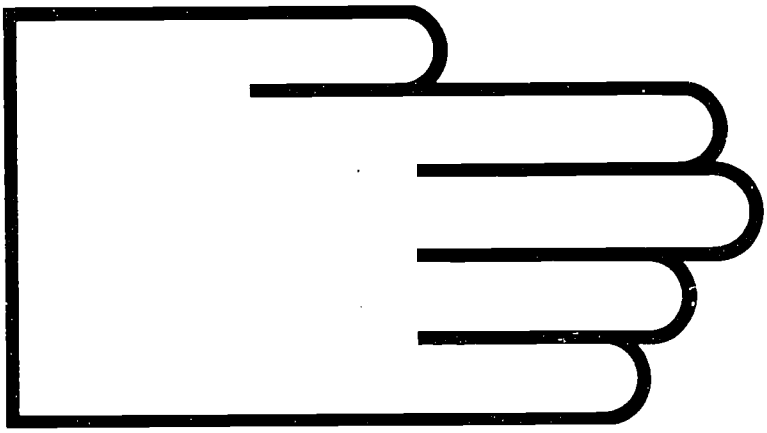
ABSTRACT

This module, one of 25 on vocational education training for careers in environmental health occupations, contains self-instructional materials on collecting samples of workplace air. Following guidelines for students and instructors and an introduction that explains what the student will learn are three lessons: (1) collecting information about sampling conditions and about the individual being sampled: (2) positioning an air sampling train on an individual so that a representative sample can be obtained while allowing the worker freedom of movement: and (3) adjusting the pump flow over the sampling period and determining if and when a new sampling device may be needed. Each lesson contains objectives, recommended methods and locations for practice, performance criteria, equipment and supplies to perform a task, detailed step-by-step instructions for learning a task, and performance exercises. Performance tests cover the subject matter of each lesson. (CT)



Collecting Samples of Workplace Air



Module 8

U.S. DEPARTMENT OF EDUCATION, Office of Vocational and Adult Education

FOREWORD

The Curriculum and Instruction Branch of the Office of Vocational and Adult Education, U.S. Department of Education, identified a need to improve the training opportunities for vocational education students interested in pursuing careers in environmental health. To fulfill that need, Consumer Dynamics, Inc., a Rockville, Maryland, based company, was awarded the contract to develop performance-oriented, competency-based modules in the environmental health sciences.

COLLECTING SAMPLES OF WORKPLACE AIR is one of the modules in the series, "Vocational Education Training in Environmental Health Sciences." The module content is based on selected materials in the environmental health field. The module is intended to supplement existing course materials.

CONTENTS

USING THESE SELF-INSTRUCTION MATERIALS

This self-instruction learning package or module is designed to allow both students and instructors flexibility of use. Although primarily intended for use in existing training programs, the module can be used by anyone interested in learning new skills or perfecting old ones. Therefore, two sets of guidelines are presented, one set addressed to students and the other set addressed to instructors. First, find out how you, the student, should use the materials in this book.

GUIDELINES FOR STUDENTS

Take the Performance Test as a pretest.

When you pick up this book and work through it, your goal is not a letter grade or a high score on an exam. Instead, you will work to develop skills that you can measure. You will not have to worry about how well someone else is doing. Before you start work on this book, you should already be able to demonstrate skills necessary to calibrate and use a personal sampling pump and sampling trains for sampling with respirable dust devices, charcoal tubes, and midget impingers. You should also be able to read dry bulb and wet bulb thermometers. To collect longperiod samples of the air workers breathe, you will not be required to determine the sampling strategy. This will be done by a trained industrial hygienist or safety specialist. If you already have experience in collecting long-period air samples, you may want to find out if you have sufficient skills to bypass the training in this module. If so, turn to the section called PERFORMANCE TEST. Read through it. If you think you can perform each item as specified, ask your instructor to obtain the necessary equipment and supplies so that you can demonstrate your skill level.

Work on parts you need to practice.

If you do everything well, according to the criteria in the Performance Test guidelines, you will not need to spend time working on this module. If, after taking the Performance Test you discover there are parts of the module you need to practice, follow the key to each item in FOR FURTHER STUDY.

Work straight through each lesson in the order presented.

Should you decide to completely work through this book, begin with the INTRODUCTION and go straight through each of the three lessons. The lesson begins with the OBJECTIVE of the training. Follow the instruction for each part in the order

presented. Practice each step in a lesson until you can do it according to the criteria stated for the step. At the end of a lesson, do the EXERCISES. When there are audiovisuals listed at the end of a lesson, ask your instructor for help in obtaining them.

Take the Performance Test as a posttest.

Finally, after you have mastered the exercises, ask your instructor to determine if you have properly collected information about the worker and the sampling conditions, to watch you position and attach the sampling train on a worker, and to observe whether you have correctly monitored the operation of the sampling equipment. The guidelines in the Performance Test can be used as a posttest to evaluate the quality of your performance. Turn now to the Performance Test to test your skills prior to training.

GUIDELINES FOR INSTRUCTORS

Approach

The approach of these materials is to provide the student with training opportunities for collecting a representative sample of the air a worker breathes over a period of several hours. The lessons are sequential in that the information presented in the previous lesson serves as a basis of skill development in a later lesson. Exercises are provided to guide the student's practice of the procedures presented in GETTING THERE--STEPS.

Use of the Performance Test

A performance test is provided to serve as a guide to the skill development progress. If a student is able to demonstrate skill development by meeting the criteria for performance given in each test item, further study is not needed. Therefore, the student should be given the option of entering training at any point. To determine at what point to start, the student should take the performance test as a pretest. At any time during the course of study the student should also be allowed to test out of the remaining portions of training.

Also, the student's capability to accurately complete the entire task in a timely manner can be evaluated by using the performance test as a posttest.

USING THESE SELF-INSTRUCTION MATERIALS

Independent Study	This module is designed to enable the student to work independently under whatever time constraints you deem reasonable. However, depending on the skill level of the students with whom you are working, you may find it desirable to start a group together at the same time with a demonstration and informal presentation on the contents of the module.
As a Laboratory Workbook	Alternatively, you may choose to use this module as a laboratory workbook in a structured laboratory session. With this option, you allow students greater access to your assistance.
General Instructions	Read through each lesson to anticipate what equipment and supplies you will need to make available for students to use. Also, order any audio-visuals or reading materials you think may present a complementary perspective to the training in this module.

INTRODUCTION

BACKGROUND

In nearly every industrial operation, the possibility exists that a worker may be exposed to potentially harmful airborne substances, including vapors, gases, fumes, mists, and particulates or dusts. To determine how much of what substance a worker is exposed to during an 8-hour workshift, a personal air sampling pump fitted with a sampling device is attached to the worker. At the end of the sampling period, the sampling train is removed from the worker and the sampling media prepared for analysis by a laboratory.

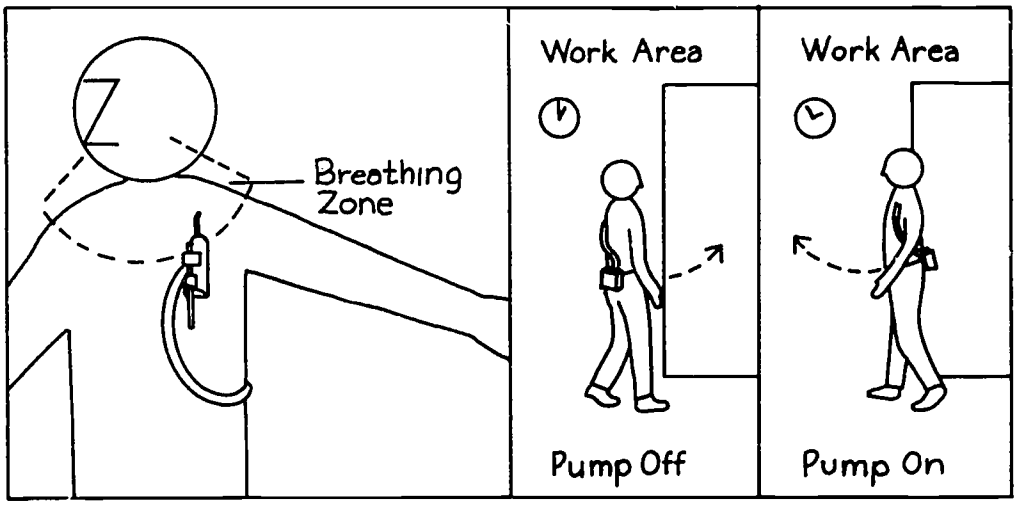
There is much more to collecting samples of workplace air than merely attaching a sampling pump and device to a worker's clothing. The airflow that the pump draws through the sampling device must be calibrated to a recommended flow rate and maintained at that flow throughout the sampling period. This means that the operation of the pump and sampling device must be periodically monitored and adjusted to compensate for the charging characteristics of the sampling pump and for loading of solid contaminants on the filter media. Either the sampling device and/or the sampling pump must be replaced when the pump can no longer be readjusted to the desired flow.

In collecting long-period samples of workplace air, information must also be collected concerning the worker's job activities, working conditions, equipment being operated, and the sampling conditions. The industrial hygienist or safety professional with whom you work will determine how much of this information you will need to collect.

Your primary responsibilities probably will be limited to obtaining basic information about the worker, working conditions, and the operation or process; attaching or "hanging" the sampling pump to the worker; monitoring the operation of the sampling train; and preparing the samples and blanks for shipment to a laboratory.

WHAT YOU WILL LEARN

When you finish working through the steps and exercises in this book, you will be able to collect a sample of the air a worker breathes over a period of several hours, and to obtain the necessary information to verify the sampling conditions.



You will learn how to obtain the sample and information about the sampling conditions and prepare the sample for analysis in three lessons:

- Lesson One

  You will be able to collect information about sampling conditions and about the individual being sampled.

- Lesson Two

  You will be able to position an air sampling train on an individual so that a representative sample can be obtained while allowing the worker freedom of movement.

- Lesson Three

  You will be able to adjust the pump flow over the sampling period, and determine if and when a new sampling device may be needed.

LESSON ONE

OBJECTIVE

You will be able to collect information about sampling conditions and about the individual being sampled.

WHERE AND HOW TO PRACTICE

Since you will be working with air sampling equipment in later lessons, your study of this lesson can be done in the equipment laboratory used by your class. After reviewing each step, work through the exercises at the end of the lesson. The exercises will require you to work with another person for practice of this lesson to be effective. To help you learn each item of information you will need to obtain, make a list using the categories included in the steps. Use the list in working through the exercises. Ideally, you should practice this and the other lessons in this book in an actual industrial workplace, although it is not essential to do so in order to learn the skills you will need to meet the lesson objectives.

HOW WELL YOU MUST DO

You must be able to list all of the information you will need to collect without using the list you will make to work through the exercises. You must also be able to read dry and wet bulb temperatures to within $\pm$ 0.5C^{o}.

THINGS YOU NEED

To work through the steps and exercises in this lesson, you will need the following:

- o paper and pencil
- o clipboard (if practicing in an actual workplace)
- o dry bulb and wet bulb thermometers.

Instructions: Now turn to the next page and begin work on Lesson One, "Getting There--Steps."

GETTING THERE--STEPS

STEP 1

When you first arrive in the workplace to take personal air samples of the air a worker breathes over a 2-, 4-, or 8-hour period, you must first record and/or collect information about:

- o the workplace conditions
- o the process, operation, and equipment
- o the worker being monitored
- o the sampling equipment being used.

KEY POINT 1

Obtain information before setting up equipment or taking samples.

STEP 2

First, obtain information about the WORKPLACE CONDITIONS. In the area where the worker you will be monitoring works, note the presence of:

- o visible dusts
- o visible mists
- o strong or unusual odors
- o strong drafts

Also determine the temperature and humidity of the area you will be sampling. Record the information in a small notebook or on a sheet of paper that you will also use to write information about the worker and sampling equipment being used.

KEY POINT 2

Describe the WORKPLACE CONDITIONS.

STEP 3

In your notebook, describe the PROCESS, OPERATION, and EQUIPMENT the worker runs or operates if this was not already done by the industrial hygienist or safety specialist who performed the preliminary survey. Record the following:

- o the name or type of process or operation
- o the name, model, and date equipment was manufactured
- o what product and how much is made with the process equipment
- o what raw ingredients are fed into the equipment, and how often
- o the means by which raw materials are added, such as batch feeding with hand-held containers, handloading materials directly into the equipment, or conveying materials through transfer lines from covered containers
- o how the equipment is cleaned, maintained, and repaired, and by whom
- o whether there are large, medium, or light accumulations of dusts, residues, or liquids on the equipment, floors, ceilings, or walls
- o what kind of ventilation equipment (general or local) is currently available and whether it is being used.

KEY POINT 3

If detailed information about the process or operation was not collected by the industrial hygienist or safety specialist, you will need to obtain it.*

*Whether you will be asked to collect this information depends on the amount of industrial health training you have received.

STEP 4

Record in your notebook the following information about the WORKER BEING SAMPLED:

- o name and social security number or company number
- o occupation or title
- o a description of each task the worker performs in which aerosols* and vapors are produced
- o a description of how long a task takes and how often it is performed.

Other information regarding the worker's personal habits, including smoking, washing after working, and the use of personal protective equipment, will not be collected at this time.

KEY POINT 4

Identify the worker and what that individual does on a routine basis.

STEP 5

Record in your notebook the following information about the SAMPLING EQUIPMENT you are using:

- o pump, manufacturer, model, and serial number
- o the type of sampling device used
- o the date and flow rate at which the pump and selected sampling device was calibrated.

KEY POINT 5

Identify the sampling pump, type of sampling device, and calibration data.

*Airborne particles or droplets.

EXERCISES

Instruction 1: Review each step carefully. If you do not understand the nature of each piece of information that you must record in each of the four categories listed in Step 1, ask your instructor for help.

Instruction 2: Follow the instructions in each step and copy into a notebook the information you are requested to obtain. Use these information labels as a job aid in Instruction 3, and to record the required information when actually in the workplace.

Instruction 3: Following is a description of a workplace environment and of an employee whose respirable dust exposure you have been asked (hypothetically) to monitor. With a classmate, take turns reading this information or writing it in a notebook. Use the job aid you prepared in Instruction 2.

George W. Washington, 49, SSN 300-80-0088, company number R1183, is a resins worker with XYZ Plastics, Inc. His job requires him to batch feed an Ace Flying Wedge, Model A, extruder with a powdered MOCA resin. He encounters a potential health risk when scooping the powdered resin out of a bulk shipping container into a 1-gallon metal container. Fine dust is given off when the resin is poured from one container to the other, and when it is poured into the hopper of the extruding equipment.

George performs the operation, which takes 5 minutes, 6 times an hour for 4 of the 8 hours he works at the plant. During the other 4 hours that he cleans and maintains the equipment, he is exposed to methylene chloride solvent vapors for about 2 hours. George wears a dust respirator while he performs dusty operations, and an air-supplied fullface mask when he works with solvents. For the entire workshift, except for two coffee breaks and a 1-hour lunch break, George remains in the extrusion area along with three other persons. These people have other jobs, including housekeeping, repair of the equipment, chemical handling, and product handling. The work area is kept quite clean; accumulations of foreign matter are limited to a very light dusting on hard-to-clean surfaces. Because chemical and solvent spills are cleaned up immediately, floors and walls in the extrusion area are also free of accumulated matter.

The personal sampling pump you will be using was calibrated just before your arrival at the plant. It was calibrated for a 1.7 lpm flow rate for collecting respirable dust samples. The pump is the MSA Personal Sampling Pump, Model G, serial number 3220142. The sampling device is the MSA respirable dust cyclone.

FILMS AND SLIDE/TAPE PROGRAMS

U.S. Bureau of Mines. "The Air We Breathe in Industrial Environments," National Audiovisual Center, Washington, DC. 1972.

This 16-minute, 16-mm color film discusses the composition and importance of air in relation to various working environments. It describes industrial health (breathing) hazards encountered and the importance of protecting workers by using protective equipment and proper ventilation.

OBJECTIVE

You will be able to position an air sampling train on an individual so that a representative sample can be obtained while allowing the worker freedom of movement.

WHERE AND HOW TO PRACTICE

Practice working through the steps in this lesson in the same location you used in Lesson One. You will need to work with another person, however. Practice each step in this lesson until you can perform all the steps within the time limits stated in "How Well You Must Do."

HOW WELL YOU MUST DO

You must be able to position the respirable dust sampling train on an individual so that the inlet orifice of the sampling device is in line with the person's breathing zone, so that the cyclone is vertical, and so that it is attached securely to prevent it from falling off during sampling. The equipment must be placed so that it does not interfere with arm or torso movements when the person is working.

THINGS YOU NEED

To work through the steps and exercises in this lesson, you will need the following equipment and supplies in addition to those used in Lesson One:

- personal air sampling pump (capable of providing high and low flow pumping rates), including a fully charged portable pump; or separate high and low flow pumps
- cyclone, respirable dust sampler with preweighed filter cassettes*
- charcoal tube holder and charcoal tubes (several)
- 2-piece filter cassettes, preweighed, for total dust sampling (several)

*The steps in this lesson give instructions using the cyclone assembly.

THINGS YOU NEED (cont'd)

- Tygon* tubing, 1 piece, 3-feet long, 1/4-inch inside diameter
- adjustable web belt
- masking tape or cloth tape, 1 roll
- safety pins, 5.

Instructions: Now turn to the next page and begin work on Lesson Two, "Getting There--Steps."

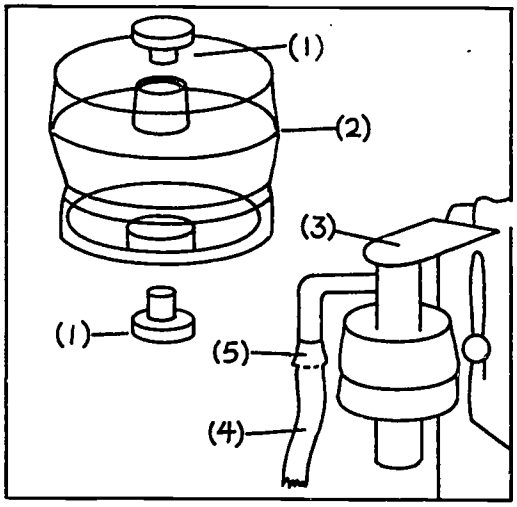
*Presentation of information in this module on any type or model of equipment should not be construed as an endoresement of the equipment by the U.S. Department of Education.

GETTING THERE--STEPS

STEP 1

In the workplace, remove the end plugs (1) from two unused, preweighed filter cassettes (2). On one of the cassettes, write the sample number. Write the number and the individual's name in your notebook next to the information you collected in Lesson One. Insert the cassette into the cyclone assembly (3). Replace the end plugs in the other cassette and label it "Blank." This cassette will be shipped to the laboratory with the other cassette. Attach the 3-foot piece of Tygon tubing (4) to the sampling flow connector (5).

KEY POINT 1

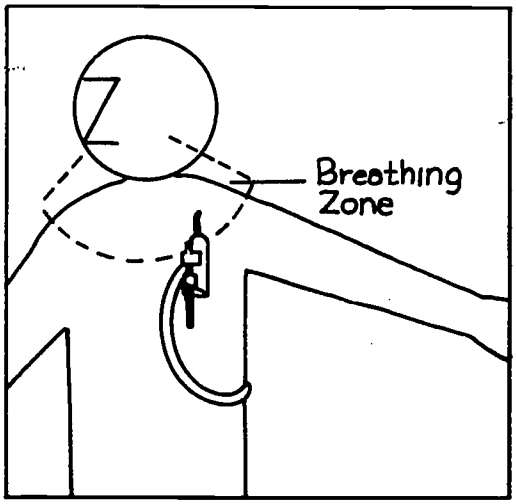


Prepare a blank and the sampling device before positioning it on the worker's clothing.

STEP 2

To sample the air the worker breathes, attach the sampler to the shirt collar or to the shoulder region, using the crocodile clip connected to the cyclone assembly. If the person is right handed, attach the sampling device and pump on the left side of the body and on the right side if the person is left handed.

KEY POINT 2

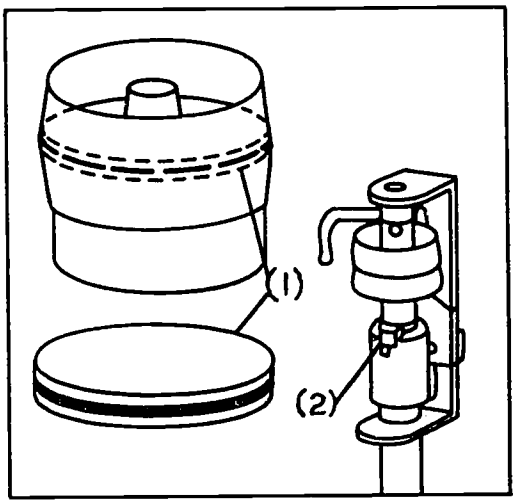


Attach the sampling device within the breathing zone and on the opposite side of the body from the hand of preference.

STEP 3

Check the cyclone assembly to make sure the filter side (1), and not the backup pad side, of the cassette is facing downward. Have the person being sampled stand up straight. Adjust the cyclone so it is vertical and the inlet port (2) is faced away from the body.

KEY POINT 3



The filter side should be faced downwards, and the inlet port of the cyclone faced outwards.

STEP 4

Turn on the pump to check that the rotameter ball is floating freely, and that air is being drawn into the inlet port and being exhausted through the outlet port. Turn off the pump.

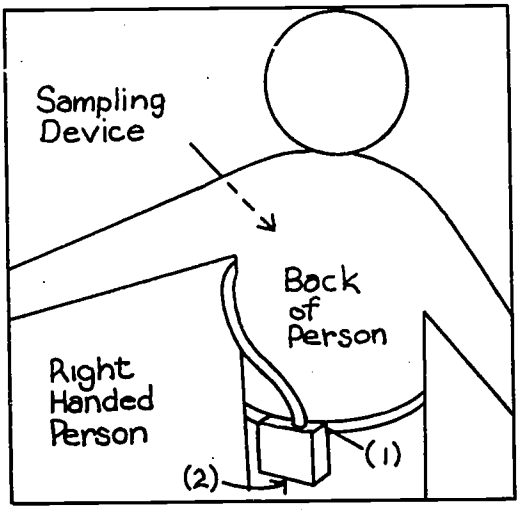
KEY POINT 4

Turn on the pump to check that it is working properly.

STEP 5

Using the wide metal clip on the side of the pump, attach the pump to the person's belt. If there is no belt, provide the individual with one to wear; otherwise, you may have to clip the pump to the top of the pants (1) on the same side of the body that the sampling device has been attached to. Adjust the pump so it does not hinder movement or the ability to work; make sure the exhaust port (2) is not covered or blocked.

KEY POINT 5

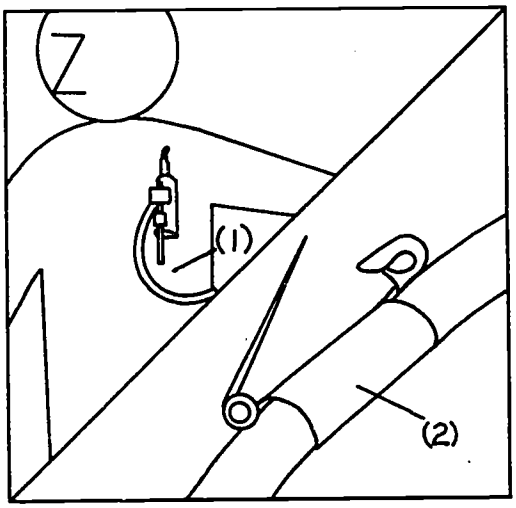


Attach the pump above the back pocket on the belt or pants on the same side of the body that the sampling device has been attached to.

STEP 6

Route the free end of the Tygon tubing under the arm (1) to the inlet port of the pump. Tape or pin the tubing to the clothing to permit easy movement. For the tape to stick for several hours, the clothing must be clean at the beginning of the sampling period. If it is necessary to use pins, tape the pins to the tubing (2).

KEY POINT 6



Route the tubing to allow free movement. Tape the tubing to clean clothing only.

EXERCISES

Instruction 1: Practice positioning and fastening the sampling train on a classmate. You should be able to perform all the steps in Lesson Two within 5 minutes.

Instruction 2: Repeat Lesson Two using a charcoal tube and holder.

Instruction 3: Repeat Lesson Two using a midget impinger. Fasten the impinger securely to prevent the liquid from spilling during sampling.

LESSON THREE

OBJECTIVE

You will be able to adjust the pump flow over the sampling period, and determine if and when a new sampling device may be needed.

WHERE AND HOW TO PRACTICE

Practice in the same manner and location as you did in Lesson Two. However, because the steps in Lesson Three contain tasks that will be performed in the workplace, you should practice the steps in an actual workplace setting, under realistic workplace conditions.

HOW WELL YOU MUST DO

You must be able to adjust the sampling pump to the desired flow rate (within limits of the pumping accuracy) throughout the sampling period, and be able to know when and how to replace the sampling media when the desired flow cannot be maintained. You must also be able to record all of the pertinent information required when readjusting the flow rate and when changing the sampling media.

THINGS YOU NEED

In addition to the equipment and supplies you used in the previous lessons, you will also need:

- screwdriver, small blade, for adjusting the pump flow rate
- a spare sampling pump, calibrated for the sampling devices being used, and fully charged
- spare filter media
- chalk-filled chalkboard erasers, 2
- dust respirator, 2.

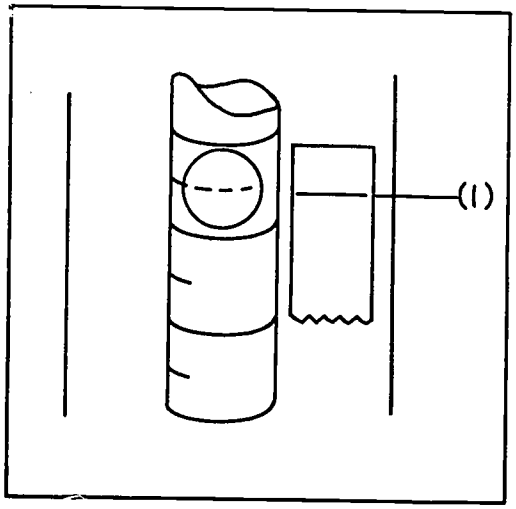
Instructions: Now turn to the next page and begin work on Lesson Three, "Getting There--Steps."

GETTING THERE--STEPS

STEP 1

Turn on the sampling pump. Note the starting time in your notebook. Adjust the pump flow rate, if necessary, so the center of the rotameter ball is aligned with the calibration mark (1). Record the identification numbers of the pump and filter media, and the location of the worker being sampled.

KEY POINT 1



Check the initial flow rate and make adjustments if necessary.

STEP 2

Observe the pump operation for several minutes to check the pump flow rate. Because of the charging characteristics of the rechargeable batteries, there may be a decrease in flow within 15 to 30 minutes after turning on the pump.

KEY POINT 2

The flow rate may change within 15 to 30 minutes due to the charging characteristics of the batteries.

STEP 3

Check the sampling train periodically throughout the sampling period. If you are sampling over an 8-hour workshift, you should check the flow rate and the tubing connections after the first 1/2-hour, first hour, and after every 2-hour period thereafter. After each check, record the time the check was made and whether any flow rate adjustments were necessary.

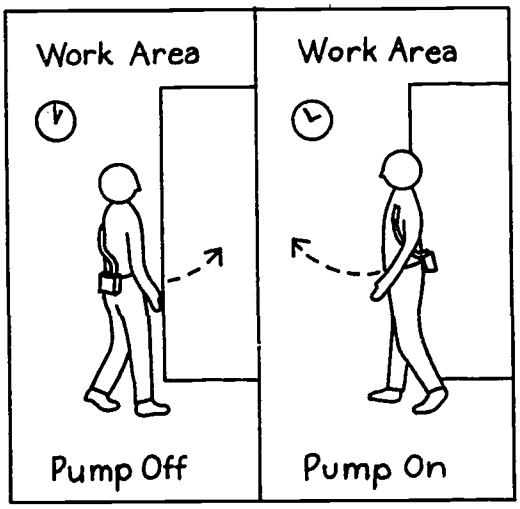
KEY POINT 3

Check the sampling train after the first 1/2-hour, first hour, and after every 2-hour period thereafter.

STEP 4

Turn the pump off each time the worker leaves the work area to go on a break or to lunch, and on again when the worker returns. This is particularly important in determining the total time the worker is exposed to workplace contaminants. Record all periods of time the pump is off.

KEY POINT 4



The pump should run only for those periods in which sampling is desired.

STEP 5

Replace the filtering media in the sampling device when large, visible deposits are present on the filter, and when the flow rate cannot be maintained at the desired flow. If you change the filter cassette during the sampling period, readjust the setting to the desired flow. Record the amount of time the filtering media was used, and check the filter number in the log.

KEY POINT 5

If the desired flow cannot be maintained because of an overloaded filter, change the filter and record the length of time it was used for sampling.

STEP 6

If you are unable to maintain the desired flow even with new filter media, there may be a problem with the pump. Turn off the pump and remove the tubing. Replace the pump with one that is fully charged, and repeat Step 1.

KEY POINT 6

After checking the filter media and tubing connections, replace the pump if you cannot maintain the desired flow.

STEP 7

At the end of the sampling period, check the flow rate and turn off the pump. Record the ending flow rate and the time the pump was turned off. The final flow rate must be the same as the initial or desired flow rate.

KEY POINT 7

The initial and final flow rates must be the same.

STEP 8

Remove the sampling train from the worker. Keep the cyclone vertical at all times to prevent particles collected in the grit pot from falling onto the filter. Blow away any loose dust from the cyclone assembly. Carefully remove the filter/cassette. Immediately place the end plugs into the cassette.

KEY POINT 8

Remove the filter cassette from the cyclone assembly and place plugs into the ends.

EXERCISES

Instruction 1: Work through the steps in Lesson Three with a classmate. To perform these exercises, wear a dust respirator. With the sampling pump running, simulate the effects of dust loading on the operation of the pump by slamming the erasers together a couple of times, no closer than 2 feet from the inlet of the sampling device. After a couple of minutes or when the cloud of dust disappears, check and adjust the flow. Repeat this process until you can no longer adjust the pump to the desired flow. Note the condition of the filter at the conclusion of the procedure.

Instruction 2: Repeat Instruction 1 except use a sampling pump that has not been recharged after a full 8-hour period of sampling. Using this pump, you will be able to notice that less dust accumulated on the filter will cause the same effect as you observed in Instruction 1.

Instruction 3: Calculate the total sampling period. First, convert the hours and minutes in each sampling period to minutes. Multiply the total sampling time by the pump flow rate.

Instruction 4: Repeat the steps in the lessons, using a charcoal tube sampling device and a filter cassette for total dust sampling.

PERFORMANCE TEST

Instruction 1: Check your skill level or progress by working through each of the items in this test. If you can perform each item as well as required, place a check in the space provided. When all of the items are checked, you are ready to demonstrate your skills to your instructor. You may use the following list, if needed. You will be considered trained in a skill after your instructor approves your performance of each of the following items.

COLLECTING INFORMATION ABOUT SAMPLING CONDITIONS AND THE INDIVIDUAL BEING SAMPLED

Instruction 2: The following items must be performed in an actual workplace to test skill development.

No. 1 ____ Characterize WORKPLACE CONDITIONS, including the presence of visible airborne dusts, visible mists, strong or unusual odors, and cleanliness of walls, ceilings, floors, and equipment.

No. 2 ____ Identify the PROCESS EQUIPMENT, including manufacturing specifications, frequency of operations, maintenance, and repair, and what worker is responsible for performing which task.

No. 3 ____ Identify the WORKER and what he or she does, and for how long.

No. 4 ____ Identify the SAMPLING EQUIPMENT, including the type of pump and sampling device, manufacturer's specifications, and flow rate calibration data.

FOR FURTHER STUDY

If you could not perform one or more of the four items above, review and practice the following lesson steps:

No. 1
Lesson One, Step 2

No. 2
Lesson One, Step 3

No. 3
Lesson One, Step 4

No. 4
Lesson One, Step 5

POSITIONING AN AIR SAMPLING TRAIN ON A WORKER

Instruction 3: The following items do not need to be performed in the workplace in order to demonstrate skills.

No. 1 _____ Attach the sampling device on the worker's clothing so that it is within the breathing zone.

No. 2 _____ Position the sampling train on the side of the worker opposite the favored hand.

No. 3 _____ Position the inlet port of the sampling device so that it faces away from the worker's body.

No. 4 _____ Prior to attaching the sampling device to the worker and prior to beginning sampling, check the flow setting and the pump inlet and outlet orifaces to make sure they are not obstructed.

No. 5 _____ After positioning the sampling train, attach it to the worker's clothing so that it will not fall off and so it does not interfere with arm or torso movements while the worker is performing his or her job.

FOR FURTHER STUDY

If you could not perform one or more of the five items above, review and practice the following lesson steps:

No. 1
Lesson Two, Step 2

No. 2
Lesson Two, Step 2

No. 3
Lesson Two, Step 3

No. 4
Lesson Two, Step 4; Lesson Three, Step 1

No. 5
Lesson Two, Steps 5 and 6.

MONITORING THE OPERATION OF SAMPLING EQUIPMENT

Instruction 4: To demonstrate knowledge of the following items, it will be necessary to sample over a minimum of a 2-hour period in a workplace environment.

No. 1 _____ Before starting to sample, observe the pumping rate for at least 15 minutes.

No. 2 _____ After the first half hour, after the first hour, and after the second hour, check and record in a notebook the flow rate and check the tubing connections.

No. 3 _____ Turn the pump off before the worker leaves the work area and on again after he or she returns to the work area. Record in a notebook these on-off times.

No. 4 _____ If the pump cannot be adjusted to the desired flow, replace the filter media; if the pump still cannot be adjusted, replace the pump with one that is fully charged. Record the changes you make. If you do not have to change the filter or the pump, demonstrate Instruction 1 of the Lesson Three Exercises.

No. 5 _____ Demonstrate how to handle the sampling device at the end of the sampling period.

FOR FURTHER STUDY

If you could not perform one or more of the five items above, review and practice the following lesson steps.

No. 1
Lesson Three, Step 2

No. 2
Lesson Three, Step 3

No. 3
Lesson Three, Step 4

No. 4
Lesson Three, Steps 5 and 6

No. 5
Lesson Three, Steps 7 and 8.

REFERENCES

U.S. DOL, Industrial Hygiene Field Operation Manual, OSHA Instruction CPL 2-2.20, April 2, 1979.