Meth Lab Cleanup Participant Guide

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Midwest Consortium for Hazardous Waste Worker Training

Acknowledgments

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Disclaimer

There is currently no Occupational Safety and Health Administration (OSHA) regulation specifically regarding the cleanup of methamphetamine (meth) labs. Since a meth lab can often be considered a hazardous waste site due to the toxic mix of chemicals that go into production, we will regularly refer to OSHA's hazardous waste site regulations. This regulation, 29 CFR 1910.120, requires training material to cover basic hazard recognition, use of provided personal protective equipment, basic hazard control, decontamination procedures, and other relevant standard operating procedures.

At the time these materials were prepared, Colorado had the most comprehensive state regulations for meth lab cleanup procedures. This introductory program is therefore based largely off the Colorado laws and standards, with references also to Washington and Tennessee state standards.

Additional training is necessary to perform many activities. These activities include implementing the emergency response plan, identifying materials using monitoring instruments, selecting protective equipment, and performing advanced control containment or confinement. Additional site-specific training for emergency response must be provided so that you understand how to recognize and respond to alarms at the site and can carry out any role which may be assigned during a response.

For information about further training, consult the training instructor, your company safety and health plan, or your company health and safety representative.

Introduction

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International Chemical Workers Union

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International Union of Operating Engineers

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Service Employees Internat'l Union, AFL-CIO

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Introduction

Preface

You are in this program because you are or will be employed as a meth lab remediation (cleanup) worker. During this program you will learn about the following topics:

- Site Safety and health plans.
- Health and safety hazards.
- Use of personal protective equipment.
- Work practices and other controls to minimize hazards normally found at meth lab cleanup sites.
- Medical surveillance.
- Monitoring.
- Material Handling.
- Emergency Response.
- Other resources.

When you finish, you will be better able to do the following:

- Recognize a meth lab.
- Recognize hazards within that lab.
- Use protective equipment.
- Perform sampling and cleanup activities.

Introduction

Proposed Agenda for Meth Lab Remediation

This agenda is flexible and may be adjusted by the instructor to the needs of the class.

Day One:

Rights and Responsibilities

Hazard Recognition

Hazard Control

Work Practices

Day Two:

Personal Protective Equipment

Monitoring

Decontamination

Emergency Response

Day Three:

Simulation

Discussion and Critique of Simulation Exercise

Introduction

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Rights and Responsibilities

Workers need to understand the laws which deal with methamphetamine (meth) lab cleanup and their rights and responsibilities. There is currently no Occupational Safety and Health Administration (OSHA) regulation specifically regarding the clean up of meth labs. Since a meth lab can sometimes be considered a hazardous waste site due to the toxic mix of chemicals that go into production, it is the best practice to observe OSHA's HAZWOPER and HazCom regulations.

Workers have the responsibility to the employer and to themselves to know and follow safety rules set by the employer, provided that the rules are reasonable. In turn, the employer has the responsibility to provide a safe and healthful workplace and the necessary protective equipment to reduce exposure to the workers.

As mentioned above, OSHA has set standards which are pertinent to meth lab cleanup personnel: (1) the Hazard Communication Standard (HazCom) , which gives workers the right to know about chemicals brought into the site for use in remediation or maintenance activities, and (2) the Hazardous Waste Operations and Emergency Response Standard (HAZWOPER), which specifies safety and health guidance for hazardous waste sites, and is also applicable for meth lab cleanup personnel.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Identify regulations that describe best practices to follow during meth lab cleanup.
- Describe key rights and responsibilities of workers under OSHA.
- Understand that HAZWOPER is only enforceable if the meth lab is considered a hazardous waste site.

Meth Lab Laws

At the federal level, there are no laws regarding meth lab cleanup. However, Congress is taking notice of the states' plight, and passed a research bill in February of 2005. This bill, known as the "Methamphetamine Remediation Research Act of 2005", provides funding for research programs that focus on meth lab cleanup, Section 3 (a) says:

> Not later than one year after the date of enactment of this Act, the Assistant Administrator for Research and Development of the Environmental Protection Agency, in consultation with the National Institute of Standards and Technology, shall establish voluntary guidelines, based on the best currently available scientific knowledge, for the remediation of former methamphetamine laboratories, including guidelines regarding preliminary site assessment and the remediation of residual contaminants.

The bill requires the EPA to write guidelines for meth lab cleanup, but since they are "voluntary guidelines", they will not be legally enforceable.

Individual states are forming laws that suit their needs. California recently passed SB 536, which requires the state Department of Toxic and Substances Control to develop a health-based cleanup standard for methamphetamine and their precursors and byproducts by October 1, 2007. Many other states including Minnesota and Tennessee have adopted detection-based (as opposed to health based) cleanup standards. Detection-based cleanup standards may be less stringent than health-based standards, which require former lab sites to be cleaned up to a level that protects the health and safety of people who may move into the home or apartment that previously served as a meth lab.

Thirty-five states and the District of Columbia have laws that protect minor children living in dwellings where meth is manufactured.. Drug Endangered Children Laws allow children to be removed from their parents if the children lived in a home where meth was manufactured and the child tests positive for drugs in his/her system. In Georgia, if the child lives where meth is manufactured, the child will be removed from the home regardless of drug residue in their system.

Some states such as Oklahoma focus on curbing the problem at the source, over-the-counter pills. These states regulate the purchase of cold capsules either by setting a monthly limit or requiring ID and a signature of purchase. This has shifted meth cooks' procurement strategy to shoplifting (if the pills are not secured behind the counter) or "smurfing" the pills by going from store to store and buying the legal limit to get the necessary ingredients for their batch. Chris Cain, coordinator for the Kansas Methamphetamine Prevention Project, once discovered a meth addict who hired a group of homeless people to buy the legal limit of cold pills. The addict/cook drove the group from store to store in a minibus.

Other states are concerned with the cleanup of the dwellling housing the meth lab because of the hazardous waste produced in the manufacturing process. Between 5 and 7 pounds of waste are generated for each pound of meth produced. States like Tennessee and Minnesota have produced a set of guidelines that cover sampling and what to do with contaminated septic systems. Those states that provide cleanup monitoring standards have a detection-based standard. Colorado currently has the most comprehensive laws that regulate meth lab cleanup (Regulations Pertaining to the Cleanup of Methamphetamine Laboratories [6CCR 1014-3].

They require preliminary sampling and assessments in order to determine the hazards the cleanup crew might encounter. Then they have established a detection based standard to determine when the property is cleaned. Minnesota recently changed their detection-based standard and no longer requires post cleanup monitoring if the cleanup was conducted according to the state regulations. Minnesota believed that since the cleanup standard was not health-based, they could not determine if it was healthy to return to the building or not.

As of May 2006, thirteen states have set detection-based cleanup standards for meth. (Alaska, Arkansas, California, Colorado, Idaho, Minnesota, Montana, North Carolina, Oregon, Tennessee, Utah, and Washington). California just passed SB 536, that requires the state Department of Toxic and Substance Control to develop a health-based cleanup standard for methamphetamine and their precursors and by-products by October 1, 2007.

Some stores are moving medicines containing pseudoephedrine behind the pharmacy counter, requiring an ID and signature before purchase. While this works to enforce the monthly limit at that particular store, smurfing is still rampant. Oklahoma is working on a state-wide computer program that will track all citizens and their purchases of cold medicines. This way, officials will be able to monitor and investigate people who buy large amounts of the pills.

States like Tennessee and Minnesota have produced a set of guidelines that decontamination crews can reference. They help identify chemicals that might be present and the proper level of cleanliness needed for human use. Washington state has an excellent set of guidelines that cover sampling and what to do with contaminated septic systems.

Resources:

Minnesota Clandestine Drug Lab General Cleanup Guidance:

http://www.health.state.mn.us/divs/eh/meth/lab/guidance0106.pdf

Tennessee Standards for Testing and Cleaning Quarantined Clandestine Drug Manufacturing Sites:

http://www.state.tn.us/sos/rules/1200/1200-01/1200-01-19.pdf

Washington State Decontamination of Illegal Drug Manufacturing of Storage Sites:

http://apps.leg.wa.gov/wac/default.aspx?cite=246-205&full=true

Washington State Guidelines for Environmental Sampling at Illegal Drug Manufacturing Sites:

http://www.doh.wa.gov/ehp/ts/CDL/cdl-envir-sampling.pdf

Washington State Department of Ecology Guidelines for Characterizing Septic Tank Wastes at CDL Sites:

http://www.doh.wa.gov/ehp/ts/CDL/cdlsepticwasteguidelines.pdf

Colorado Regulations Pertaining to the Cleanup of Methamphetamine Laboratories:

http://www.cdphe.state.co.us/op/regs/boardofhealth/101403methlabrules.pdf

Scenario

Carol Friedman, a new employee of Drug Lab Decontamination, walks into her supervisor's office to report for duty assignments. Carol hopes that her first day at her new job will involve a challenge even though it is an entry-level position. She walks through her supervisor's door (Ted Bear), extends her hand, and introduces herself.

Ted: Welcome aboard, Carol! Boy, am I glad to see you. We are in a major bind, and you're my savior. It rained all week last week, and we are behind in decontaminating the motel on Route 5. I need you to get in there ASAP and start pulling down drywall and packaging it for shipment out.

Carol: But, Mr. Bear, my last job involved organizing MSDS; I've never really pulled down drywall, or packaged it, or been on a worksite at all for that matter.

Ted: Listen, I'm short-staffed and need to get this work completed. We are two days behind schedule as it is. We'll provide you with an APR and a Tyvek suit. Get ready, and I'll meet you outside.

Carol: But what about my training? My 40-hour training was in 2004.

Ted: We'll get to that after this week . . . say, Friday?

Questions

1. Could this scenario happen?

2. What are Carol's rights in this situation?

3. What are Ted's rights in this situation?

4. What are Carol's responsibilities?

5. What are Ted's responsibilities?

6. What should Carol do?

HAZWOPER - A Review
Hazardous Waste Operations and Emergency Response

Hazard control requirements are found in a number of federal regulations. The intent of these requirements is to protect worker safety and health. The major federal regulation designed to safeguard the safety and health of workers at hazardous waste sites is from the Occupational Safety and Health Administration (OSHA).

Primary programs required by HAZWOPER for conducting operations at waste sites are discussed on the next several pages.

There are no specific federal regulations regarding the cleanup of an illegal drug lab. However, meth lab cleanup operations are closely related to hazardous waste site operations, for which there are regulations. The following materials are to be considered best practices for meth lab cleanup practices.

OSHA's standard was developed to protect hazardous waste operations personnel and emergency response personnel. This standard is commonly called Hazardous Waste Operations and Emergency Response (HAZWOPER), or 29 CFR 1910.120. This rule has been in effect since March 6, 1989.

Requirements for General Site Workers

29 CFR 1910.120

29	=	OSHA regulations are located in Title 29.
CFR	=	Code of Federal Regulations is the title of the government publication.
1910	=	Part number 1910 covers General Industry.
.120	=	Section number 120 covers hazardous waste operations and emergency response.
(e)	=	The paragraph which describes a specific topic such as Training.

Safety and Health Plan

The employer should have a written safety and health plan for employees involved in meth lab cleanup operations. The plan should be available for inspection by employees, their representatives, and OSHA personnel.

This plan should also be designed to help personnel identify, evaluate, and control safety and health hazards at the site. The safety and health plan ought to address emergency response. If a number of contractors are at the site, many of these details may be included in the plan developed by the prime contractor. Subcontractors should make employees aware of this site-specific information.

Medical Surveillance Program

The employer should have a medical surveillance program that meets the requirements of paragraph (f) of HAZWOPER. This requirement will be discussed in detail in the Toxicology and Health Effects section of the Hazard Recognition chapter of this manual.

Decontamination Program

Decontamination activities at meth lab sites should meet the requirements of paragraph (k) of HAZWOPER. This section of the standard describes:

- Decontamination procedures.
- Decontamination line location.
- Equipment and solvents.
- Personal protective equipment and clothing.
- Unauthorized employee control.

These requirements are the major topic of this manual.

New Technology Program

The employer should meet the requirements under paragraph (o) for introducing into the workplace new and innovative technologies, equipment, and control measures developed for worker protection.

Material Handling Program

For employees handling drums or containers, the employer should meet the requirements in paragraphs (j) (1) (ii) through (viii) and (xi), as well as (j) (3) through (j) (8). These sections cover the following:

- General material handling requirements.
- Equipment used to transfer drums and containers.
- Shipping and transport.

These requirements will be covered in detail in later sections of the manual.

Training Program

The employers must have a training program as part of a model safety and health program. OSHA requires that a new site worker receive 40 hours of general training off the site. General training is followed by three days of site-specific training before starting work at a hazardous waste site. Site supervisors participate in an additional 8 hours of training. All workers and supervisors must successfully complete 8 hours of refresher training each year.

This meth lab cleanup program is intended to follow the 40-hour site worker class. We use many of the same techniques in dealing with chemical contamination at a meth lab as we would at any other hazardous waste site.

Emergency Response Plan

An emergency response plan should be developed and include the following:

- Specific steps or elements to execute during an emergency.
- Training for emergency response employees.
- Procedures for handling emergency incidents.

The requirements of this section are described in more detail later in this manual.

HAZCOM - Hazard Communication Standard

A meth lab cleanup company must have a hazard communication program for all hazardous materials that are not hazardous wastes. These materials might include solvents, vehicle maintenance products, and chemicals used to decontaminate surfaces or chemicals for portable toilets. OSHA's Hazard Communication Standard was enacted for three major reasons:

- To ensure that the hazards of manufactured and imported chemicals are evaluated.
- To ensure that information regarding chemical hazards in the workplace is given to employees.
- To pre-empt inconsistent state laws covering hazard communication.

The Hazard Communication Standard consists of four primary sections:

- Written Hazard Communication Program.
- Labels.
- Material Safety Data Sheets.
- Employee Information and Training.

Written Hazard Communication Program

This program must include the following:

- A written hazard communication program available to employees, designated representatives, OSHA, and NIOSH describing how the employer will comply with the Hazard Communication Standard.
- A section covering container labeling, Material Safety Data Sheets (MSDS), and employee training.
- A list of hazardous chemicals in each work area.
- An explanation of methods for communicating hazards to employees involved in non-routine tasks.
- An explanation of methods used to inform contractors about chemical hazards in the facility.

Labels

Regulations for labels on incoming containers (not hazardous waste) include the following:

- Labels must be attached to the containers by the manufacturer, importer, or distributor of the shipped container.
- The identity (chemical and common names), a hazard warning, and the name and address of the manufacturer must be printed on the label.
- Employers must ensure that each container of hazardous chemicals in the workplace is labeled (except for portable containers used by a single employee to transfer the chemical).

Piping systems and pipes are exempt from a labeling requirement.

Material Safety Data Sheets

The following requirements concern Material Safety Data Sheets:

- Manufacturers, employers, and distributors must forward MSDSs to an employer at the time of initial shipment.
- Employers are required to obtain and maintain MSDSs for each hazardous chemical in their workplace.
- MSDSs must include information on identity, physical and chemical characteristics, health effects, exposure limits, precautionary measures, emergency and first aid procedures, date of preparation, and identification of the party responsible for the MSDS.
- MSDSs must be filled out completely and accurately.
- New information must be incorporated on MSDSs within three months.
- Copies of MSDSs must be immediately accessible in the workplace to employees, designated representatives, OSHA, and the National Institute for Occupational Safety and Health (NIOSH).

Employee Information and Training

Employees must be informed and trained by their employer according to the following guidelines:

- Training must take place at initial assignment and when new hazards are introduced.
- Education must include the requirements of the OSHA Hazard Communication Standard.
- Employees must be informed as to the location of the employer's written hazard communication program, MSDSs, and hazardous chemical lists.
- Employees must be made aware of specific chemical hazards in their work area.
- Employees must be taught how to read and interpret information on labels and MSDSs.

OSHA

The Occupational Safety and Health Administration (OSHA) is concerned with the protection of worker safety and health on the job. OSHA is located within the Department of Labor and was created to develop regulations and enforce the OSHAct, which applies to all employment in the United States. OSHA is based in Washington, D.C., but has regional and area offices nationwide. Regulations set by OSHA are published in Section 29 of the Federal Register, with Parts 1915 reserved for maritime industries, Parts 1910 for General Industry, and Parts 1926 for the Construction Industry.

OSHA regulations apply to all employers regardless of size. However, small employers (less than 10 employees) are exempted from some injury record-keeping requirements (29 CFR 1904).

In addition to setting standards such as HAZWOPER and HAZCOM, OSHA is charged with:

- Inspecting workplaces to assure standards are being met.
- Issuing citations and fines to companies that do not meet the standards.
- Overseeing state plans for safety and health.
- Encouraging the development of training programs for workers, management, and health professionals.

OSHA Complaint Form

U. S. Department of Labor
Occupational Safety and Health Administration

Notice of Alleged Safety or Health Hazards

For the General Public:

This form is provided for the assistance of any complainant and is not intended to constitute the exclusive means by which a complaint may be registered with the U.S. Department of Labor.

Sec 8(f)(1) of the Williams-Steiger Occupational Safety and Health Act, 29 U.S.C. 651, provides as follows: Any employees or representative of employees who believe that a violation of a safety or health standard exists that threatens physical harm, or that an imminent danger exists, may request an inspection by giving notice to the Secretary or his authorized representative of such violation or danger. Any such notice shall be reduced to writing, shall set forth with reasonable particularity the grounds for the notice, and shall be signed by the employee or representative of employees, and a copy shall be provided the employer or his agent no later than at the time of inspection, except that, upon request of the person giving such notice, his name and the names of individual employees referred to therein shall not appear in such copy or on any record published, released, or made available pursuant to subsection (g) of this section. If upon receipt of such notification the Secretary determines there are reasonable grounds to believe that such violation or danger exists, he shall make a special inspection in accordance with the provisions of this section as soon as practicable to determine if such violation or danger exists. If the Secretary determines there are no reasonable grounds to believe that a violation or danger exists, he shall notify the employees or representative of the employees in writing of such determination.

NOTE: Section 11(c) of the Act provides explicit protection for employees exercising their rights, including making safety and health complaints.

For Federal Employees:

This report format is provided to assist Federal employees or authorized representatives in registering a report of unsafe or unhealthful working conditions with the U.S.Department of Labor.

The Secretary of Labor may conduct unannounced inspection of agency workplaces when deemed necessary if an agency does not have occupational safety and health committees established in accordance with Subpart F, 29 CFR 1960; or in response to the reports of unsafe or unhealthful working conditions upon request of such agency committees under Sec. 1-3, Executive Order 12196; or in the case of a report of imminent danger when such a committee has not responded to the report as required in Sec. 1-201(h).

INSTRUCTIONS:

Open the form and complete the front page as accurately and completely as possible. Describe each hazard you think exists in as much detail as you can. If the hazards described in your complaint are not all in the same area, please identify where each hazard can be found at the worksite. If there is any particular evidence that supports your suspicion that a hazard exists (for instance, a recent accident or physical symptoms of employees at your site) include the information in your description. If you need more space than is provided on the form, continue on any other sheet of paper.

After you have completed the form, return it to your local OSHA office.

NOTE: It is unlawful to make any false statement, representation or certification in any document filed pursuant to the Occupational Safety and Health Act of 1970. Violations can be punished by a fine of not more than $10,000. or by imprisonment of not more than six months, or by both. (Section 17(g))

Public reporting burden for this voluntary collection of information is estimated to vary from 15 to 25 minutes per response with an average of 17 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An Agency may not conduct or sponsor, and persons are not required to respond to the collection of information unless it displays a valid OMB Control Number. Send comment regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to the Directorate of Enforcement Programs, Department of Labor, Room N-3119, 200 Constitution Ave., NW, Washington, DC; 20210.

OMB Approval# 1218-0064; Expires: 2-29-2008

Do not send the completed form to this Office.

U. S. Department of Labor
Occupational Safety and Health Administration

Notice of Alleged Safety or Health Hazards

			Complaint Number	
Establishment Name				
Site Address				
	Site Phone		Site FAX	
Mailing Address				
	Mail Phone		Mail FAX	
Management Official			Telephone	
Type of Business				

HAZARD DESCRIPTION/LOCATION. Describe briefly the hazard(s) which you believe exist. Include the approximate number of employees exposed to or threatened by each hazard. Specify the particular building or worksite where the alleged violation exists.

Has this condition been brought to the attention of:	☐ Employer ☐ Other Government Agency(specify)
Please Indicate Your Desire:	☐ Do NOT reveal my name to my Employer ☐ My name may be revealed to the Employer
The Undersigned believes that a violation of an Occupational Safety or Health standard exists which is a job safety or health hazard at the establishment named on this form.	(Mark "X" in ONE box) ☐ Employee ☐ Federal Safety and Health Committee ☐ Representative of Employees ☐ Other (specify)

Complainant Name		Telephone	
Address(Street,City,State,Zip)			
Signature		Date	

If you are an authorized representative of employees affected by this complaint, please state the name of the organization that you represent and your title:

Organization Name: Your Title:

Worker Rights Under the OSHAct

Your Right to Have an Inspection of a Workplace:

It is possible for a worker to file a complaint against the employer. A formal procedure is followed, including the completion and submission of the OSHA Complaint Form as illustrated on the preceeding three pages. Once a complaint is received at the OSHA Office, it will be assigned to one of their compliance officers. The inspection priority is defined by OSHA as follows:

- Imminent danger.
- Catastrophic (a fatality, or three or more workers are hospitalized overnight as a result of an on-the-job exposure).
- Complaint inspection (as a result of a worker or union complaint).
- Scheduled inspection (general OSHA inspection not because of a complaint or catastrophe, but because injury statistics show that the employer has more injuries and illness than similar employers).
- General inspection or “pick of the hat.” (Previously inspected sites are pooled and, through random selection, two sites are drawn and visited in a given year.)

Your Right to Participate in the OSHA Walk-Around Inspection:

Through an employee organization such as a union, an employee representative is designated to accompany the OSHA compliance officer in the walk-around inspection. It should be noted that OSHA regulations currently do not require the employer to pay the employee for time spent on the OSHA walk-around; however, some states with a state OSHA plan do pay for the walk around. Walk-around activities include all opening and closing conferences related to the conduct of the inspection but do not include any post-citation appeal procedures.

Your Right to Be a Witness or to Give Information:

Every employee has the right to appear as a witness at an OSHA hearing. During the walk-around inspection, or before or after the inspection for that matter, any employee has the right to provide OSHA with any information regarding possible safety and health hazards. This right is protected by law.

Your Right to Be Informed of Imminent Dangers:

All employees have the right to be informed by the OSHA compliance officer if it is determined that they are exposed to an imminent danger (one which could cause death or serious injury now or in the near future). The compliance officer will also ask the employer to stop the particular work process voluntarily and remove the employees. If the employer refuses to stop the work process upon the request of the compliance officer, a judge can force the employer to do so if necessary.

Your Right to Be Told About Citations:

Notices of OSHA citations must be posted in the workplace near the site where the violation occurred and must remain posted for three days or until the hazard is corrected, whichever is longer.

Citations and penalty notification forms are, in general, available upon request from the OSHA Area Office.

When an OSHA industrial hygiene inspection has taken place, the hygienist's report, which includes substances collected, procedure used, and measurement results, may also be obtained by the employees, their representatives, or their union upon request.

Your Right to Appeal OSHA Performances:

If OSHA fails to perform in a responsible and timely manner, the employees, employer, or union has the right to meet with the OSHA Area Director and the OSHA Regional Administrator and may ultimately appeal to the Secretary of Labor.

Your Right to Appeal Abatement Dates (When a Violation Must Be Fixed):

The findings of the OSHA officer may be appealed within 15 working days of the issuance of the citation to the employer. The right to contest citation is limited only to the question of the reasonableness of the abatement period of the citation. Employees or their organization cannot contest the penalty amount or the citation itself.

Your Right to Have a Closing Conference After an Inspection:

Employees have the right to meet privately with the OSHA officer and discuss the results of the inspection. OSHA procedures state that the OSHA inspector shall inform the employers and employees that a generally responsive discussion covering general issues will be held.

Your Right to Know of Health Hazard Exposures:

Employees have the right to be notified if exposed to occupational health hazards and to be notified of the results of occupational health studies conducted by the employer or OSHA officers.

The employees or their organization can and should ask for any and all instrument readings or levels of contaminants found. A copy of the lab report should also be requested from OSHA. These documents are normally available upon request but may also be obtained by any member of the public pursuant to the Freedom of Information Act.

Your Right to Have Access to OSHA Records:

Generally speaking, most OSHA records are available upon request (after the initial 15-day appeal period, unless the case is appealed). The employees, or their organization, should contact the OSHA Area Office where the plant is located.

Your Right to Participate in Development of New Standards:

Every employee has the right to participate in the development of new safety and health standards or modification of old codes through their employee organization. Individuals may also comment on proposed standards during open periods of comment.

Your Right to Review a Citation Procedure When a Citation Is Not Issued:

Every employee has the right to request an informal review of an OSHA officer's refusal to issue a citation or any other issue related to an inspection, citation, notice of proposed penalty, or notice of intention to contest a citation. A written statement as to why a citation was not issued in particular instances may be requested.

Your Right to File a Discrimination Complaint:

If an employee has been discriminated against as a result of exercising his/her rights under OSHA, that employee has the right to file a complaint with the OSHA Area Office within 30 days. This time limit is strictly enforced. Similar rights to file a complaint may exist with state and local anti-discrimination agencies, as well as the employee organization.

Worker Responsibilities Under the OSHAct

Your Responsibility to Abide by Established Safety Rules:

Workers cannot be cited or fined by OSHA, but employers can take disciplinary action for violation of established safety rules.

Your Responsibility to Wear and/or Use Required Safety Equipment:

Workers are responsible for wearing and/or using required safety equipment.

Your Responsibility to Seek Prompt Medical Treatment When Required:

Workers should seek medical treatment promptly when required. Depending on applicable state law, workers have a right to be treated by a physician of their own choice for work-related injuries. The key here is not to delay medical treatment when necessary.

Your Responsibility to Bring Safety and Health Concerns to the Attention of Management:

Workers should bring safety and health hazards or concerns to the attention of their supervisors or foremen as soon as possible. If the workers are organized, then they may want to ask their representative to bring the issue to the attention of management.

Employer Responsibilities Under the OSHAct

The OSHAct places important responsibilities on the employer. Understanding exactly what these responsibilities are is essential to maintaining a safe and healthful workplace and meeting other legal requirements of the law.

Employer's Responsibility to Furnish a Safe and Healthy Job and Work Environment:

The employer must furnish each "employee employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm" to employees. This responsibility is commonly referred to as the "general duty clause" of the Act. It describes the overall or general responsibility of the employer not to expose employees to harmful situations or chemicals.

Employer's Responsibility to Comply With OSHA Standards:

Employers of meth lab cleanup workers must comply with applicable parts of the OSHA General Industry Standard (1910). In the event of conflict between HAZWOPER and the general standard, the most protective will generally be enforced.

The **General Industry Standards** cover virtually all production industries and have other important requirements that may apply at your workplace. These standards include:

- 1910.38: Employer Emergency Plans and Fire Prevention Plans
- 1910.134: Respiratory Protection
- 1910.146: Confined Space
- 1910.147: The Control of Hazardous Energy (Lock-Out)
- 1910.156: Fire Brigades
- 1910.1000: Permissible Exposure Limits on Airborne Toxic Substances
- 1910.1020: Employee Access to Exposure and Medical Records
- 1910.1200: The Hazard Communication (Right-to-Know) Standard

Employer's Responsibility to Maintain Records of Injuries:

Under the OSHAct, all employers with more than 10 employees must maintain a log of injuries and make it available to OSHA compliance officers upon request. Each year, the employer must post an annual summary of the injury log for the information of the employees. This form is called the OSHA 300A and must be displayed each year for the months of February, March, and April. A portion of the form is shown on the following two pages. The employer must also display the required OSHA poster, which outlines specifics of the OSHAct.

The employer is required to record information about specific occupational injuries and illnesses. Every occupational death and non-fatal illness must be recorded on the OSHA log. Other non-fatal injuries which must be recorded include loss of consciousness, restriction of work motion, transfer to another job, or medical treatment other than first aid.

Contact your local OSHA office with questions about recordable illnesses and injuries.

OSHA's Form 300A

Summary of Work-Related Injuries and Illnesses

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
_____	_____	_____	_____
(G)	(H)	(I)	(J)

Number of Days

Total number of days of job transfer or restriction	Total number of days away from work
_____	_____
(K)	(L)

Injury and Illness Types

Total number of . . .
(M)

(1) Injuries	_____	(4) Poisonings	_____
(2) Skin disorders	_____	(5) All other illnesses	_____
(3) Respiratory conditions	_____		

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 50 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave., NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A (cont.)

Summary of Work-Related Injuries and Illnesses

Establishment information

Your establishment name _____

Street _____

City _____ State _____ Zip _____

Industry description (e.g., Manufacture of motor truck trailers)

_____

Standard Industrial Classification (SIC), if known (e.g., SIC 3715) _____ _____ _____ _____

Employment information *(If you don't have these figures, see the Worksheet on the back of this page to estimate.)*

Annual average number of employees _____

Total hours worked by all employees last year _____

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

_____
Company executive Title

(_____)_____
Phone Date

Summary - Rights and Responsibilites

OSHA is the federal government agency which has major responsibility for writing and enforcing safety and health rules in the workplace. In some states, regulations are enforced by the federal government. In other states, state government employees enforce the regulations and the federal government monitors the program to assure that it is “at least as effective” as the federal effort.

The OSHAct establishes both employee and employer rights and responsibilities. A major employer responsibility is to furnish a workplace free of recognized safety and health hazards likely to cause serious physical harm. A major employee responsibility is to follow reasonable employer safety rules and to wear personal protective equipment when required. Both employers and employees have certain rights relative to OSHA enforcement, development of standards, and inspections. Two specific OSHA regulations important to workers who deal with meth labs are:

- The Hazardous Waste Operations and Emergency Response Standard (HAZWOPER)—Final Rule was issued March 6, 1989 by OSHA. Though HAZWOPER was originally developed for Hazardous Waste Site Workers, the principles of the standard apply to meth lab decontamination workers because they, too, work closely with hazardous materials.
- Hazard Communication Standard (29 CFR 1910.1200) requires manufacturers and employers to inventory, classify, and label the chemical substances produced or used that are considered by regulation to be “hazardous,” injurious to health, or have physical properties that are hazardous. The employer must establish an effective, written hazard communication program for workers which includes:
    - Inspecting and inventory.
    - Labeling.
    - Acquiring and making available Material Safety Data Sheets.
    - Employee training.
    - Agency reporting and recordkeeping systems.

Key Terms - Rights and Responsibilites

Identify or define the following:

- OSHA
- HAZWOPER
- HAZCOM

Review Questions - Rights and Responsibilites

T or F 1. The employer must pay for all safety and health equipment required by OSHA standards.

T or F 2. OSHA can fine workers for violating OSHA standards.

T or F 3. If OSHA conducts an inspection of the work site, the union or employee representatives must be paid for time they spend on the walk-around, according to OSHA regulations.

T or F 4. The General Industry Standard covers activities such as hazardous waste site clean up.

T or F 5. The OSHA 300A form must be posted during the months of February, March, and April and presents the annual summary of recordable employee injuries.

T or F 6. The OSHAct applies only to companies with 10 or more employees. Companies with fewer than 10 employees are excluded from all aspects of the Act.

7. List at least five plans or programs required by HAZWOPER.

Meth Lab Basics

In order to best prepare for cleaning up a meth lab, it is helpful to know about the manufacturing process and hazards you might encounter. This chapter will introduce you to ingredients in methamphetamine, why it is necessary to decontaminate them, and some statistics about meth labs in the United States.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Understand the effects of meth on users.
- Recognize meth production methods.
- Identify places meth labs are typically located.
- Identify reasons to clean up a meth lab.

What is Meth?

Methamphetamine (meth) is a stimulant that attacks the central nervous system. Users stay awake and energized for days, followed by a serious crash lasting an equal amount of time. Some compare meth highs to cocaine highs, saying they feel just as intense, but longer-lasting, less expensive, and much easier to come by.

Meth addicts often have severe scarring on their face, arms, and legs because they “feel” imaginary bugs crawling all over their skin, and scratch to get them off. Emergency room staff have reported seeing meth addicts with gouges down to the bone, swollen and infected. Meth “cooks”, as the manufacturers are called, sometimes enter the ER with burns covering over half of their body from chemical spills, fires, or explosions. Users rarely shower or eat, because they think these menial taks are not important enough to waste their vast amounts of energy on.

These photos of a woman named Theresa came from a project called “Faces of Meth” in Oregon. Deputy Bret King compiled mug shots of inmates known to use meth. The before and after photos are only two and a half years apart.

Before Meth

2.5 Years Later

Methods of Manufacture

The basic ingredient in meth is pseudoephedrine, which comes from over-the-counter cold pills. It takes about 1100 of these pills to make a one ounce batch (approximately 280 doses). Cooks use chemicals like toluene(brake cleaner), drain cleaner, kerosene, acetone (nail polish remover), ammonia, battery acid, and the strike strip off matchbooks to create meth.

There are three methods of making methamphetamine: P2P, Red Phosphorus, and the Nazi method.

Method	Common Ingredients
P2P	Phenylalanine; Thionyl chloride; Lithium aluminum hydride; Sodium borohydride; Vaporized chloromethane; Gaseous Pyridene
Nazi	Anhydrous ammonia; Lithium batteries; Starter fluid; Cold pills; Sulfuric acid; Hydrogen chloride gas; Hydrochloric acid; Nitric acid; Sodium or potassium nitrate; Ethanol; Aluminum foil
Red Phosphorus	Cold pills; Heet^{tm}; Rubbing alcohol; Muriatic acid (concrete cleaner); Coleman's fuel (kerosene); Acetone; Iodine crystals or tincture; Hydrogen peroxide; Sodium hydroxide; Matchbooks; Hydriodic acid; Hydrochloric acid; Sulfuric acid; Vinegar; Toluene (brake cleaner); Methanol; Methylamine; Calcium chloride; Nitrogen; Benzyl chloride; Ethyl ether

The oldest method is P2P, which is a shortened version of the main ingredient, phenyl-2-propanone. Bikers on the West Coast (California region) made meth big with this method. Using the P2P method can take days to turn out a batch of meth, while newer methods are much faster today, and more prevalent.

Hitler supposedly made meth for his troops using the recipe now known as the Nazi method to help keep demoralized and run-down soldiers energetic. It works faster than P2P, but not as fast as the Red Phosphorus method. Users find it relatively easy to purchase or steal Red Phosphorus ingredients like drain cleaner and toluene, while it is harder to come by the anhydrous ammonia used in the Nazi method. Cooks often steal it from farmers, who sometimes keep highly pressurized tanks of the chemical to use for fertilizer.

Red phosphorus is the newest, fastest, and most common method, with an experienced cook able to make a batch in a matter of hours. The ingredients are fairly easy to come by, and the recipe is less complicated than earlier versions. Every pound of meth made using this recipe generates five to seven pounds of toxic waste.

Where is Meth Made?

Did you notice anything interesting about the chemicals mentioned above? All the ingredients can be purchased from local drug, hardware, and even grocery stores. Because it's so easy to get the ingredients, labs are popping up everywhere. Manufacturing used to take place in "super labs" where pounds of the drug were turned out on a weekly basis. Now, "mom and pop" or "beavis and butthead" labs are a more common sight for law enforcement officers.

The mix of chemicals in a meth lab creates a powerful odor. Labs using the Nazi method reek of the ammonia that goes into the drug. Other common odors are cat urine or rotten eggs. In order to stay undetected, meth cooks tend to keep their labs in rural areas with little traffic and few neighbors. The meth kitchen can be in a home or a shed in the yard.

Some cooks set up their labs in motel rooms, so they don't put their personal homes and property in danger of explosion or chemical contamination. Extended-stay motels are popular choices. Other meth cooks have what is known as a "rolling meth lab". Some people take their campers or RVs out on the road while a batch is cooking. They leave the windows down to vent out the poisonous gases that come out of the manufacturing process. However roomy an RV might be, meth cooks do not require that much space. An entire lab can be made to fit into a large Rubbermaid container that goes easily into the trunk of an average-sized car or sits in the bed of a truck.

Why Is It Necessary to Decontaminate a Meth Lab?

Take a look at some of the potential hazards from each of these chemicals:

Chemical	Hazards
Acetone	Reproductive damage, unconsciousness, nausea, kidney/liver damage
Ammonia	Lung damage, burns, blindness
Benzene	Anemia, depressed immune system, nausea, carcinogen
Ether	Coma, respiratory irritation, fire/explosion hazard
Freon	Cardiac arrhythmia, asphyxiation, aggravates heart conditions
Hydrochloric acid	Death due to fluid in the lungs, severe corrosion
Iodine	Skin, lung, and reproductive organ damage
Lithium	Serious burns especially on wet skin or eyes, reacts violently with water
Phosphine gas	Abdominal pain, nausea, bronchitis, pulmonary edema, death, anemia, frostbite, gastrointestinal problems
Red phosphorus	Eye irritation, liver damage, blood disorders, flammable
Pseudoephedrine	Health damage from abuse
Sodium hydroxide	Severe burns, fluid in lungs, loss of pulse, blindness, death
Sulfuric acid	Severe burns, respiratory irritation, ingestion can result in death
Toluene	Memory loss, nausea, confusion, hearing loss, loss of color vision, kidney failure, death

Each of these chemicals are hazardous on their own, but a combination is deadly. Let's say a meth cook is using the Red Phosphorus method for the first time, after years of P2P. She's got some lithium leftover from a previous cook, sitting in a corner of the kitchen. She's trying to get the new assembly set up, but when she turns on the camp stove to test it, she burns her finger. She rushes over to the sink to run cold water over it, but the water splashes on the lithium in the corner. The lithium explodes, since it is highly water reactive, and the explosion causes the red phosphorus and toluene to catch fire, sending the whole lab up in flames. The cook staggers out with serious lung damage from inhaling ammonia and sodium hydroxide and third-degree burns over 40% of her body.

According to Arian Campo-Flores' article "The Fallout: I Felt My Face Just Melting", Selena Humphrey, only 19 years old, experienced something similar when her meth lab exploded. The walls of the lab were lined with a thin, hard plastic: surgeons at a nearby hospital spent hours picking shards of it out of her seriously burned skin. The same article describes when Ricky Houchens, 27, was cooking meth in his trailer - all was going well until he noticed it overheating. When he picked up the pitcher off the burner, the bottom gave out, splashing the flammable mixture all over the camp stove. His hospital bill was over $550,000 and he still carries scars over 40% of his body.

The chemicals used in meth production aren't as easy to clean up as you might think. It takes a thorough remediation process to remove the hazardous chemicals because they soak into porous materials like drywall or carpeting. The wood beams of the house can also become contaminated, requiring high-powered water jets to scrub out the chemicals. Even human skin is susceptible: a meth cook who doesn't actually use the drug often feels the high because it soaks in through his skin.

Between health hazards and fire hazard, meth labs are serious problems that require serious tactics to combat.

Statistics: The Growing Problem

- According to Terry Goddard's annual report for the Arizona Drug Endangered Children Program, Arizona police uncovered 297 meth labs, totaling $760,068 for decontamination in 2002.
- 2002 also found 122 meth labs in Montana; the state's Department of Justice estimates this cost taxpayers an estimated $1,005,000.
- In 2003, there were 9364 labs seized in the United States. Missouri had the most seized (1045) followed by California (838) and Tennessee (659), according to a report by EPIC's National Clandestine Lab System.
- By 2004, the number of meth lab incidents had increased to 16,326. Missouri again had the biggest problem (2788), followed by Iowa (1300), Tennessee (1273), Indiana (1040), and Illinois (1005), according to Missouri's "2004 Nationwide Methamphetamine Laboratory Incidents."
- In 2005 the number of incidents decreased slightly to 12,484 again Missouri led the way (2,176) followed by Indiana (981), Tennessee (873) and Iowa (761) according to the Clandestine Laboratory Database and reported in the *Christian Science Monitor*, November 8, 2006.
- Joseph Mazzuca, Operations Director of the Texas-based Meth Lab Cleanup Co., estimates that there are about one and a half million meth labs in the United States. Mazzuca bases this on the fact that three-quarters of the meth labs cleanup calls received by his company never involved law enforcement.
- According to Senator Feinstein's (CA) website, the cost of cleaning up a meth lab ranges from as little as $5,000 to well over $150,000, and taxpayers often have to foot the bill.

Summary

Methamphetamine (meth) is a dangerous drug that, when cooked, creates a hazardous environment. Cooks use a mix of chemicals like acetone, drain cleaner, and toluene that create health and fire hazards. The chemicals soak into the porous elements of the house, so that even if it looks clean, you could be in danger.

Review Questions

1. What is the most common method of meth production?

2. Name at least four chemicals that go into meth production.

3. Where are meth labs commonly located?

4. Name at least three health hazards these chemicals create.

Resources:

Campo-Flores, Arian. "The Fallout: I Felt My Face Just Melting". Newsweek. 8 August 2005. http://msnbc.msn.com/id/8769919/site/newsweek/

Goddard, Terry. "Arizona Drug Endangered Children Program (DEC): Annual Report". 31 October 2003. http://www.azag.gov/DEC/AnnualReport2003.pdf

Missouri State Highway Patrol. "2004 Nationwide Methamphetamine Laboratory Incidents." http://www.mshp.dps.missouri.gov/MSHPWeb/Publications/Reports/2004NationwideLabIncidents.pdf

"Seizures by State 01/01/2003 - 12/31/2003: Report Generated By EPIC's National Clandestine Laboratory Seizure System." http://www.drugfreeinfo.org/PDFs/Stateseizures.pdf

Montana Department of Justice. "Meth in Montana." http://www.doj.state.mt.us/enforcement/methinmontana.asp

Website of US Senator Dianne Feinstein. "Senators Feinstein, Hutchinson, Kohl Introduce Bill to Provide 125.5 Million to fight Methamphetamine." 19 July 2002. http://www.senate.gov/~feinstein/Releases02/meth.htm

Hazard Recognition

Many types of chemical, physical, biological, and psychological hazards may be found at a meth lab cleanup project. Workers should never develop a false sense of security because a work site doesn't "look bad." Workers need to know how to recognize hazards and the signs and symptoms of exposure in order to protect themselves, others, and the environment. If workers know how the hazard occurs and how the body may be affected, then they are better able to take appropriate actions to minimize the risk of exposure. A unique hazard at many meth labs may come from "booby traps". Cooks want to protect their product and one study found that 45% of the labs were booby trapped, some with "Improvised Explosive Devices" (IEDs). This chapter includes four aspects of hazard recognition: (1) chemistry, (2) toxicology and health effects, (3) physical and safety hazards, and (4) material identification.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Understand general chemistry and chemical exposure hazards.
- Understand biological hazards, basic toxicology, measures of concentration, and personal exposure limits.
- Identify routes of entry and target organs affected by chemicals using the *NIOSH Pocket Guide to Chemical Hazards*.
- Use a Material Safety Data Sheet (MSDS).
- Understand electrical, safety, and physical hazards such as punctures from contaminated glass or utensils.

Introduction

Preplanning helps to identify hazards and select protection methods. Evaluation of potential hazardous situations is a continuous process which includes a preliminary evaluation of each raw material, hazard identification, personal protective equipment, storage, monitoring and sampling, risk identification, and employee notification/training.

Preliminary evaluation of hazards at a meth lab must be done by a qualified person. Information is obtained through interviews, existing records, perimeter surveys, and material safety data sheets (MSDS) or other documents regarding materials at the site.

A map of the area to be cleaned up is essential to planning for the potential hazards and PPE needed for the cleanup operation.

Hazard identification includes documenting all potential conditions posing inhalation or skin absorption hazards that are immediately dangerous to life and health (IDLH) or other conditions that may cause death or serious harm. Hazards may include:

- Potentially explosive or flammable situations.
- Residue on surfaces and embedded in fabrics and other porous materials (furniture, toys, drapes, carpet).
- Release of hazardous material to the ground surface water, sewer, or septic system.

This section provides basic information to guide in the recognition of hazards at a meth lab cleanup. (See also Potential Meth Lab Hazards on pg. 127.)

Chemicals Commonly Found in a Meth Lab

- Acetaldehyde[4]
- Acetic acid (vinegar)[4]
- Acetic anhydride[4]
- Acetone (fingernail polish remover)[1]
- Allyl chloride[4]
- Allylbenzene [4]
- Aluminum[4]
- Ammonium acetate[4]
- Ammonium formate[4]
- Ammonium hydroxide[4]
- Anhydrous ammonia (farm fertilizer)[1]
- Benzaldehyde[4]
- Benzene (dye, varnish, lacquer)[2]
- Benzyl chloride[4]
- Chloroform[4]
- Ether (engine starter)[1]
- Formamide[4]
- Freon (refrigerant, propellant)[2]
- Hexane[4]
- Hydrochloric acid (iron ore processing)[2]
- Hydroiodic acid (driveway cleaner)[2]
- Iodine (tincture or crystal)[1]
- Isopropanol[4]
- Isopropyl alcohol (rubbing alcohol)[1]
- Lead acetate[4]
- Lithium (batteries)[1]
- Lithium aluminum hydride[4]
- Magnesium[4]
- Mercuric chloride[4]
- Methanol/alcohol (gasoline additive)[1]
- Methylamine[4]
- Methylene chloride a.k.a. dichloromethane (paint stripper)[3]
- Monomethylamine[4]
- MSM (cutting agent)[1]
- Muriatic acid (swimming pool cleaner)[1]
- N-methylformamide[4]
- Nitroethane[4]
- Norpseudoephedrine[4]
- Palladium[4]
- Phenyl-2-propanone[4]
- Phenylacetic acid[4]
- Phenylpropanolamine[4]
- Phosphine gas (pesticides)[2]
- Phosphoric acid[4]
- Propiophenone[4]
- Pseudoephedrine/ephedrine (cold pills)[1]
- Raney nickel[4]
- Red phosphorus (matches/flares)[1]
- Sodium carbonate[4]
- Sodium chloride (table/rock salt)[1]
- Sodium cyanide[4]
- Sodium hydroxide (lye)[1]
- Sodium metal (gasoline additive)[1]
- Sulfuric acid (drain cleaner)[1]
- Thionyl chloride[4]
- Toluene (brake cleaner)[1]
- Trichloroethane (gun scrubber)[1]

Equipment Commonly Found in a Meth Lab

- Glass dishes (Pyrex)[1]
- Jugs & bottles[1]
- Paper towels[1]
- Coffee filters[1]
- Thermometer[1]
- Cheesecloth[1]
- Funnels[1]
- Blenders[1]
- Rubber tubing/gloves[1]
- Pails & buckets[1]
- Gas cans[1]
- Tape/clamps[1]
- Aluminum foil[1]
- Propane gas tanks (20 lb)[1]
- Hot plates[1]
- Plastic storage containers[1]
- Ice chests[1]
- Measuring cups[1]
- Towels/bed sheets
- Laboratory beakers/glassware[1]
- Hypodermic needles

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1. Umbrell. "Meth Lab Cleanup." The Synergist. Jan 2006: 33-36.
2. Washington State Department of Health. "Hazards of Methamphetamine Production." Jan 2006. http://www.doh.wa.gov/ehp/ts/CDL/methhazards.htm
3. Wisconsin Division of Public Health. "Cleaning up Hazardous Chemicals at Methamphetamine Laboratories." Nov 2003. http://www.dhfs.state.wi.us/eh/ChemFS/pdf/MethFS.pdf
4. North Carolina Department of Health and Human Services. "Clandestine Methamphetamine Laboratories Information & Safety Sheet." Nov 2002. http://www.epi.state.nc.us/epi/oii/pdf/methlab.pdf

Meth Lab Recognition

Most meth labs can be identified in several ways. For example, the chemicals that go into meth create powerful odors like cat urine or rotten eggs. Neighbors can sometimes smell these and report them to police, who then investigate.

The presence of unusual items in trash can be a warning sign too. If there is a lot of cold pill packaging in the trash, this could indicate a meth lab as well, since the pills are a primary ingredient in meth. Many empty containers of toluene, acetone, ammonia and drain cleaner also point to a meth lab because these are important ingredients in the manufacturing process.

Unusual activity is something else to keep in mind. Lots of traffic at odd hours, a non-chemist possessing lots of glassware or thefts of ammonia from agricultural stores, or farms are activities that may indicate meth labs in the area.

Section I- Basic Principles of Chemistry

- **Chemistry** is the study of the properties of chemicals and the changes that occur when different materials are mixed, heated, and/or exposed to extreme pressure or temperature.

- **Chemicals** are made from 111 elements (atoms), 91 of which are naturally occurring on Earth and 20 of which are man-made. Each of the elements is described in their simplest form, the atom.

  About three-fourths of the elements are classified as metals. Some examples are:

Aluminum	(Al)	Lead	(Pb)	Potassium	(K)
Cadmium	(Cd)	Manganese	(Mn)	Sodium	(Na)
Chromium	(Cr)	Mercury	(Hg)	Tin	(Sn)
Copper	(Cu)	Nickel	(Ni)	Uranium	(U)
Gold	(Au)	Platinum	(Pt)	Zinc	(Zn)
Iron	(Fe)				

  Less than one-fourth of the elements combine with metals. Some examples are:

Bromine	(Br)	Hydrogen	(H)	Oxygen	(O)
Chlorine	(Cl)	Iodine	(I)	Sulfur	(S)
Fluorine	(F)	Nitrogen	(N)		

- **Elements** are the basic building blocks of chemical compounds. A combination of two or more elements is called a chemical compound. Generally, substances are divided into two broad categories, inorganic and organic.

- **Inorganic Chemical Compounds:** Some chemical compounds are called inorganic. Generally, chemicals in this group do not contain a carbon (C) atom. Examples include:

Ammonia	(NH3)	Sodium Chloride	(NaCl)
Asbestos	(hydrated mineral silicates)	Sodium Hydroxide	(NaOH)
Hydrochloric acid	(HCl)	Sulfuric Acid	(H_2SO_4)
Silica	(SiO_2)	Water	(H_20)

But there are exceptions, such as Carbon Monoxide (CO).

- **Organic Chemical Compounds:** Compounds that contain carbon (C) are generally classified as organic compounds. Many solvents (degreasing agents) are organic. Petroleum, coal, and oils are made of organic chemical compounds. Some organic compounds are:

Benzene	(C6H6)	Ethyl alcohol	(CH3CH2OH)
Carbon tetrachloride	(CCl4)	Glucose	(C6H12O6)
Chloroform	(CHCl3)	Methyl alcohol	(CH3OH)
Methylene chloride	(CH2Cl2)		

Thousands of chemical products identified on a label or in company manuals by a trade name (manufacturer's) name rather than a chemical name and formula. Trade names may be listed in a chemical dictionary, on the Material Safety Data Sheet (MSDS), and in the *NIOSH Pocket Guide to Chemical Hazards*.

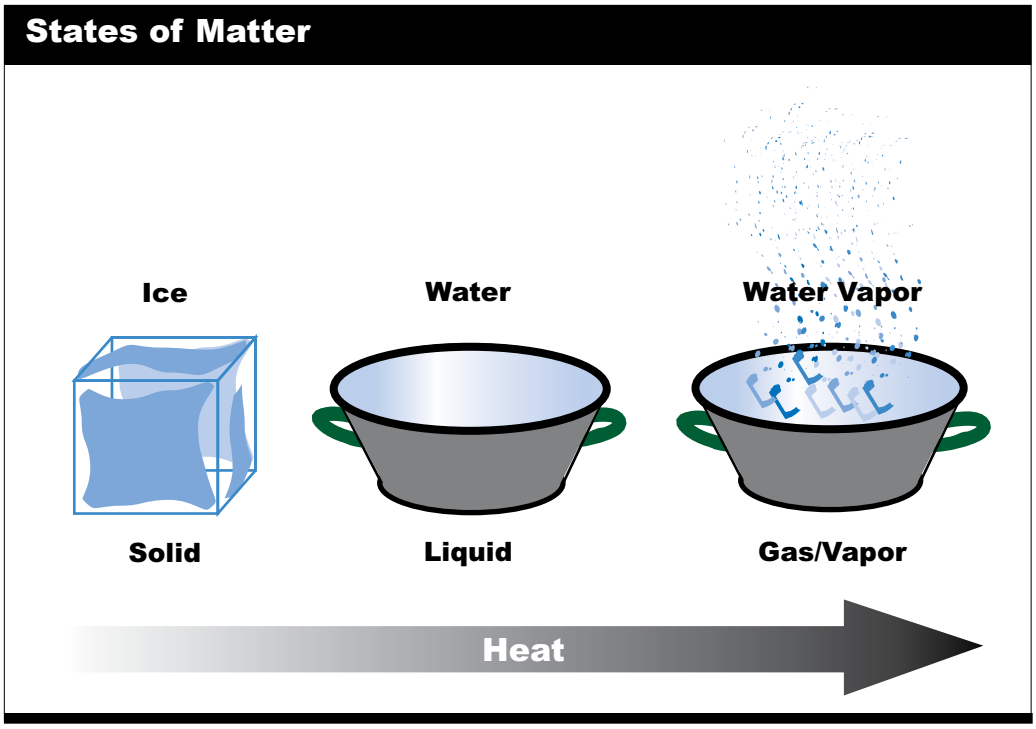
- **NTP**: **Normal Temperature and Pressure** (room conditions) 77ºF or 25ºC; 1 atmosphere or 710 mmHg
- **STP**: **Standard Temperature and Pressure** 32ºF or 0ºC, 1 atmosphere or 710 mmHg

Many properties of materials depend on temperature and pressure. The conditions at which the property is measured will be stated as NTP or STP.

Solid, Liquid, Gas, or Vapor

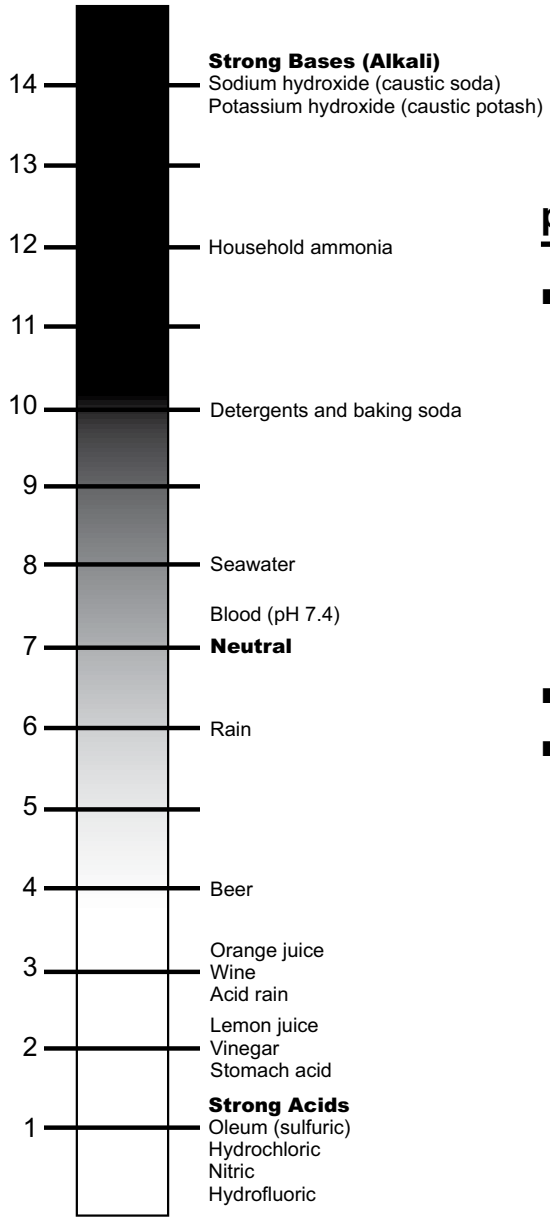
The same compound may be a solid, liquid, or gas/vapor (molecules in the air) depending on its temperature and pressure. For example, lead sheets are solid; but if heated, the lead may melt into a liquid. If heated more, a lead vapor may disperse into the air. Organic solvents such as benzene are liquid when a full container is stored at room temperature. If the container is opened, some will “evaporate” into the air; this vapor can then be inhaled. Dry ice is frozen carbon dioxide; at room temperature the carbon dioxide enters the air as a gas.

The amount of hazard associated with a material may change depending on its physical form. In the example of lead, a sheet of lead may be a safety hazard if dropped, but it cannot get into the body. Liquid lead will solidify at room temperature and would be a burn hazard if touched while hot, but lead vapor when inhaled is absorbed into the blood. Liquid benzene may be absorbed through the skin, especially if there are cuts or sores. Benzene vapor inhaled with air is quickly absorbed by the body. Solid carbon dioxide (dry ice) can cause severe skin damage from a cold burn; high concentrations of the gas result in drowsiness.



Chemical and Physical Properties

If chemicals or wastes are accidentally spilled, released or combined, as often happens at meth labs, it is important to know how they will react. The way chemicals react depends upon their physical and chemical properties. Understanding the way chemicals behave can help workers anticipate the hazards a substance may present. A number of important terms and examples used to describe chemical and physical properties of substances are described on the next several pages.



pH

- **Definition** — Hydrogen ion concentration (pH) is used to determine if a substance is an acid or a base. A pH of 1 is very acidic; a pH of 14 is very alkaline. Because of the very large range in the values of pH, a special scale has been created. On it a change in pH of one unit (for example, from 3 to 4) represents a 10-fold change in acidity or alkalinity.
- **Example** — See scale.
- **Importance** — Compounds with high and low pH values will cause burns, irritate eyes, and irritate the nose and lungs. Substances with a pH of less than or equal to 2 or greater than or equal to 12.5 are legally defined as hazardous waste. Materials with a pH less than 2.0 or greater than 11.5, such as hydrochloric acid or sodium hydroxide, will burn skin, eyes, and lungs.

Corrosive

- **Definition** — A compound which can quickly damage skin, eyes, other tissues, metal, and other solids. For example, strong acids (low pH) and bases (high pH) are corrosive (OSHA definition).
- **Examples**
  - Sulfuric acid (oleum)
  - Benzene
  - Hydrochloric acid
  - Freon
  - Sodium hydroxide
  - Iodine
  - Lye
  - Lithium metal
- **Importance** — Corrosives are reactive health and physical hazards; they must be stored in glass or special plastics.

Freezing Point (FRZ) or Melting Point (MP)

- **Definition** — Temperature at which a liquid or gas becomes a solid or vice versa.
- **Example** — Water changes to ice; ice melts into water.
- **Importance** — Helps determine what form the compound will be in.

Boiling Point (BP)

- **Definition** — The temperature at which a liquid changes into a vapor or gas at atmospheric pressure (1 atm, 760 mm Hg).
- **Examples**

Water	212ºF (100ºC)	Cadmium	1,409ºF
Acetone	133ºF	Ammonia	–28ºF

- **Importance** — Determines whether a substance will be a liquid or gas at the temperature of the air.

Flash Point (Fl. P.)

- **Definition** — The lowest temperature at which a liquid will give off enough vapor to start burning.
- **Examples** — **in degrees Fahrenheit (ºF)**

Gasoline	–45	Acetone	0
Benzene	12	Toluene	40
Ether	–40		

- **Importance** — The flash point is used to classify the relative fire hazards of liquids. If the flash point of a liquid is low, it is considered flammable.

Flammable, Combustible, and Ignitable

- **Definition** — The potential for a substance to catch fire.

  Highly **flammable** materials have a Fl. P. ≤ 140ºF (DOT); (new OSHA regulations Fl. P. ≤ 100ºF). Materials are divided into Hazard Class 2, 3, or 4 depending on the physical state of matter.

  Materials are said to be **combustible** if their flash points range from 141º to 200ºF.

  Ignitable materials have a Fl. P. < 140ºF.

- **Examples** — Gasoline is an example of a flammable liquid. Propane is an example of a flammable gas.
- **Importance** — The flammable, combustible, or ignitable properties of a substance are important to know to determine the probability of a fire.

Autoignition Temperature (AIT)

- **Definition** — The lowest temperature at which a flammable gas/vapor-air mixture will ignite from its own heat source or contact with a heated surface without needing a spark or flame. Vapors and gases will spontaneously ignite at a lower temperature in pure oxygen than in air (21% oxygen).
- **Examples**

Acetone	1,000ºF (537ºC)	Benzene	1,044ºF (562ºC)
Toluene	997ºF (536ºC)	Phosphine	212ºF (100ºC)

- **Importance** — Autoignition temperatures of chemicals may be lowered by physical contact with other substances at a site.

Oxidizer

- **Definition** — A chemical that reacts and gives off large amounts of oxygen and may react readily with other chemicals. Because these chemicals give off oxygen when heated, the hazard is increased at high temperatures.
- **Examples**
  - Ozone
  - Hydrogen peroxide
  - Sodium and Potassium Nitrate
- **Importance** — Fires or explosions are more likely to occur and are more severe if oxidizers are stored near flammables.

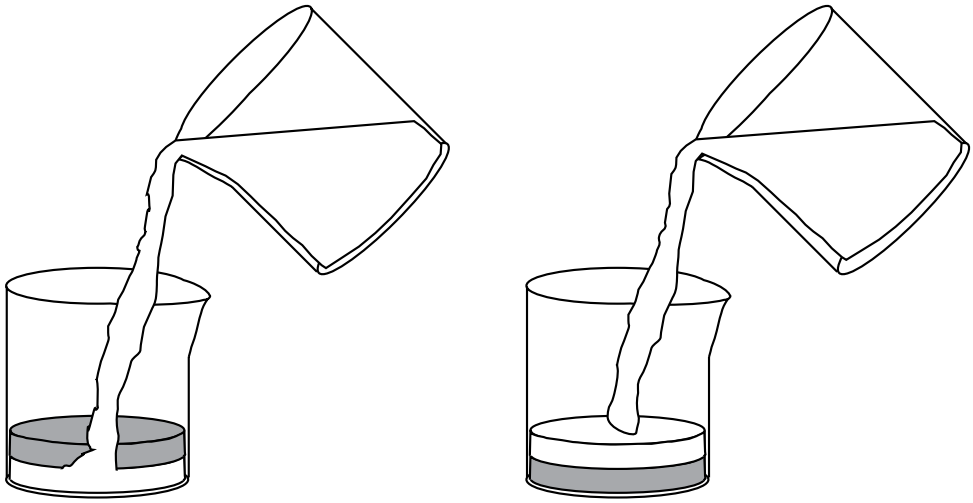
Specific Gravity (Sp. G.)

- **Definition** — Weight of a liquid compared with an equal volume of water (water = 1). If the chemical is not soluble in water and the specific gravity is less than one, the chemical will float. When the Sp. G. is greater than one, the chemical will sink.
- **Examples**

Toluene	0.87	Methylene chloride	1.33
Benzene	0.88	Cadmium	8.65

- **Importance** — If a compound is spilled into standing water, Sp. G. allows you to predict if it will float or sink.

Specific Gravity



Specific gravity greater than 1 **Specific gravity less than 1**

Specific gravity of water equals 1.

Relative Gas Density (R Gas D)

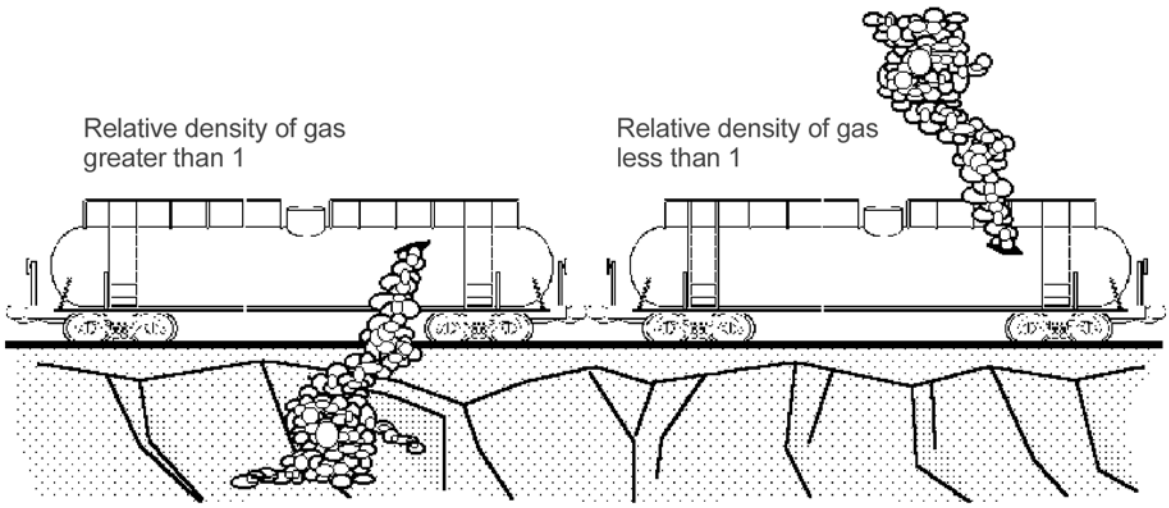
- **Definition** Weight of a vapor or gas compared to an equal volume of air (air = 1). If greater than 1.0, the vapor or gas is heavier than air and will concentrate in low places. If less than 1.0, the vapor or gas will rise.

- **Examples**

Ammonia	0.59	Hydrogen sulfide	1.19
Benzene	2.70	Methylene chloride	2.90
Ethylene	0.97	Trichloroethylene	4.50
Gasoline	4.40		

- **Importance** Important because most vapors from toxic materials and many flammable materials are heavier than air and will accumulate in low-lying areas.

Relative Gas Density



Vapor Pressure (VP)

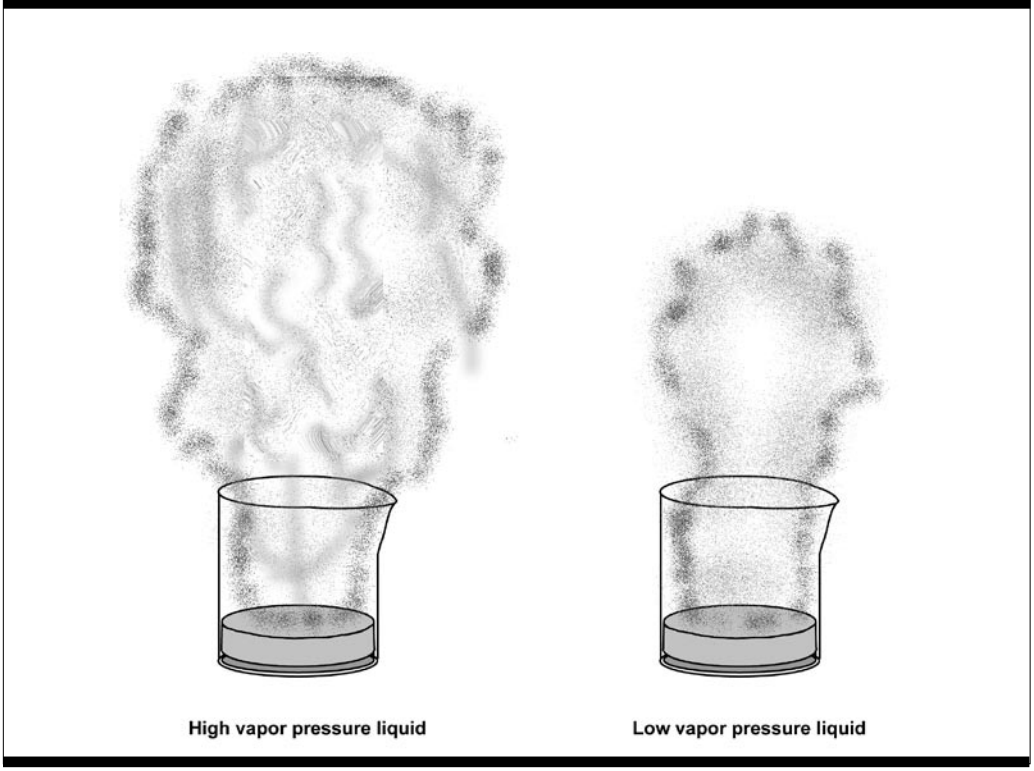
- **Definition** — The measure of the actual maximum amount of the material in air at a given temperature. (MSDS lists this property in millimeters of mercury [mmHg] at 68ºF.) The *lower* the boiling point, the *higher* the vapor pressure.

- **Examples**

	BP (ºF)	VP(mmHg) at 68ºF
Chlorine	-29	> atmosphere
Methylene Chloride	104	350
Acetone	133	180
Trichloroethylene	189	58
Xylene	269	9
Styrene	293	5
Cadmium	1,409	~ 0

- **Importance** — Material with high vapor pressure will enter the air quickly and could overcome a decontamination worker who is not protected. Also, the higher the vapor pressure of a sealed chemical container, the more likely it is to explode as the temperature rises.

Vapor Pressure



Toxicity

- **Definition** — How harmful or deadly a substance is.
- **Examples** — *Skin contact hazard*:
  Acids and alkalies

  Inhalation hazard:
  Methyl bromide and solvents

  Ingestion hazard:
  Radioactive materials and solvents
- **Importance** — The worker has the right to know the health effects of the chemicals identified at a job site.

  The EPA has a specific definition of *toxic* and lists of toxic hazardous wastes. It is important to remember that all substances which may cause harm are not on the official lists.

Viscosity

- **Definition** — Thickness of a liquid or its ability to flow. As the temperature increases, the thickness of a liquid may decrease. Measured in Centipoise (CP).
- **Example**
  - Water has a low viscosity.
  - Molasses has a high viscosity.
- **Importance** — Because viscosity can change with the temperature, a high-viscosity substance may become runny when exposed to heat and spread faster.

Volatility

- **Definition** — Volatility refers to how readily a material will evaporate into the air (vaporize). Volatility increases as the temperature increases.
- **Example** — Gasoline is a volatile liquid; lubricating oil is not.
- **Importance** — Volatile liquids can give off vapors which may be harmful to your health. Some volatile materials can produce a vapor heavier than air (high vapor density) that can creep along the ground and fill up manholes, trenches, or other low-lying areas. The vapor forces out oxygen and can result in death by suffocation. Some vapors' concentrations are explosive or flammable.

Catalysts and Inhibitors

- **Definition** — A catalyst is a chemical that when present can cause a reaction to occur more rapidly. An inhibitor is a negative catalyst; a reaction will not occur or will be slower because of the presence of a chemical inhibitor. A chemical that slows another's action or prevents rust is an inhibitor.
- **Example**
  - **Catalyst**—halides, oxides, sulfides.
  - **Inhibitor**—acetanilide: retards decomposition of hydrogen peroxide, salicylic acid: prevents degradation of rubber.
- **Importance** — A chemical stored in close contact with other chemicals may act as a catalyst and cause a fire or explosion. The removal of a chemical inhibitor may cause explosions or other dangerous conditions.

Surface Tension

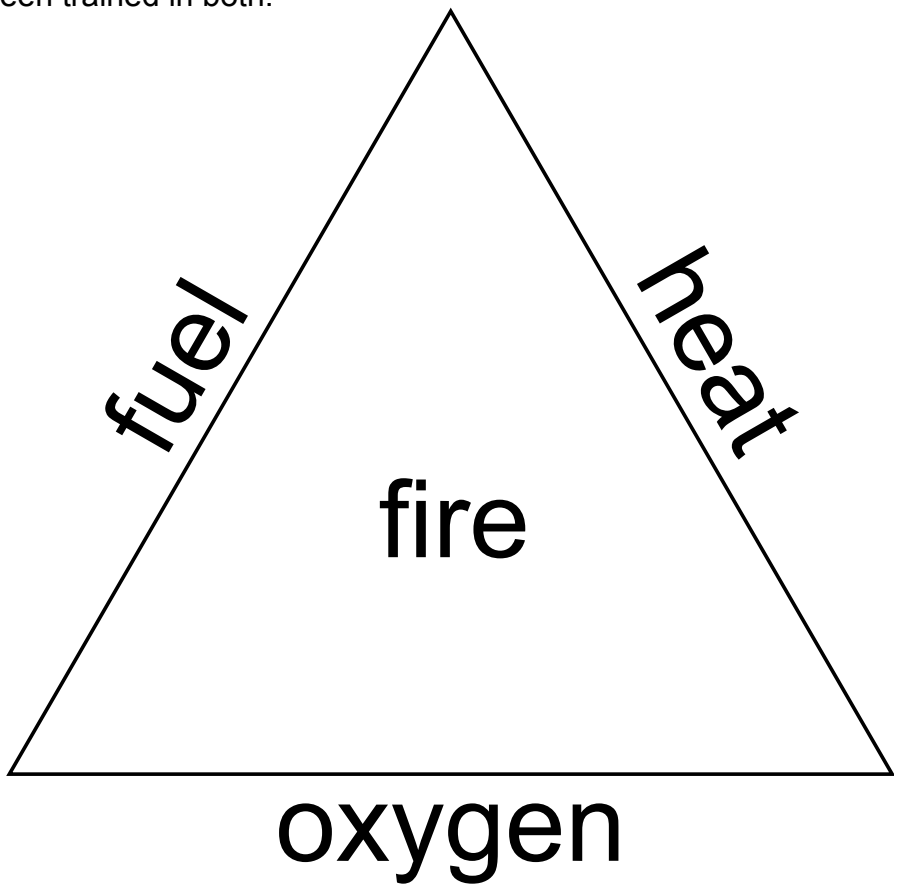
- **Definition** — Surface tension is the attractive force exerted which acts as an inwards pull, restraining the liquid from flowing.
- **Example** — You can see an example of surface tension by filling a glass with water. The water level can be above the glass rim (before it overflows) due to surface tension. Mercury has the highest surface tension; benzene and ethanol have almost no surface tension.
- **Importance** — Mercury will flow, but it will form into droplets. Benzene and ethanol will flow more readily than water. This principle will help determine what sort of containment and decontamination methods should be used.

Fire Triangle: Fuel, Oxygen, and Heat

For a fire to start, three things must exist: fuel (which may be a flammable vapor), oxygen from the air or other source, and heat (or source of flame or spark). These three items make up the **fire triangle**. The fire triangle helps predict situations that may result in fire.

Once a fire is started, the temperature is determined by the amount of heat produced by the fuel. Some types of fuel burn hotter than others. To put out a fire, you must remove one of the three elements.

According to 1910.120, firefighting and emergency response cannot be combined unless someone has been trained in both.



For example:

In an automobile engine, the fuel (gasoline), oxygen (in the air), and heat (spark plug) combine to form a rapid series of explosions which push the cylinders to power the vehicle. These explosions occur because the gasoline vapor (fuel) becomes so concentrated in the air (contains oxygen) that a spark from the plug produces a violent reaction.

Toxic Products of Combustion

When a fire destroys a building, it presents a very hostile environment. Heat from a fire can exceed 1,000ºF; thermal drafts can create gale-force winds; buildings weakened by fire can collapse on firefighters; and the lack of oxygen can cause suffocation.

Fires can also create hidden dangers in the form of chemicals that are given off when products burn. Products such as furniture, pipes, wall coverings, and insulation materials contain chemicals that can give off deadly gases and fumes when burned.

For example, polyvinyl chloride (PVC), one of the major ingredients in many plastics, decomposes in a fire to form hydrogen chloride, phosgene, and many other products. In addition to being poisonous, some of these gases also may cause cancer.

Here are a few types of common materials that might be in a meth lab or surrounding rooms and the chemicals created when they are burned. Each of the toxic chemicals can interfere with your ability to breathe.

Product	Created When Burned
Wool, silk, nylon, polyurethane, upholstery	Hydrogen cyanide
Wool, silk, nylon, melamine tableware	Ammonia
PVC, acrylics, retardant-treated materials	Hydrogen chloride, phosgene
Fluorinated resins (Teflon ™)	Hydrogen fluoride
Sulfur sources (such as Sulfuric acid)	Sulfur dioxide
Hair, wool, meats, hides	Hydrogen sulfide
Plastics, chlorinated solvents (chloroform, trichloroethane, methylene chloride)	Phosgene
Fabrics, celluloid	Nitrogen Oxides

Fire in a building that houses a meth lab presents an even greater hostile environment. In addition to the toxins normally associated with a building fire, the chemicals used in the manufacturing process present not only toxic atmospheres but also explosive atmospheres.

Materials used to produce meth can produce toxins when exposed to air or water during fire fighting. Examples are shown below:

Chemical	**Result if in contact with**	
	Air	Water
Acetic Anhydride		Acetic Acid
Phosphoric Gas	Flame	
Sodium Hydroxide		Heat sufficient to cause combustion

Source: NIOSH Pocket Guide

Explosive Limits

When there is just enough gas or vapor in the air to cause an explosion, this concentration is called the **Lower Explosive Limit** or LEL (% in air). As the amount of chemical in the air increases, it will reach a point where there is too much to produce a fire and subsequent explosion. This concentration is called the **Upper Explosive Limit** or UEL (% in air).

Compare these explosive limits to the operation of the car engine. When the mixture is too lean (not enough gas), the engine will not run. The gas vapor is below the LEL and the engine will not run. If the engine floods (too much gas), then the UEL has been exceeded and the car will not run. When the mixture is right and the spark plugs are working, the gas/air mixture burns and the engine fires.

During an emergency or operations involving flammable/explosive gases or vapors, constant air monitoring is essential, because the concentration of the gas can rapidly change. The air also needs to be monitored throughout the site, not just in the immediate area of the release.

Lower Explosive Limit (LEL) is the minimum concentration (% in air) of a substance which is required for ignition. Concentrations below the LEL will not ignite. Below the LEL, the mixture is called “lean.” *If the concentration of a flammable vapor or gas is greater than 10% of the LEL, evacuate the area.*

Upper Explosive Limit (UEL) is the maximum concentration (% in air) of a substance which is required for ignition. Concentrations above the UEL will not ignite. Above the UEL, the mixture is called “rich.”

Minimum Explosive Concentration (MEC) is the minimum concentration of a solid material dispersed in air (g/m^3) that is explosive.

Explosive Range is the concentration of a substance in air between the LEL and UEL. In this range, the substance will readily ignite.

Incompatible Chemicals

Incompatible chemicals react violently when they come in contact with each other. They may become more volatile and react due to an atmospheric change such as a temperature increase.

Reactions of incompatible materials may result in:

- Heat.
- Fire.
- Explosion.
- Toxic gas release.

When strong acids and alkalies (bases) are mixed, the resulting heat and spattering can damage eyes and skin. Acids added to cyanides produce hydrogen cyanide gas, which can cause death. Acids added to sulfides produce hydrogen sulfide gas, which can cause death.

Incompatible chemicals must be stored away from each other and protected from coming into contact. The containers may leak or rupture. Water on some chemicals will create heat, spattering of liquids, and toxic fumes. Examples of incompatible compounds are:

Chemical	Incompatible with:
Acetone	Oxidizers, acids
Ammonia	Strong oxidizers, acids, halogens, salts of silver & zinc
Benzene	Strong oxidizers, many fluorides & perchlorates, nitric acid
Ether	Strong oxidizers, halogens, sulfur, sulfur compounds, tends to form explosive peroxides under influence of air and light
Hydrochloric acid	Hydroxides, amines, alkalis, copper, brass, zinc
Iodine	Ammonia, acetylene, acetaldehyde, powdered aluminim, active metals, liquid chlorine
Lithium	Water
Phosphine	Air, oxidizers, chlorine, acids, moisture, halogenated hydrocarbons, copper, may ignite SPONTANEOUSLY on contact with air
Red phosphorus	Halogens, halides, sulfur, oxidizing materials, alkalis
Sodium hydroxide	Water, acids, flammable liquids, organic halogens, aluminum, tin, zinc, nitromethane
Sulfuric acid	Organic materials, chlorates, carbides, fulminates, water, powdered metals, reacts violently with water with evolution of heat
Toluene	Strong oxidizers

Potentially Dangerous Chemical Properties

Unstable compounds, as well as water-reactive and air-reactive chemicals, pose additional problems for meth lab cleanup teams. It is important to be aware of the special procedures necessary to deal with these types of chemicals.

Unstable Compounds

Unstable materials will decompose without reacting with any other compound. Heat or flammable gases may be generated, resulting in fire or explosion. Toxic gases may also result.

Ethers stored for a long time react with the oxygen in the air to form peroxides. These peroxides are chemically unstable and shock-sensitive, and explosion may result from moving a container. Ethyl ethers are examples of ethers which form peroxides, for example.

Water-Reactive Materials

Some materials react violently if contacted by water. These materials must be identified and appropriately labeled to prevent use of water for firefighting, diversion of a spill into a sewer line, or use of water during cleanup procedures. Examples include sulfuric acid (release of heat) and sodium metal (release of hydrogen gas).

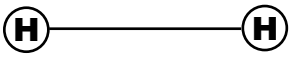
The so called Nazi method of methamphetamine production uses lithium metal out of camera batteries. Lithium, along with other group one metals (the first column in the periodic table of the elements), is water-reactive. In small amounts, lithium will float and fizz. Sodium has a stonger reaction - it floats as well, but melts completely. One step further down the periodic table leads us to potassium, which will erupt into a pinkish flame.

What causes these reactions? First, realize that water is made of hydrogen and oxygen atomes (H_2O). When the group one metals hit the water, they cause such an elemental ruckus that the oxygen and hydrogen atoms in water split apart, forming hydrogen gas and hydroxide ions. The newly formed hydrogen gas is what ignites with the potassium.

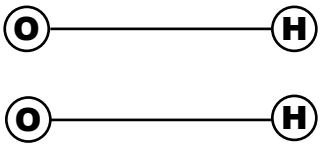
Water Molecules:

After adding group one metal:

H_2 Hydrogen (gas)



OH^- (Hydroxide ions)



H = Hydrogen

O = Oxygen

Notice how there are still four hydrogen atoms (circles with an H inside) and two oxygen atoms (circles with an O inside). The water molecules have been broken down and rearranged.

Air-Reactive Materials

Some materials ignite if exposed to air. These materials are generally stored under water or another non-reactive material. Examples of these pyrophoric materials include potassium (stored under water-free xylene) and white phosphorous (stored under water).

When ether, a typical solvent used in meth manufacture is exposed to air, it forms explosive peroxides. Phosphine gas, a byproduct of cooking the drug, can ignite spontaneously when it comes into contact with air.

Explosions

Some chemical reactions produce gas from solids or liquids. When the reaction between the ingredients of blasting powder is started with a spark or shock, a violent generation of heat and gas occurs that can shatter rocks or shell casings. In such a reaction one compound that can burn reacts with another called an oxidizer, which takes the place of the oxygen in the air. Nitrates, perchlorates, and peroxides are examples of oxidizers. Some single compounds such as trinitrotoluene (TNT) contain all the ingredients necessary to create an explosion.

Movement After the Release

As a first step in preplanning, it is important to determine the location and volume of each material that may be released. The next step is to understand how these materials may spread around the work area or into the community through the air, water, or soil or your work efforts. This process of predicting the dispersion of the hazardous substance also requires understanding what incompatible substances may also be released or come in contact with one another. How materials disperse depends on whether they are solid, liquid, or gas/vapor. For example, a liquid containing cyanide salts when mixed with an acid forms hydrogen cyanide gas—a lethal gas.

Liquid Movement

Liquids may be released to the air, a solid surface, or water.

Liquids in the air include streams released under pressure or droplets. The stream will tend to fall due to gravity, but it may be carried some distance due to wind. Droplets or a cloud of droplets will also tend to fall, but at a slower rate; droplets are also more easily affected by wind or other air currents. The smaller droplets will stay airborne longer. They may form a plume and be carried downwind of the release. As the distance from the point of release increases, so does the width of the plume. Liquids released into the air will also evaporate; the rate of evaporation depends on many factors, including the vapor pressure and the total size of the liquid surface exposed to the air.

Liquids may be released to a solid surface such as the plant floor, ground, or a roadway. Liquids will tend to disperse or spread across the surface, “soak into” or percolate into the surface, or evaporate depending upon physical parameters. If the surface is inclined, the liquid will flow toward the lowest point; the rate at which it flows is related to viscosity.

Liquids released on water or which flow into water will disperse depending on a number of physical factors. The specific gravity and water solubility determine where the spilled material will settle in a body of still water. Materials on the surface of the water will enter the air, depending on the vapor pressure. Solubility of the contaminant influences the rate at which it will dissolve in the water. In still water, dense, insoluble material will sink; however, this principle cannot be predicted if the water is moving or being mixed. The dispersion of a material released to water must be considered in three dimensions: above the surface, at the surface, and below the surface. This dispersion is called a plume.

Predicting Behavior of a Liquid on a Solid Surface

Physical factors which help predict behavior of a liquid on a solid surface include:

Disperse
- Viscosity of liquid
- Temperature of surface and liquid
- Incline of surface

Percolate
- Viscosity of liquid
- Density of surface/ soil

Evaporate
- Surface area exposed to air
- Vapor pressure
- Temperature of surface and air
- Pressure of liquefied gases

Solid Movement

Solids released to still air will tend to fall, unless a source of ignition is present and the material is flammable or the concentration explosive. Solid products of combustion will settle and may be toxic. If solids are released at high pressure or into a rapidly moving air stream, a plume will form and the material may be carried for some distance.

Gas/Vapor Movement

The release of a gas or vapor into still air will result in the contaminant dispersing outward in all directions. The concentration decreases as distance from the point of emission increases. When the air is not still, the plume is transported away from the emission source. How this transport occurs will depend on the turbulence of the air (direction, speed) and the rate of the emission (one-time versus continuous stream). The prediction of dispersion will be based on the meteorological conditions at the time of discharge. Nonetheless, where potential releases to the air are identified in risk assessment, the usual wind speed and direction for each season should be obtained and used to characterize the hazards more fully.

NIOSH Pocket Guide Directions

The *NIOSH Pocket Guide to Chemical Hazards* is useful for identifying chemical and physical properties, protective equipment, and known health hazards for workers. Directions for using the guide are detailed below.

The first part of the guide explains how to use it. Tables of codes and abbreviations are defined as well. This exercise will help you understand how to use the pocket guide.

Turn to page with the listing for *ammonia* in the *NIOSH Pocket Guide to Chemical Hazards*. Chemicals are listed in alphabetical order along the far left margin of the guide. Read across the top of the page to see the kinds of information included:

- Chemical Name
- Synonyms
- Exposure Limits
- Immediately Dangerous to Life and Health (IDLH) level
- Physical Description
- Health Hazards
- Chemical/Physical Properties
- Incompatibilities and Reactivities
- Measurement Method
- Personal Protection/Sanitation
- Recommendations for Respirator

Information on **ammonia** is as follows:

Chemical Name:	ammonia	RTECS:	BO0875000
Structural Formula:	NH_3	DOT ID:	1005 (anhydrous)
CAS:	7664-41-7	DOT Guide #:	15 (anhydrous)

Summary - Chemistry

Hazardous substance releases and reactions can cause harm to people and the environment by:

- Releasing toxic gases.
- Putting out large amounts of heat.
- Causing a fire or explosion.
- Producing direct effects by liquid, solid, or gaseous contact with persons.

Chemical terms used to describe the chemical and physical properties of substances help the worker anticipate the hazards that may be present. The most commonly used terms are:

- Boiling point.
- Relative density of gases.
- Flash point.
- pH—acid or alkali.
- Flammability.
- Vapor pressure.

Knowing the upper and lower explosive limits helps the worker determine if the atmosphere is potentially explosive. If the concentration of a flammable vapor or gas is greater than 10% of the LEL, the area should be evacuated. The fire triangle shows the three elements necessary for a fire to burn:

- Fuel (can be solid, liquid, or a flammable vapor).
- Heat (spark or fire source).
- Oxygen in the air.

It is very important that workers identify incompatible chemicals for their own safety. The *NIOSH Pocket Guide to Chemical Hazards* is one reference which may be consulted to identify water-reactive chemicals, oxidizers, degreasing solvents, alkalis (bases), and acids.

Key Terms - Chemistry

Identify or define the following:

- pH
- Oxidizer
- Boiling point
- Solubility
- Corrosive
- Specific gravity
- Fire triangle
- Toxicity
- Flash point
- Relative gas density
- Flammable, combustible, and ignitable
- Vapor pressure
- LEL
- UEL
- Viscosity
- Incompatible chemicals
- Autoignition temperature
- Melting point
- Volatility
- Freezing point

Review Questions - Chemistry

1. What hazards can result from chemical reactions?

2. Describe three different properties of chemicals, and tell the importance of each.

3. What three things are necessary to start a fire?

4. Describe the possible results of improper storage of incompatible chemicals.

5. If the concentration of a flammable vapor or gas is greater than 10% of the LEL, what should you do?

Section II - Toxicology and Health Effects

Basic Principles of Toxicology

Toxicology is the study of physical and chemical agents that damage humans, animals, and/or the environment.

What is a toxic response?

- Remember the first time you inhaled cigarette smoke? What reaction did you have—eye, throat, and airways irritation; nausea; dizziness?
- Do you, or someone you know, have a runny nose and red eyes during “ragweed season?”
- Remember the first time you drank too much alcohol? Did you experience slurred speech, dizziness, nausea, vomiting, “passing out,” and hangover complete with headache?

These are examples of toxic responses; your body reacted to the exposure. The damage to your body was felt quite soon in each of these examples.

Responses to Exposures Exercise

Think for a moment about responses you have experienced to exposures that may have occurred at home or during work or other activities. List them in the table below:

Chemical/Exposure/Activity	Response

Acute Exposure

An acute exposure is an exposure to a high concentration of a chemical for a short period of time that harms you immediately or causes a delayed response.

After recovery you may have no evidence of damage or may have permanent damage. Immediately dangerous to life and health (IDLH) concentrations are set to help prevent severe acute effects. An acute exposure can cause death. Check the *NIOSH Pocket Guide to Chemical Hazards* for IDLH levels and acute effects for chemicals of concern. Many Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) have been set to prevent other acute effects, such as eye or skin irritation.

Acute Exposure	IDLH	Acute Response
Anhydrous Ammonia	30 ppm	Irritation to eyes, nose, throat, chest pains, skin burns, liquid: frostbite
Acetone	2500 ppm	Central nervous system depression, dizziness
Hydrochloric acid	50 ppm	Irritation to nose, throat, larynx, coughing, choking, liquid: frostbite
Iodine	2 ppm	Irritation to eyes, skin, nose, chest tightening, skin burns
Ethyl Ether	1900 ppm	Irritation to eyes, skin, upper respiratory system, dizziness, drowsiness, headache, nausea, vomiting
Sodium hydroxide	10 mg/m^3	Irritation to eyes, skin, mucous membranes, burns, temporary loss of hair

You usually recognize an acute exposure and remove yourself from the area if the chemical has good warning properties. Warnings include:

- Irritation to the skin, eyes, or lungs.
- Odor or bad smell (but don’t depend on your nose to alert you).
- Chest pain.
- Dizziness.

Chronic Exposure

A chronic exposure is a long-term, generally low-concentration exposure to a chemical which may produce repeated irritation of the skin, organ damage, and/or cancer. For example, an alcoholic develops cirrhosis (scarring) of the liver over 20–30 years of repeated exposure.

Many Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) were set to help prevent chronic disease. See the *NIOSH Pocket Guide to Chemical Hazards* for PELs and TLVs for chemicals of concern.

Chronic exposures may not seem to bother you, but be smart; you have a right to know the effects chemicals have on your health.

Some chemicals can cause both acute and chronic exposures, depending on how long you were exposed and the chemical concentration. The following chart provides examples of chronic exposure response to chemicals commonly found in meth labs.

Chemical	Chronic Exposure Response
Acetone	Severe skin irritation or dermatitis
Anhydrous ammonia	Damages lungs and mucous membranes
Isopropyl alcohol	Central nervous system effects
Ethyl Ether	May be habit-forming, headache, drowsiness, increased excitability and psychiatric problems.
Hydrochloric acid	Erosion of enamel on front teeth
Iodine	Insomnia, conjunctivitis, bronchitis, tremors, rapid heart rate, weight loss, allergies
Lithium	Kidney toxicity, blindness, reduced heart rate and blood pressure
Trichloroethane	Liver toxicity
Red phosphorus	Systemic phosphorus poisoning, liver damage, kidney damage, jaw/tooth abnormatlities, blood disorders and cardiovascular effects
Sodium hydroxide	Destroys tissue
Sulfuric acid	Erosion of enamel on front teeth
Toluene	Central nervous system effects, memory problems, muscle weakness, coma

Some chemicals can cause both acute and chronic exposures, depending on how long you were exposed and the chemical concentration.

Routes of Entry

The way a harmful material enters the body is called the “route of entry.” The four routes of entry are skin absorption, inhalation, ingestion, and injection. Taking a toxic material into the body by these routes of entry can result in acute or chronic effects.

Skin Absorption

The skin may be a major route of exposure, as many chemicals (solvents and liquid insecticides) cross through the skin and get into the bloodstream. Some chemicals (e.g., formaldehyde) penetrate the skin and set up an allergic reaction. Chemicals pass through the skin into the blood. If the skin is irritated, damaged, or punctured, absorption is increased. Human skin in different areas of the body absorbs chemicals at different rates. If you compare the rates of absorption of chemicals through the skin in different parts of the body to that absorbed through the skin of the foot, there are great differences.

Area of Body	Times Greater Than Absorbed through The Foot
Scalp and forehead	34 - 36
Arms	10 -15
Hands	5 - 10
Scrotum	300

Inhalation

As we breathe, we take in whatever is in the air. If dusts, particles, and chemicals are in the air, they may be deposited in the lungs or cross into the bloodstream along with oxygen. Inhaled dusts and fibers caught in the nose and airways are moved out of the nose and airways on an “escalator” made of hair-like cilia and mucus and then swallowed. Inhalation is the major way that toxic substances get into your body. If the “escalator” becomes damaged, you will keep more of the particles in your lungs.

Ingestion

Chemicals can be ingested through the mouth and swallowed when eating, drinking, or smoking. Don’t eat, drink, smoke, or apply cosmetics in a contaminated area. Never carry cigarettes or cosmetics into contaminated areas.

Toxic particles are cleared (moved out) from the nose and lung in mucus. The mucus is swallowed and moves through the stomach and intestines. Toxic particles may be absorbed from the intestines into the bloodstream.

Injection

A chemical can be accidentally injected into the body if you get injured by a tool, compressed air/gas line, fall, or sharp object.

Some chemicals can enter the body in more than one way.

- Solvents: absorption, inhalation, ingestion, injection
- Metal fumes: absorption
- Carbon monoxide: absorption
- Metal particles: inhalation

Local and Systemic Effects and Target Organs

Local Effects

Local effects occur at the point of contact with the skin, eyes, nose, throat, and airways. Chemical and physical agents that produce local damage include corrosive action of acids and alkalies on the skin and eyes; irritation of the nose, throat, and lungs by chlorine, ammonia, and sulfur dioxide; and skin irritation from ultraviolet radiation (sunlight). The effect occurs in the tissue where the contact occurred.

Systemic Effects

Systemic effects occur when a chemical or physical agent gets into the blood and is distributed in minutes throughout the body to all organs and tissues (including muscle and fat). For example, the route of entry of solvents such as benzene may be at the skin or through the lungs, but the exposure affects the bone marrow or brain. A toxic gas such as hydrogen cyanide is inhaled, but the exposure affects the use of oxygen in the muscles and organs. If the heart (muscle) or brain (organ) can't use oxygen, you are dead in minutes.

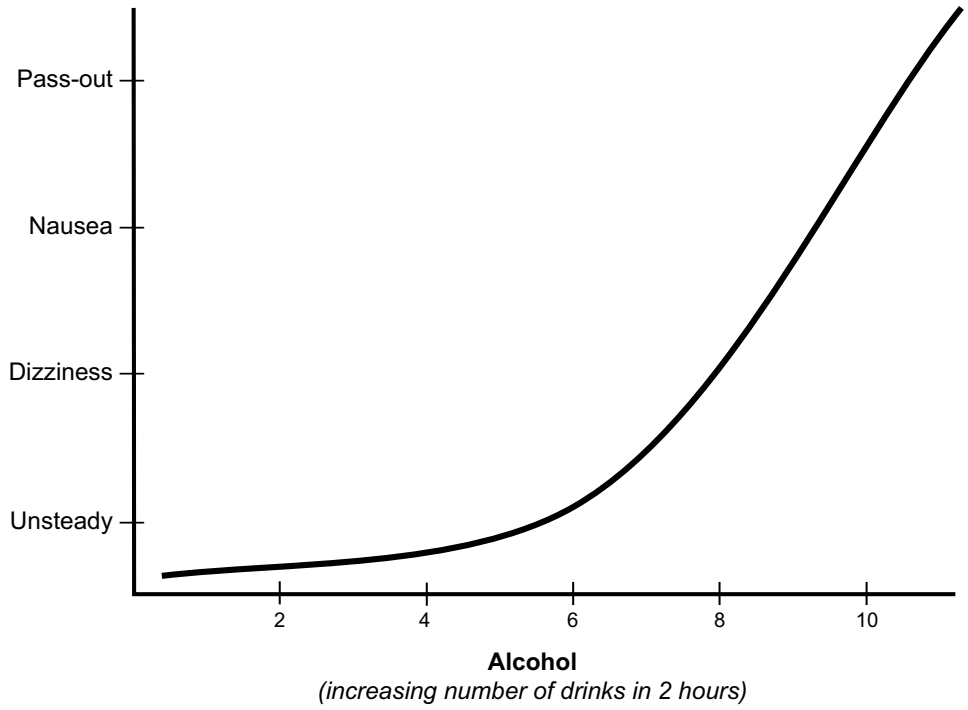
The part of the body which is affected by the exposure is called the target organ. A few examples are given below.

Exposure	Target Organ(s)
Toluene	Eyes, respiratory system
Trichloroethane	Respiratory system
Sulfuric acid	Eyes, skin, teeth

The Body's Response to Exposure

Dose Response—The higher the dose (concentration), the greater the response (reaction).

Dose Response



Importance: Each person has his/her own dose response to alcohol, and the same is true with respect to chemicals at work sites.

If we gave 30 people 12 alcoholic drinks, when 15 people "passed out," there would be somebody who would not appear to be drunk.

What affects an individual's response to a toxic chemical?

- Body weight.
- Male or female.
- Physical and health condition.
- Personal habits.
- Heredity.
- Age.

When any exposure results in an effect, there is no threshold of response. Workplace exposure limits may not protect the hypersensitive and frequently permit mild adverse effects, such as irritation or noticeable odors, as a warning property.

Chemical and physical agents sometimes interact to produce a greater or lesser toxic effect:

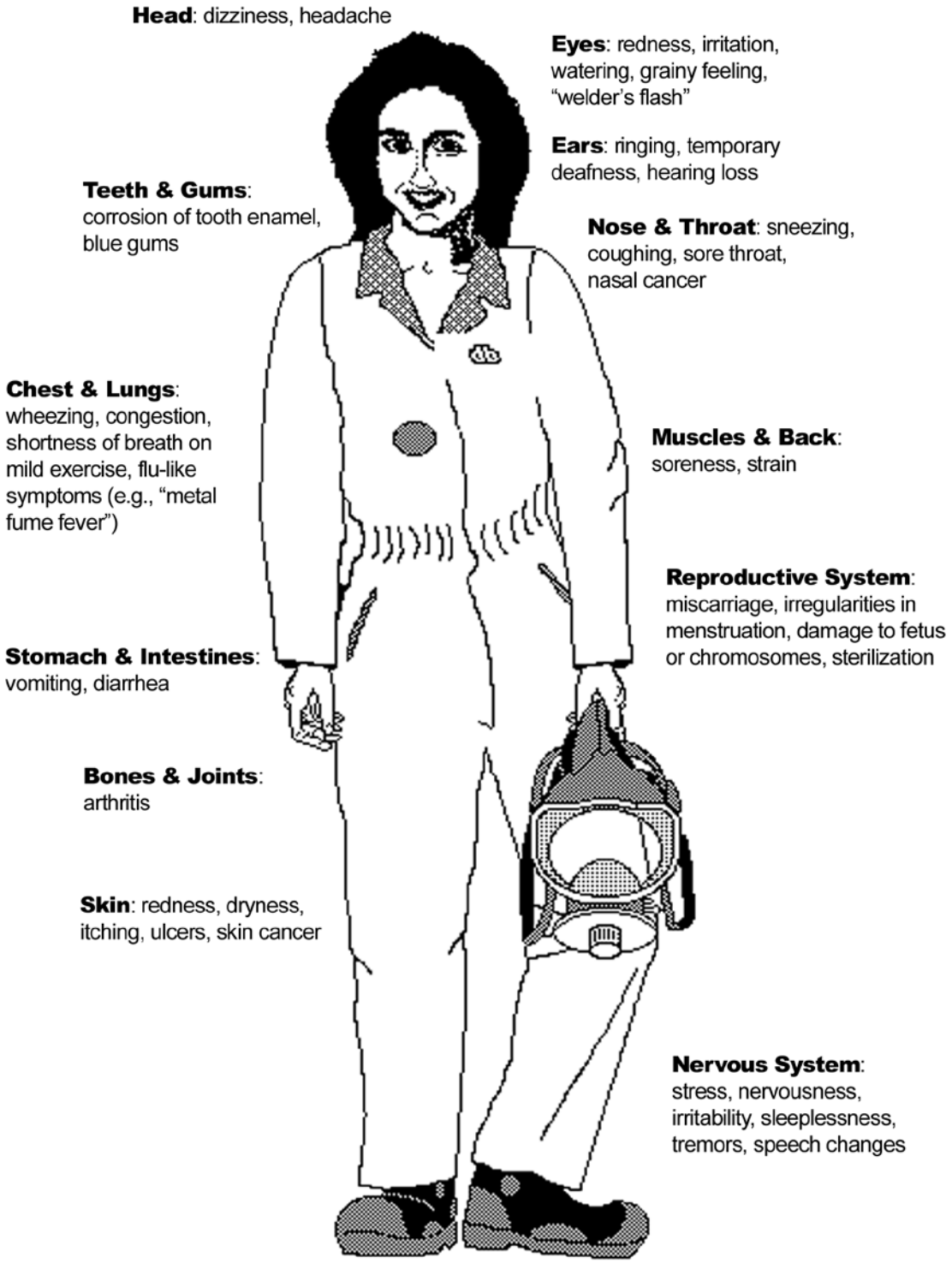
- Additive (2 + 2 = 4)—The combination of the parts equals the sum. The insecticides Malathion™ and Sevin have the same effect on the body. If one were exposed to Malathion™ and then to Sevin, the effect would be additive.
- Subtractive (2 – 1 = 1)—The parts combine to be less than the sum. Eating a meal after consuming an alcoholic drink will reduce the effects of the alcohol.
- Synergistic (2 + 8 = 16)—The parts combine to be greater than the sum. Exposure to a combination of asbestos and cigarette smoke increases the risk of lung cancer more than the two risks added together.
- Potentiative (0 + 2 = 4)—The presence of one part amplifies the other so that the effect is greater than expected. One alcoholic drink during the course of an hour, which would not impair most functions, will impair function among those who have been exposed to chlorinated solvents. For example, Degreaser's Flush is a term used to describe the red face of a degreaser operator who has had a beer with lunch. Alcohol is considered less toxic than chlorinated solvents, but the solvent potentiates the effect.

Effects on Specific Body Systems

Chemical and physical agents (such as radiation and heat) may affect various parts of the body. In the next few pages, some examples are given of effects on the:

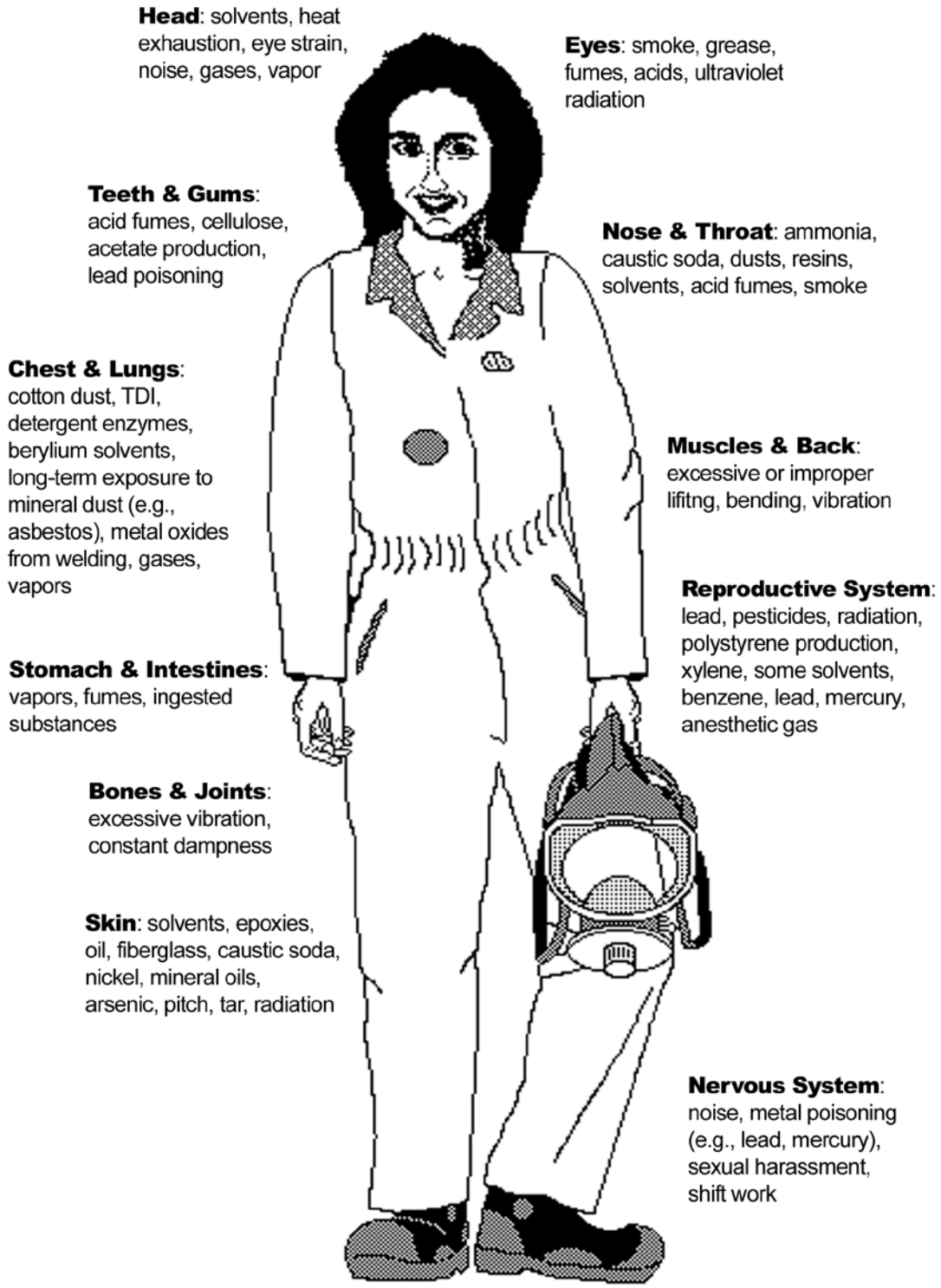
- Skin.
- Eyes.
- Respiratory system.
- Gastrointestinal system.
- Nervous system.
- Kidneys and bladder.
- Blood, bone marrow, and heart.
- Reproductive system.

Health Effects:
How does your body react?



Adapted from the International Metal Worker's Union

Health Effects: What affects your body?



Adapted from the International Metal Worker's Union

Cancer Caused by Chemical or Physical Agents

A number of chemical and physical agents have been shown to cause cancer when exposure is repeated over a long period of time. The higher the concentration and more regular the exposure, the shorter the time for cancer to develop.

Scientists debate the ability of a single exposure to cause cancer, because the body has many repair mechanisms which work well if not overtaxed. Two terms must be defined.

- Mutagen — A chemical or physical agent that damages the blueprint (DNA [genetic code]) of cells in your body.

  Examples: Ultraviolet light.
  Toluene (benzene contaminated)
  Solvents

- Carcinogen — A chemical or physical agent that causes cancer. Characteristics of cancer include uncontrolled cell division, invasion of tissue, and dispersion to other tissues and organs (metastasis).

  Examples: Lead
  Toluene (benzene contaminated)
  Solvents

When cells are exposed to a **mutagen** and DNA is damaged, the cell goes to work and tries to repair the damage before dividing. Exposure inhibits the target organ's ability to repair the damaged DNA, and cancer develops over a long time period.

Some chemicals which are not mutagens cause cancer. How this happens is still being studied.

Chemicals Listed As Carcinogenic in the NIOSH Pocket Guide to Chemical Hazards (1990)

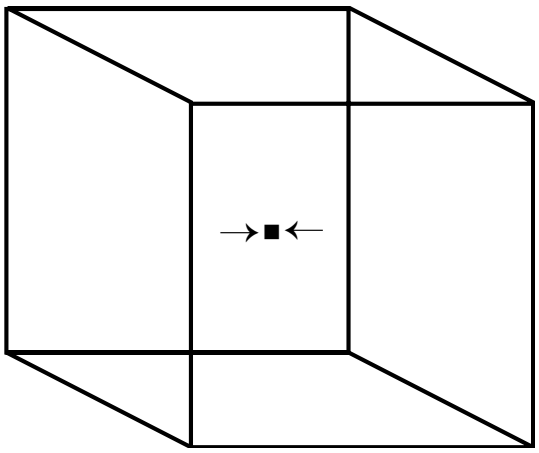
- Acetaldehyde
- 2-Acetylaminofluorene
- Acrylamide
- Acrylonitrile
- Aldrin
- 4-Aminobiphenyl
- Aniline
- Anisidine
- Arsenic and compounds
- Arsine
- Asbestos
- Benzene
- Benzidine
- Beryllium
- 1,3-Butudiene
- tert-Butyl chromate
- Cadmium dust
- Cadmium fume
- Carbon black
- Carbon tetrachloride
- Chlordane
- Chlorinated camphene
- Chlorodiphenyl (42 and 54% chlorine)
- Chloroform
- bis-Chloromethyl ether
- Chloromethyl methyl ether
- beta-Chloroprene
- Chromic acid and chromates
- Coal tar pitch
- DDT
- 1,2-Dibromo-3-chloropropane
- p-Dichlorobenzene
- 3,3-Dichlorobenzidine (and its salts)
- Dichloroethyl ether
- Dieldrin
- Diglycidyl ether
- 4-Dimethylaminoazobenzene
- 1,1-Dimethylhydrazine
- Deimethyl sulfate
- Dinitrotoluene
- Di-sec octyl phthalate
- Dioxane
- Epichlorohydrin
- Ethyl acrylate
- Ethylene dibromide
- Ethylene dichloride
- Ethyleneimine
- Ethylene oxide
- Formaldehyde
- Heptachlo
- Hexachloroethane
- Hydrazine
- Methoxychlor
- Methyl bromide
- Methyl chloride
- Methylene chloride
- Methyl hydrazine
- Methyl iodide
- alpha-Naphthylamine
- beta-Naphthylamine
- Nickel carbonyl
- Nickel metal and compounds
- 4-Nitrobiphenyl
- p-Nitrochlorobenzene
- 2-Nitropropane
- N-Nitrosodimethylamine
- Phenyl glycidyl ether
- Phenyl hydrazine
- beta-Propiolactone
- Propylene dichloride
- Propylene imine
- Propylene oxide
- Silica (crystalline)
- 1,1,2,2-Tetrachloroethane
- Tetrachloroethane
- Titanium dioside
- Toluene-2,4-diisocyanate
- o-Toluidine
- 1,1,2-Trichloroethane
- Trichloroethylene
- 1,2,3-Trichloropropane
- Uranium compounds
- Vinyl chloride

Note: Partial list—see current issue of the *NIOSH Pocket Guide to Chemical Hazards* for additional information.

Measurements of Concentration

- Concentration is the amount of a substance contained in a certain volume of relative material. Concentration of gases and vapors is usually measured in parts per million (ppm).
- 1 part per million is equivalent to 1 inch in 16.7 miles.
- 1 ppm is equivalent to 1 teaspoon in 1,300 gallons.
- Concentrations of particulates, dusts, and mists are usually measured in milligrams per cubic meter of air (mg/m3).
- There are about 400,000 milligrams in one pound.
- There are about 35 cubic feet in one cubic meter. (A meter is about 40 inches.)
- Fiber concentrations are measured in fibers per cubic centimeter (f/cc).
- A cc is about the size of a sugar cube.

Schematic of Part Per Million (PPM)



Exposure Limits

Enforceable exposure limits are set by OSHA. NIOSH and non-governmental agencies (such as the American Conference of Governmental Industrial Hygienists [ACGIH]) have also established limits which are used to determine exposures. These guidelines and recommendations are not legally enforced. Several exposure limits are discussed below.

Permissible Exposure Limits (PELs)

Permissible exposure limits (PELs) are legal exposure levels set by OSHA. Employers must keep exposures below the PELs.

Results of exposure monitoring can be requested under the OSHA Standard "Access to Employee Exposure and Medical Records" (1910.1020). Records which workers can request include either environmental information or personal medical records. According to OSHA 1910.1020(e)(1), "Whenever an employee or designated representative requests access to a record, the employer shall assure access is provided in a reasonable time, place and manner, but in no event later than fifteen working days after the request is made." The employer can comply by either making a copy of the requested record at no cost to the employee, allowing the employee to use the employer copy machine to copy the requested record, or by allowing the employee an opportunity to inspect the record.

Threshold Limit Values (TLVs)

Threshold limit values are recommendations for exposure limits which are prepared by the ACGIH, a private, non-governmental agency. TLVs, which are not legally enforceable, are reviewed and updated annually.

Recommended Exposure Levels (RELs)

Recommended exposure levels (RELs) are set by NIOSH. RELs are not legally enforceable.

Most PELs, TLVs, and RELs are determined as average exposures over an 8-hour work shift. Some PELs, TLVs, and RELs have a "skin" description, which means that the material is readily absorbed through the skin.

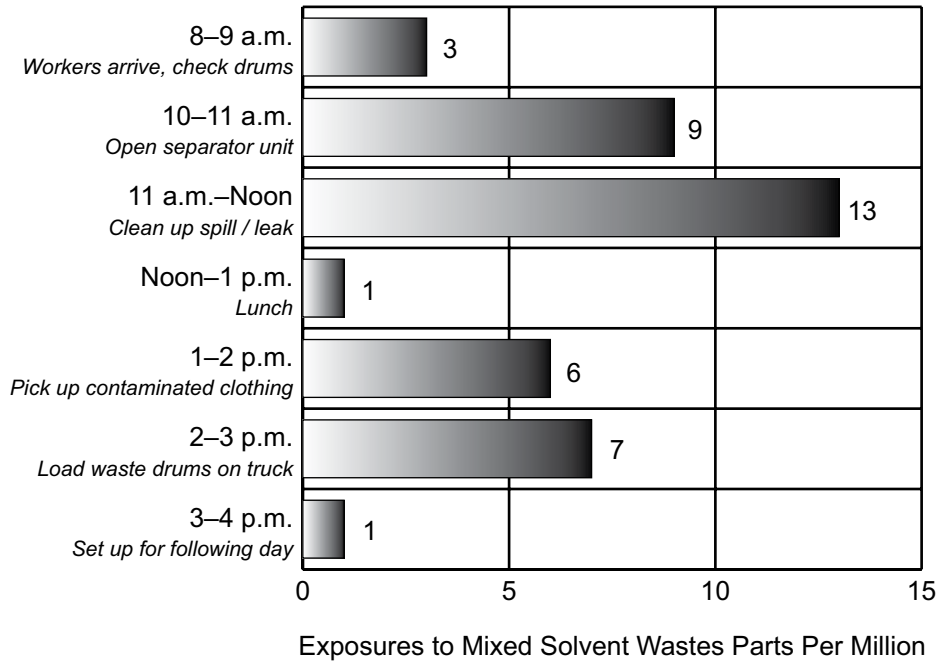
Short-Term Exposure Limits (STELs)

These exposure limits are set by ACGIH, OSHA, and NIOSH. The STEL is a maximum average concentration a person may be exposed to over a short period of time, usually 15 minutes. It is legally enforceable if set by OSHA. STEL is sometimes abbreviated further to ST.

Ceiling Limits (C)

The ceiling limit is an exposure level set by ACGIH, OSHA, and NIOSH which should not be exceeded at any time. It is legally enforceable if set by OSHA.

Exposure Picture in a Hazardous Waste Area



IDLH

Immediately **D**angerous to **L**ife and **H**ealth (IDLH)

Conditions which pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants which are likely to have harmful effects on health.

The current NIOSH definition for an IDLH exposure condition, as stated in the NIOSH Respirator Decision Logic (DHHS [NIOSH] Publication No. 87-108, NTIS Publication No. PB 91-151183), is a condition "that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment." The purpose of establishing an IDLH exposure concentration is to "ensure that the worker can escape from a given contaminated environment in the event of failure of the respiratory protection equipment."

Time-Weighted Averages (TWAs)

Most PELs, TLVs, and RELs are 8-hour time-weighted average concentrations. The purpose of this type of measurement is to determine the average exposure over a typical 8-hour work shift. An example of how the TWA is calculated follows:

Time-Weighted Averages Calculated

During a meth lab cleanup, a worker is exposed to construction dust from drywall rip-out at 5 mg/m^3 for 4 hours and other unspecified dust during carpet work at 0.5 mg/m^3 for 4 hours. What is the TWA?

$$\text{TWA} = \frac{(5\ \text{mg/m}^3 \times 4\ \text{hrs}) + (0.5\ \text{mg/m}^3 \times 4\ \text{hrs})}{(4\ \text{hrs} + 4\ \text{hrs})}$$

$$\text{TWA} = \frac{(20 + 2)\ \text{mg/m}^3 \times \text{hrs}}{8\ \text{hrs}}$$

$$\text{TWA} = 2.5\ \text{mg/m}^3$$

Compare this result with the current OSHA PEL for dust, (inert or nuisance) of 15 mg/m^3.

- Has the PEL been exceeded?
- Was it exceeded for any portion of the time sampled?
- Is there a STEL, C, or S designation in the *NIOSH Pocket Guide to Chemical Hazards*?

Biological Exposure Guidelines

Some exposures can be measured in blood, urine, or exhaled breath. Examples include:

Substance	How Measured
Lead	Blood, urine
Solvents	Breath
Lithium	Urine
Ephedrine	Urine

All methods of methamphetamine manufacture use solvents. Some meth "cooks" prefer toluene, whereas others use Coleman™ fuel, paint thinners, ethers, alcohols, or gasolines. Few OSHA standards include biological monitoring; lead exposure during cleanup and other industrial processes is one example.

Biological exposures are reported as concentrations. Blood concentrations are in units of micrograms per 100 milliliters (ug/100 ml) or 1 deciliter (ug/dl) of blood.

Urine concentrations include a measure of weight (milligrams or micrograms) per liter of urine or per gram of creatinine. Expressing the results relative to grams of creatinine allows us to compare results between very concentrated and very dilute urine. Breath analysis is usually given in parts per million (ppm).

For more information on biological exposure guidelines, see individual OSHA standards and the ACGIH annual publication on TLVs and BEIs.

Important Points to Remember About Personal Exposure Limits

- Most PELs, RELs, and TLVs are 8-hour averages for exposure. Short-term exposures may not be adequately separated.
- STELs are set for very few compounds.
- IDLH, STELs, and Ceiling limits are for acute exposure.
- Results of exposure monitoring can be requested by the employee under the OSHA Standard on Access to Employee Exposure and Medical Records (1910.1020).

NIOSH Pocket Guide Exercise

Groups will be assigned a compound which may be found at a meth lab. Complete the following worksheet for that chemical.

Chemical name _____

TWA limit _____

NIOSH exposure limit _____

OSHA exposure limit _____

IDLH level _____

Is it a carcinogen? Yes _____ No _____

List four symptoms of exposure:

1. _____ 2. _____

3. _____ 4. _____

What would you do if it got on your skin? _____

_____

_____

_____

What parts of the body are affected by exposure? _____

_____

_____

Date_____ Instructor's Signature _____

Summary - Toxicology and Health Effects

An **acute exposure** involves a high concentration (dose) of a toxic chemical for a short period of time. Immediately dangerous to life and health (IDLH) situations result in acute exposures. A **chronic exposur**e involves a low concentration of a toxic chemical over a long period of time.

Local effects of a toxic chemical occur at the point of contact with the body (skin, eyes, and lungs). **Systemic effects** occur when a toxic chemical enters the bloodstream and is distributed to all the tissues and organs in the body.

Routes of entry for systemic toxins are absorption through the skin, inhalation, injection, and ingestion.

Dose-response refers to the relationship between a chemical and toxic response. As the concentration of a toxic chemical increases, the toxic response of the worker increases. Each worker has his or her own dose response to a chemical.

Chemical agents can be dangerous to humans and the environment. Exposures may be short-term high concentrations (acute) or persistent low concentrations (chronic). In either case, chemicals attack specific organs of the body and can have irreversible consequences. Workers should be able to identify these hazards and take the necessary precautions to prevent exposure or injury.

Solvents irritate the skin, eyes, and airways of the nose, throat, and lungs. When solvents get into the blood, the nervous system is affected. Long-term exposure can cause damage to the liver and kidneys.

Acids and caustics (alkalies) damage the skin, eyes, and airways. These concentrated corrosive chemicals cause burns and ulcerations.

A mutagen is a chemical or physical agent that damages the blueprint (DNA) of the cell. A carcinogen is a chemical or physical agent that can cause cancer when a worker is exposed over a long period of time. A teratogen is a chemical or physical agent that causes birth defects. Chemicals can cause reproductive effects in men and women. Infertility, change in hormones, and menstrual problems are associated with exposure. Birth defects and developmental problems in children may also occur when the woman is exposed during pregnancy.

When heavy metals get into the body in high concentrations, the central nervous system is affected. At low concentrations lead can cause anemia; cadmium and uranium can cause kidney damage.

Exposures can be described in terms relative to PELs, RELs, TLVs, or Ceiling values for specific chemical exposures. PELs are legally enforceable.

Key Terms - Toxicology and Health Effects

Identify or define the following:

- Absorption
- Acute exposure
- Additive effect
- Carcinogen
- Chronic exposure
- Dose response
- Emphysema
- Fibrosis
- Ingestion
- Inhalation
- Injection
- Local effect
- Mutagen
- Potentiation
- Synergistic effect
- Systemic effect
- PEL
- REL
- Ceiling

Review Questions - Toxicology and Health Effects

1. Corrosives (acids and caustics) damage the skin and eyes. Describe what may happen to the skin and eyes following an acute exposure to corrosives.

2. Solvents that get into the bloodstream may be toxic to many organs. Name four target organs.

3. What is meant by “dose response?”

4. Name the routes of entry of chemicals into the body.

5. What is the difference between local and systemic effects?

6. Name the two areas of the body that absorb the most chemicals through the skin.

7. Describe the difference between acute and chronic exposures.

Section III - Physical and Safety Hazards

This section will cover typical physical and safety hazards encountered at meth lab cleanup sites.

Types of Hazards

Physical and safety hazards include a wide range of potential exposures. Many of the hazards that exist at meth lab sites are the same as those faced by industry every day:

- Slips, trips, and falls
- Struck-by hazards
- Vehicle safety
- Steam
- Noise
- Needle sticks
- Booby Traps
- Fire and explosion
- Excavation
- Electricity
- Heat and cold
- Confined spaces
- Broken glass

Confined Spaces

Confined-space work should never be attempted without training in proper procedures. During the cleanup of a meth lab, the most common confined spaces you'll encounter are crawl spaces, attics, and sewer/septic systems.

Confined spaces will be discussed further in the "Work Practices" chapter of this manual.

Fire and Explosion

Generation of heat or sparks in areas of flammable vapors may cause a fire or explosion. Procedures and precautions should be established and followed prior to this type of work.

Fire prevention will be discussed more fully in the "Work Practices" chapter of this manual.

Excavation

In the cleanup of a super lab or a lab that produced considerable buried toxic waste or had a highly contaminated septic system, it may be necessary to engage in on-site excavation.

When working at an excavation, workers should take the following precautions to prevent cave-ins:

- Shoring if trench is in stable soil and over 5 feet deep.
- Laying sides back to the natural angle of repose if over 5 feet deep in stable soil.

Federal OSHA does not require cave-in prevention in stable soil if the trench is less than 5 feet deep and removed soil is at least 2 feet from the edge of excavation. Unstable soil excavation of any depth requires protection. Excavation workers are generally required to wear head and foot protection to prevent injury. Refer to the OSHA Construction Standard, 29 CFR 1926.651, for additional details. This standard was significantly revised in 1990.

Other excavation safety considerations include:

- Locating of overhead and underground utilities safely.
- Removal of soil (spoil) at least 2 feet from the edge of excavation.
- Providing access every 25 feet for ingress and egress.
- Identifying vibration or moisture sources that may cause the banks to cave in.

Electricity

Electrocution may result at meth lab cleanup sites from the same sources as in most industry. These sources include:

- Contact with energized equipment.
- Use of electrical energized equipment in wet areas.
- Equipment failure.

Precautions to prevent electrocution include:

- Lock-out/tag-out.
- Using double-insulated tools.
- Using pneumatic equipment.
- Using ground fault interrupter equipment.
- Using cords and equipment with ground prong in good condition.
- Using cords and equipment in good repair only.

Electrical repair/maintenance work must be done by qualified personnel only. Lock-out is discussed further in the “Work Practices” chapter of this manual.

Heat and Cold

What health hazard is of great concern at a meth lab cleanup site? Heat stress brought on by wearing protective equipment in any climate. This type of personal protection will be more fully discussed in the “Personal Protective Equipment” chapter of this manual.

Temperature puts extra physical stress on the body. Long periods of exposure to heat may cause illness, particularly if an employee is not accustomed to working in hot areas. Also, heat builds up inside protective clothing, particularly when wearing full body suits, so there is a risk of heat stress even if outside temperatures are moderate. Cold stress is less common but may occur if work is required outdoors in winter months or in cold storage/freezer compartments.

Heat stress is probably one of the most common illnesses at any work site. Regular monitoring and other protective measures are vital. Individuals react to heat in different ways. Some factors which predispose someone to heat stress include:

- Lack of physical fitness.
- Age.
- Lack of fluid intake.
- Alcohol and drug use.
- Sunburn.
- Diarrhea.
- Infection.

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and individual characteristics.

There are several easy ways to help prevent heat stress:

- Drink lots of fluids frequently. One cup of water every 20 minutes will keep you more hydrated than drinking a quart every time you feel thirsty.
- Do the hardest work in the coolest parts of the day.
- When first beginning to work in a warm environment, start out slowly, doing about 20% of a full work load. Over four days, increase this work load by 20% each day, till you are working at 100% of the workload. This process is called acclimatization, where you train your body to get used to working with the extra heat.
- Wear loose and breathable clothes, such as cotton.
- Take frequent, short breaks in shaded areas.
- If the work environment is very hot, there are personal cooling devices which are designed to fit under personal protective equipment (full body suits, respirators) to keep workers from heat-related illnesses.

Signs and Symptoms of Heat Stress

Heat Cramps

Symptoms:	Painful muscle spasms
Cause:	Profuse sweating and drinking large amounts of water
Treatment:	Provide liquids with electrolytes (sodium, potassium) like diluted Gatorade™.

Heat Exhaustion

Symptoms:	Weakness; fatigue; dizziness; pale, cool, moist skin; heavy sweating; headache; nausea; and fainting
Cause:	Reduced blood volume resulting from dehydration from profuse seating and insufficient replacement of water and salts.
Treatment:	If worker is conscious, he or she should rest in a cool place. Replace water and electrolytes lost in sweat. If worker is unconscious, get medical help immediately. *Do not give liquids if the person is unconscious.*

Heat Stroke

Symptoms:	Very dry, hot skin with red, mottled or bluish appearance; confusion; convulsions; unconsciousness; rapidly rising temperature.
Cause:	Body becomes overheated because the worker does not sweat. Can be fatal.
Treatment:	Call for medical help immediately. Move person to a cool place. Remove PPE. Use wet towels or water and fan to cool while waiting for help.

Heat stroke is a life-threatening emergency. Medical attention is required.

Remember: Treatment of heat-related illnesses is very important to worker health, but preventive measures, like those on the previous page, can keep an emergency from happening.

Cold may also be a hazard. If the body is overexposed to cold, the following problems could occur:

Frostbite

Symptoms: Numbness of hands, feet, or face.

Cause: Prolonged exposure to cold environments.

Treatment: Frostbitten tissue should be gently warmed and not exposed to further cold.

Hypothermia

Symptoms: Lowered body temperature, shivering, or drowsiness. If body temperature is reduced to 80ºF (or below), unconsciousness is often followed by death.

Cause: Wet, cold, exhaustion; body's response to minimize heat loss becomes ineffective when body temperature goes below 86ºF.

Treatment: Warm the body. Get medical assistance.

Specific training is required to deal with these emergencies. The potential for these stresses at your facility should be recognized in advance, and appropriate programs should be implemented to prevent injury.

Slips, Trips, and Falls

Slips, trips, and falls are common causes of injuries at sites. Prevention is the key to avoiding injuries such as broken bones or injured backs. Avoid wet or oily floors. Don't climb up the fall line on steep slopes. Avoid climbing over equipment. Don't put yourself in situations which could result in injury.

Improper use of ladders is a major cause of falls. To prevent accidents when using ladders, the following practices are suggested:

- Check ladders to see if they need repair.
- Extend extension ladders 3 feet above the level to be reached.
- Tie off extension ladders to prevent slippage.
- Check that the distance from the wall is one-fourth of the used length of the ladder.
- Avoid carrying items in your hands when climbing ladders. Use a "tag" line to convey items up and down.
- Use cages or fall arrestors when climbing fixed ladders.
- Use a step ladder tall enough for the job. Do not stand on the top step.
- Never lean out to the side of a ladder past your navel!

Examples of situations causing slips, trips, and falls at sites include:

- Slick surfaces.
- Steps.
- Ice and snow.
- Poor-fitting PPE.
- Work area cluttered with debris.

Struck-By Hazards

At meth lab cleanup sites, various equipment may be moving in proximity to the workers. To avoid being hit by moving equipment:

- Stay alert to activities around you.
- Listen for vehicle back-up alarms/horns.

Also be aware of movement of other workers, carrying materials to be disposed off, or work tools such as ladders.

Vehicle Safety

The following procedures for vehicular safety should be noted:

- Do not leave any unattended unit running.
- Transport equipment being loaded or unloaded should have brakes set and wheels chocked.
- Heavy-equipment operators must use seat belts for the roll-over protection system to be effective.
- Prevent potential carbon monoxide hazards by minimizing exhaust in closed areas.

Steam

Steam from ruptured lines can cause severe burns. Maintain a safe distance. The steam, or the heat from it, may also react with other materials to compound the problem at sites.

It is possible that what appears to be steam may not actually be steam. Some chemicals may give off toxic clouds that appear steam-like. Also, gases escaping from a pressurized container may look like steam.

Ergonomics

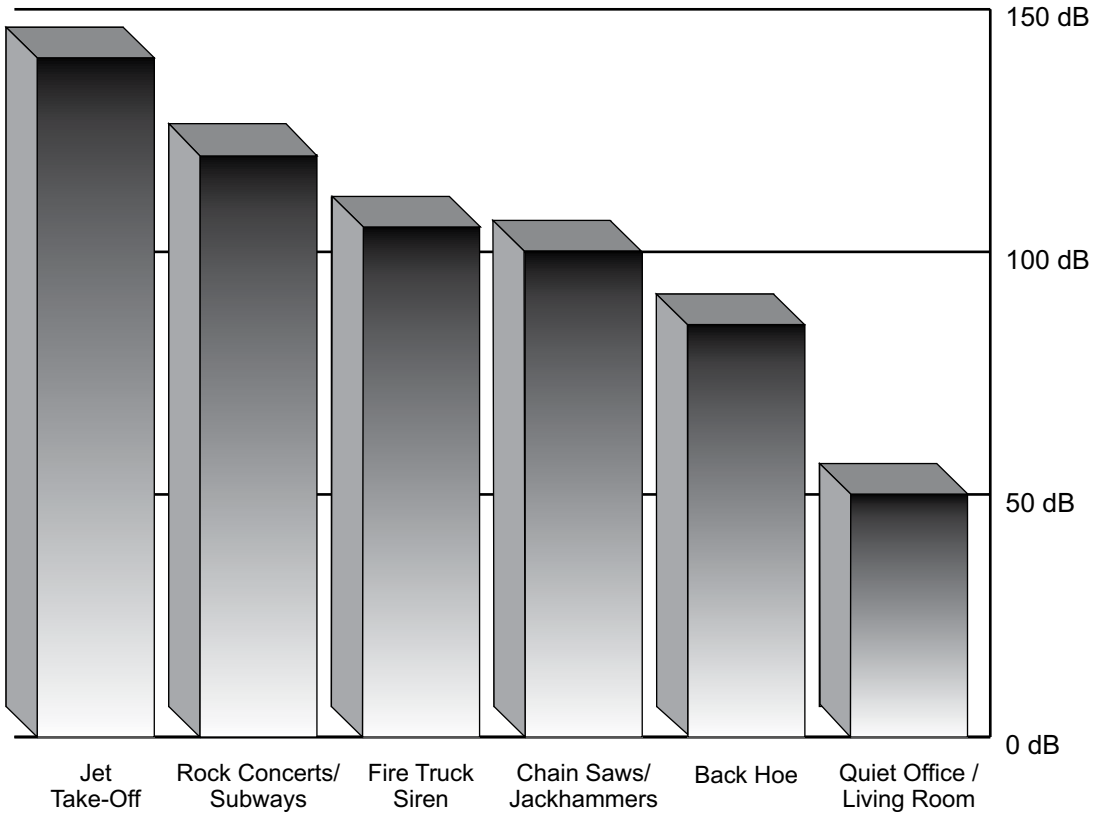
Ergonomics is the study of human characteristics for the design of the living and work environments. The goals of ergonomics are to increase the well-being of the worker and make the workplace safer and more efficient.

OSHA currently has voluntary guidelines covering ergonomics in the poultry and retail grocery industries as well as for nursing home workers. The next set of guidelines will be about the shipyard industry.

Noise

At a work site, the noise may exceed the allowable level. Repeated exposure to excessive noise may cause permanent hearing loss and may be stressful for the worker. Excessive exposure to noise is a primary cause of hearing disorders. High-volume sound is also linked to high blood pressure, stress, insomnia, anxiety, headaches, and ulcers. Although the harmful effects of noise vary among individuals, noise levels above 85 to 90 decibels should be considered dangerous.

Decibel Levels for Various Noises



Broken Glass

A meth cook will typically use glassware during the process of making methamphetamine. If an explosion occurs, glass shards will be everywhere. Even without an explosion, a meth lab is not the most tidy place in the world, so be aware that broken glass can appear in unlikely spots. Wear sturdy boots to protect your feet. If you must pick up broken glass, wear gloves and dispose of the pieces in a sturdy plastic container.

Needle Sticks

Methamphetamine is sometimes injected into the bloodstream. Users often leave needles lying around, presenting a needle-stick hazard. Check couch-cushions, blankets, and mattresses. Use caution when around used hypodermic needles because they could carry bloodborne pathogens. If you find a needle, dispose of it in a sturdy plastic container - in a pinch, a laundry detergent bottle or 20-ounce soda bottle will usually work. Use pliers to pick up needles to minimize risk of puncture.

Bloodborne Pathogens

Due in large part to needle sticks, workers who clean up meth labs are at an increased risk for exposure to bloodborne pathogens. A dirty needle could be contaminated with Hepatitis B, Hepatitis C, HIV, or any number of other pathogens. Though there are no vaccines for Hepatitis C or HIV, your doctor can administer a Hepatitis B vaccine to protect you during work at a meth lab.

OSHA created the Bloodborne Pathogens Standard (29 CFR 1910.1030), effective as of March 6, 1992, to help protect workers who work with or who may be exposed to bloodborne pathogens. The standard stresses safe work practices and engineering controls to minimize exposure. Personal protective equipment such as gloves are to be worn at all times when exposure is possible.

Meth labs may also have urine and/or feces contaminating the area. These may only contain small amounts of viruses, but present other health risks, so protect yourself with gloves and other equipment when around these materials.

Booby Traps: One study found that 45% of the meth labs were booby trapped and 75% of the labs stored multiple firearms. If the remediation site was discovered by law enforcement booby traps if present were likely disarmed and removed. However, mistakes can occur and traps overlooked or not found. Extreme care should be taken when moving into new areas of the lab.

Summary - Physical and Safety Hazards

As a meth lab cleanup worker, you may encounter a variety of physical and safety hazards that are common to industry. Being aware of potential hazards and how to prevent them will protect your health and safety.

In confined spaces you should wear the proper protective equipment and have proper training in safe work practices.

Excavation sites may pose dangers such as cave-in. Before attempting work in these sites, you need to determine whether shoring is necessary, whether vibration or moisture sources exist, whether protective equipment is available, and where overhead and underground utilities are located.

Electrocution by energized equipment and equipment failure may occur at hazardous waste sites. To prevent electrocution, follow precautions such as using functional equipment and not attempting electrical repair/maintenance work unless you are trained and qualified.

Health hazards from heat and cold may be present at the work site. Individuals working under conditions of extreme heat should understand the factors that make heat stress more likely, as well as the symptoms of the condition and necessary actions to take if it develops.

Overexposure to extreme cold may produce frostbite or hypothermia, which may require assistance from trained personnel.

Common causes of injury at sites are slips, trips, and falls, often resulting from improper ladder use. When using ladders, check their condition and follow safe, recommended procedures.

Other potential hazards include struck-by hazards from moving equipment or vehicles, steam from ruptured lines that may cause severe burns, and noise levels that may impair or damage hearing.

Section IV - Materials Identification

This section will cover MSDSs in detail. It is important to understand how to use an MSDS because they may assist in identifying a contaminant at a meth lab. In addition to MSDSs it is important to properly label all containers to assist with materials identification.

While it is important to know and understand labeling of hazardous materials, it is also important to remember that just because a jar or package is labeled, you should not be certain that the material indicated is in the package or jar. Meth labs are labs in name only. They are places where illegal drugs are manufactured and proper labeling procedures are often not followed.

Recognizing Chemical and Biological Hazards— Labels and Placards

It is important to understand the systems which are used to identify hazardous materials. Identification information is included on labels fixed to small containers (drums, packages, boxes) and placards fixed to large containers (trailers, rail cars, tanks). There are several different systems; one or more may be used at the plant by contract personnel or companies which supply raw materials. Some of these systems are described below.

Emergency Response Guidebook— System of Placards and Labels

(Enforced by the Department of Transportation [DOT])

What does the DOT system look like?

- Diamond-shaped.
- Color-coded.
- Word-coded (hazard class name).

  For Example:
  - Explosives
  - Blasting Agents
  - Dangerous (may be used with mixed loads).

- Symbol-coded.

Color	Hazard
Orange	Explosive
Red	Flammable or combustible
Green	Non-flammable gas
Yellow	Reactive Oxidizer or organic peroxide
White	Poisonous or toxic
White and red vertical stripes	Flammable solid
White top with black bottom	Corrosive
Two colors	Two major hazards
Blue	Dangerous when wet
Yellow top with white bottom	Radioactive
White top with red bottom	Spontaneously combustible

Symbol	Hazard
Bursting ball	Explosive
Flame	Flammable
W with slash	Dangerous when wet
Skull and crossbones	Poisonous
Circle and flame	Oxidizing material
Cylinder	Non-flammable gas
Propeller / Trefoil	Radioactive
Test tube / hand/ metal	Corrosive
Special symbol	Infectious (discussed later)

- Number-coded.

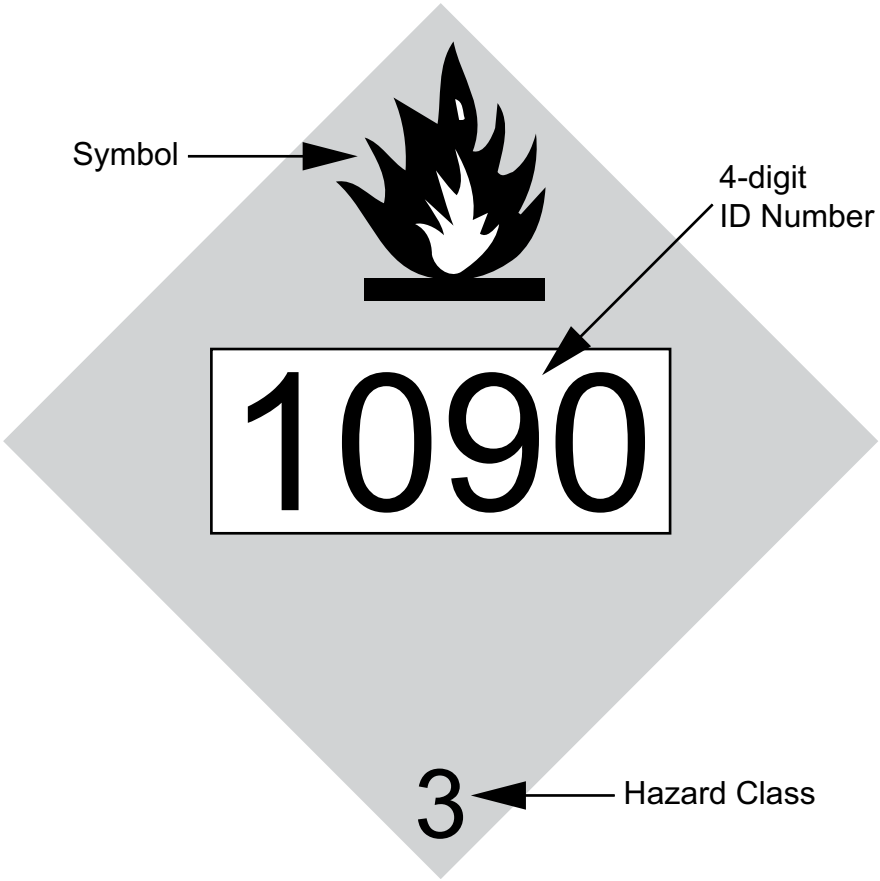
  A **four-digit** number in the **center** identifies a specific compound. These numbers are identified in the *Emergency Response Guidebook*. For example, 1223 is kerosene. This number may be in the center of the placard or on an orange-colored panel below the placard.

  A **one-digit** number at the **bottom** is the Hazard Identification Code.

#	Hazard Class
1	Explosives
2	Gases (compressed, liquefied, or dissolved under pressure)
3	Flammable liquids
4	Flammable solids or substances, spontaneously combustible materials, and dangerous when wet materials / water-reative materials.
5	Oxidizing substances and Organic peroxides
6	Poisonous and infectious substances
7	Radioactive substances
8	Corrosives
9	Miscellaneous dangerous substances / organisms

The placard displayed below is red with white symbols except for the black four-digit number. This placard tells you that the substance is Flammable (the flame and red background), a Flammable Liquid (Hazard Class 3), and Acetone (the four-digit number 1090).

Placard for Acetone



The Acetone placard is called a “number placard,” which means that the number in the center of the placard specifies the exact contents of the container. “Word placards” are so named because a word designating a type of hazard (e.g., flammable) will be printed in the middle of the placard. Number placards must be displayed on large portable tanks, tank trucks, and rail cars. A word placard means that drums or smaller containers are present.

You can find more information on what these numbers and symbols mean in a DOT Chart and the *Emergency Response Guidebook*.

To use the guidebook, you need to know either the chemical name or the identification number.

- If you know the name, look in the blue pages to find the guide number. The guide in the white pages with orange tops contains more detailed information on the chemical.
- If you know the number, look in the yellow pages to find the guide number. The guide in the white pages with orange tops contains more detailed information on the chemical.

National Fire Protection Association (NFPA)—704 System

The National Fire Protection Association (NFPA) system may be used on storage vessels and containers at a stationary facility. Some facilities may use this system throughout their departments and put the NFPA label on all hazardous materials. The facility's hazard communication training can inform the worker if this warning system is being used at the work site.

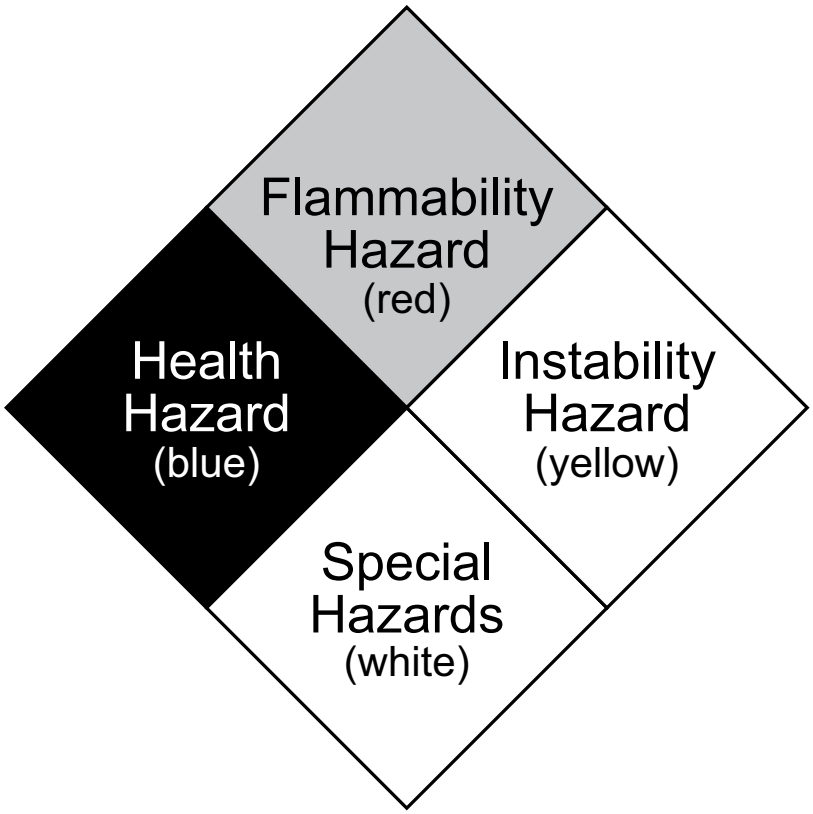
What does the NFPA system look like?

- Diamond-shaped.
- Color-coded in four small diamonds.

Color	Hazard
Red	Flammability
Blue	Health
Yellow	Instability
White	Special Hazards

- Number-coded in the red, blue, and yellow diamonds—Ranks the potential flammability, health, and instability hazard. Ranges from 0 (least hazard) to 4 (highest hazard).

NFPA-704 System



The Special Hazards (white) section of the NFPA-704 label may contain symbols (examples shown below) that give more information about the chemical. The following symbols might be found in the Special Hazards (white) section of the NFPA-704 label.

NFPA Symbols

Do not use water.

Oxidizer

The Hazardous Materials Information System (HMIS)

These labels are used on storage vessels and containers.

What does the HMIS label look like?

- Rectangular
- Color-coded

Companies are currently revising this long-standing system. The new labels alert workers to:

Color	Hazard
Blue	Health risk
Red	Flammability
Orange	Physical hazards
White	Personal protection

- Number-Coded
- Ranks the potential health, flammability, and physical hazard. Ranges from 0 (minimal hazard) to 4 (severe hazard).
- Letter-coded
- Tells you what personal protective equipment you should use to protect yourself when working with the material. Capital letters range from A (safety glasses) to K (full protective suit with gloves, boots, a hood or mask, and an air line or Self-Contained Breathing Apparatus). If the personal protection is coded X, specialized handling procedures are needed. Lower-case letters n through u, w, y, and z are codes for specific protective equipment. For example, q represents boots, and u represents an organic vapor respirator. A chart outlining each letter code should be available wherever these labels are used.

HMIS Label

Two boxes appear next to *Health*. The first box contains an asterisk (*) if the material poses a risk of a chronic health effect; otherwise, a slash (/) should be in the box. The box on the right contains the numerical hazard rating (0–4). Alternatively, the two symbols may be combined in the box on the right. For example, 3*.

The part of the body affected by exposure is also designated: blood, eye, nervous system, kidney, liver, reproductive, skin, respiratory. Icons are available for each.

Physical hazards include: water-reactive, organic peroxides, explosives, compressed gases, pyrophorics, oxidizers, and unstable reactives. Each hazard is represented by an icon.

A Hazard Summary Label is available for shipped containers; it has more complete information on health hazards, routes of exposure, and physical hazards.

Infectious Materials Symbols

While it is unlikely that this symbol will be found at a meth lab site, it is very possible that infectious materials will be found on site. Meth can be injected and syringes and needles could easily be found on site having slipped down into over stuffed chairs and couches. Working around materials that could hide needles or syringes must be done with extreme care. Any that are discovered should be handled with pliers or other such grabbing tools and discarded into plastic containers and properly labeled for disposal.

Infectious Materials Symbol

Documentation

Material Safety Data Sheets (MSDSs) are available describing hazardous chemicals that might be used in cleanup.

Material Safety Data Sheets (MSDSs)

MSDSs are required by the OSHA Hazard Communication Standard (29 CFR 1910.1200). No standard format is required; however, the following information must be provided:

- Contact Person at Manufacturer/Supplier.
- Hazardous Ingredients/Identity Information.
- Physical/Chemical Characteristics.
- Fire and Explosion Hazard.
- Health Hazard Data.
- Reactivity Data.
- Precautions for Safe Handling, Use, and Disposal.
- Control Measures.
- Date of Writing or Revising MSDS.
- Primary Route of Entry.
- Exposure Limits.
- Emergency and First Aid Procedures.
- Work Practices/Personal Protective Equipment.

Review of information on MSDSs is an essential part of handling hazardous materials and emergency situations and planning response actions.

An example of how to read a material safety data sheet is shown on the next few pages.

How to Read Each Section of an MSDS

Section I: Material Identification

Section I		
Manufacturer's Name ACME Company	**Emergency Telephone No.** (311) 555-0100	**Date** 07/04/49
Address 8501 Sutherland Drive, Anywhere, USA 99999		
Chemical Name and Synonyms Does not apply.	**Trade Name and Synonyms** Remover & Thinner	
Chemical Family Remover & Thinner	**Formula** Does not apply	

Section I identifies the product and manufacturer or supplier. The name of the product that appears in this section must be exactly the same as the name on the container label. The manufacturer's name, address, and phone number are also listed. If more than one name is used for a specific chemical, both names should be listed. Chemical formulas and the NFPA fire diamond showing degrees of hazard may be listed for quick identification but are not required. Finally, the date of the preparation must be indicated. This date is important because MSDSs prepared before November 25, 1985, when the new requirements went into effect, may not be in full compliance with the law; also, the date will help determine whether the most recent revision is available at the site.

Section II: Hazardous Ingredients

Section II—Hazardous Ingredients			
Paint, Solvents & Preservatives	**CAS Registry No.**	**Percent**	**TLV (Units)**
Solvents: Denatured Alcohol	64-17-5	80	1,000 ppm
Solvents: Butyl Acetate	123-86-4	20	150 ppm

Any chemical comprising 1% or more of the product (or 0.1% if it is a carcinogen) and known to have hazardous properties must be listed in this section. Next to each hazardous ingredient, the MSDS preparer must list the OSHA Permissible Exposure Limit (PEL), which is the amount to which a worker can be legally exposed. The PEL may b listed in parts per million (ppm) or in milligrams per cubic meter (mg/m^3). Legal limits have been set for only about 500 substances, so the ingredient you encounter may not have an OSHA PEL.

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The Chemical Abstracts Service (CAS) registry number is a specific number for each chemical. One six-digit number is assigned to each chemical.

ELs but often times may be lower.

Another organization which recommends exposure limits is the National Institute for Occupational Safety and Health (NIOSH). NIOSH limits tend to be the lowest and should be listed if one has been set. The manufacturer may also list its own recommended limit. In general, the lower the exposure limit (PEL or TLV), the more hazardous the substance is. You may see the notation “skin” after a PEL or TLV. This notation indicates that the chemical can be easily absorbed into the body through the skin.

Percentages of ingredients may be listed but are not required by law, which makes it difficult to determine if all ingredients have been listed. It is also more difficult to evaluate the hazards of the chemical without percentages. For this reason, the employer should request percentage information from the chemical supplier.

Finally, trade secret claims have to be identified on the MSDS for any hazardous ingredients that are being withheld. These claims are usually indicated by the phrase “Proprietary Information,” “Confidential,” or something similar.

Section III: Physical and Chemical Characteristics

Section III—Physical Data	
Boiling Point (ºF) 165ºF	**Specific Gravity** .824 at 25ºC
Vapor Pressure 43.2 mmHg 20ºC	**Percent, Volatile by Volume (%)** 99
Vapor Density Heavier than air	**Evaporation Rate (____ =) (Butyl Acetate = 1)** Faster than Butyl Acetate
Solubility in Water Slightly	**Appearance and Odor** Colorless, Mild Odor

This section tells you whether the material is a solid, liquid, vapor, or gas, etc. The description listed here should match the appearance of the material you are using.

Boiling point, vapor pressure, vapor density, solubility, and specific gravity were defined earlier in this chapter. The percent volatile is an indication of how much could evaporate into the air; the value is given in percent of the volume. For example, a container of degreaser would have a value of 100%. The value for a paint product might be 40%.

Evaporation rate indicates how fast the material will evaporate compared with a reference compound such as butyl acetate. If the rate is less than 1, the material evaporates less rapidly.

The appearance and odor may help you to identify what you are working with. Remember that the odor or smell is a poor measure of the concentration of the substance in the air. Although the nose can detect the presence of some chemicals, many substances can reach hazardous levels with no noticeable odor. Some people have a poor sense of smell. Also, you may lose your ability to smell a particular substance over a period of time due to the nerve endings in the nose blocking out the odor (olfactory fatigue).

Section IV: Fire and Explosion Hazard Data

Section IV—Fire and Explosion Hazard Data	
Flash Point 61ºF (OC)	**Explosive Limits** 1.8–19%
Extinguishing Media Carbon Dioxide, Regular Foam, Dry Chemical	
Special Firefighting Procedures Wear self-contained breathing apparatus in enclosed areas.	
Unusual Fire and Explosion Hazards Vapors are heavier than air and may travel along the ground or be moved by ventilation and ignited by sparks, flame, and other ignition sources.	

Section IV provides information on how to prevent and fight fires and explosions. This section will also list the type of fire extinguisher which should be used and whether special protective equipment is needed for fighting fires. This information on the MSDS may be inadequate to respond to emergency situations because of the number of chemicals that may be involved.

Under state Right-to-Know laws and the new federal Community Right-to-Know law, firefighters have the right to review workplace chemical inventories and MSDSs and to inspect the workplace in order to plan for and prevent fires and explosions.

Section V: Health Hazard Data

Section V—Health Hazard Data
Threshold Limit Value 840 ppm (estimated)
Effects of Overexposure Irritation of nose and throat, redness and irritation of eyes. Excessive breathing of vapors can cause nausea and respiratory irritation.
Emergency and First Aid Procedures If swallowed, call physician. Flush eye; contact with water. If exposed to excessive vapors, remove to fresh air.

This section should list any harmful effects that may be caused by the chemicals listed in the Hazardous Ingredients section. The health hazards may be acute (short-term) or chronic (long-term).

In addition to listing the health hazards, the MSDS must also detail the routes of entry, signs and symptoms of exposure, medical conditions aggravated by exposures, and emergency and First Aid procedures.

Section VI: Reactivity Data

Section VI—Reactivity Data	
Stability Unstable ☐ Stable ☒	**Conditions to Avoid** None
Incompatibility Strong oxidizing agents	
Hazardous Decomposition Products Carbon Monoxide or Carbon Dioxide	
Hazardous Polymerization May Occur ☐ Will Not Occur ☒	**Conditions to Avoid** None

Section VI provides information on conditions that could cause the product to react dangerously or decompose and release dangerous materials. A complete MSDS will tell you whether the substance is likely to break down or react with other substances, what conditions are likely to cause the substance to change its composition, and what new hazards might result. This information can be very valuable if a substance makes contact with heated surfaces or is mixed with other chemicals. This information usually pertains to immediate reactions.

Section VII: Precautions for Safe Handling and Use

Section VII—Spill or Leak Procedures
Steps to be Taken in Case Material is Released or Spilled Clean up in normal manner for flammables. Absorb in absorbent material.
Waste Disposal Methods No waste normally. Incinerate or normal disposal for flammables, in accordance with local, state and federal regulations.

This section will explain what steps to take in the event of a release or spill, how to dispose of waste material, what precautions to take in handling and storing the material, and any other precautionary measures that might be appropriate. In this section many MSDSs will simply warn, “avoid breathing gases and vapors.” This section should provide information on whether to evacuate, what type of emergency respirators to have on hand, and how to clean up large and small spills.

Section VIII: Control Measures

Section VIII—Special Protection Information			
Respiratory Protection (Specify type) None needed under normal usage			
Ventilation **Local**: Ordinary	**Mechanical**: Acceptable	**Special**: None	**Other**: None
Protective Gloves None needed with normal use		**Eye Protection** None needed under normal conditions	
Other Protective Equipment None needed			

Section VII will generally describe only the minimum measures that are necessary to reduce exposures to hazardous substances.

First, it must indicate the type of ventilation that can adequately remove air contaminants. Mechanical or general ventilation means a fan or other source of fresh air which dilutes the contaminated air. Local exhaust ventilation refers to systems which capture hazardous chemicals at the source of contamination.

This section should also list the specific respiratory protection that is required. The MSDS must also list the specific protective glove that is required. As with respirators, the type of glove necessary depends on the substance and the manner in which it is being used. The MSDS should specify the appropriate material (viton, rubber, polyvinyl alcohol, etc.) to use with the product.

Section VIII will also list eye protection and other protective clothing or equipment which should be used.

Section IX: Special Precautions

Section IX—Special Precautions
Precautions to be Taken in Handling and Storing Keep away from heat and flame. Use with adequate ventilation.
Other Precautions None

Special precautions are noted in this section. Handling and storage precautions might indicate incompatible chemicals or specific storage containers. Section IX may also give a shelf-life warning or discuss the material's potential to react.

Limitations of MSDSs

Although MSDSs contain important information, there are a number of limitations to their use during an emergency. Some of these limitations are listed below.

- Limited information

  The information may be incomplete or inaccurate.

  Space on the form may be inadequate.

  The information may not be relevant for the cleanup activity.

- Insufficient time to read the information.

- Insufficient time to call the manufacturer's/supplier's contact person.

- Not immediately available

  MSDS may not be located at the cleanup site.

Material Safety Data Sheet Exercise

Review the MSDS given to you by the instructor. Using the MSDS, answer the following questions. Write your answers in the space provided.

1. What is the product name?

2. Name the manufacturer.

3. What color is the material?

4. What are the material's incompatibilities?

5. Are there special handling and storage procedures?

6. What are potential health hazards and symptoms of exposure?

7. Does this product contain cancer-causing agents (carcinogens)?

8. What is the UN number?

9. What steps should be taken to stop leakage?

10. Is there a chemical odor?

11. What personal protective equipment should be used?

12. List the fire hazard information and precautions.

13. Are there DOT shipping names and hazard classifications?

Summary - Material Identification

Labeling is a method used to communicate or identify information about chemicals. Raw materials and chemical products are required by OSHA to have hazard labels. Placards are signs on a transportation vehicle which provide information about the material being transported.

A Material Safety Data Sheet (MSDS) is a compilation of information required under the OSHA Hazard Communication Standard (29 CFR 1910.1200) about the identity of hazardous chemicals, health and physical hazards, worker exposure limits, First Aid, and spill precautions. MSDSs must be available on the site for any products used in remediation activities.

If available, MSDSs for hazardous materials are valuable sources of information.

Review Question - Material Identification

1. List major types of information contained on an MSDS.

Background Reading Material - Hazard Recognition

NIOSH Pocket Guide to Chemical Hazards. (1997, June). U.S. Department of HHS, PHS, CDC, NIOSH. (NIOSH #90-140)

Sax and Lewis. (1987). *Hawley's Condensed Chemical Dictionary*. (11th ed.) Van Nostrand Reinhold CO., 115 Fifth Ave, N.Y. 10003

Fischman, M.L., Hughes, J.P., & Proctor, N.H. (1988). *Chemical Hazards of the Workplace* (2nd ed.). J.B. Lippincott Company, Philadelphia, PA.

Hazardous Substance Fact Sheet. New Jersey Department of Health. Trenton, NJ 08625.

Occupational Health Guidelines for Individual Chemicals. U.S. Department of Labor. Occupational Safety and Health Administration.

Hazardous Waste Operations and Emergency Response; Final Rule
March 6, 1989. (29 CFR 1910.120)
.120 (e) (1) (ii) Training in the hazards at the site

Hazard Communication Final Rule
August 24, 1987.(29 CFR 1910.1200)
.1200 (c) Definitions
.1200 (h) Employee Information and Training
.1200 (g) Material Data Safety Sheets
Appendix A Health Hazard Definitions

Occupational Safety and Health Guidance Manual for Hazardous Waste Sites
1985. (NIOSH #85-115)
Chapter 2, Hazards p. 1–3

EPA's Standard Operating Safety Guides
July, 1988
Part 1, p. 1–3.

Davis, Bobby R. *"A Guide to Preventing Heat Stress."* North Carolina. Department of Labor. May 2001. http://www.nclabor.com/osha/etta/indguide/ig35.pdf.

Hazard Control

The purpose of cleaning up meth labs is to control worker, community, and environmental exposure to toxic materials. Workers' exposure to hazards at a lab site is controlled through engineering and administrative controls and personal protective equipment (PPE). Personal protective equipment does not control the source of exposure or concentration of toxic substances in the air, but it does reduce the amount of substance reaching the body. This chapter is an introduction to topics associated with hazard control. Coverage of many topics is expanded in later chapters of this manual (i.e., PPE, Decontamination, etc.).

A worker needs to understand the elements of a site-specific safety and health plan and its significance for determining safe work practices, air monitoring schedules, levels of protection, worker training requirements, site control, and medical surveillance programs.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Define the components of site characterization and its relationship to hazard control in a typical meth lab.
- Provide examples of engineering, work practice, and administrative controls at a meth lab cleanup site.
- Outline the requirements of the medical surveillance section of the Final Rule and its role in hazard control and personal health management at a hazardous waste site.
- Detail the role of the site safety and health plan.
- Demonstrate a better understanding of the key components of site control, including site maps, cleanup activities, work zones, the buddy system, and the communication system.

Hazard Control Exercise

When you were hired to clean up meth labs, the supervisor explained the types of activities that would be done. Using this knowledge and your previous work experience, discuss in a small group what some of the hazards might be on a work site and some possible methods of controlling each hazard. If you have trouble coming up with ideas for hazards, review material in the previous chapter. Record your ideas in the space provided below. One member of the group should be prepared to report back to the class.

Hazard	Control Methods

Types of Hazard Control

There are three basic approaches to hazard control :

- Prevent the hazardous situation.
- Remove the exposure before it reaches the worker.
- Prevent exposure from contacting the worker.

Preventing hazardous situation is sometimes referred to as an administrative control. **Administrative controls** are policies and practices written before the work begins to minimize employee exposure to chemical and physical hazards. Examples include industrial hygiene monitoring programs, medical surveillance programs, confined-space entry and hot-work permits and policies, and lock-out procedures. Other examples are limiting the duration and exposure to hazards (noise, radiation [Thorium Oxide, a catalyst in the P2P cooking method is an alpha emitter]), or control the number of workers allowed in contaminated areas of the meth lab. Also developing a written plan describing the maintenance of protective clothing, and implementing specific work practices which reduce or prevent exposure.

Most meth lab cleanup sites are also crime scenes and the police have removed and cataloged the chemicals as evidence in the criminal case. This removal of the chemicals used in the manufacturing process is considered an engineering control. **Engineering controls** utilized at meth lab cleanup sites also include ventilation and isolation. Examples include: heating the meth lab space to 90 degrees Fahrenheit for 48 to 72 hours prior to ventilation to enhance volatilazation, opening of windows of the lab site and using blowers, exhaust fans and/or negative air machines to ventilate for several days prior to the arrival of remediation workers and shielding of radiation or explosion exposures. Since most meth labs are crime scenes, the police remove all chemicals used in the manufacturing process prior to the arrival of remediation workers because they are evidence in the criminal investigation. Ventilation and removal of all chemicals reduce the level of personal protective equipment. It is important to note however, it is possible that the police may not remove all of the chemicals, either because of error or the fact that chemicals may have been hidden and not discovered. If chemicals are discovered on-site, remediation workers should evacuate and call a qualified individual to remove or evaluate the potential hazard.

When all the hazards cannot be removed, **personal protective equipment (PPE)** must be used to reduce employee exposures. Examples of personal protective equipment include: gloves, steel-toed boots, chemical protective suits, and face shields. PPE is discussed in further detail later in this manual.

All potential or identified hazards at a site and methods to control them should be described in writing. These topics are covered in the on-site training and are included in the safety and health program. Details about this important resource are in the next section.

Safety and Health Program

The safety and health program is a written document which describes:

- An organizational structure.
- A comprehensive work plan.
- A site-specific safety and health plan.
- The safety and health training program.
- The medical surveillance program.
- The standard operating procedures for safety and health.
- The interface between general and site-specific programs.

The program is developed to identify, evaluate, and control safety and health hazards and provide for emergency response at work sites. Copies of the written plan should be located at the work site where workers, contractors, sub-contractors' representatives, and government personnel have access. Programs already written as part of other required safety and health efforts may be referenced in the safety and health program.

Specific hazard control aspects of the program are:

- Organizational structure.
- Content of the safety and health plan.
- Selected comprehensive work plan activities, site characterization and analysis, and site control program.
- Safety and health training requirements.
- Medical aspects such as the facility and surveillance.
- Standard operating procedures.

Organizational Structure

Knowing the responsibilities of each person at the site is essential for carrying out the work effectively and resolving unexpected circumstances quickly. The organizational structure should be written and included in site-specific training. A general supervisor has the overall responsibility to conduct the cleanup activities. The safety and health supervisor develops and implements the site safety and health plan and verifies compliance. Responsibilities of all other site workers are described, as well as lines of authority, responsibility, and communication.

The organizational structure is reviewed periodically and updated as necessary. Each site will differ, so site-specific training is needed whenever there is a change in work location.

Comprehensive Work Plan

At each site, a comprehensive work plan should be developed to address activities, logistics, and use of resources. Topics from the comprehensive work plan should be reviewed during the site-specific training. Included in the work plan are written descriptions of:

- Normal procedures.
- Cleanup activities.
- Task objectives and procedures.
- Personal requirements for carrying out the activities.
- Training program.
- Required informational programs.
- Medical surveillance requirements.

Site-Specific Safety and Health Plan

The safety and health plan addresses the hazards during each phase of the work and the procedures to protect employees. Each of the following topics should be covered:

- Safety and health risk or hazard analysis for each task or operation.
- Employee training.
- Personal protective equipment.
- Medical surveillance requirements.
- Air monitoring protocol.
- Site control.
- Decontamination/remediation.
- Emergency response plan.
- Confined-space entry.
- Spill-containment program (for any chemicals used for cleanup).

The risk/hazard analysis and specifics of each of the other topics will be included in site-specific information. General requirements of the other topics listed above are included in the program.

The site-specific safety and health plan should be used as a planning guide before any remediation work begins. It should also be used as a reference tool throughout the remediation activities to ensure employees' awareness of the plan and company compliance with it. As information on the site is obtained during periodic site inspections, relevant sections of the plan should be updated by the safety and health supervisor or another person knowledgeable in safety and health.

New Technologies

All fields, including meth lab cleanup, that deal with potentially hazardous substances are constantly changing as new methods of working with and treating hazardous substances become available; similarly, better methods of employee protection are being developed.

As part of the safety and health program, the employer must develop and implement an SOP for introducing effective new technologies and equipment for improved worker protection as part of the safety and health program.

For example, new technologies to reduce airborne contamination while tearing out drywall or controlling spills must be evaluated by the employer or his/her representative. The evaluation is done to assess the effectiveness of the new approach before it is implemented at the site on a large scale. Data from the manufacturer or supplier may be included in the evaluation. The process and all data must be available to OSHA.

Medical Assistance

Medical facilities must be identified prior to undertaking any characterization work at the cleanup site. Workers engaged in the remediation may also be covered by the medical surveillance program.

The location of the nearest medical facility must be included in the site control plan. All employees must be told where the facility is and how to notify it if an emergency occurs or when treatment is needed.

Site Characterization and Analysis

Key details about individual meth lab cleanup sites differ greatly. Therefore, site characterization and analysis should be conducted at each site to provide information needed to identify site hazards and select worker protection methods. Sites differ on the length of time and amount of manufacturing that occured. It is logical that the longer the lab is in existence and the greater the amount of drugs prepared, the greater the contamination is likely to be. The second major reason for difference in site contamination is the type of process and types of chemicals in the manufacturing process. Site characterization is a detailed process which includes a preliminary evaluation, hazard identification, personal protective equipment, environmental sampling and monitoring, risk identification, and employee identification. Think of it as tailoring plans to the specific needs of each site. Conditions should be constantly monitored after site characterization to detect changes in the work areas.

Preliminary Evaluation

Preliminary evaluation of the meth lab cleanup site's characteristics should be done by a qualified individual (industrial hygieniest) prior to the site entry in order to select proper protection for the remediation team. Information is obtained away from the site through interviews with police, review of law enforcement documents, other documents regarding site characteristics. As part of the preliminary evaluation, the qualified individual may make an initial site entry to further characterize the contaminations and other hazards at the site. At this point appropriate administrative, and engineering controls as well as personal protective equipment can be determined.

In most cases meth lab cleanup sites are also crime scenes. The police should have removed and cataloged all chemicals on site that were used in the manufacturing process. Once the manufacturing history is known from law enforcement reports and interviews, both the type and probable extent of contamination will be better understood.

Potential Meth Lab Hazards

Biological

- Fungal Virus (Hepatitis B)
- HIV
- Human waste
- Other infection due to needle sticks
- Animal (snakes or spiders)

Chemical

- Acids (Hydrochloric acid)
- Bases (Ammonia)
- Gases (Phosphine gas)
- Liquids (Acetone)
- Solids (Iodine crystals)
- Vapors
- Dusts
- Fumes

Physical

- Broken glass
- Burns (hot plates)
- Electricity
- Temperatures: Heat and cold
- Slips, trips, falls
- Punctures: Needle sticks
- Fire
- Explosions
- Noise

Psychological

- Monotonous jobs
- Disorientation in PPE
- Sexual harassment
- Fear of Booby Traps
- Stress

From this preliminary evaluation the following should be known:

1. Property description including physical address, number and types of structures on the property and the description of adjacent and/or surrounding properties.
2. From the law enforcement reports the type of chemicals removed from the property, the manufacturing method, where cooking occured, location of chemical storage areas, and location of contamination waste disposal areas.
3. Identification of structural features such as attics, false ceilings, basements, crawl spaces, closets and cabinets.
4. From visual observations of an entry team, document signs of contamination such as staining, etching, fire damage, and/or outdoor areas of dead vegetation.
5. Inspect plumbing system integrity and identify potential disposal into sanitary sewers or individual septic system. The septic system may need to be field screened and/or sampled to determine if meth lab wastes were deposited into the system. (See Sampling section).
6. In an apartment building, motel or other multi family structure, identify any adjacent units or common areas where contamination may have spread or been tracked.
7. Identify any common HVAC systems with adjacent units or common areas.

Hazard Identification

Hazard identification includes documenting all suspected conditions that may pose IDLH, inhalation or skin absorption hazards, as well as other potentially dangerous or lethal conditions. Hazards may include:

- Confined spaces (including trenches and low spots).
- Potentially explosive or flammable materials.
- Booby traps.
- Biological indicators such as dead animals or vegetation.

The following information should be obtained to the extent available before employees enter a work area:

- Location and approximate size of the site.
- Description of the response activity and/or the job task to be performed.
- Duration of the planned employee activity.
- Site topography and accessibility by air and roads.
- Safety and health hazards expected at the site.
- Pathways for hazardous substance dispersion.
- Present status and capabilities of emergency response teams that would provide assistance to meth lab cleanup employees at the time of an emergency.
- Expected hazardous substances and their health hazards and chemical properties.

Personal Protective Equipment

Personal protective equipment should be provided for workers engaged in initial meth lab entry. The specific program will be designed to keep inhalation hazards below published guidelines and control all other anticipated safety hazards.

When the preliminary evaluation does not produce the type of information that can be used to predict airborne concentrations, Level B protection should be used at a minimum. Employees will have an escape bottle, as appropriate. Instrumentation to detect situations immediately dangerous to life and health will be used.

Once further information on the hazards is available, the protective equipment will be re-evaluated by the health and safety specialist and adjusted to be more or less stringent.

Monitoring

Monitoring should be conducted when the site evaluation reveals the potential presence of an IDLH condition, ionizing radiation, or insufficient information. The following steps will be taken:

- Monitoring for hazardous levels of ionizing radiation with direct-reading instruments.
- Monitoring the air for IDLH, combustible or explosive atmospheres, oxygen deficiency, or toxic substances with direct-reading instruments.
- Visually observing for signs of potential IDLH or other dangerous conditions.
- Implementing an ongoing air monitoring program for the site characterization.

Notification

Notification of the chemical, physical, and toxic properties of all substances known or suspected to be present at the site should be made to each employee who may be affected by the hazard. Employee notification must be completed before the work activity begins.

Working With Local Fire/Emergency Personnel

The Local Emergency Planning Committee (LEPC) can facilitate development of the ERP and contact with the local fire and emergency personnel. It is essential to communicate clearly with the local fire and emergency groups to assure that the location of potentially hazardous chemical situations is known to all groups. There should be preplanning discussions of the role of each group in the potential emergencies which could occur. Supervisors should take the lead in maintaining communication between the groups.

Risk Identification

Risk identification is conducted and documented once the presence of specific hazardous materials or conditions is identified. Employees must be informed of any risks, including:

- Exposures exceeding published levels.
- IDLH concentrations.
- Potential skin absorption and irritation sources.
- Potential eye irritation sources.
- Explosion and flammability ranges.
- Oxygen deficiency.

Emergency Release Notification

Facilities must immediately notify the SERC and LEPC of any accidental releases of “Extremely Hazardous Substances” that are above reportable quantities. They must also provide written follow-up reports on actions taken and medical effects that could be caused by the release. Although the LEPC is not required to notify the fire department in the event of such a release, a good emergency response plan will provide for such notification. You should contact your local LEPC for additional states’ laws which might be applicable.

Enforcement

The U.S. Environmental Protection Agency is responsible for enforcing the Emergency Planning and Community Right-to-Know Act. The EPA may assess civil and administrative penalties of up to $75,000 per day against facilities that fail to comply with the reporting requirements. Some states have enacted similar requirements and do their own enforcement.

The SERC, LEPC, or state and local governments may begin legal actions against facilities that fail to comply with this law. Citizens may also file lawsuits against facilities, the SERC, and the EPA for failure to meet legal requirements.

Site Control Program

In order to protect personnel working at site characterization surveys, a site control program should be implemented. A site control program should include these components:

- Site maps.
- Work zones.
- “Buddy system.”
- Site communication, including means for emergency alert.
- Standard operating procedures or safe work practices.
- Identification of the nearest medical assistance.

The purpose of this program is to control employee exposure before actual remediation work begins.

Site Maps

A site map is a graphic representation of the lab facility and surrounding topographic features; prevailing wind direction; drainage; and the location of any nearby buildings, ponds, and tanks. Site maps are helpful for planning activities related to PPE, assigning personnel to work zones, identifying problem areas and access and evacuation routes, and reviewing conditions at the daily safety and health briefing of the field team. A site map is designated before site entry and should be modified during site work to reflect changes in activities. Clear overlays can be used to help prevent information from cluttering the map.

Work Zones

Meth labs should be divided into as many different zones as needed to reduce accidental spread of toxins from a contaminated area to a clean area, reduce the number of personnel authorized in high-risk areas, delineate required levels of protection to be worn, and plan emergency evacuation routes. Most areas will have at least three zones. These zones are named differently depending upon the site. Some ways of naming these areas are shown below.

Potential for Hazardous Exposure	Scheme 1	Scheme 2	Scheme 3
High	Hot Zone	Exclusion Zone	Danger Zone
Medium	Warm Zone	Contamination Reduction Zone	Decontamination Zone
Low/None	Cold Zone	Support Zone	Clean Zone

The **Exclusion Zone (EZ)** (Hot Zone/Danger Zone) is the area where contamination may occur. The primary activities in this area are:

- Site characterization (e.g., mapping, sampling, photographing)
- Cleanup work (e.g., removing heavily contaminated furnishings and structural members, HEPA vacuuming, washing and encapsulating in the liveable space).
- Installation of wells for ground water monitoring (this would happen only on a super lab cleanup site where large amounts of waste were dumped and migrated into the ground water).

The outer boundary of this zone is called the **Hot Line**. It is to be clearly marked with hazard tape, rope or chain. Openings on the Hot Line such as windows and doors maybe enclosed with 6. mil poly to prevent the spread of contaminants. On large super lab sites that may require a long-term clean up, the barrier may be more permanent such as fencing.

Personnel in this zone wear the highest level of PPE. They may include field team leader, work parties and specialized personnel such as plumbers. The middle zone is called the **Contamination Reduction Corridor (CRC)** (Warm Zone/ Decontamination Zone), where decontamination procedures are performed.

For smaller meth labs that are contained in a building there would only be one decontamination line for the workers and the small tools they use. Again for Super Labs which generated massive amounts of waste with large outdoor areas of contamination there may need to be two decontamination lines one specifically for heavy equipment.

Specific personnel usually stationed there include the site safety officer, personnel decontamination station operator, and ready emergency response personnel. Equipment resupplies and sample packaging for laboratories are also located there. The workers' temporary rest areas are there, as well as decontaminated water drainage containment.

The **Support Zone** (SZ) (Cold Zone/Clean Zone)) is where administrative, support, and any other function not requiring respiratory protective equipment is performed. Personnel often present at this location are the command post supervisor, the project team leader, and support field team members. Personnel have no respiratory or skin exposure in this zone. Location of this zone is chosen for accessibility (emergency vehicles), resources (power lines, water, shelter), visibility (line of sight to the Exclusion Zone), wind direction (upwind of the Exclusion Zone), and distance (as far from the highest hazard as practical).

The size and complexity of these zones will vary greatly depending upon the contaminants found at the meth lab. For example, the state of Tennessee categorizes four tiers of response depending on the contamination encountered. With each tier, the work zones will be totally different. Usin the Tennessee categorization, we can examine how the work zones might differ depending upon the scope of the contamination and size of the cleanup.

Tier 1 Response:

The crime scene evidence suggests that the manufacturing process was initiated. However, limited amounts of reagents or precursors are present and open. It is uncertain if a “cook” occured, or was limited to one or two low yield “Nazi” cooks. There is only minor spilling and staining. This could occur if a short term guest began the manufacturing process in a hotel, motel , state or federal park cabin, or in a relative or friend’s residence over the weekend. In this case the hot zone might be confined to the room where the actual cooking occured. It would be assumed that the storage of chemicals was in the same room as the cooking. The warm zone would be next to the hot zone as a buffer to the cold zone. Through the warm zone a corridor for decontamination would lead to the cold zone. The entire zones might be confined within one structure or surely one property.

Tier 2 Response:

The crime scene evidence suggests that a limited amount of methamphetamine, reagents and precursors were produced over a relative short period of time, a week or so. One or two Red Phosphoreus or three to four low yield “Nazi” cooks took place. Spills and staining will be observed. An example of this would be where the guest in the motel, hotel, park cabin, or home stayed less than two weeks. Again depending upon the extent of contamination the three zones could be contained within a relatively small area. The cook area and storage areas would be the most contaminated and common areas or high traffic areas may also be contaminated and part of the hot zone. Once again the warm zone would be next to the hot zone and could still be in the same building and not need cleaning.

Tier 3 Response:

The crime scene evidence suggests that numerous Red P and/or Nazi “cooks” or precursors and reagent production have occured periodically over an extended period of time, many weeks to several months. Chemical spills, staining and burn pits are often observed at these locations. An example of this would be appropriate where homes and rental property owners or tenants manufacture methamphetamine periodically. In this case, the entire building where the cooking occured and the chemicals stored might be the hot zone. In addition, if vegetation appears to be dead, the hot zone may take in areas surrounding the building. Once again the warm zone would surround the hot zone and house the contamination reduction corridor. The cold zone would surround the warm zone.

Tier 4 Response:

The crime scene evidence suggests that this lab is capable of producing large quantities (multiple pounds) of methamphetamine, reagents, or precursors during a manufacturing event. Examples of this would be homes, rental properties, commercial buildings, and/or farms where large capacity labs are discovered. In this case lare quantities of drummed and/or buried waste may be discovered on the property. Again, the hot zone may take in large areas where contamination is discovered. The warm zone and contamination reduction corridor may have to accomodate heavy equipment as well as workers engaged in the cleanup. Again the cold zone would accomodate the personal vehicles of the workers.

Buddy System

The “buddy system” is a protective procedure where workers perform in pairs or within close proximity of one another in order to safeguard other’s safety and health tasks or assignments. A buddy provides assistance, observes his/her partner for signs of chemical or heat exposure, periodically checks the integrity of the partner’s protective clothing, and notifies the command post supervisor or others if emergency help is needed. Buddies should work in line-of-sight contact or communication with each other and the command post supervisor. When wearing protective clothing, workers must make sure that hand signals are understood. Some common hand signals are shown on the next page.

Communication Systems

Communication systems need to be established to alert workers to emergencies, or unusual events, pass along work information, initiate changes in work tasks, and maintain work control. Communication systems are referred to as internal and external systems. Internal systems consist of visual cues such as hand signals, lights, flags, and audio cues such as bells, whistles, or compressed-air horns. External communication systems such as telephones or radios are useful but may be limited when static electricity or protective clothing prohibit the clarity of sound transmission or pose a safety hazard. Decontamination workers need to be trained to use both communication systems and a back-up properly. Employees also must be knowledgeable of emergency systems' alerting horns or other warning systems. Actual methods used at each cleanup site may differ. Site-specific training is required.

Standard Operating Procedures

Standard operating procedures (SOPs) are written work plans and activity descriptions which help assure that site characterization is conducted according to a uniform plan. Examples of SOPs include:

- Use of specialized air-monitoring equipment.
- Actions to take if underground cables are suspected or discovered.
- Neighborhood communication.
- Lines of authority.

These SOPs are outside the scope of this program but would be covered in site-specific training. The written health and safety information provided to contractors includes:

- Lines of communication and responsibility.
- Site emergency alerting and response (potential hazards including fire and explosion).
- Up-to-date briefing in anticipated hazards.

Worker Training Requirements

Under the OSHA standard 29 CFR 1910.120 (e), all employees working at a site who are exposed to hazardous substances, health hazards, or safety hazards must receive a minimum of 40 hours of instruction off the site and a **minimum of three days actual field experience** under the direct supervision of a trained, experienced supervisor. Supervisors are required to complete the 40-hour general program, three on-site training hours, and an additional 8 hours of training designed for managers. Annual 8-hour refresher training is required of all site workers and supervisors. Employees who will assist with emergency response (ER) activities must receive site-specific ER training.

This program is designed as a continuance of the 40-hour site worker program. After the general HAZWOPER training, this program teaches specifically how to deal with a methamphetamine lab. Though highly recommended, completion of a course like this is not legally required in all states in order to decontaminate a meth lab.

Medical Surveillance Program

Medical surveillance of meth lab cleanup workers is a part of the safety and health program. It is essential to assess and monitor workers' health and fitness both prior to and during the course of employment, provide emergency and other treatment as needed, and retain accurate records for future reference. The medical surveillance program should be instituted by the employer for the following employees:

- All employees who are or may be exposed to hazardous substances or health hazards at or above the PEL or above another published exposure level (if no PEL) for 30 days or more a year.
- All employees who wear a respirator for 30 days or more a year.
- All employees who are injured due to overexposure from an emergency incident involving hazardous substances or health hazards.
- Members of official hazardous materials response teams.

In accordance with the standard, medical examinations and consultations are made available by the employer to each employee who falls into one or more of the above categories. Medical exams should be conducted:

- Prior to a new job assignment (pre-placement or reassessment exam).
- At least once every year but not less often than every two years.
- At the termination of a job.
- If an employee exhibits signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident, or if the employee has been injured or exposed above the PEL or published exposure levels in an emergency situation.
- More than once each year, if the physician determines that an increased frequency of examination is medically necessary.

All medical examinations and procedures must be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine. The exam is provided without cost to the employee, without loss of pay, and at a reasonable time and place.

The content of the examination or consultations made will be determined by the physician. The physician may not understand the details of the employee's work. Therefore before the examination, it is important to explain to the physician the type of work, potential health risks, and the type of protective equipment which may be worn on the job. Examinations and consultations may include but may not be limited to:

- Medical and work history.
- Physical exam.
- Pulmonary function test.
- Hearing test.
- Electrocardiogram (EKG).

The employer pays for mandatory medical surveillance exams. Prior to the exam appointment, the employer should provide the attending physician with:

- The employee's job description relevant to the employee's exposures.
- The employee's current or anticipated exposure levels.
- A description of personal protective equipment that has been or will be used.
- Information from previous medical examinations of the employee which are not readily available at the examination date.

The employer should then obtain the following items from the attending physician and furnish it to the employee:

- The physician's opinion relative to the individual's employment. (Findings not relevant to the job are not to be included.)
- The physician's recommended limitations upon the employee's assigned work.
- The results of the medical examination and tests if requested by the employee.
- A statement that the employee has been informed by the physician of the examination results and any conditions which require further examination or treatment.

The employee has a right to request and be given a copy of the physician's full report. The report should be kept in a safe place or forwarded to your family physician.

The employer should keep records of medical exams and other exposure records for the duration of an individual's employment plus 30 years thereafter. The record should include at least the following items:

- Name and social security number and employee physician's report.
- Employee reports of health effects related to exposure.
- Copy of information provided to the physician by the employer.

Summary - Hazard Control

Site characterization and analysis are important and continuous parts of hazard control. They are conducted before and during site work to assess health and safety risks and determine ways to control hazards and contamination. Only qualified people should conduct such investigative work.

Administrative controls usually consist of written programs or plans which are implemented to prevent harmful situations. Engineering controls include substitution, isolation and ventilation. If the meth lab is located in a building, it should be ventilated with exhaust fans or negative air machines for several days prior to workers arriving on the site. Isolation occurs when the police remove all the chemicals as evidence in the criminal investigation. Finally, use of personal protective equipment is another method of limiting exposure.

Elements of a site safety and health program include: the organizational structure, comprehensive work plan, site-specific safety and health plan, standard operating procedures (SOPs), safety and health training, medical surveillance program, and any information necessary to link the overall company to the site-specific plan.

Hazard control procedures are to be planned and implemented before cleanup workers enter the site. The site control program must include: site map, work zones, buddy system, site communication procedures for routine and emergency situations, standard operating procedures, and identification of the nearest medical facility.

Medical surveillance is an administrative control used for evaluation of hazard control effectiveness. It can provide the baseline health status of new employees, as well as annual information and post-employment health information.

All persons at a site who are exposed to hazardous substances, health hazards, and safety hazards must first receive at least 40 hours of off-site training before entering the site. Three days of on-site training are required before beginning work. Supervisors receive an additional 8 hours of off-site training. All employees attend an additional 8-hour refresher training course each year. This course is to be taken in addition to the 40-hour course.

Work zones are boundaries determined by physical layout and monitoring conducted during the site characterization to minimize the spread of contamination outside of the work site. Work zones include: exclusion zone (Hot Zone, Danger Zone), contamination reduction zone (Warm Zone, Decontamination Zone), and support zone (Cold Zone, Clean Zone).

Key Terms - Hazard Control

Identify or define the following:

- Administrative controls
- Engineering controls
- Safety and health plan
- Site control
- Exclusion zone (EZ)
- Contamination reduction zone (CRZ)
- Support zone (SZ)
- Hotline
- Containment control line
- “Buddy system”

Review Questions - Hazard Control

1. What are some ways of controlling exposure?

2. Describe what you know of the types of sites where you will be working.

3. List and describe topics which must be included in the safety and health program.

4. Discuss site characterization and why it is important. When is it done?

Background Reading Material - Hazard Control

Hazardous Waste Operations and Emergency Response Standard Federal Register

Final Rule, March 6, 1989. (29 CFR 1910.120)

.120 (b) (3)Site Control Plan

.120 (d)Site Control

.120 (c)Site Characterization

.120 (k)Decontamination

Occupational Safety and Health Guidance Manual for Hazardous Waste Sites, 1984 (NIOSH # 85-115)

Chapter 9—Site Control, p. 1–7

Chapter 10—Decontamination, p. 1–7

Chapter 3—Planning and Organization, p. 1–7

Chapter 6—Site Characterization, p. 1–8

EPA's Standard Operating Safety Guides, July 1988

Part 6—Site Control—Work Zones, p. 1–8

Part 7—Site Control—Decontamination, p. 1–12

Part 7—Annex 1 through 4, Decontamination of Levels of Protection

NIOSH Pocket Guide to Chemical Hazards. (June 1994). NIOSH, DHHS (NIOSH) Publication No. 94-116.

Hazard Control

Work Practices

Some common work practices for meth lab cleanup are outlined in this chapter. Safe work practices are vitally important to protect your safety and health. Standard operating procedures (SOPs) are written instructions for safe work practices and are a form of administrative control.

Although every work site possesses a unique set of characteristics, the techniques used to work around equipment and confined spaces, and clean up the area are similar. Workers need to know safe work practices to minimize exposure to themselves, the environment, and nearby communities.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Define the term standard operating procedure and understand why SOPs are necessary to reduce the risk of injury at a meth lab site.
- Identify common SOPs relevant to major activities routinely performed during the cleanup of a meth lab.
- Practice activities such as:
  - Evaluate a Confined Space Entry Permit
  - Evaluate a lock-out tag.
  - Debris removal.
  - Encase rug in poly and remove.
  - Vacuum and wash duct.
  - Duct cleaning.

Standard Operating Procedures

The comprehensive work plan includes information about the actual work tasks and activities which will be undertaken at the site. The tasks and the methods of conducting the work are described. The details of the methods may be referred to as standard operating procedures (SOPs).

SOPs are carefully planned and detailed written work instructions intended to guide workers in carrying out work tasks safely. Some SOPs are used in routine operations; others provide guidelines for actions that should and should not be taken during an emergency. The following sections provide examples of SOPs for specific work practices at meth lab decontamination sites.

A very important work practice for cleanup workers is the Buddy System. Workers are organized into teams and assigned to observe the activities of at least one person in the group. The "buddy" provides the partner with assistance; observes for signs of distress, heat exposure, and fatigue; and alerts others if emergency help is needed.

Workers are guided by SOPs while performing their regular work tasks. Examples of some areas covered by SOPs are:

- Confined-space entry.
- Lock-out.
- Fire prevention.
- Equipment and vehicle operation.
- Ladder and scaffolding use.
- Respirator use and maintenance.
- Site security.
- Critique and revision.
- Termination.

Many of these topics included in routine SOPs are described in the following pages. Respirators are covered in a separate chapter of this manual. Site security is specific to the work area and must be discussed in the available written safety and health plan.

Design an SOP Exercise

Your instructor will break the class into several small groups. One of the work practices listed on the previous page will be assigned to each group. Take 15 minutes to discuss the questions below and record your ideas. One member of your group should be prepared to report the ideas to the entire class.

Work Practice: _____

1. Describe situations where this work practice may be used and/or needed at a meth lab decontamination site.

2. In an ideal world, what should be included in an SOP for this work practice?

3 What safety and health hazards will following this SOP prevent?

60 Response Tactics

There are many levels of contamination that can be found in a meth lab. The Tennessee Department of Environment and Conservation has published "Reasonable, Appropriate, and Protective (RAP) Cleanup Response and Documentation Guidance for Properties Quarantined due to Clandestine Methamphetamine Laboratory (CML) Activities" which delineates four different "tiers" of response (2005).

Tier 1 – "Abandonment or 'spooked cook' scenario"

- Evidence indicates only small amounts of meth have been cooked over a short period of time.
- No significant spills or stains visible.
- 1-2 batches using anhydrous ammonia (Nazi) method.
- Cleanup is necessary, even if contamination is not visible.

Tier 2 – "Motel/Hotel 'transient cook' scenario"

- Evidence indicates that limited amounts of meth have been cooked.
- Moderate staining and/or spills may be visible.
- Any batch cooked using the Red Phosphorus method begins at Tier 2.

Tier 3 – "Rental Property 'entrenched cook' scenario"

- Evidence indicates that larger amounts of meth have been cooked over an extended period of time.
- Large stains and/or spills are visible on surfaces.
- Poor indoor air quality.

Tier 4 – "The 'mass-production cook/drugs-for-profit' Super Lab scenario"

- Evidence indicates long-term and large-scale meth production.
- Large stains and/or spills covering surfaces extensively.
- Poor indoor and/or outdoor air quality.
- Hazardous substances have accumulated enough (indoor and/or outdoor) that they present a threat to the environment.
- Tier 4 sites are required by federal law to follow OSHA's Hazardous Waste Site regulations.

Steps to Take During Meth Lab Cleanup

While there are no federal requirements for cleaning up a meth lab, several states have set up a series of remediation steps. The following are a compilation of some of the best practices outlined in a number of state regulations.

Sampling prior to cleanup is important for two reasons. Samples tell you what you'll be up against so you can select the appropriate personal protective equipment. Samples also tell you where the contamination is (even if it is not visible) and outlines the area of the Hot Zone. In addition samples can help prosecutors make a case against the responsible parties. When taking samples, always wear adequate protection. You will learn about sampling techniques in the monitoring chapter.

Air It Out

Airing out the structure is necessary before, during, and after the cleanup, except when it interferes with air sampling. In some cases it may be prudent to increase the meth lab building temperature to 85-90 degrees Fahrenheit for 48-72 hours prior to venting to enhance the process of the chemicals turning into gases. Solvents and other chemicals ,may have soaked into the walls or furnishing of the meth lab and maybe slowly becoming gases in the building. Higher temperature will speed up the chemicals turning to gases. Open all windows and use exhaust fans, blowers, or prior to cleaning and for two to three days after cleaning is completed. Caution should be taken to ensure that contaminants are ventilated into the outdoors and not into another building's air intake system. After the building has been cleaned, and the building again aired out the property should be examined for re-staining or odors, either of which would indicate that the initial cleaning was not successful and more extensive steps should be taken.

Avoid using the HVAC system during the entire cleaning process especially while carpets and other contents are being removed and while the structural surfaces and features are being washed and sealed with paint or other solvent based coatings. Make sure there is adequate ventilation during these processes.

It is recommended that at least a half-face respiratory with appropriate cartridges for the contaminant be worn especially if adequate ventilation cannot be achieved (e.g. in very cold weather); during the use of solvent cleaners, epoxy sealants or while removing carpeting and other highly contaminated materials.

Heating Ventilation and Air Cooling (HVAC) Forced Air System

Ventilation systems tend to collect fumes and dust and redistribute them throughout the structure. The vents, ducts, filters and even the walls and ceilings near vents can become contaminated. In a motel, row house, or other multiple family dwelling the same ventilation system may serve more than one unit or structure.

Assessment of HVAC systems should be performed early in the cleaning process. Depending on the assessment and the system, the following steps may be required:

- During the cleanup of each room or area:
  - Remove and clean or replace all vents.
  - Remove debris to arm's length.
  - HEPA-vacuum ductwork at least to arm's length.
  - Twice-wash and rinse ductwork at least to arm's length, with hot water and detergent
- Remove and clean, or replace supply diffusers.
- Replace all filters in the system at the end of the cleanup process and after all dust disturbances have occured.

HVAC outlets in each room or area of the lab should be cleaned when that room or area is cleaned. If there are flexible duct as opposed to sheetmetal ducts these cannot be cleaned and should be removed and replaced. If the duct work monitoring shows high levels of contamination it may be necessary to sub contract to an HVAC contractor qualified to clean the entire system.

Gross Cleanup - Remove the Bulk

Evaluation of chemical spills:

All residual powers and liquids should be tested to determine their corrosivity, toxicity, and flammability. If pH testing indicates the presence of acids or bases their harmful effects should be reduced or neutralized (acids with sodium bicarbonate and bases with a weak acid wash solution, e.g. vinegar, citric or acetic acid), and absorbed with a clay or another non-reactive material (kitty litter) and packaged for proper waste disposal. Solids can be scooped up and packaged for disposal. After removal the surface should be checked for neutralization. Badly stained or contaminated surfaces should be removed and discarded.

During the meth cooking process, vapors are given off that can spread and be absorbed by nearby material. Spilled chemicals, supplies and equipment can further contaminate non-lab items. Smoking meth in the home can spread contaminates as well as tracking spills throughout common walkways. All items that are visibly stained or give off odors should be removed and disposed off. Many state regulations assume that the contents of a contaminated structure are contaminated and recommend that they all be disposed off. Howevr decisions regarding alternatives to disposal are generally based on value and potential for future human contact.

Cleanup should be systematic within the hot zone. Large items that are badly strained etched, or give off odors should be removed and rendered unusable. Mattresses, carpeting, ceiling tiles in the contaminated area, and large upholstered items should almost always be discarded. If placed at the street for pick up people might determine that these items have value and pick them up. These items must be made unusable to anyone. The best way is to simply cut and break them up. Items like these should be securely wrapped in 4-6 mil poly to prevent the spread of contaminants in the building during removal and properly disposed off. Sinks, tubs toilets where chemicals may have been dumped that are chemically etched or badly stained should also be discarded.

Absorbent materials such as drapes, furnishings, wallpaper, clothing if stained or give off odors must be removed and disposed off. It may be possible to wash or clean items not stained or giving off odors but the cost of the cleaning may be more than the replacement value of the item. However rubber backed drapes and woolens must be discarded. Cleaning porous materials that are not discarded will usually consist of HEPA vacuuming followed by hot water detergent scrubbing. Non-washable materials such as lined curtains, that are not heavily contaminated (and disposed off) can be drycleaned.

If the cook process took place in the kitchen, all food preparation counter tops, if stained, should be removed and disposed off. Large appliances if not badly stained or etched might be cleaned and saved otherwise they should be removed and disposed off. Dishes, flat ware and other hard items should be disposed off, however hard items like metals, glass, ceramics that have not been used in the cook process may be twice washed and rinsed using detergent and hot water. Low value, high contact items like tooth brushes, food utensils, plastic toys, plastic kitchen and household items, bedding, pillows, etc. should be discarded. A screw driver or garden rake or other metal or hard material items may be cleaned in some circumstances. Photographs, legal documents and documents of historical significance may be salvaged without cleaning, but most other paper items including books and magazines should be discarded.

In the cook area it may be necessary to remove the drywell or plaster from the wall; tile, drywall, or plaster from the ceiling, as well as tile, linoleum, rug and the sub-floor down to the floor joists. Some cooks disconnect stove vents to prevent their neighbors from smelling the fumes. They then stuff the vent into the insulation creating a bigger hazard and spreading contamination. In fact sometimes, it may be cost effective to demolish the building rather than clean it up.

Bear in mind that meth users sometimes inject the drug. Loose needles are likely to be lodged in unlikely places (i.e. between couch cushions), creating a hazard for cleanup workers. Blood-borne pathogens can be present on needles, and should you be stuck by one, arrange for immediate medical treatment.

If you come across any sharps, obtain a thick walled plastic container like a laundry detergent bottle or a 20oz. soda bottle. Slip the needles into the container, seal the lid tightly, and mark it well before moving it out of the area.

Cleanup - vacuuming, washing and encapsulation

After the building has been stripped of the contaminated contents, nonporous and semi-porous surfaces (such as floors, counters, tiles, walls and ceilings) especially in areas where the cooking and preparation occured can hold contaminants. If these members were stained or etched, they have been removed; if they were not, they must be properly cleaned first with an aggressive HEPA vacuuming and then with a detergent-water solution or steam cleaning. If detergent washed, there should be two washings, each followed with a thorough rinse. Washing must include frequent changes to fresh cloth rags and detergent solutions and rinsing of the surface with clean rags and fresh water. Capture of all cleaning and rinsing solutions from the surface being cleaned is critical to meth. Used wash water should be tested and properly disposed off.

Hard non-porous, smooth structural furnishings such as bathtubs, mirrors, windows and doorframes (metal) should also be washed twice with detergent and hot water and rinsed. Painted and unpainted cement and cement block maybe power washed, with the wash water collected. The wet vacuum used for collection must be decontaminated after use. Another alternative would be to steam clean with extraction of the cleaning solution. Brick and raw wood are difficult to wet clean as these materials absorb the cleaning solutions. Oxidizing cleaners (such as oxygen bleach) cleaners may be most effective on these porous materials. HEPA vacuuming also would be effective but would be very time consuming.

With the building down to structural members having been HEPA vacuumed and double washed and rinsed all surfaces of rooms where people live must be encapsulated. Walls, ceilings, floors, and woodwork must be coated with paint or polyurethane after cleaning to isolate the remaining meth. Apply at least two coats of high quality paint or polyurethane. A primer coat will improve the adhesion of the second coat of sealant. Paint should be sprayed not brushed or rolled. The first coat should be allowed to cure to the full manufacturers recommendations before applying a second or third coat. Oil, urethane, and epoxy products provide a superior encapsulation to latex products. Sealing cement, brick, wood or other porous materials is required in living spaces and is usually recommended in other locations.

As each room of the building is cleaned it should be cordoned off with 4-6 mil poly to prevent the recontamination as the rest of the structure is cleaned.

Plumbing and Sanitary Septic/Sewer

Waste products generated during meth manufacturing are often disposed down sinks, bathtubs or toilets. These wastes can collect in drains, traps and/or septic systems and give off fumes. As stated before if staining or etching is noted, the toilet, sink or tub must be removed and replaced. Attempting to remove these items or deal with odors must be done with caution as the traps may be highly contaminated. The system should be flushed with plenty of water to reduce the concentration of residual chemicals. Attempts to pump out or remove the trap (necessary function if the sink, or tub are removed) may result in chemical exposure and possible serious injury.

If air reactive chemicals are in the drain (e.g. phosphorus, lithium metal) exposure of these chemicals to air might result in ignition.Before beginning any work in drains or traps, ask your supervisor about the materials used at this lab. Decontamination should be in the site safety plan, if available. If there is no information or the possibility of air-reactive materials contamination, the local fire department hazardous materials team should be contacted and all work done by a licensed plumber in collaboration with the haz mat team.

Septic System Cleaning

Unless the lab is a super lab or a lab that appears to have produced for a very long time and dumped waste into the septic system, it is probably appropriate to pump out the tank and determine if it will still function. In some cases, the chemical waste may have killed the organisms that make the tank process human waste and then there would be a “dead tank” that must be treated. In cases of large or long term production, it is appropriate to test the tank for volatile organic compounds (VOC).

The state of Washington recommends sampling when there are reasons for concern about the dumping of lab chemicals into the system. Reason for concern might come from:

witness statements;
stained or etched sinks, bathtubs or toilets;
chemical odors coming from the septic system, plumbing or tank;
visual observation of unusual conditions within the septic tank (dead tank);
or stressed or dead vegetation in a drain field.

If VOC levels are high (over 10,000 ppm) Washington state designates the tank material as toxic dangerous waste. In this case, a hazardous waste contractor must deal with the tank. If the VOC is over 1000 ppm, the tank must be aired out further to reduce the VOC to under 1000 ppm where it can be pumped and treated at a septic treatment facility.

States like Colorado require that clearance sampling be performed and that samples show that contamination is at or below 0.5 micrograms/100 cm squared. Minnesota has just eliminated its requirement for clearance sampling because many contractors were not reaching the clearance level and it was believed that there was no clear level that would ensure the health of the people who would now live in the building. Minnesota does require that their cleanup process be followed.

Painting

It is a good idea to repaint all surfaces like walls and ceilings to help seal in contaminants. The chemicals may not be completely gone, but a paint job can help keep them away from the next occupants of the building.

Sample Again

To ensure that the decontamination process was successful, you need to take another set of samples. This regimen makes sure that the building is safe for re-use by humans.

Colorado's guidelines for safe levels are:

- Methamphetamine 0.5 micrograms/100cm^2
- Iodine 22 micrograms/100cm^2
- Lead 40 micrograms/ft^2
- Mercury 1.0 micrograms/m^3

Refer to the NIOSH Pocket Guide for acceptable levels of chemicals not mentioned.

Write a Report

A report should be written immediately following the decontamination process. It should include descriptions of:

- The property: address, owner, buildings present.
- Manufacturing method and any chemicals present.
- Contamination, including photo documentation.
- Sampling methods and results (before and after).
- Decontamination process.
- Safety procedures implemented.
- Where and how contaminated objects were disposed of.
- Where and how waste water was disposed of.
- Certifications/qualifications of involved persons.
- Signature.

Confined-Space Entry Procedures

A **confined space** generally has three distinct properties which set it apart from other areas and dramatically increase the risk of injury or illness.

Properties of Confined Spaces

- Limited ways to get in and out of the space
- Not intended for continuous human occupancy
- Bodily entry is possible and work can be performed.

The most common confined spaces a meth lab cleanup crew will encounter are crawl spaces, attics, and septic tanks.

Lack of natural ventilation makes it easier for toxic or flammable materials to accumulate. Something as simple as rusting metal or the operation of fuel-powered engines can deplete the existing oxygen supply. Decaying organic materials such as plants or animals can create hydrogen sulfide gas.

Many toxic gases don't have any warning properties, so workers about to enter the confined space have no way of knowing what hazards they might face without first testing the air. The most common confined-space injuries are asphyxiation from lack of oxygen, being overcome by very high concentrations of toxic vapors, or rapid skin absorption of organic solvents.

Other common confined-space hazards involve explosions or fires. Getting in and out of a confined space can cause injuries and hinder rescue efforts in emergencies. Entry into confined spaces may block your view of what else is happening around you.

All confined space SOPs should be reviewed to determine compliance with OSHA's final rule on Permit-Required Confined Spaces (1910.146), issued in January of 1993.

A trench or low area where chemicals have been stored or disposed of may be a confined space.

A permit-required confined space (permit space) has one or more of the following characteristics:

- Contains (or has a potential to contain) a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.

- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

Several steps should be taken to make work safer in confined spaces. Careful advance planning for confined-space entry can help minimize the risk of injury. This advance planning must include the following points:

- Identifying confined spaces. (Determine which require a permit to enter.)
- Developing written standard operating procedures (SOPs).
- Arranging for and strategically locating adequate supplies of air-supplying respirators and protective and life-saving equipment.
- Training personnel who must enter permit-required confined spaces to deal with emergency events.
- Training personnel how to monitor and properly safeguard the space before and during entry.
- Posting a qualified and trained safety attendant outside the confined-space entrance at all times.
- Training personnel to recognize when the hazards of a confined space may have changed.

The hazards of confined-space entry are further reduced by:

- Monitoring confined spaces before entry and during work for oxygen deficiency and flammable or toxic atmospheres. Monitoring must be conducted throughout the space, not just at the entry point.
- Providing appropriate ventilation before and during the work.
- Complying with the permit and logging system. Under this system, confined-space entry is permitted only after information about oxygen and toxic and flammable vapor levels has been collected. The permit must be signed by a responsible manager. No personnel can enter the confined space without a signed entry permit. Permits are valid only for a specific date, time, and place.

Through careful monitoring, training, and planning, a confined-space entry SOP minimizes danger by trying to control factors that may cause or contribute to accidents or emergencies through careful monitoring, training, and planning. These required standard procedures are an administrative control. An example of a confined-space entry permit is illustrated on the next two pages.

Confined-Space Entry Permit

Date and time issued: _____ Date and time expires: _____

Job site/space ID: _____ Job supervisor: _____

Equipment to be worked on: _____ Work to be performed: _____

Stand-by personnel: _____

1. Atmospheric checks:
   Time _____
   Oxygen _____%
   Explosive _____% LFL
   Toxic _____PPM

2. Tester's signature: _____

3. Source isolation (no entry):
   Pumps or limes blinded, disconnected, or blocked ..... ☐ N/A ☐ Yes ☐ No

4. Ventilation modification:
   Mechanical ..... ☐ N/A ☐ Yes ☐ No
   Natural ventilation only ..... ☐ N/A ☐ Yes ☐ No

5. Atmospheric check after isolation and ventilation:

Oxygen	_____%	>	19.5	%
Explosive	_____% LFL	<	10	%
Toxic	_____PPM	<	10	PPM H(2)S
Time	_____			

   Tester's signature: _____

6. Communication procedures: _____

7. Rescue procedures: _____

Confined-Space Entry Permit, cont.

8. Entry, standby, and back up persons:

Successfully completed required training?	☐ Yes	☐ No
Is it current?	☐ Yes	☐ No

9. Equipment:

Direct reading gas monitor tested	☐ N/A	☐ Yes	☐ No
Safety harnesses and lifelines for entry and standby persons	☐ N/A	☐ Yes	☐ No
Hoisting equipment	☐ N/A	☐ Yes	☐ No
Powered communications	☐ N/A	☐ Yes	☐ No
SCBAs for entry and standby persons	☐ N/A	☐ Yes	☐ No
Protective clothing	☐ N/A	☐ Yes	☐ No
All electric equipment listed Class I, Division I, Group D, and non-sparking tools	☐ N/A	☐ Yes	☐ No

10. Periodic atmospheric tests:

Oxygen	_____%	Time	_____	Oxygen	_____%	Time	_____
Oxygen	_____%	Time	_____	Oxygen	_____%	Time	_____
Explosive	_____%	Time	_____	Explosive	_____%	Time	_____
Explosive	_____%	Time	_____	Explosive	_____%	Time	_____
Toxic	_____%	Time	_____	Toxic	_____%	Time	_____
Toxic	_____%	Time	_____	Toxic	_____%	Time	_____

We have reviewed the work authorized by this permit and the information contained herein. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the “No” column. This permit is not valid unless all appropriate items are completed.

Permit prepared by: (Supervisor) _____

Approved by: (Unit Supervisor) _____

Reviewed by: (Cs Operations Personnel) _____

This permit to be kept at job site. Return job site copy to Safety Officer following job completion.

Copies: White Original (Safety Office), Yellow (Unit Supervisor), Pink (Job site)

The confined-space entry program must be in writing. The initial training of attendant, entrant, supervisor, and rescue workers is detailed, as is the documentation of annual retraining. All procedures to be used during activities related to the entry are included. The program must include a description of procedures to:

- Prevent unauthorized entry.
- Identify/evaluate hazards prior to entry.
- Provide means/practices for safe entry.
- Provide equipment for testing, monitoring, ventilating, communication, PPE, lighting, barring and shielding, safe access/egress, and rescue and emergency.
- Evaluate conditions during operations.
- Provide at least one attendant.
- Provide adequate response capability.
- Designate roles and responsibilities.
- Summon rescue/emergency personnel.
- Carry out the permit system.
- Coordinate operations if multiple employers are represented.
- Provide for conclusion of entry.
- Review operation.
- Review program.
- Provide training.

Important examples of pre-entry, entry, and post-entry procedures are listed on the following page.

Pre-Entry Procedures

- Install signs and barricades, and secure the perimeter.
- Isolate space from unauthorized personnel.
- Obtain and fill out a confined-space permit.
- Test and continually monitor the atmosphere.
- Ventilate and reset space.
- Must use retrieval lines with harness.

Entry Procedures

- An entry worker makes initial atmospheric tests within space.
- Attendant remains outside at all times and records atmospheric readings on the confined-space permit.
- Attendant maintains continuous communication (visual or radio) with entry workers.
- Retrieval lines are manned outside by rescue personnel.
- Under no circumstance shall workers enter an IDLH environment unless wearing a harness and retrieval line.
- If retrieval line may cause a tripping or entanglement hazard, another suitable rescue mechanism must be used.
- An entry worker attendant or supervisor must have authority to evacuate the space.
- All housekeeping duties must be performed during or after completion of the work.

Post-Entry Procedures

- If any problems were encountered, have follow-up critique to resolve.
- Check all equipment; repair as necessary and store.
- Complete report.

Annually, the entire program should be reviewed and updated. If you are involved in confined-space work, the details of the SOP must be included in site-specific training.

Lock-out Procedures

Lock-out procedures are used to prevent injury especially from electrical sources. Equipment or sources are locked out of operation so that they will not be turned on by someone who is unaware of the activity of another worker.

Know the site lock-out procedure before any operation is attempted.

Never assume a circuit
or pipe is locked out just because it should be.

When in doubt, lock it out!

The following are common examples of equipment requiring lock-out that may be found at a meth lab:

- Electrical junction boxes.
- Pipes carrying liquid, steam, etc.

The risk of ignition of flammable materials and electrocution is lessened by locking out an electrical circuit. Locking out a steam or hot water pipe may cut off a transmission path for vapors or fumes and prevent burns or accidental contact with the contents of the piping system.

Lock-out requirements are described in 29 CFR 1910.147, The Control of Hazardous Energy (Lock-Out/Tag-Out).

LOCKED OUT

This tag must always be used and completely filled out before it is used.

Do Not Start! Do Not Open! Do Not Close!

Do Not Energize! Do Not Operate!

1. Employee name _____
2. Date lock placed _____
3. Time lock placed _____
4. Was starter pushed to determine equipment to be worked on did de-energize?
   Yes ☐ No ☐
5. Has the undersigned verified that the correct main breaker has been locked out? Yes ☐ No ☐
6. Has the equipment been isolated from other energy systems such as hydraulic or pneumatic which could endanger others? Yes ☐ No ☐

   Comments _____

   _____

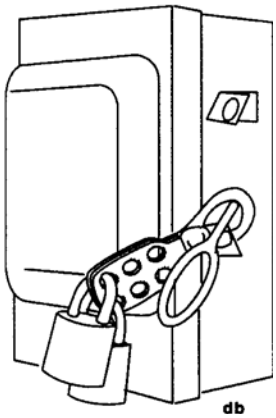
   _____

Example of a Lock-Out Tag

The minimum recommended elements of a lock-out procedure are listed below:

- Get lock-out approval/permit (lock-out tag).
- The first person to work on a piece of equipment should be sure the primary power source is turned off and install a personal lock with a lock-out clamp. This clamp must be installed so that the disconnect cannot be turned on with the clamp and lock in place. The switch is then activated to see if the circuit is truly de-energized.
- Each person who works on the equipment must go through the standard process described above.
- Each person must remove his or her lock after completing the job and all personnel are out of the danger area. After the last lock and clamp are removed, the warning tag can be removed and the equipment re-energized.
- A lock must be removed only by the person who installed it. Any exceptions are detailed in the SOP and must be included in the site-specific training.
- Critique any problems and revise SOP.
- Annually, review and update SOP if needed.

Failure to follow lock-out procedures may result in immediate hazards to life and property. Hazards to worker safety and health include electrocution; chemical or other burns; or being caught in or crushed by mechanical, pneumatic, or other moving parts.



Typical Lock-Out Device With Multiple Locks

Fire Prevention

Fires or explosions may occur at a meth lab cleanup site due to operation of heavy equipment near flammable materials, as a result of mixing incompatible chemicals, or during hot-work activities such as using a cutting torch.

Although it is necessary to monitor for the presence of flammable vapors, constant attention must also be given to preventing fires and explosions. Prevention is the responsibility of both the employer and the employee. Standard operating procedures for fire prevention usually include safety rules, equipment maintenance/testing, training, and warning signs.

Employer Responsibilities for Fire Prevention

- Maintaining adequate supplies of fire-extinguishing media appropriate for the hazards.
- Making certain that fire-extinguishing equipment and supplies are properly positioned.
- Ensuring that responsible fire brigade crews are adequately trained to use the specific firefighting equipment and supplies for the hazards which may be present.
- Conducting routine evacuation and fire-response drills.
- Conducting frequent walk-through inspections for fire safety purposes.
- Inspecting fire-suppression equipment routinely.
- Posting evacuation routes.
- Training employees in hazard recognition.
- Handling and storing of compressed gases properly.

Worker Responsibilities for Fire Prevention

- Using non-sparking tools.
- Observing no-smoking rules.
- Using only non-sparking (i.e., “intrinsically safe”) radios and other electrical equipment.
- Following other reasonable rules to reduce the possibility of fire.

To be truly effective, fire prevention SOPs require ongoing worker training and follow-up reminders, as well as inspections, warning signs, and monitoring at the site.

Spill Control

On most meth lab cleanups, all of the chemicals should have been removed from the site. However, it is possible to come across missed containers of chemicals. If the chemicals you have come across are spilled, there are procedures you can undertake to correct the problem. A spill containment program is required whenever container rupture may result in a major spill. (OSHA does not define a major spill). This program may be the part of an overall spill control plan, which describes actions to be taken if a minor or a major spill occurs.

Spill control activities are broken down into three types: Basic, Containment, and Confinement. **Basic** control prevents further release. Procedures may include shutting off a valve or positioning a container so that the hole is at the top. **Containment** includes procedures undertaken to keep a material in its container. Containment activities include:

- Plugging—A plug is placed in the leaking drum to prevent or limit further release. Common plugging materials include wood, soap, and rags. All plug materials must be compatible with the chemical which is leaking.
- Patching—A patch is applied over the leaking area. Patching materials include rubber, patching mud, and tape. Patching materials must be compatible with the chemical that is leaking.
- Overpacking—Placing a leaking drum into a larger drum will contain the spread of the contents.

Confinement includes procedures used to keep a material in a defined area. As an Operations-level worker, you will be trained to perform confinement techniques, but not containment techniques, which are for technician-level workers. Confinement activities include:

- Diking—Dikes may be built around the perimeter of the leak with sand, earth, straw, sorbent, or similar materials. The diking material must be compatible with the spill material. Plastic sheeting can be used as an additional barrier to slow leakage, if appropriate.
- Blocking—Drains, ditches, or storm sewers should be covered and blocked to prevent run-off of spill materials. This blocking can be done with a sorbent pad, a piece of plastic, or a rubber pad. If flammable or toxic materials enter these systems, the potential for damage to property or people is increased.
- Absorption—Run-off can sometimes be absorbed with dirt, sand, soda ash, saw dust, wood

chips, peat moss, vermiculite, or other material. The sorbent material should be positioned so that spill material runs into it. The sorbent must be compatible with the spill.

- Collection—Run-off can also be collected in containers such as drums or buckets.

Specific methods of control, containment, and confinement at sites should be outlined in an SOP.

Confinement is done from a distance. You should maintain enough distance to prevent contact with the leaking material. During containment, you approach the point of release. Your potential for exposure is generally greater during containment.

Heavy Equipment and Vehicle Operation

Extensive training in the use of the different “rigs” is required before a worker is assigned to become an operator. Experienced operators need to become familiar with the differences in driving and operating their equipment when wearing PPE due to motion and visibility restrictions. Characteristics of levels of protection will be discussed in the Personal Protective Equipment chapter of this manual.

The following should be part of an SOP describing heavy equipment operation:

- Whenever the equipment is parked, the parking brake must be set.
- Equipment parked on inclines must have wheels chocked and parking brake set.
- Equipment should be fueled before the start of work whenever possible to reduce the risk of fire if fuel is spilled.
- Breathing air cylinders must be positioned to prevent valve and regulator damage during operation.
- Cylinders must be securely attached to equipment.
- All equipment taken into the Hot Zone (contaminated area) must remain in that zone until decontaminated.

While it is probably rare on a meth lab cleanup job, Level B maybe required for some operators in a highly contaminated situation. Operators working in this Level must be able to access and connect the equipment aur system without the use of the 5-minute escape system. This may be done by:

- Having operator park equipment at edge of Hot Zone and use egress to decontaminate and enter support area. A long decontamination procedure may require air line hook-up in decontamination area.
- Use air line from support area to access and egress, switching air line at equipment. An assistant will be required to take out and return the air line.

Motor Vehicles

Automobiles, pick-up trucks, and forklifts may be in use at a site. Proper operation will minimize the spread of contamination and reduce the potential for accidents.

General Requirements for Motor Vehicles (off-highway use only)

All vehicles in use should be checked at the beginning of each shift to assure that the following parts, equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use:

- Service brakes (including trailer brake connection, fluid level, etc.).
- Parking system (hand brake).
- Emergency stopping system (brakes).
- Tires.
- Horn.
- Steering mechanism.
- Coupling device.
- Seat belts.
- Operating controls.
- Safety devices (back-up alarms, fire extinguisher, mirrors, etc.).
- Lights, reflectors.
- Windshield wipers.
- Defrosters.

All defects shall be corrected before the vehicle is placed in service.

Only trained and qualified personnel authorized by the company shall operate equipment. Operators who have not previously operated equipment while using PPE should familiarize themselves with the restriction the PPE imposes before operating in close proximity of people or other critical situations. Prior to operating each day, operators should inspect their equipment for failures and defects.

When operating vehicles equipped with the Roll Over Protection System (ROPS), workers must wear seat belts for the system to be effective. When leaving a machine, operators should step to the ground instead of jumping from the equipment because of extra hazards due to PPE. Blades, buckets, or other similar devices should be lowered to the ground and the engine shut down before leaving the equipment. Because the contaminant level may rise suddenly, operators must be prepared to shut down and immediately leave the area when signaled to do so. Care should be taken that all waste goes into the transport vehicle. Spillage on the side of trucks may require that they be decontaminated before leaving the site.

It is important to remember that when people are working in a group:

- A signal person should be designated. The signal person will provide when-to-move signals to the operator to avoid confusion and unexpected movement.
- All personnel in the area of the equipment should remain in view of the operator at all times.
- All personnel in the area of the equipment should remain out of the “swing area” and path of the equipment, unless the operator knows they are there.

Equipment is to be used only for its intended purpose and must not be overloaded or abused. Equipment must not be used to carry passengers unless it is equipped with seats to do so. Equipment should operate up-wind from the site whenever possible.

Ladders and Scaffolding

Ladders and scaffolding may be used on the site to access vessel entry ports or in disassembly operations at sites being cleaned up.

Ladder safety is described in OSHA Construction Standard 29 CFR 1926.450. Extra care should be taken when climbing ladders while wearing PPE due to restriction of motion and visibility. All fixed or existing ladders should be carefully inspected for deterioration of parts and attachments before use.

Scaffolding requirements are found in OSHA Construction Standard 29 CFR 1926.451. Extra care should be taken when working on scaffolds in PPE due to restriction of motion and visibility. Aerial lifts such as extendible boom platforms, serial ladders, articulated boom platforms, vertical towers, and their combinations should be used in place of scaffolds whenever possible and practical, in accordance with OSHA 29 CFR 1926.556.

Other Work Practice Considerations

Adequate lighting and sanitation facilities must be available if the work activities are to be performed in a safe and healthful manner. Specific requirements for hazardous waste sites, and thus for any meth lab site that fits this qualification, are described below.

Illumination

At a minimum, work and rest areas must be illuminated to the levels listed in the following table (1910.120 [m]).

Minimum Illumination

Foot Candles	Area or Operations
3	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling and field maintenance areas
5	General site areas
5	Indoors: warehouses, corridors, hallways
5	Tunnels: shafts and general underground work areas. (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling.)
10	General shops: mechanical and electrical equipment rooms, active storerooms, barracks
30	First aid stations, infirmaries, and offices

These values apply while work is in progress only; lower levels may be furnished during non-work hours. The safety and health officer will determine the illumination level required at the site.

Sanitation at Temporary Workplaces

Water

An adequate supply of drinking (potable) water must be provided at the site. If portable containers are used to dispense drinking water, they must be tightly closed and equipped with a tap; it is not permissible to dip from a common container. The container must be clearly marked and never used for another purpose. If single-use cups are supplied, they must be kept sanitary prior to use and disposed of in a provided trash can.

If water unfit for drinking (non-potable) is available at the site for firefighting or other purposes, the water lines and hose connections must be clearly marked to indicate that it not to be used for drinking, washing, or cooking. Systems shall be designed to prevent any potential cross-connection with a potable source.

Toilet Facilities

Toilet facilities with doors and inside locks must be provided for employees, unless employees are part of a mobile work crew having transportation available to nearby toilets. Work sites without sewers must be provided with chemical, recirculating, combustion, or flush toilets, unless they are prohibited by local codes. At least one toilet facility must be available at temporary field conditions. For other work sites, a minimum of one facility should be available for 20 or fewer employees, one toilet seat and one urinal per 40 employees for 20–200 employees, and one toilet seat and one urinal per 50 employees for more than 200 employees.

Food Handling

All employee food services must meet all laws and ordinances of the areas where they are located.

Sleeping Quarters

Temporary sleeping quarters must be heated, ventilated, and lighted.

Washing Facilities and Showers

Employers must provide nearby washing facilities. They shall be located in areas under the control of the employer where exposure levels are below the PEL and published exposure levels. The facilities shall be sufficient to assure that employees can remove hazardous materials from themselves.

When work will continue for six months or longer, showers and change rooms for all employees exposed to hazardous substances and health hazards must be provided, consistent with the following regulations:

- Showers must be provided in accordance with OSHA 29 CFR 1910.141 (d)(3).
- Change rooms must have two separate areas, one for removal and storage of clean clothes and one for the removal and storage of work clothing. Change rooms must meet the requirements of 29 CFR 1910.141 (e).
- Showers and change rooms must be located in areas where exposures are below the PEL and published exposure levels. If this is not possible, then a ventilation and supplied-air system must be provided to reduce exposures to the required level.
- Employers must ensure that all employees shower at the end of the work shift and when leaving the site.

Handling Materials Safely

The weight, size and shape of materials to be moved have a direct effect on the strain to your body. If an object has to be moved, size-up the load and the job before starting work…

What is the weight?
What is the size?
What is the shape?
Can contents or parts shift during transfer?
What is your physical capacity to lift?
Is there someone else to help?
Is there a lifting device or dolly?
Do I need tools to handle the material?

When you have a plan for the activity, use the following work guidelines:

Lifting:
- Place your feet close to the object, 8 to 12 inches apart for good balance
- Bend your knees to a comfortable degree
- Get a hand hold on the object
- Use your leg and back muscles to lift the load straight up, keeping the load close to your body
- Lift the load to the carrying position, without turning or twisting
- Observe the path you must take, making sure it is clear
- Turn your body with foot position changes
- Set the load down using leg and back muscles by bending your knees
- Release your grip

Use teamwork
- Large and odd-shaped loads
- Keep load at same level by all carriers (for example when carrying carpet)

Use the proper equipment
- Use a ladder; never use a chair, boxes or pallets

Practice safety
- Over-reaching and stretching cause strains
- Twisting positions cause strain while lifting or carrying
- Carrying stacks that obscure your view may result in tripping or bumping
- Unstable or uneven surfaces increase the likelihood of falls/trips/slips
- Tie down loose or shifting parts (for example secure a sofa bed to assure that it does not open during transfer)

Chose the right equipment

Make sure tools (e.g., shovels, hammers, pry bars) are in good repair.
Handle length of tool should be appropriate for the job.
Dollys have straps
Ladders are in good repair and of sufficient height that you do not have to approach the top rung
Use J-handles when carrying large pieces of drywall

Work Practices Labs

The class will be divided into groups for this exercise. Each group will rotate through each of the following stations:

- Rug Removal
- Lockout
- Duct Cleaning
- Gross Removal

The instructor at each station will describe the problem, provide additional materials, and answer questions. Complete the Lab Performance Checklists provided by your instructor for each station, then have the instructor review and sign them. These checklists will be retained by the training center as part of your training records. The checklists provided in the next few pages are for your records if you want to complete them.

Name _____

Buddy's Name _____

Work Practices Lab Performance Checklist
Station 1: Rug Removal

Action	Completed/Observed	
1. Elected a leader.	☐ Yes	☐ No
2. Selected appropriate materials from available supplies.	☐ Yes	☐ No
3. Properly donned PPE.	☐ Yes	☐ No
4. Worked in a manner to minimize contamination.	☐ Yes	☐ No
5. Worked in a manner that minimizes musculo-skeletal problems.	☐ Yes	☐ No
6. Ensured transfer technique did not cause contamination.	☐ Yes	☐ No
7 Maintained Buddy System.	☐ Yes	☐ No

_____

_____

Other Actions Observed **Was Contact Minimized?** ☐ Yes ☐ No

_____

_____

_____

_____

Date _____ Instructor's Signature _____

Name _____

Buddy's Name _____

Work Practices Lab Performance Checklist
Station 2: Lockout

Action

1. Identified three hazards that could be minimized by lockout. .....a. ☐ Yes ☐ No

   .....b. ☐ Yes ☐ No

   .....c. ☐ Yes ☐ No

2. Identified complete lockout tag. ..... ☐ Yes ☐ No
3. Discussed importance of lockout at meth lab sites. ..... ☐ Yes ☐ No

Other Topics Discussed

_____

_____

_____

_____

Date _____ Instructor's Signature _____

Name _____

Buddy's Name_____

Work Practices Lab Performance Checklist
Station 3: Duct Cleaning

Action

1. Properly donned PPE. ..... ☐ Yes ☐ No
2. Worked in a manner to minimize contamination. ..... ☐ Yes ☐ No
3. Was the duct grill removed and cleaned? ..... ☐ Yes ☐ No
4. Was the duct properly vacuumed? ..... ☐ Yes ☐ No
5. Was the duct properly washed and rinsed? ..... ☐ Yes ☐ No
6. Was the contact paper examined for dust? ..... ☐ Yes ☐ No

Other Actions Observed

_____

_____

Date _____ Instructor's Signature _____

Name _____

Buddy's Name _____

Work Practices Lab Performance Checklist
Station 4: Gross Debris Removal

Action

1. Properly donned PPE. ..... ☐ Yes ☐ No
2. Were "sharps" found and properly disposed off? ..... ☐ Yes ☐ No
3. Was debris removed with minimal dust generation? ..... ☐ Yes ☐ No
4. Was debris removed with minimal musculo-skeletal exertion? ..... ☐ Yes ☐ No
5. Maintained Buddy System ..... ☐ Yes ☐ No

Other Actions Observed

_____

_____

Date _____ Instructor's Signature _____

Summary - Work Practices

Work practices are required to help protect worker safety and health.

Standard Operating Procedures (SOPs) are carefully planned, detailed written work instructions intended to provide workers with necessary guidelines to carry out work tasks safely.

SOPs for confined-space entry, lock-out, and fire prevention, delineate some necessary work practices required to protect a worker's safety and health.

Specific SOPs should also be in place for rug removal, debris handling and the use of ladders and scaffolding.

At each cleanup site, employees must be trained in the specific SOPs that are relevant to their duties.

When cleaning up a meth lab, first air it out, then remove the bulk of the contaminants, and then clean the remaining surfaces. Surfaces can be cleaned by physically and chemically removing contaminants, rinsing them off, or disinfecting and sterilizing. Sometimes a combination of techniques works best.

Key Terms - Work Practices

Identify or define each of the following:

- Confined space
- SOP
- Confined-space entry
- Fire prevention
- HEPA

Review Questions - Work Practices

1. Define the term Standard Operating Procedure, and show how it applies to worker safety and health.

2. What should be included in an SOP for confined-space entry?

3. What should be included in an SOP for lock-out?

4. What should be included in an SOP for work on plumbing and water traps?

Background Reading Material - Work Practices

Hazardous Waste Operations and Emergency Response Standard, Federal Register, Final Rule: March 6, 1989, 29 CFR 1910.120 (j) Drums and Containers.

Occupational Safety and Health Guidance Manual for Hazardous Waste Sites, (NIOSH # 85-115) 1984, Chapter 11, Handling Drums and Other Containers, p. 1–12.

EPA's Standard Operating Safety Guides July 1988, Part 2, Standard Operating Safety Procedures.

Monitoring

Identifying hazardous substances at a work site is very important for the safety and health of workers. Substance levels can be detected through the use of monitoring instruments such as oxygen meters, combustible-gas indicators, and colorimetric tubes.

Exposure levels and explosive limits have been determined by government agencies such as OSHA and NIOSH and both private and non-government agencies like ACGIH. These levels and limits are used to determine proper protective equipment and ensure a safer work environment.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Describe why the work environment needs to be monitored.
- Understand the value of personal, area, and perimeter monitoring.
- Identify several types of monitoring equipment, their strengths and limitations used on a typical meth lab site.
- Layout and take a wipe sample of a vertical and horizontal surface.

The Importance of Monitoring

Monitoring provides important information about the presence of hazardous substances at a work site. Readings or samples of the atmosphere are taken regularly in different site locations. Although no single instrument can detect all hazards, proper use of air-sampling equipment can provide information needed to protect life and property. Using the wrong type of instrument may expose workers to an unsafe work environment.

Monitoring must be performed when there is a question that employees may be exposed to hazardous substances; the results are used as one factor in selecting PPE. The reasons for monitoring are:

- To detect whether potential hazardous conditions exist.
- To measure the concentration of hazardous substances.

Monitoring is also done in order to:

- Determine whether hazardous materials are present during normal operations.
- Determine possible immediate effects of hazards, especially conditions which are immediately dangerous to life and health (IDLH).
- Determine when sudden releases of toxic materials occur that would require a change in work practice or donning of a specific type of protective equipment.
- Determine that no hazardous substances remain after a sudden release.

Monitoring is done to measure concentrations in order to:

- Determine worker exposure level.
- Determine the extent of hazardous conditions.
- Determine community exposure.
- Assist in planning work activity.
- Provide records of exposure.
- Provide a historical record to submit to regulatory agencies.
- Determine whether employees need medical assistance.

Whenever possible, it is desirable both to detect and measure the hazardous substance.

Personnel with advanced training will identify specific compounds, if the substance(s) are unknown. This information will:

- Assist in the selection of respiratory protection and ensure that it remains effective during the work period.
- Assist in the selection of chemical-protective clothing.
- Help determine whether there is a need for medical monitoring.
- Verify the level of chemical exposure and help determine the appropriate recommendations.

Initial entry monitoring is designed to identify IDLH situations at representative areas of the site. Other situations to be identified as part of initial entry monitoring include overexposure concentrations to chemicals, dusts or radioactive materials, or other dangerous situations such as the presence of flammable or oxygen-deficient atmospheres.

Periodic monitoring alerts workers to hazardous conditions and should be conducted when there are IDLH conditions, flammable atmospheres, or indications that exposures may have risen over permissible or published exposure limits since the last monitoring. It is possible that exposures may have changed when:

- Work begins in a different area of the site.
- Contaminants other than those previously identified are being handled.
- Work tasks change.
- Obvious liquid contamination is in the work area.

During cleanup activities, the employer must monitor those employees likely to have the highest exposure. The results of this monitoring are used to determine future sample collection and:

- If some workers are overexposed, then the program is expanded to identify all overexposed workers.
- The monitoring must be repeated if work activities or types of materials handled change.

What Can Be Monitored in the Air?

- Toxic Chemicals
- Fire and Explosion Hazards
- Oxygen Enrichment
- Biological Hazards
- Oxygen Deficiency

Toxic Chemicals

The ability to determine the specific hazard by monitoring the air will be limited to the capabilities of the monitoring instrument used. For immediate results (direct reading), toxic chemicals are commonly measured with a detector which can identify the presence of gases, vapors, or mists yet cannot identify specific toxins. Longer-duration samples (personal monitoring) can be sent to a laboratory for analysis of specific materials in the air.

Fire and Explosion Hazards

Determining whether there is a possibility of fire or explosion is critical. During the cooking process meth labs are susceptible to both fire and explosions. Most of the reported deaths connected to meth labs were from fire and explosions. While the cleanup worker may believe that these hazards were removed by the police, there are many examples of chemicals being left behind due to error or failure to find all of the well-hidden supply. Flammable and explosive atmospheres develop when reactions occur with oxygen in the air, evaporation of flammables, gas leaks, and dust accumulation. Protective clothing and respirators which protect the worker from toxic hazards provide little, if any, protection against fire or explosions.

Biological Hazards

Workers may also be exposed to biological hazards such as bacteria, viruses, and certain parasites. The presence of these agents will help determine the selection of PPE, as well as decontamination and disposal procedures. When it is suspected that biological hazards are present, specialists must be brought in to investigate.

Oxygen-Enriched Atmospheres

The atmosphere is defined as **oxygen-enriched** if it contains more than 23.5% oxygen. This situation poses a threat of explosion, especially if flammable materials are present. As a result, special procedures are necessary in the area.

Oxygen-Deficient Atmospheres

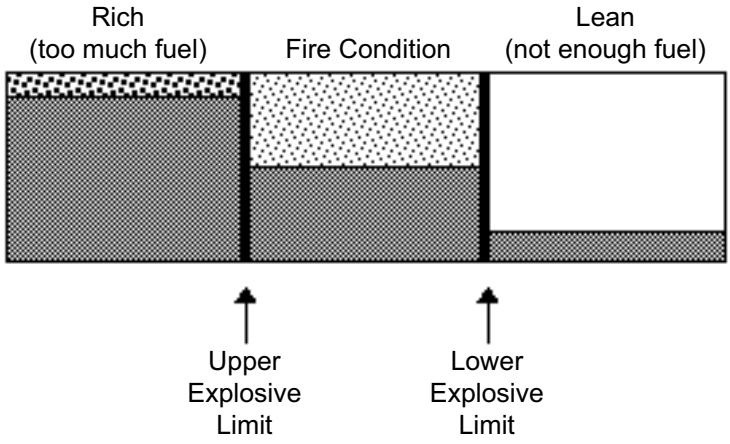
One must remember that a meth lab is a lab in name only. Containers may be miss labeled or not labeled at all. In addition, meth users and particularly the small quantity cookers/users may experience paranoia as a result of their drug use and because they are engaged in illegal activity. As a result, cooks are becoming more creative in hiding their labs. Not only are the chemicals stored in out of the way places (confined spaces) but also the actual cook facility may be found in what could be described as a confined space. As states previously, one might believe that the police removed all of the chemicals in their criminal investigation, but one should not assume it is true. Without an adequate concentration of oxygen in the air, the worker is in an immediately dangerous to life and health (IDLH) atmosphere. Normal breathing air contains 20.9% oxygen. OSHA requires a minimum of 19.5% oxygen to be present at the site; otherwise, or the atmosphere is considered oxygen-deficient. Confined spaces such as tanks, pits, silos, pipelines, boilers, vaults, and sewers are examples of possible oxygen-deficient work areas. Oxygen levels can be reduced during certain chemical reactions, rusting, or some bacterial action (fermentation). Oxygen-deficient atmospheres may cause a person to feel lethargic and potentially lose consciousness. OSHA requires respiratory protection in atmospheres below 19.5% oxygen.

Explosive Limits

Explosions are most likely to occur during the cook process. Since the police have removed most (all) of the chemicals, one might think the chance for explosions are minor. However, it is possible for chemicals to be missed or residue left that may create an explosive atmosphere.

Monitoring results reported as percents can provide information about substances in the air which may potentially cause an explosion. For flammable vapors and dusts, explosive limits have been determined. Three determined limits are listed below:

- Lower Explosive Limit (LEL) is the minimum concentration of a substance in the air which is required for ignition. Concentrations below the LEL will not ignite. Below the LEL, the mixture is called “lean.”
- Upper Explosive Limit (UEL) is the maximum concentration of a substance in the air which is required for ignition. Concentrations above the UEL will not ignite. Above the UEL, the mixture is called “rich.”
- Explosive Range is the concentration of a substance in the air between the LEL and UEL. In this range, the substance will readily ignite.



Types of Air Sampling

Air samples may be collected by placing sampling devices directly on the worker (personal sampling) or by placing a sampling device in the work area. Sampling equipment with alarms can be set up in a work area to alert workers to unusual or unexpected concentrations of substances in the air. Real-time, or direct-reading, sampling is a type of area monitoring which provides an immediate reading of air contamination. Other types of area monitors, called indirect monitors, collect samples which are sent away for analysis at a lab. Results from these tests may not be available for several days to several weeks.

Personal Sampling

Personal sampling is used to detect and measure exposures. It determines the quality of air the worker is breathing or would breathe if not protected. Samples are usually collected by placing a battery operated air pump on the wearer's belt and clipping a collection tube or filter in the breathing zone, usually on the collar near the nose. Air from the environment is pulled into the collection device where the contaminants are trapped, and then the sample is sent to a laboratory for analysis.

Personal air samples also can be collected by using a passive dosimeter. This device is a badge clipped to the worker's collar which collects a sample without using a pump.

Advantages of personal air sampling:

- It is the most accurate measurement of a worker's actual exposure, because it goes where the worker goes and can be placed in the breathing zone (near the nose).
- Results can be converted to a TWA or STEL and compared with the OSHA, ACGIH, and NIOSH limits.
- Personal air monitoring documents exposure.

Disadvantages of personal air sampling:

- Laboratory analysis of the sample may take 1–14 days.
- If collected over several hours, samples provide no data concerning peak or ceiling exposures.
- Generally sampling requires knowledge of the specific chemical in the air.
- Preparation is necessary so that the equipment can be used.

Considerations if you are requested to wear a sampling device are:

- The monitor should be positioned properly.
- Safety or sampling personnel should be notified if any problems occur.
- Your sample should not be “spiked” by placing monitors outside of your normal work area.
- You should request the results of the test using the OSHA Access to Employee Exposure and Medical Records Standard, 1910.1020. (Management must provide results, if requested.)
- Results can be compared with PELs, TLVs, and RELs.
- You should keep the results and/or give them to a physician and/or your employee representative.

Real-Time or Direct-Read Sampling

Real-time monitoring with direct-reading instruments provides an immediate measurement of the exposure in air. It can be done with a variety of equipment. The equipment selected at any site will normally depend upon the potential hazards present, including but not limited to gases, vapors, dusts, flammable atmospheres, oxygen, heat, and noise.

Advantages of real-time monitoring:

- It allows information to be immediately available at the site.
- It is available for a wide range of potential hazards.
- It measures chemicals that might cause acute health effects and IDLH situations.
- It allows identification of potentially high levels of toxic and flammable materials.
- It helps determine whether the atmosphere within a confined space is safe for entry (not oxygen-deficient, oxygen-enriched, flammable, or toxic).

Disadvantages of real-time monitoring:

- It may not be sensitive enough to detect low levels of contaminants. (A reading of “zero” may mean contaminants are present but at levels below the detection capability of the instrument.)
- Most of the measuring instruments cannot identify a specific contaminant or distinguish one from another.
- Instruments equipped with alarms may give a false alarm; however, any alarm should be considered real until an investigation is conducted.
- It may give an inaccurate reading because of background levels or the presence of chemicals other than the one being sampled (cross-sensitivity).
- Instruments may require factory maintenance.
- Improper calibration or lack of calibration may result in inaccurate readings.
- NIOSH-certified equipment readings can vary by ±25%.

Environmental Sampling

Sampling other than air monitoring may be performed at sites. Water sampling, soil testing, wipe testing, or compatibility testing may occur.

Water Sampling

Sampling and analysis of effluent groundwater and water from wells, ponds, and streams may be performed at a work site to determine whether wastes are present.

Soil Testing

Soil testing may be done at a work site and on neighboring property to determine if waste has migrated and been released to the soil. Soil testing will indicate how much, if any, contamination there is, how deep it is, and the limits of the area contaminated.

Wipe (Swipe) Testing

Surfaces may be tested by wipe testing to determine if any contaminants are present. This testing is done by wiping a surface with a piece of cloth or other material according to specified procedure and then submitting the sample to a labortory for analysis.

Compatibility Testing

Tests performed by a laboratory can determine whether the hazardous materials can or cannot be mixed safely (compatible or incompatible). Many emergency situations have resulted from mixing two incompatible wastes. Compatibility software programs have been developed by the U. S. EPA, Army Corp of Engineers, and other groups. These approaches to incompatibility problems are qualitative.

Sampling at Meth Labs

There are currently no federal regulations specific to sampling at Meth labs, but the NIOSH Pocket Guide does contain Permissible Exposure Limits and IDLH levels for many chemicals you will encounter. A few states do not have regulations and guideline covering sampling at meth labs but there is no agreement to the cleanup level or when sampling must occur. Generally those states that have levels do require sampling to verify that the cleanup has reached a particular cleanup-up standard. However, Minnesota just enacted a statute that eliminates clearance sampling to determine a cleanup standard if the cleanup process follows the state's protocol. Minnesota states that due to the lack of health effects data there is no health based standard. Therefore they rely on a remediation process rather than a number that is not science based. In spite of this their sampling guidelines were used on the basis of the procedures listed below.

Where sampling is required or suggested, three types of monitoring are most prevalent. First, wipe sampling and/or micro vacuuming to determine the presence of methamphetamine. Second, Photoionization Detectors to determine the presence of volatile organic carbons in the air but also in HVAC ducts, plumbing and septic system. Commonly used VOCs (solvents) include but are not limited to Acetone, Benzene, Ether, Freon, Hexane, Isopropanol, Methanol, Toluene and Xylene. VOC testing should be conducted in all rooms of the structure to ensure the safety of the workers. Finally, pH sampling to determine the presence of corrosives. Commonly used corrosives include but are not limited to Hydrochloric Acid, Sulphuric Acid, Sodium Hydroxide, Anhydrous Ammonia, Phosphoric Acid and Muriatic Acid. Surface pH testing should be done during the assessment phase to determine that common acids and bases are not present at levels to pose a health risk to workers. If during the cleanup, workers encounter unknown substances, pH testing may be needed.

Wipe Sampling Procedures:

This sampling is performed to establish the presence of methamphetamine. All samples should be taken using methanol-dampened wipes. Water dampened wipes do not captured meth nearly as well as methanol dampened wipes. Wipes used may vary widely (gauze material such as Johnson and Johnson cotton squares, filter paper such as Whatman 40, 41, 42, 43, 44, 540, 541; Ahlstrom 54; WWR 454; S&S WH medium; Kendall Versalon sterile, all purpose spnges).

The sampler must have clean hands and wear gloves during each sampling event to avoid contaminating the surface. The sampling area should be dry and post cleanup sampling is performed after washing, painting or sealing of walls and other surfaces to be sampled.

Procedures include:

1. Sampler puts on clean pair of gloves
2. Sampler attaches template or measures with a ruler and marks by using tape a pre-de signed sampling area. Sampling must avoid touching the sampling area. Sampler can either mark one sampling area at a time or all the sampling areas at the beginning. Photograph sample sites with an identifying reference point.
3. Replace the gloves with a clean pair of gloves.
4. Either soak the sampling wipe (filter, gauze, etc.) with 2ml of methanol or take the wipe out of a pre-soaked container. Use dampened wipe within 5 seconds of applying methanol to be sure that the wipe is still damp. A dry wipe will not capture a meth sample.
5. Using firm pressure, horizontally wipe the surface within the marked template side to side in an overlapping “Z” pattern. Wipe so that the entire selected surface area is covered. End with an upward scooping motion. Avoid wiping the marking tape or template.
6. Open the wipe and fold the sampled side in. Wipe a clean quarter section of the wipe exposed and using firm pressure, vertically wipe the surface within the template side to side in an overlapping “N” pattern. Wipe so that the entire selected surface area is covered. End with an upward scooping motion. Avoid wiping the marked tape or template.
7. Fold the wipe so the sampled side is folded in. Insert the wipe into the sample collection container.
8. Record the exact location, including the room and the approximate height (from the floor), date, time of the sample on the sample container, the chain of custody form and sampling notebook.
9. Discard gloves and marking tape and proceed to the next sampling location.
10. Chain of custody record must be maintained from when the sample is taken until its final disposition.

Vacuum Sampling Procedures:

Typical sampling materials: Carpet, drapes, texturized upholstered furniture, porous stone (bricks or cinder blocks), raw wood or any surface with accumulated dust particles.

Equipment needed:

1. Area sampling pumps capable of atleast 20 L/min flow rate (e.g. SKC carpet sampling pump kit.
2. 37mm cassettes equipped with glass fiber filters and backup pads.
3. Flexible tubing to connect the pump to the filter cassettes.
4. Small piece of tubing (1 to 2 inches) with one end cut at a 45 degree angle to be used as the “vacuum nozzle”.
5. Primary flow meter (e.g. SKC DC-Lite) for pump calibration.
6. Field rotameter for convenient calibration checks.

Procedures:

Pumps should be calibrated to approximately 20 L/min (with exact calibration flow rate recorded) before the sampling begins. Confirmation of the calibration can be periodically checked between samples and must be confirmed at the end of the sampling project. The calibration should be performed while the tube and the type of filter cassette to be used during sampling are attached to the pump. If desired, an in-line filter rotameter can be used throughout the sampling process, to monitor the flow rate.

The sampling area should be measured and delineated (100 sq.cm; 6”X 6”; 1 sq.ft). In general, visibly soiled, dusty, or heavily used areas are good choices for sampling. Perform a minimum of two passes at right angles to each other while sampling for one minute. During the sampling of soft materials, press the angled tubing nozzle firmly onto the sampling surface to agitate particles.

Avoid plugging the nozzle on the tubing as this restricts the flow and could damage the pump. Typical causes of plugging are pressing the nozzle too firmly into the sample without sufficient movement (causing a seal between the surface and the nozzle) and sucking up large, loose particles that either block the nozzle opening or building at the inlet to the filter cartridge.

Immediately after an individual sample has been collected, the pump should be turned off so no extraneous material is collected. The filter cassette should be disconnected, sealed and labeled to prepare for transport back to the lab where chemical analysis can be completed. After all sampling has been completed, the pump exterior should be decontaminated (e.g. wiped with a 10% bleach solution). The short angled nozzle piece should be discarded. Inspect the collection hose between the filter and pump and discard it visibly contaminated.

VOC sampling and Testing procedures:

A properly calibrated photoionization detector (PID) or flame ionization detector (FID) capable of detecting volatile organic carbons (VOCs) shall be used for testing.

> The background concentration of VOCs are obtained by testing three exterior areas outside the limits of the residually contaminated portion of the meth lab and in areas with no known or suspected sources of VOCs. All readings are recorded for each location.
>
> At least three locations in each room in the building housing the meth lab that is suspected of contamination. In each location, hold the probe at least 30 seconds to obtain a reading.

All accessible plumbing traps should be tested for VOCs by holding the probe in the plumbing pipe above the trap for atleast 60 seconds.

If the septic system is to be tested for the presences of VOCs, open the tank and hold the probe in the tank opening for atleast 60 seconds.

pH Testing Procedures:

Surface pH measurements are made using deionized water and pH test strips with a visual indication for a pH between 6 and 8. The pH reading is recorded for each sample location.

For horizontal surfaces, deionized water is applied to the surface and allowed to stand for atleast three minutes. The pH test strip is then placed in the water for a minimum of 30 seconds and read.

For vertical surfaces, a Whatman 40 ashless filter paper or equivalent filter paper is wetted with deionized water and wiped over a 100 square centimeter surface at least five times in two perpendicular directions. The filter paper is then placed in a clean sample container and covered with deionized water. The filter and water is allowed to stand for atleast three minutes prior to placing the pH strip in the water for a minimum of 30 seconds and read.

pH testing is conducted on atleast three locations in each room within the areas of visible contamination and within areas known to store or handle chemicals used in cooking.

Testing for Lead and Mercury are also part of several states protocols. However, these chemicals are usually present only when the phenyl 2 propanine (P2P) cooking method is used and this method appears to be in rapid decline in favor of the “Birch Reduction”, Red Phosphorus, or cold method.

Individual Sewage Disposal Systems sampling procedures:

The most common types of drug lab wastes that appear in the ISDS include:

solvents (e.g. toluene, xylene, alcohol, acetone);
Petroleum distillates (e.g. paint thinner, acetone);
Corrosives (e.g. sulphuric acid, muriatic acid, sodium hydroxide solutions); and,
Mixtures with residual ephedrine methamphetamine, iodine, red phosphorus.

Field screening and sample collection should be conducted to confirm or deny the presence of methamphetamine waste, and to ensure proper disposal of any methamphetamine waste identified. Field screening of septic tanks should be conducted if there is evidence that drug lab waste may have been disposed off into an ISDS. Evidence of drug lab wastes disposal into an ISDS includes but is not limited to:

Witness statements;
Stained or etched sinks, bathtubs or toilets;
Chemical odors coming from the ISDS, plumbing, or tank, or
Visual observations of unusual conditions within the septic tank (“dead tank”); or
Stressed or dead vegatation in a drain field.

Field screening can consist of the following:

Monitoring the septic tank for VOCs using a PID of FID.
Testing the pH of the liquid in the septic tank with pH paper or a pH meter.

If it is determined from field screening that the septic system has been impacted by drug lab wastes, it should be determined if the liquids in the tank contain a hazardous waste. Colorado recommends the following protocol for sampling a septic tank.

1. Prior to sampling, the septic tank must have been sufficiently excavated to indicate whether the tank consists of one or two chambers.
2. Samples from single chamber tanks are collected from the baffles on the outlet end of the tank.
3. Samples from dual chamber tanks are collected from the baffle on the outlet end of chamber number one.
4. Samples must be representative of the wastes found in the septic tank. Sampling procedures may include the use for drum thieves, sludge judges or equivalent equipment.
5. Remove access cover from the first (or only) chamber and locate outlet baffles.
6. Move any floating surface matter away from the insertion point of the sampling device. Do not collect any matter in the sampling device.
7. Insert the sampling device into the tank, lowering it until it hits bottom.
8. Trap the sample inside the sampling device.
9. Remove the sampling device and fill the laboratory supplied sample containers. The specific volume and type of sampling container will be determined based on the type of analysis desired. For VOC analysis two 40 ml vials are filled, leaving no head space.
10. Replace the access cover at the completion of sample collection.
11. Samples maybe collected in laboratory preserved bottles, or in unpreserved bottles. If the samples are collected in unpreserved bottles, the laboratory must be notified that the samples are unpreserved.
12. Sample containers are placed in a cooler with enough ice or ice packs to maintain a temperature of 4 degree Celcius.

13. A Chain of Custody Record shall be maintained from the time the sample is collected until the final disposition. Every transfer of custody shall be noted and signed for and a copy of the record shall be kept by each individual who has signed in. Samples shall be kept by each individual who has signed it. Samples shall be sealed, labeled, and secured. All samples collected shall be transported directly to the laboratory. All sample documents shall be retained for the project record.

A few states have regulations or guidelines covering sampling at meth labs. There are currently no federal regulations specific to sampling at meth labs, but the NIOSH Pocket Guide does contain Permissible Exposure Limits and IDLH levels for many chemicals you will encounter.

Tennessee - Standards

- For human reuse

  On hard surfaces, the level of methamphetamine cannot be higher than 0.1 microgram/100 cm^3.

  Volatile Organic Compounds in the air may not be higher than 1 ppm.

  Lead concentrations cannot exceed 50 micrograms/m^3.

  Mercury levels cannot exceed 50 micrograms/m^3.
- Sampling must be done by a Certified Industrial Hygienist.

Washington State - Guidelines

- Check that sampling plan has been approved by the local health department.
- No eating, drinking, smoking, etc.
- Have two people present during sampling, a “Sampler” and a “Record Keeper”.
- Take a “media blank” sample - place filter paper into a collection container, wet it down with methanol, and carry it with you as you go through the meth lab. Do not open this container; it will be used for comparison purposes only.
- Take duplicate samples - this is in case one container breaks.
- Take an “equipment rinsate” sample - rinse your sampling equipment with distilled water. Collect the water and send it in for analysis along with the rest of the samples.
- After taking methamphetamine and VOC samples, put them in a cooler, on ice, at 40° Celsius.
- Document the chain of custody of the samples.

Colorado - Regulations

- Sampling is necessary as part of a preliminary assessment.
- Take samples from areas you expect to have high levels and also from areas the contaminants may have traveled to.
- Those responsible for sampling must be separate from those that do the decontamination work to prevent a conflict of interest.
- The level of meth in a wipe sample should be less than 0.5 micrograms/100 cm^2.
- Iodine concentrations should be under 22 micrograms/100 cm^2.
- Lead concentrations cannot exceed 1.0 micrograms/ft^2.
- Mercury levels cannot exceed 1.0 micrograms/m^3.
- Sampling must also be conducted when the decontamination process is over to ensure that safe levels have been reached.
- A final report is necessary to document all the work done on the area.

Wipe Samples Exercise

Washington State has very specific guidelines for how to conduct wipe samples at meth labs, as found in the Guidelines for Environmental Sampling at Illegal Drug Manufacturing Sites. Go through this checklist as you practice taking a wipe sample.

Action	Did You?	
1. Fold filter paper into quarters and insert into sample containers.	☐ Yes	☐ No
2. Wet with methanol (40 drops or 2 mls).	☐ Yes	☐ No
3. Put on clean gloves	☐ Yes	☐ No
4. Take out the wet filter paper, still folded in quarters, and put paper on area to be sampled	☐ Yes	☐ No
5. Press firmly	☐ Yes	☐ No
6. Use a Z pattern, covering the entire area with an even pressure	☐ Yes	☐ No
7. Fold the sampled side in and repeat wiping technique in the opposite direction (N-pattern)	☐ Yes	☐ No
8. Close the lid tightly	☐ Yes	☐ No
9. Use a Z pattern, covering the entire area with an even pressure	☐ Yes	☐ No

Date _____ Instructor's Signature _____

Monitoring Lab Data Sheet
pH Measurement

Type of equipment _____

_____

_____

Brand of equipment _____

_____

_____

Purpose of equipment _____

_____

_____

Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____

What are the limitations of this equipment?

Date _____ Instructor's Signature _____

Monitoring Lab Data Sheet
PID

Type of equipment _____

_____

_____

Brand of equipment _____

_____

_____

Purpose of equipment _____

_____

_____

Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____
Sample No. _____ Reading (and units) _____

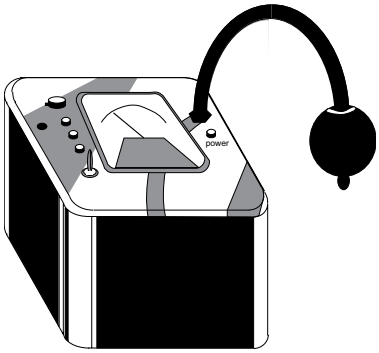
What are the limitations of this equipment?

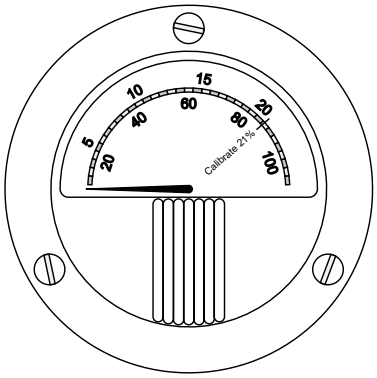
Date _____ Instructor's Signature _____

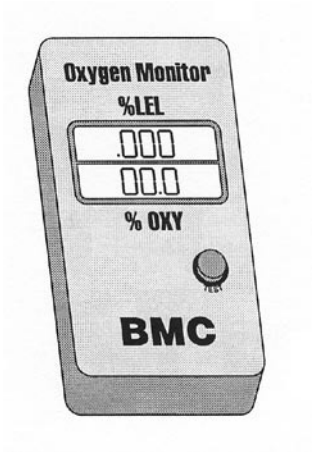
Sampling Instruments

Site area sampling frequently utilizes real-time samplers. These instruments are selected to measure the specific potential hazards. This section outlines the general uses of some commonly used instruments.

Oxygen Meter







Use:

- To sample oxygen concentration, particularly near and in confined spaces.

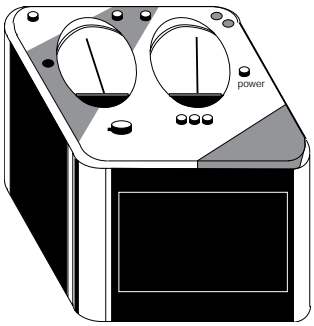
Read-out:

- Usually 0%–25% or 0%–100% oxygen concentration.
- At greater than 23.5% oxygen, the explosion hazard increases.
- At less than 19.5%, do not enter without an SCBA or SAR.

Precautions:

- Affected by temperature and pressure.
- Carbon dioxide levels may affect reading.
- Must be calibrated regularly.
- Requires maintenance.
- User must be trained.

Combustible-Gas Indicator (CGI)/ LEL Meter/Explosion Meter

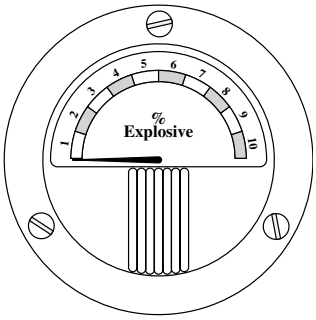


Use:

- To sample flammable vapor concentration, particularly near and in confined spaces.

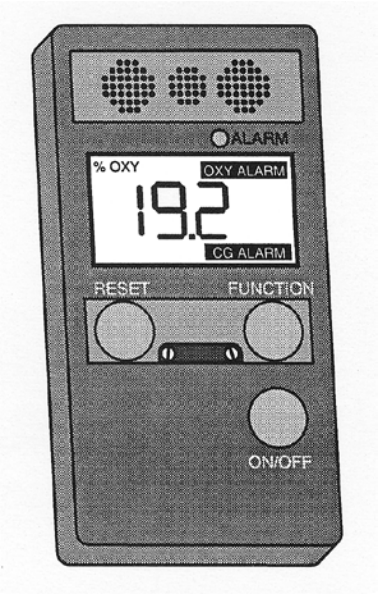
Read-out:

- % LEL (sometimes referred to as Lower Flammable Limit).
- A reading above 10% should be considered a potentially explosive atmosphere. For added safety, many companies use lower values such as any positive reading, or 5%.

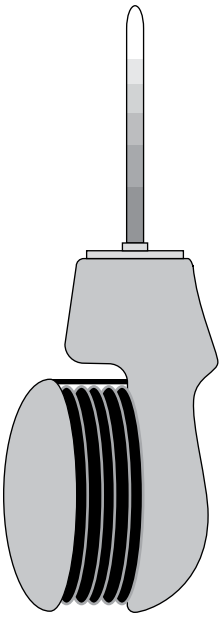


Precautions:

- Requires periodic factory calibrations.
- Does not respond the same to all vapors.
- Oxygen must be measured first. Many combustible-gas instruments require sufficient oxygen in order to determine LEL.
- Models with a needle indicator require constant observation during use, as the needle may peg out (swing far to the right and back to 0 and then be misread as 0).
- User must be trained.
- Must be field-calibrated by trained personnel before and after each use.



Colorimetric Detector Tubes (Drager, MSA, Sensidine)



Use:

- To sample gas or vapor concentration in any work space.

Read-out:

- Percent concentration is indicated by color change or length of color stain.

Precautions:

- Not very accurate—within 25% of the real value at best.
- Pump must be checked for leaks and calibrated.
- Tubes have a limited lifetime, so the expiration date on the container should be checked before use.
- Results may be affected by temperature and humidity.
- User must be trained in reading the scales on the tubes used.
- User must follow specific pump-stroke requirements.
- Interferences are possible; not very specific.
- May be misread if the sample-taker is color blind.

A colorimetric detector tube is a glass tube filled with a solid material or gel that has been impregnated with an indicator chemical. When the detector tube is used, the ends are broken off and the tube is inserted into a bellows or piston pump. An arrow on the tube indicates which end of the tube to insert into the pump orifice. A predetermined volume of air is pulled through the pump. The contaminant of interest reacts with the chemical in the tube. This reaction produces a stain in the tube with a length proportional to the concentration of the contaminant.

Hydrocarbon Detectors

During emergencies, direct-reading instruments are used to provide an immediate estimate of concentration. The amount of organic compounds is usually measured using an instrument with either a Flame Ionization Detector (FID) or a Photoionization Detector (PID).

In FID instruments, the gases and vapors are ionized (molecules broken apart) in a flame. A current is produced which is proportional to the number of carbon atoms. The current is converted to a measure of concentration.

Ultraviolet radiation is used to ionize gases and vapors in the PID instruments. The current produced is proportional to the number of ions and is a measure of concentration.

The energy needed to ionize a compound is its characteristic “ionization potential” (IP), expressed in electron volts (eV). Ionization potentials for selected materials are shown below.

Chemical	IP (eV)
Hydrogen cyanide	13.9
Methane	13.0
Chlorine	11.5
Hydrogen sulfide	10.5
Hexane	10.2
Acetone	9.7
Benzene	9.2
Phenol	8.5

For special purposes, a portable Infrared (IR) spectrophotometer may be used to detect gases and vapors. Different IR frequencies are passed across the air stream. Some of the frequencies are absorbed by the molecules in the air. Because specific compounds absorb specific frequencies, the results can be used to identify the contaminant present and its concentration. Water vapor and carbon dioxide are frequent interferences. The unit must be transported with care and used only by highly trained operators.

Photoionization Detectors (PID)

Use:

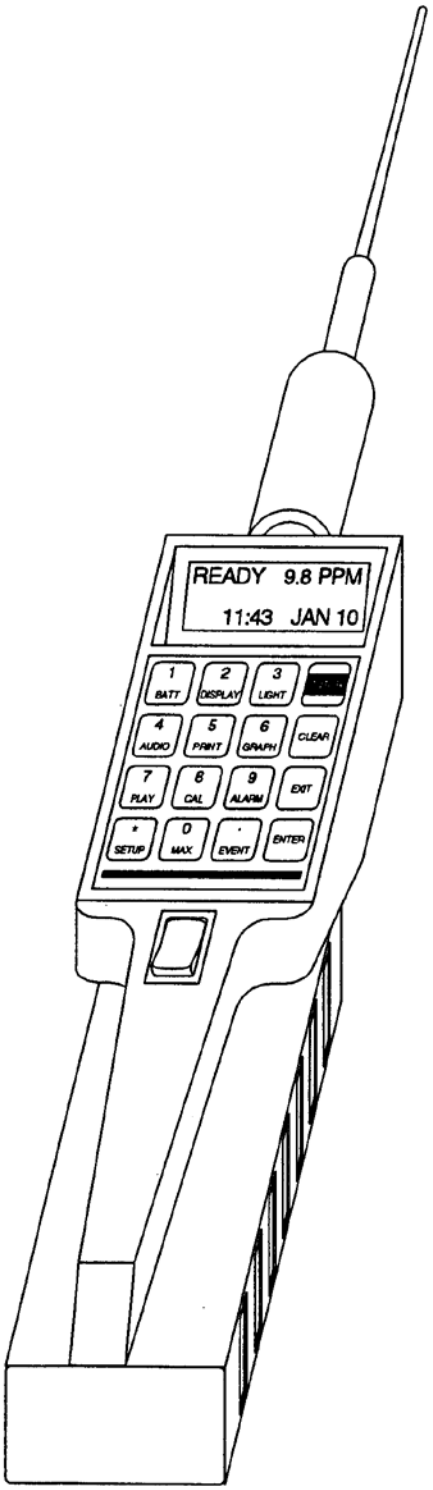
- To sample flammable vapor concentration, particularly near and in confined spaces.

Readout:

- ppm

Precautions:

- Does not detect methane.
- Detects only those compounds with ionization potentials less than the energy of the probe.
- Must use multiple probes to identify specific compounds if you know what compounds are present.
- Response affected by composition of mixed gases.
- Other voltage sources may interfere.
- Requires calibration.
- User must be trained.
- Requires regular maintenance.



Flame Ionization Detectors (FID)

Use:

- To detect many organic gases and vapors.

Readout:

- ppm.

Precautions:

- In survey mode, detects total organics which can be measured with instrument.
- Requires gas chromatography option to identify and measure specific compounds.
- Does not detect inorganics.
- Affected by low temperatures, high contaminant concentrations, and oxygen-deficient atmospheres.
- Must be calibrated.
- User must be trained.
- Requires maintenance and leak checks.
- Must be intrinsically safe if used where explosive atmospheres may exist.

Personal Alarm Systems

Use:

- To sample gas or vapor concentration in any work space.
- Battery-operated, worn on belt.
- Alert workers to levels of contaminants to which they should not be exposed.

Read-out:

- Audible alarm and sometimes a measure of concentration (examples: ppm or %).

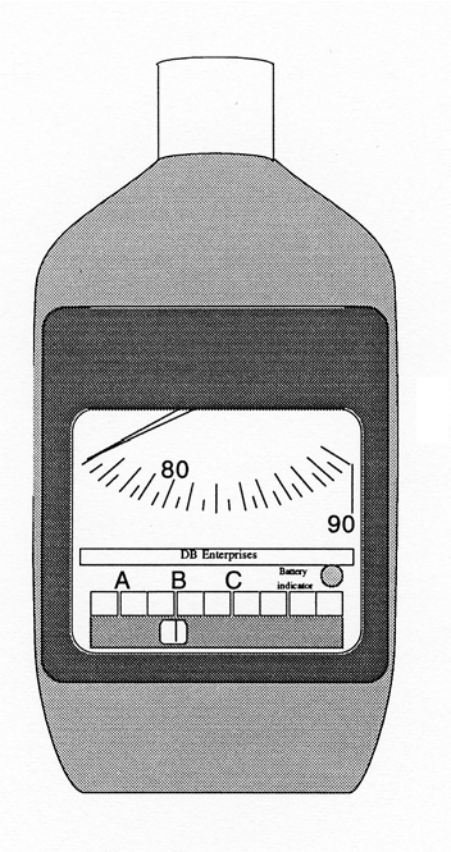
Precautions:

- Inaccurate readings may be given if there are interferences.
- Wearers must be trained in actions to take if the alarm sounds.

Noise Sampling

Purpose:

- To monitor noise exposure. A Sound Level Meter (SLM) is a direct-reading instrument.



Read-out:

- Decibels (dB), usually on the A-Scale. The A-Scale has been developed to mimic the way the human ear responds to noise.

Precautions:

- Requires calibration before and after each use.
- Some instruments require manually changing the range of noise that can be measured.
- Battery must be checked before use.
- General-purpose meters are designed to measure continuous noise only (sounds which last at least 1 second).
- Dial must be constantly viewed while using instrument.
- Personnel must be trained to use instrument.

NOTE: Personal noise dosimeters are also available for routine operations. These instruments are worn by the employee during the entire shift and give a time-weighted average exposure.

Selecting Monitoring Equipment

Site management is responsible for selecting equipment appropriate for routine sampling and anticipated emergencies. Manufacturers should provide information about equipment used and its limitations. NIOSH (National Institute of Occupational Safety and Health) and the EPA (Environmental Protection Agency) can also provide information about equipment. Some general considerations when selecting monitoring equipment follow.

- The unit should be intrinsically safe. (That is, it will not produce sparks that could trigger an explosion.) Check the label and the manufacturer's guide to make sure.
- Most direct-reading instruments are designed to sample only one contaminant or group of contaminants.
- There are no instruments which can sample all toxic substances.
- Equipment should be easy to transport and operate in the field under changing conditions.
- Instruments should operate properly at temperatures which are anticipated during site activities.
- Instrument training should be provided through routine "hands-on" practice.

Sampling and Calibration Protocols

Site management is responsible for the proper use and calibration of all sampling equipment. Protocols that describe these activities will help to ensure accurate monitoring programs.

- Sampling personnel must be trained in proper calibration procedures.
- Sampling strategies should be developed to provide accurate and reliable results.
- Instrumentation maintenance protocols should be designed to ensure that reliable equipment is available at all times.
- All protocols should be in written form with the signature of responsible parties and effective dates.

Six Basic Rules of Operation

Listed below are the six basic rules for operating monitoring equipment:

1. **Calibrate**

   Before you use any direct-reading instrument, check with the safety officer to be sure that it has been properly calibrated. Calibration involves exposing the instrument to a known concentration of a compound and testing for the proper response. It is important that all instruments be calibrated on a regular basis. Most direct-reading instruments have a built-in test system that you should know how to use.

2. **Be conservative.**

   If the instrument gives an unexpectedly high response, assume that it is correct. If the reading is suspiciously low, assume that there may be an instrument problem.

3. **Realize that a zero reading does not mean clean air.**

   Always remember that a reading of zero does not mean that the air is clean. Some highly toxic materials are not detected by common direct-reading instruments.

4. **Read even a small response as positive.**

   Any response, even a small one, on a direct-reading instrument should be interpreted as indicating a potentially dangerous situation. These instruments are usually not very sensitive, and the sensitivity varies for different chemicals. Therefore, it is hard to get an accurate measurement of the concentration of a chemical. Under those conditions it is better not to try to judge the degree of hazard. It is far safer to assume that if the instrument can detect a chemical, the concentration may be high enough to pose a health threat.

5. **Use multiple instrument types.**

   Whenever possible, use more than one type of direct-reading instrument. Remember that each type of instrument can respond to only one or a few chemicals, so a reading of zero on one instrument could turn out to be a high reading on another instruments.

6. **Follow the maintenance guidelines.**

   All equipment is supplied with a recommended maintenance schedule. Follow it. Should any indication of malfunction be noted during routine checks or duties, follow the maintenance SOP immediately.

Sampling Equipment Lab

During this exercise, you will have the opportunity to use a combustible-gas indicator, indicator tubes, and an oxygen meter. There are three stations, in which you will:

- Measure ethyl alcohol with a combustible-gas indicator at three distances: 1 inch, 6 inches, and 2 feet.
- Measure ammonia with indicator tubes at three distances: 1 inch, 6 inches, and 2 feet.
- Exhale into a bag and measure the oxygen.

Use the sampling data sheets on the following pages to record your readings from the instruments.

Summary - Monitoring

When there are questions of employee exposure to hazardous concentrations of hazardous substances, monitoring is done to ensure proper selection of employee protection.

Toxic chemicals, fire and explosion hazards, oxygen-enriched and oxygen-deficient atmospheres, radioactivity, and biological hazards can be monitored at the site.

There are two types of air sampling:

- **Personal sampling** is used to measure the amount of a toxic chemical in the air to which a worker is exposed, and it requires laboratory support.
- **Real-time sampling** gives you a direct reading of air contamination at the moment you are using the equipment. Direct-reading instruments may be used to detect IDLH conditions, flammable vapors, oxygen, and toxic materials.

Personal sampling (when the worker wears a small pump all day and the sample is taken in the breathing zone) gives the best information on a worker's exposure.

The air in a confined space must be tested with direct-reading instruments for oxygen deficiency, known toxic substances, and flammable conditions before you enter a confined space and throughout the work period inside the space.

If the combustible-gas indicator reads above the level specified in the site's confined-space entry procedure, leave the area immediately and alert your supervisor.

Key Terms - Monitoring

Identify or define the following:

- Oxygen-Deficient Atmosphere
- Oxygen-Enriched Atmosphere
- Lower Explosive Limit
- Upper Explosive Limit
- Explosive Range
- Wipe (Swipe) Testing
- Personal Sampling
- Direct-Read Sampling
- Personal Alarm Systems
- Colorimetric Detector Tubes

Review Questions - Monitoring

1. What types of surface sampling might be done at a meth lab?

2. What instrument(s) are used to test air in a confined space?

3. Why is chain of custody important?

4. What group of compounds can be detected using pH sampling?

Background Reading Material - Monitoring

Hazardous Waste Operations and Emergency Response Standard Final Rule, March 6, 1990 (29 CFR 1910.120)

.120 (h)	Monitoring
.120 (b) (7)	Monitoring Program
.120 (c) (5)	Site Characterization Monitoring
.120 (c) (8)	Ongoing Air Monitoring Program

Occupational Safety and Heath Guidance Manual for Waste Site Activities

October 1985. (NIOSH # 85-115)

Chapter 7	Air Monitoring, p. 1–7

EPA's Standard Operating Safety Guides, July 1988

Part 8	Air Surveillance p. 1–8 and Annex 5 and 6
Appendix I	Characteristics of HNU Photoionizer and Organic Vapor Analyzer, p. 1–4
Appendix II	Rationale for Relating Total Atmospheric Vapor/Gas Concentrations to the Selection of the Level of Protection

NIOSH Pocket Guide to Chemical Hazards, June 1994. (NIOSH # 85-114) p. 19-21.

Emergency Response

Supervisors must provide a detailed SOP for emergency procedures. Knowing what actions to take and avoid during an emergency helps workers protect their safety and health.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Identify required elements in the Emergency Response Plan.
- Discuss jobs and duties performed by personnel in the Incident Command System (ICS).
- Understand that the Meth Lab Cleanup program does not qualify you for work on an emergency response team.

Emergencies

A hazardous materials emergency is a spill or release that cannot be controlled without outside help. OSHA defines “outside help” to mean anyone other than employees working in the immediate area or maintenance personnel. The most common types of emergencies at meth lab cleanups are injuries, not spills. Nonetheless, proper planning is required.

Notify your supervisor whenever an emergency or unexpected event occurs. With your input, the supervisor will decide whether outside help is required. The following questions should be considered:

- Do you know the extent of the injury or event?
- Do you know the nature and type of release as well as the material involved?
- Have you been given explicit instructions by a qualified person on how to procede?

If you answered NO to any of these questions, your supervisor will sound the emergency alarm.

If you answered YES to all of these questions, non-emergency containment procedures might be appropriate, if provided for in your safety and health plan. Supervisors should be notified in all instances before a response is undertaken.

Emergency Response Plan (ERP)

Employers must develop and put in practice an emergency response plan (ERP) in accordance with OSHA 1910.129 (l) to handle anticipated emergencies before work starts at the hazardous waste site. This written emergency response plan is a required section of the safety and health plan. It must be in writing and available for review and copying by employees, their representatives, and personnel from OSHA and other relevant agencies. The ERP must be compatible and integrated with the disaster, fire, and/or local, state, and federal response plans. Employers exempt from the requirement must:

- Evacuate workers when an emergency occurs.
- Not permit workers to help handle the emergency.
- Have an emergency action plan already in place, consistent with OSHA General Industry Standard 1910.38.

The elements of the emergency response plan detail:

- Emergency escape procedures and escape route assignments.
- Procedures for employees who remain to perform critical operations such as machine shut-down.
- Methods to account for all employees after evacuation is complete.
- Rescue and medical duty assignment for employees.
- Procedures for reporting fires and emergencies to other responders.
- The name of whom to contact for further information about the action plan.

Emergency Response Plan Topics

The emergency response plan must address the following topics:

- Pre-emergency planning and coordination.
- Personnel roles, lines of authority, and communication.
- Emergency recognition and prevention.
- Safe distances and places of refuge.
- Site security and control.
- Evacuation routes and procedures.
- Decontamination procedures not covered elsewhere in the site safety and health plan.
- Emergency medical treatment and first aid.
- Emergency alerting and response procedures.
- Critique of response and follow-up.
- PPE and emergency equipment.
- Site topography, layout, and prevailing weather conditions.
- Procedures for reporting incidents to local, state, and federal governmental agencies.

Based on the information available at the time of the emergency, employers will evaluate the incident and their response capability and proceed with the appropriate actions to implement the ERP.

The ERP must be reviewed periodically. If site conditions have changed or new information is available concerning hazards, the ERP must be amended by the employer to deal with the new information.

The overall training program in site operations requires regular drills in the ERP.

First Aid Caution

It is not possible to include complete First Aid training in a course like this. Although First Aid training is beyond the scope of this course, general knowledge of it is valuable. Several aspects of first aid response to potential site exposures are mentioned in the manual, because they would be of special interest to those engaged in decon work.

However, this course in no way attempts to provide or substitute for First Aid training. Personnel designated to conduct First Aid activities require additional training.

Employee Alerting Systems

In order to alert all employees to the presence of an emergency situation, an alarm system must be in place (OSHA CFR 1910.165). The alarm system must:

- Notify all employees of an emergency.
- Result in work being stopped if necessary.
- Result in lower background noise to speed communication.
- Signal the start of emergency procedures.

The alarm system must produce a signal (noise, light, etc.) that can be perceived by all employees in the affected area of the site. All alarms must be distinct and recognized as signaling a specific action.

As part of the site-specific training, the employer must explain to each employee the procedure for reporting an emergency. When telephones are used to report, emergency telephone numbers must be posted near them or in conspicuous locations. If another communication system is used, the emergency message shall have priority over all other messages. All manually operated warning systems used to supplement the alarm must be unobstructed, conspicuous, and readily accessible for use. The employer shall assure that all components of the alarm system are approved for the work site and operating properly. After use (for testing or alarm), the system must be returned to normal operation as soon as possible by the employer. Back-up parts or systems must be available as appropriate.

The system must be tested at least every two months. If several methods are available to activate the system, a different method must be used for each successive test. The system must be operational at all times, unless it is undergoing repairs or maintenance. Maintenance work must be done by trained personnel. Systems installed after January 1, 1981 which were designed to be supervised must be operated as designed and tested annually.

Non-Emergency Containment

Containment and remediation of minor spills or releases may be detailed in the spill containment program. Methods may include:

- Moving the container so that the leaking area is at the top.
- Overpacking the container in a larger container.
- Collecting material in a second container or diked area.
- Using absorbent material.

Consult the company's spill containment program for details on approved methods for containment and remediation of small leaks.

Your Responsibilities in an Emergency

If you observe a life-threatening event:

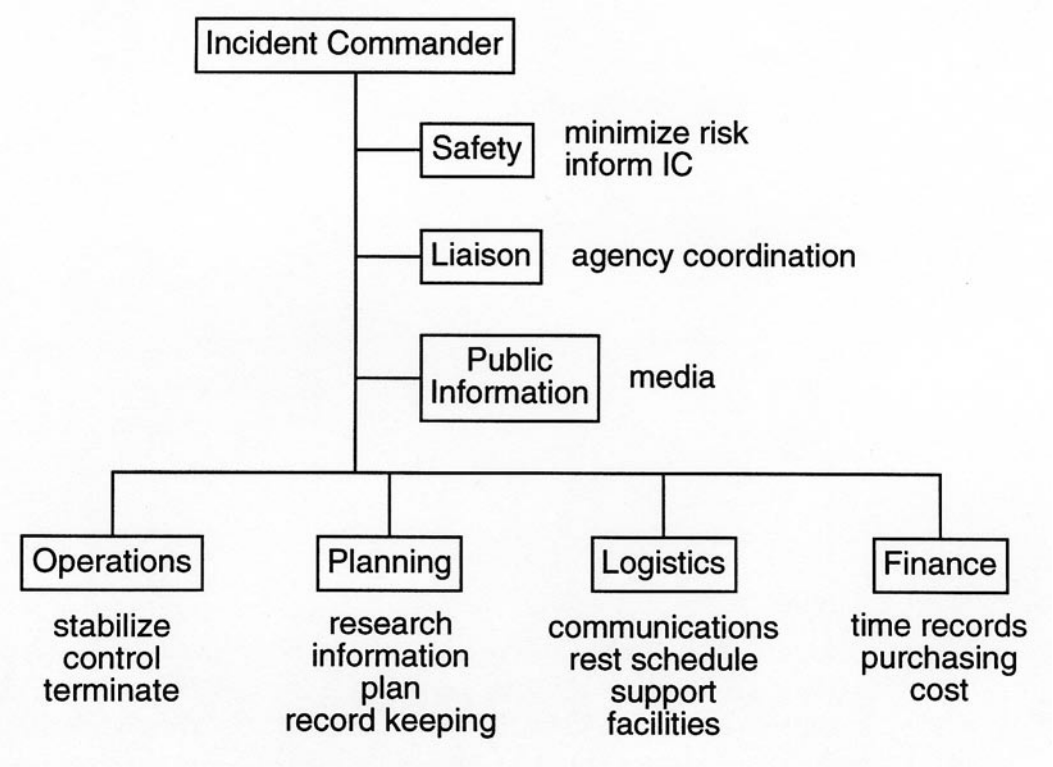
- Activate the alarm system.
- Notify the supervisor/emergency coordinator.
- Carry out your designated activities.

Make sure you know where to go and what to do before an emergency occurs. When it happens, it's too late to read the plan!

Incident Command System (ICS)

To respond to an emergency, employers need a pre-planned chain-of-command system, usually referred to as the Incident Command System (ICS). The ICS includes personnel fulfilling a number of different roles. The number of people involved and their roles depend on the types and nature of emergencies that could occur at a site. Pre-planning, training, and practice are required to ensure that each person knows his or her role within the overall ICS. Each member of the team must receive training and practice for his or her anticipated role. An example of an incident command organizational chart is shown below. The ERP must include a section on chain-of-command, lines of communication, and responsibilities. This section generally describes the ICS for the site.

Incident Command System Organizational Chart



Note: This chart should be adapted for the specific event and the available personnel. Other personnel may be added.

The duties and actions of each member of the ICS must be coordinated and practiced. Each participant requires specialized training that is outside the scope of this program. Site-specific training is required for effective response to an emergency situation.

Personnel and Duties in the ICS

Incident Commander:

Also called senior official, project leader, or on-scene coordinator.

Functions:
- Directs all aspects of the response.
- Coordinates all teams' efforts.
- Establishes a command post and chain of command.
- Maintains ongoing communication with all teams.
- Coordinates off-site personnel.
- Keeps a log of all response activities and maintains records.

Safety Officer

Functions:
- Reports directly to the Incident Commander.
- Implements the safety plan.
- Minimizes risks.

Liaison Officer

Functions:
- Coordinates the involvement of agencies such as fire and law enforcement.
- Maintains communication between outside agencies and in-house response.
- Designates places for agencies to report to and communicate with each other.

Public Information Officer

Functions:
- Establishes an area for the press and media.
- Releases accurate information concerning the incident as it is cleared by the Incident Commander.

Operations Officer

Functions:
- Controls operations to bring the emergency under control.
- Terminates emergency operations.
- Executes specific tasks such as entry, decon, sampling, and security.
- Establishes all zones and access points.
- Directs the response at the hands-on level.

Planning Officer

Functions:
- Collects information on appropriate PPE and decontamination methods.
- Prepares a research brief on the hazardous material involved, including incompatibilities, flammability and explosion hazard, First Aid methods, and other relevant information.
- Develops action plans and alternative plans.

Logistics Officer

Functions:
- Provides equipment, supplies, and services needed to support the incident.
- Establishes provisions for long-duration incidents, such as food, toilet facilities, vehicle refueling, and other support services.

Finance Officer

Functions:
- Purchases needed materials; records personnel's work time and other monetary matters.
- Evaluates the financial aspects of the incident.

What Would You Do If...

Explain what actions you should take in response to each situation below.

1. You and your coworkers are beginning work at a meth lab cleanup site. You have done this sort of work before, but this site is new to you. Before you arrived, certified industrial hygienists came and sampled the air to see if there was a risk of inhalation hazard. Even though you thought they went a little too quickly, they said the air was fine for breathing, and so you went inside with no respiratory protection. Once inside, you notice a funny smell in the air.

   Actions: _____

   _____

   _____

   Other Information Needed: _____

   _____

   _____

2. You and a friend are performing cleanup activities at a meth lab site located inside a house. You have been assigned to remove some of the bulky materials in the home. As you are picking up the mattress, your friend, who has carelessly forgotten his leather gloves, is stuck with a hypodermic needle lodged in the side of the mattress.

   Actions: _____

   _____

   _____

   Other Information Needed: _____

   _____

   _____

Summary - Emergency Response

Additional training is required for employees before they are permitted to respond to an emergency incident. The information in this chapter and the content of this course do not qualify you to respond to emergencies. An emergency is any sudden or unexpected event requiring outside help.

The emergency response plan is a written document developed and implemented before site work begins in an effort to help companies respond to emergency situations. The plan must contain specific information and be available for employees to copy or read.

Work sites must be equipped to respond to unplanned emergencies. Telephones, horns, fire extinguishers, spill control equipment, and hand signals are effective when responding to accidents and alerting employees.

The Incident Command System is a pre-planned chain of command which specifies lines of authority, communication, and responsibilities.

Key Terms - Emergency Response

Identify or define the following:

- Emergency
- Emergency Response Plan
- Incident Command System

Review Questions - Emergency Response

1. What are some requirements of an ERP?

2. What is one of the most frequent emergencies at a meth lab cleanup?

3. What is one emergency response role which all employees have?

4. List three personnel in the ICS and their duties.

Background Reading Material - Emergency Response

Hazardous Waste Operations and Emergency Response; Final Rule

March 6, 1989. (29 CFR 1910.120)

.120 (l)

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

October 1985. (NIOSH #85-115)

EPA's Standard Operating Safety Guides. July,1988.

Part 9 Site Safety Plan, p.2-3, 7-8

Annex 7 Emergency Operations Color Codes

NIOSH Pocket Guide to Chemical Hazards.

June 1990. (NIOSH #90-117)

Simulation

During this program, you will participate in a Simulation Exercise that will take at least half the day, with the rest of the day spent in critiquing and evaluating your actions. This exercise is geared to prepare you for the cleanup activities you will be doing at meth lab sites. Book knowledge is very important, and can save lives, but it is imperative that you be able to put that knowledge into action. This simulation is an opportunity to practice and evaluate these skills.

You will begin the session by participating in a briefing, where the instructor will explain the set-up of the Simulation, each activity, and the order you will do the activities in. This is a group-oriented exercise, so you will be placed in a small group of 3-6 participants, based on the number of students in the class.

These are the activities you will engage in, not necessarily in this order:

- Donning and Doffing Level C PPE
- Donning and Doffing Level D PPE
- Rug Removal
- Duct Cleaning
- Surface cleaning
- Scaling surfaces

Pay close attention to all safety protocols and procedures you have learned in this course. You will be wearing chemical-protective clothing and respirators, so you must present a signed doctor's note to the instructor verifying that this PPE will not have an adverse effect on your health. You are encouraged to treat this as a "real life" event and act your role as much as possible. If at any time you feel concerned about your own safety, or the safety of someone else in the area, notify the instructor IMMEDIATELY. He or she will take appropriate actions according the Emergency Response Plan for this Simulation.

Your instructor will assign team groups and provide checklists for all activities.

Simulation

GLOSSARY

A

Absorption—materials may be taken into the body (absorbed) through the skin or lungs.

Acid—any chemical with a low pH (< 7) that can cause skin or tissue damage (see also pH).

Acute effect—a health effect which develops rapidly. Exposure to carbon monoxide may cause a person to pass out, an acute effect.

Additive effect—one in which the combined effect of two chemicals is equal to the sum of the agents acting alone.

Administrative controls—policies and practices written before work begins to minimize exposure to chemical and physical hazards.

Adsorption—when a chemical becomes attached to another material, for example, soil.

Air-purifying respirator—protective mask which filters air and toxic materials through filters.

Alkali—any chemical with a high pH (> 7) that in water solution is bitter and more or less irritating or caustic to the skin. Strong alkalies in solution are corrosive to the skin and mucous membranes. (See also **pH**.)

Alveoli—the small air spaces deep in the lung where oxygen goes into the blood.

American Conference of Governmental Industrial Hygienists (ACGIH)—An organization of professional personnel in governmental agencies or educational institutions engaged in occupational safety and health programs. The ACGIH develops and publishes recommended occupational exposure limits (see **TLV**) for hundreds of chemical substances and physical agents.

Amphetamines - stimulants or “uppers” - which can be manufactured in legal and illegal labs. Amphetamines stimulate the users central nervous system with a sense of well-being and higher energy, resulting in social inhibitions and feelings of cleverness, competence and power. They are also used in weight reduction. The term amphetamine refers to a large class of stimulants: amphetamines (black beauties, white bennies), dextroamphetamine (dexies, beans), and methamphetamine (crank, meth crystal, ice, speed). They can be taken orally, injected, smoked, or snorted. Chronic use can cause paranoia, picking at the skin, auditory and visual hallucinations, and extremely violent and erratic behavior. Amphetamines are addictive.

Anhydrous—free from water.

Anhydrous Ammonia - a chemical extensively used as farm fertilizer but is also an ingredient in the production of meth, which can cause severe chemical burns on the skin.

Antagonism—the situation in which two chemicals, when introduced, interfere with each other’s actions.

Asphyxiant—a vapor or gas which can cause unconsciousness or death by suffocation (lack of oxygen). Asphyxiation is one of the principal potential hazards of working in confined spaces.

B

Base—A liquid or solid which has pH between 7 and 14.

Boiling point—temperature at which a liquid changes to a vapor. Flammable materials with low boiling points generally present special fire hazards.

Buddy system—a work practice in which workers team up in pairs during work activities.

Bung—the cap or plug that fits into the holes in a drum.

C

Carcinogen—a substance which can cause cancer.

CAS Number—a unique number assigned to a chemical by the Chemical Abstract Service.

Catalyst—a substance that speeds up a chemical reaction.

cc—cubic centimeter, a metric measurement about the size of a sugar cube.

Ceiling (C)—the maximum allowable exposure limit for an airborne substance, not to be exceeded during the shift.

Central Nervous System (CNS)—the part of the nervous system protected by the skull and the spinal column.

Chemical cartridge—a filtering device which is attached to an air-purifying respirator.

Chemical-resistant material—prevents chemicals from penetration.

Chronic effect—a health effect which develops slowly over a long period of time.

Clandestine Drug Lab Operation - The unlawful manufacture or attempt to manufacture a controlled substance within any area of a structure such as a dwelling, building, motor vehicle, trailer, boat, or other appliance.

Clandestine Drug Lab Site - Any part(s) of a structure such as a dwelling, building, motor vehicle, trailer,, boat, or appliance occupied or affected by conditions and/or chemicals typically associated with a clandestine drug lab operation.

Cleanup - Proper removal and/or containment of substance hazardous to humans and/or the environment at a chemical investigation site. Cleanup refers to two specific parts: removal occurs when a meth lab is identified and seized by law enforcement, and bulk chemicals, equipment, and wastes are removed by hazardous waste contractor under contract with the Drug Enforcement Agency or paid by a local agency. Remediation refers to the cleaning and containment of residual contamination that exists after the bulk removal of chemicals and chemical wastes.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—authorized government money for clean-up of abandoned hazardous waste sites, clean-up and emergency response to transportation incidents involving chemical releases, payment to injured or diseased citizens, etc. It was amended in 1986.

Concentration—the amount of one material in another.

Controlled substance - a drug, substance, or immediate precursor in Schedule I.

Cook - a slang term for the process of manufacturing methamphetamine and other illegal substances or the person(s) responsible for manufacturing methamphetamine or other illegal substances.

Confined space—any area which limits natural ventilation, making it easier for gases or vapors to accumulate.

Corrosive—a liquid or solid that eats away another material or substance with which it comes in contact.

cu m (or m^3)—cubic meter.

D

Decibels—a unit of measurement to detect noise levels.

Decomposition—the breakdown of a material (by heat, chemical reaction, decay, or other processes).

Decontamination—the chemical or physical process of reducing and preventing the spread of contamination from persons and equipment used at a hazardous materials incident.

Decontamination line—a line set up with stations for decontamination procedures between the Exclusion Zone and the Support Zone.

Degradation—method by which the protective properties of CPC are diminished.

Demand regulator—reduces tank pressure to provide air when the wearer inhales.

Department of Transportation (DOT)—Regulates the shipments and transfer of hazardous materials.

Dermatitis—redness or irritation of the skin.

Dilution—method of reducing the concentration of a contaminant to a safe level.

Dose—the quantity of a chemical taken into the body.

Dose response—the relationship between the amount of the chemical and the amount of response in humans or animals.

Dose-response curve—a graph that shows how much of the chemical dose causes an observed effect.

Drug Enforcement Agency - DEA

E

Emergency—an unexpected or unplanned event requiring remedial action.

Emergency response plan—written descriptions of planned actions and personnel responsibilities for emergency response.

Engineering control—substitution, isolation, and ventilation methods used to reduce the level of the contaminant at the source.

Environmental Protection Agency (EPA)—federal agency concerned with environmental air, water, and land quality.

Evaporation rate—how fast a liquid enters the air when compared with a known material. The evaporation rate can be useful in evaluating the health and fire hazards of a material.

Exclusion zone (Hot Zone)—the area where the hazard is present—contaminated area.

Exposure—the concentration of a material in the air to which a worker can come into contact. Usually, exposure is measured near the nose of the worker.

F

Flammable—a liquid with a flash point below 100ºF (37.8ºC). Class I A—those having flash points below 73ºF and having a boiling point below 100ºF; Class I B—those having flash points below 73ºF and having a boiling point at or above 100ºF; Class I C—those having flash points at or above 73ºF and below 100ºF.

Flash Point—the temperature at which a liquid will give off enough flammable vapor to burn. There are several flash point test methods, and flash points may vary for the same material, depending on the method used; so the test method is indicated when the flash point is given.

G

Gram (gm)—a metric unit of weight. One U.S. ounce is about 28.4 grams.

H

Hazardous material—to be considered hazardous, a waste must be on the list of specific hazardous waste streams or chemicals, or else it must exhibit one or more of certain specific characteristics including flammability, corrosivity, reactivity, and toxicity. The definition excludes household waste, agricultural waste returned to the soil, and mining overburden returned to the mine site. It also excludes all wastewater returned directly or indirectly to surface waters. However, hazardous waste may physically be in the liquid state.

Hazardous Waste Operations and Emergency Response (HAZWOPER)—OSHA standard which was developed to protect hazardous waste personnel and emergency response personnel.

Hazards—the inherent characteristics of a material that may cause incapacitation, injury, or mortality by contact, inhalation, or ingestion.

HAZCOM (1910.1200)—OSHA Hazard Communication Standard.

Heat exhaustion—prolonged exposure to intense heat exceeds the body's ability to cool down, causing excessive sweating and sodium deficiency.

Heat stroke—a life-threatening condition during prolonged exposure to intense heat when the body is unable to sweat; extremely high body temperature and collapse may result.

Heavy metals—the major toxic metals.

Hematotoxin—toxic to the blood or organs where blood is made.

Hepatotoxin—toxic to the liver.

I

Immediately Dangerous to Life and Health (IDLH)—any condition which may result in damage to health which cannot be repaired. IDLH situations include explosive and oxygen-deficient environments and the presence of Class A poisons or substances which can be absorbed through the skin.

Incident Command System (ICS)—an organized system of personnel and delegation of responsibilities which controls the response to an emergency.

Incident commander—person in charge of on-site management of all activities at a hazardous materials emergency.

Incompatible chemicals—chemicals which produce a negative reaction when mixed.

Ingestion—taking a substance in through the mouth.

Inhalation—breathing in through the mouth or nose a substance in the form of a gas, vapor, fume, mist, or dust.

Irritant—a substance which causes an inflammatory response when brought into contact with the eyes, skin, or respiratory system.

ISDS or individual sewage disposal system - an absorption system of any size or flow or system or facility for treating, neutralizing, stabilizing, or disposing off sewage which is not a part of or connected to a sewage treatment works.

Isolation—method of decontamination in which contaminated equipment and materials are bagged or covered and set aside, usually for subsequent shipment to an approved landfill for disposal.

K

Kitchen—the place where meth is cooked/manufactured.

L

Lab—a methamphetamine laboratory, where meth is manufactured.

Latency—the time interval between exposure to a substance and the development of a disease.

Lock-out—a procedure to prevent use of any equipment which should not be used. The equipment is generally tagged and locked off or closed.

Lower explosive limit—the lowest concentration (lowest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, arc, flame) is present.

M

M—meter; a metric unit of length equal to about 39 inches.

Main-line valve—controls air flow to the regulator on supplied-air respirators.

Material Safety Data Sheet (MSDS)—informational sheet which is sent with hazardous materials. Lists source of chemical properties, emergency response actions, reactivity data, control measures, safe handling procedures, and manufacturer.

Melting point—the temperature at which a solid substance changes to a liquid state. For mixtures, a melting range may be given.

Metabolism—the chemical reactions that go on in the body to maintain life.

meth—methamphetamine. A stimulant which attacks the central nervous system.

Micro vacuum sample or vacuum sample - a non-airborne dust sample collected from a known surface area of a porous surface or material using standard Micro vacuum sampling techniques.

Milligrams per cubic meter (mg/m^3)—unit of measurement generally used to weigh fibers. One U.S. gram is about 1,000 milligrams.

Monitoring—measuring concentrations of substances in the workplace.

Morbidity—non-fatal disease from an exposure.

Mortality—death from an exposure.

Mutagen—a substance which can change the genetic material (DNA) in a living cell.

N

National Fire Protection Association (NFPA)—produces many standards, including the four-color diamond used on labels to indicate hazard. Health, fire, and reactivity hazards are rated from 0 (none) to 4 (extreme). The Health rating is in the blue section, Fire in red, and Reactivity in yellow. The white section is reserved for other Specific Hazards (for example, “radiation: do not use water,” or “fire.”)

National Institute for Environmental Health Sciences (NIEHS)—a federal agency responsible for issues related to the environment.

National Institute for Occupational Safety and Health (NIOSH)—a federal research agency responsible for issues related to occupational safety and health.

Neurotoxin—a substance which is toxic to the brain and nerves.

Neutralization—method of decontamination in which the chemical structure of the hazardous material is altered by mixing it with another reactive chemical to lessen the danger of the hazardous material.

Non-porous - material that does not contain holes or pores usually a hard surface

Nuclear Regulatory Commission—a federal agency responsible for community and worker protection from radiation hazards.

O

Occupational Safety and Health Administration (OSHA)—a federal unit responsible for creating and enforcing laws related to occupational safety and health.

Olfactory—relating to the nose or sense of smell.

Oral—taken into the body through the mouth.

Oral toxicity—adverse effects resulting from taking a substance into the body through the mouth.

Oxidation—a reaction in which a substance combines with oxygen, the oxygen being provided by an oxidizer or oxidizing agent.

Oxidizer—a substance that gives up oxygen readily to stimulate the combustion of organic matter.

Oxygen-deficient—air which contains less than 19.5% oxygen.

Oxygen-enriched—atmosphere containing more than 23.5% oxygen.

P

Parts per million (ppm)—a unit used to measure particulates.

Penetration—the flow of a chemical through zippers, stitched seams, pores, or imperfections in the material.

Percutaneous absorption—absorption into the skin.

Permeation—process by which a chemical dissolves in or moves through a protective clothing material on a molecular level.

Permissible Exposure Limit (PEL)—the highest level of a substance to which a person can be exposed. These limits are set by OSHA.

pH—applies to liquids. A pH less than 7 is acid. A pH of 7 is neutral, and a pH greater than 7 is alkaline.

Physical agent—heat, noise, radiation, vibration.

Porous - material that contains holes or pores.

Precursor - A substance from which another substance is formed. In meth related areas, precursors are any compounds or mixtures containing ephedrine or pseudoephedrine. Those two drugs are precursors to methamphetamine.

Pulmonary toxin—a substance which is toxic to the lungs.

Q

Qualitative fit-test—measures effectiveness of a respirator by exposing the wearer to a test atmosphere containing an irritating or smelly substance. The wearer should not be able to detect the substance.

Quantitative fit-test—measures effectiveness of a respirator in preventing a substance from entering the facepiece while the wearer is in a test chamber. Actual amount of concentration of substance is measured inside the facepiece of the respirator.

R

Reactivity—a description of the tendency of a substance to undergo chemical reaction with the release of energy. Undesirable effects such as pressure build-up, temperature increase, or formation of noxious, toxic, or corrosive by-products may occur because of the reactivity of a substance to heating, burning, direct contact with other material, or other conditions found in use or in storage.

Red Phosphorous - Ingredient that can be used in the manufacture of meth, the strike plate on a book of matches is a frequently used source of red phosphorous.

REM—Roentgen Equivalent Man, a measure of radiation dose.

Renal—pertaining to the kidney.

Residual volume (RV)—the amount of air remaining in the lung after maximum expiratory effort.

Resource Conservation and Recovery Act (RCRA)—a federal law which regulates management and disposal of hazardous materials and wastes.

Risk—exposure to the chance of injury or loss.

Rolling lab—a meth lab located inside a vehicle (i.e. car trunk, truck bed, mobile home).

Route of Entry—how material gets into the body: inhaled, ingested, via the skin (dermal) or eye(s).

S

Self-Contained Breathing Apparatus (SCBA)—a supplied-air respirator consisting of an oxygen tank, carrying assembly, gauge, safety valve, and full facepiece for use when exposures are unknown or particularly toxic.

Sensitizer—a substance which on first exposure causes little or no reaction but which on repeated exposure may cause a marked response not necessarily limited to the contact site.

Septic System - A small scale typically private waste management system. Most often used for homes/facilities in rural areas, the system usually contains a settling tank and a grainfield, which may cause groundwater contamination if not working properly.

Short-Term Exposure Limit (STEL)—an exposure limit set by the ACGIH for the maximum concentration a worker can be exposed to during a 15-minute period.

Solubility in water—a measure of how much of a material will dissolve in water.

Specific gravity—the weight of a material compared to the weight of an equal volume of water; an expression of the density (or heaviness) of the material. Insoluble materials with a specific gravity less than 1.0 will float in water; insoluble materials with a specific gravity greater than 1.0 will sink in water.

Stability—an expression of the ability of a material to remain unchanged. For MSDS purposes, a material is stable if it remains in the same form under expected and reasonable conditions of storage or use. Conditions which may cause instability (dangerous change) are stated. Examples are temperatures above 150ºF or shock from dropping.

Standard Operating Procedures (SOP)—written descriptions of tasks and activities to be followed during work.

Support zone (cold zone)—area where administrative and support functions not requiring respiratory protective equipment are performed.

Synergistic Effect—a combined effect of two or more substances which is greater than the sum of the effect of each.

Systemic—relating to the whole body rather than its individual parts.

T

Teratogen—a substance or agent to which exposure of a pregnant female can result in changes in the fetus.

Threshold—the lowest dose or exposure to a chemical at which a specific effect is observed.

Threshold Limit Value (TLV)—A term used by the ACGIH to express the airborne concentration of a material to which nearly all persons can be exposed day after day without adverse effects. The ACGIH express TLVs in three ways:

TLV-TWA—the allowable time-weighted average concentration for a normal 8-hour workday.

TLV-STEL—the short-term exposure limit, or maximum concentration for a continuous 15-minute exposure period (maximum of four-such periods a day, with at least 60 minutes between exposure periods and provided that the daily TLV-TWA is not exceeded).

TLV-C—The ceiling exposure limit or "the concentration that should not be exceeded during any part of the working exposure . . . those substances which may cause immediate irritation . . ."

Time-Weighted Average (TWA)—measurement to determine the worker's average exposure to a substance over a typical 8-hour work shift. The actual exposure is then compared to OSHA standards or other professional guidelines.

Toxic Substances Control Act (TSCA)—a list of reviewed harmful substances that require precautions and safe work practices by the community as well as industry.

Toxicity—the adverse effects from exposure.

U

United Nations Identification Number (UN Number)—A number used internationally to identify a hazardous material.

United States Coast Guard (USCG)—concerned with the transportation of hazardous materials across navigable waterways and other bodies of water.

Upper Explosive Limit or Upper Flammable Limit (UEL/UFL)—pertaining to a vapor or gas. The highest concentration (highest percentage of the substance in air) that will produce a flash of fire when an ignition source (heat, arc, or flame) is present. At higher concentrations, the mixture is too "rich" to burn. Also see "LEL."

V

Vapor—gaseous form of a substance normally in the liquid or solid state at room temperature.

Vapor density—the weight of a vapor or gas compared to the weight of an equal volume of air. Materials lighter than air have vapor densities less than 1.0. Materials heavier than air have vapor densities greater than 1.0.

Vapor pressure—indicates the tendency of a liquid to evaporate into the air.

Ventilation—a form of engineering control that removes airborne contaminants.

Viscosity—the property of liquid; resistance to flow.

Volatile Organic Compounds - Organic compounds that evaporate readily into the air. VOCs include substances such as benzene and toluene, which can be used in the manufacturing of meth.

W

Waste profile sheet—a document which is provided by the laboratory that conducted the analysis of the hazardous waste. Describes the physical and chemical properties of the waste sample.

Appendix A: Personal Protective Equipment

Personal protective equipment (PPE) is required by the Occupational Safety and Health Administration (OSHA) for all individuals working with or around hazardous materials. PPE is designed to shield or isolate people from the chemical, physical , and biological hazards that may be encountered at a meth lab decontamination site when engineering and work practice controls are not feasible to control exposures. Careful selection and use of adequate PPE should protect the respiratory system, skin, eyes, ears, face, hands, feet, and head. This chapter describes the various types of PPE, such as respiratory equipment and protective clothing that will help you be as safe as possible when you are decontaminating a methamphetamine (meth) lab.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Describe general types and uses of PPE, including chemical-protective clothing (CPC) and respirators.
- Identify the selection process, strengths, and limitations pertaining to different types of respirators and protective clothing.
- Don and doff PPE in an appropriate manner and describe precautions to take while wearing it.
- Identify the proper procedures for routine inspection, maintenance, and storage of PPE.
- Identify situations where respiratory protection would be needed in the course of cleaning up a meth lab.

Personal Protective Equipment Program

A written personal protective equipment program is required by OSHA as part of the employer's safety and health program. PPE must be selected which will protect employees from known or likely potential hazards. The proper selection of PPE is based on many factors, including potential hazards, physical characteristics of the site, and specific conditions under which work tasks will be conducted.

Remember: PPE must be properly selected and used to be effective.

The PPE program must address:

- Selection, based upon site hazards.
- Use and limitations.
- Work task duration.
- Maintenance and storage.
- Decontamination and disposal.
- Training and proper fitting.
- Donning and doffing procedures prior to, during, and after use.
- Inspection procedures.
- Evaluation of the effectiveness of the PPE program.
- Special limitations during temperature extremes, heat stress, and other appropriate medical considerations.

When model procedure descriptions provided by the manufacturer will be followed exactly at the site, they may be incorporated into the PPE Program as is.

Appropriate PPE must be selected and properly used during initial site entry and characterization and site remediation activities. The preliminary site evaluation should provide sufficient information to select PPE that will protect personnel from overexposures to chemicals; if this information is not available, OSHA mandates a specific level of protection, along with the use of special equipment to monitor the air (1910.120 [c] [5] [i] and [ii]). In order to safeguard the lungs adequately during initial entry, wherever respirators are used that are not self-contained (air source on back), a 5-minute or longer escape breathing apparatus must be used.

Once the hazards of the site have been identified, the use of PPE for remediation activities detailed in the program is followed.

All PPE selected and used must meet OSHA requirements, where applicable (1910, Subpart I and 1910.120).

This chapter is divided into two sections. Section I addresses respiratory protection, and Section II covers chemical-protective clothing. Combined, these two sections describe personal protective equipment (PPE).

Section I - Respiratory Protection

Respiratory protection is required at work sites where adequate protection from chemicals cannot be provided through the use of engineering or administrative controls. This section outlines different types of respiratory protection equipment, its use, and its limitations.

Respirators provide protection against chemical and dust exposure. Employers must provide workers with appropriate respirators and training if respirators are needed for usual or emergency work tasks. OSHA Standard 29 CFR 1910.134 requires that a written respiratory protection program be developed by the employer if workers may be required to wear respirators or if they are available for voluntary use.

Respirator Selection

Different types of hazards require different types of respirators. A number of factors should be considered when selecting a respirator. Selecting the appropriate respirator is the responsibility of qualified personnel, such as an industrial hygienist.

Some considerations used to select a respirator include:

- Is there enough oxygen in the atmosphere (19.5% to 23.5%)?
- What are the hazardous substances to which the worker may be exposed?
- Is the atmosphere immediately dangerous to life and health (IDLH)?
- What is the concentration of the substance in the air?
- What is the maximum Permissible Exposure Limit (PEL) or Short-term Exposure Limit (STEL) for the substance?
- Is the respirator approved for the application?

Other selection considerations include:

- Communication needs.
- Use in confined space.
- Use in extreme temperatures.
- Skin and eye absorption hazards.
- Maximum concentrations for exposure.
- Face protection.

Types of Respirators

Two basic types of respiratory protection are:

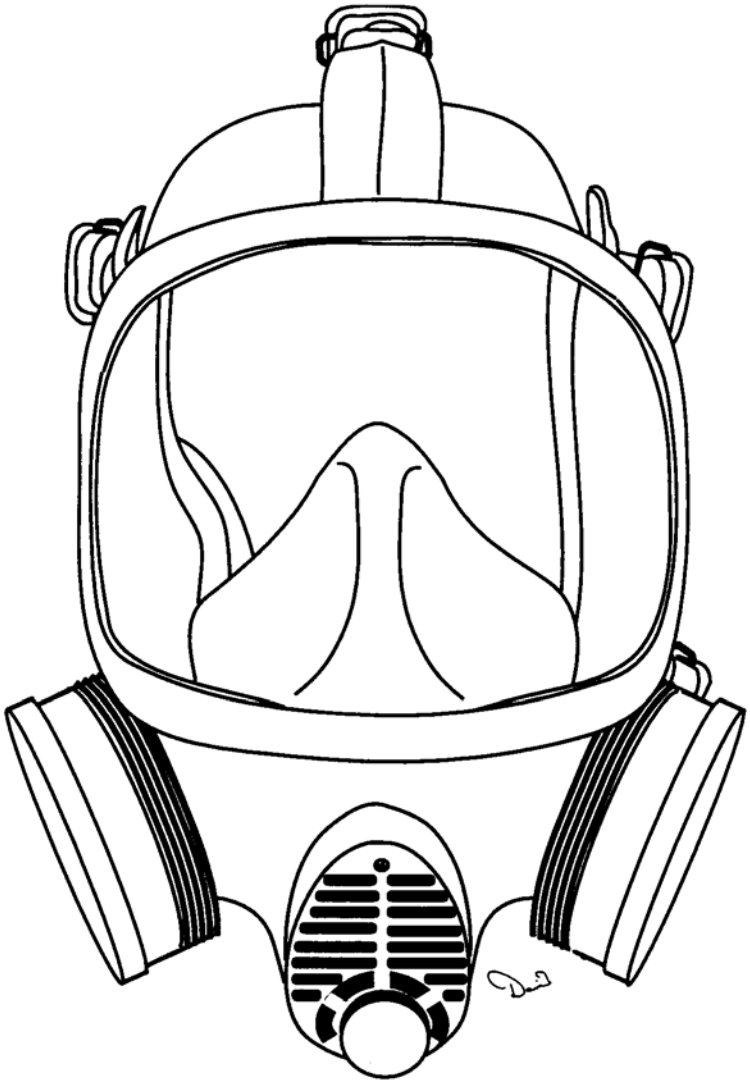
- Air-Purifying Respirator (APR), which protects against toxic dusts, gases, and vapors by filtering the air before it enters the lungs.
- Atmosphere-Supplying Respirator (ASR), which provides “breathing air from a source independent of the ambient atmosphere.” ASRs include supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA).

Air-Purifying Respirators

Air-Purifying Respirators (APRs) are used to protect against specific dusts and toxic chemicals. They work by filtering air before it is inhaled. If APRs are used, all toxic substances must be identified, and the concentration must be known and remain constant, verified by monitoring, and the cartridge must be selected to protect against those specific chemicals.

APRs consist of a facepiece with an exhalation valve and one or two filtering cartridges through which the air enters. The most widely used facepieces are full-face or half-mask. Half-mask and full-face respirators are illustrated on the following pages.

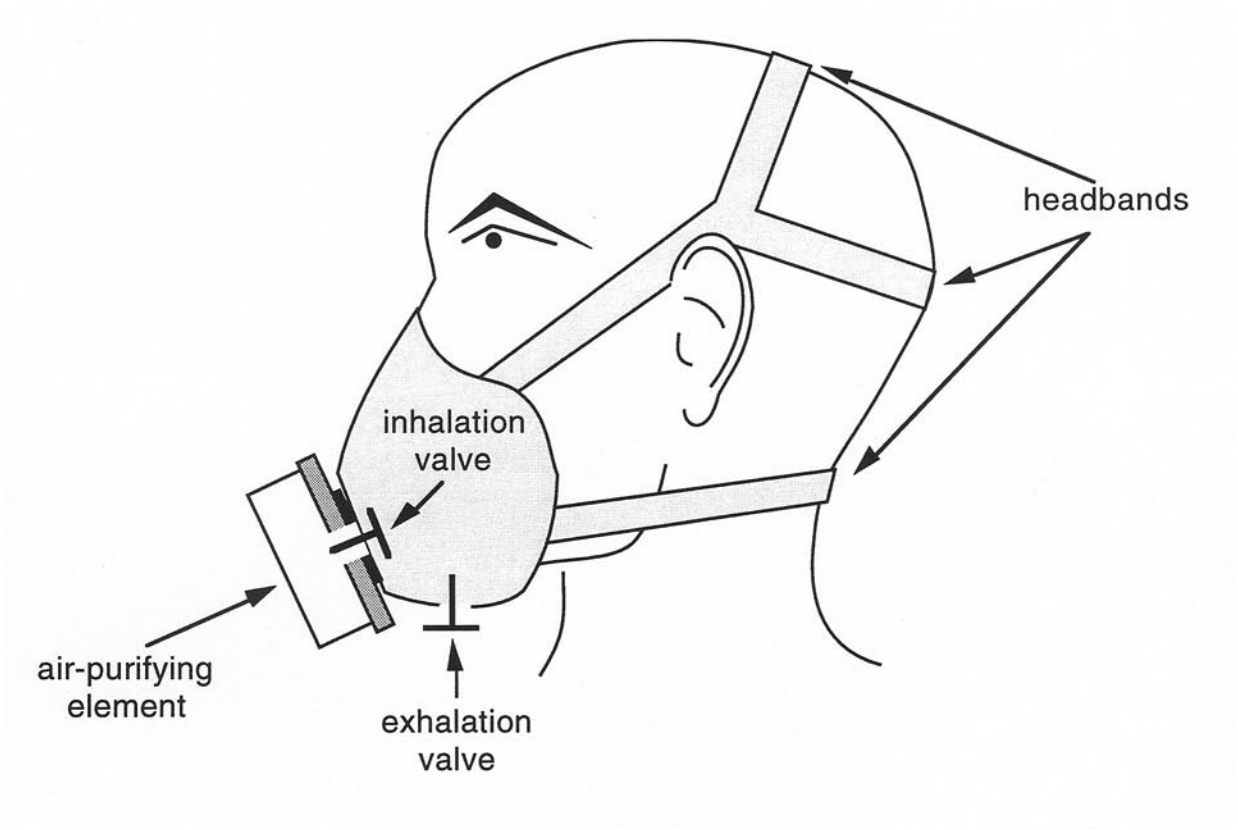
Full-Face Air-Purifying Respirator



Half-Mask Air-Purifying Respirator

Operation of an Air-Purifying Respirator

Air enters through the cartridges and exits through a valve. Also, note the proper placement of the headbands for a half-mask respirator. Half-mask respirators without the head harness (only two single straps) must not be used.



Filters and Cartridges

Two types of filters are used with APRs.

- Particulate filters are used to protect against dusts, mists, and fumes.
- Chemical cartridges are used to protect against certain vapors and gases.

Filters and cartridges are selected according to specific exposures which are expected. Factors which affect how well the APR works include the size of the particles, concentration of the substance, and type of filter used. The filter(s) must be changed when loaded with the dust (particulate) or substance (chemical cartridge) or if it gets wet. Certain contaminants do not have an appropriate protective cartridge/canister due to their oxygen displacement characteristics or the fact that they are known or suspected carcinogens.

Cartridge and filter colors designate what type of particulates or chemicals are filtered. OSHA regulation 29 CFR 1910.134 dictates the colors that may be used. The table on the following page lists OSHA-approved color and protection combinations.

How do you tell if the cartridge needs to be changed? The respirator standard 1910.134(d)(3) requires that respirators used to prevent gas or vapor exposures be equipped with an indicator showing that the cartridge has expired; this is called an End-of-Service-Life Indicator (ESLI). If no cartridge approved for a specific gas/vapor exposure has an ESLI, then the employer must use objective data to determine a change schedule. Should you smell contaminant before the cartridge has “officially expired,” notify the supervisor immediately and change the cartridge. For dust, a wearer may notice that it is more difficult to breathe as the filter becomes loaded.

Colors Assigned to Atmospheric Contaminants

Atmospheric Contaminants to be Protected Against	Color Assigned[1]
Acid gases	White
Hydrocyanic acid gas	White with 1/2-inch green stripe completely around the canister near the bottom
Chlorine gas	White with 1/2-inch yellow stripe completely around the canister near the bottom
Organic vapors	Black
Ammonia gas	Green
Acid gases and ammonia gas	Green with 1/2-inch white stripe completely around the canister near the bottom
Carbon monoxide	Blue
Acid gases and organic vapors	Yellow
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2-inch blue stripe completely around the canister near the bottom
Acid gases, organic vapors, and ammonia gases	Brown
Radioactive materials, excepting tritium and noble gases	Purple (magenta)
Particulates (dusts, fumes, mists, fogs, or smoke) in combination with any of the above gases or vapors	Canister color for contaminant, as designated above, with 1/2-inch gray stripe completely around the canister near the top
All of the above atmospheric contaminants	Red with 1/2-inch gray stripe completely around the canister near the top

[1]Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

Note: Orange shall be used as a complete body or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.

Chemical Cartridge Respirators Do Not Protect You From:

- Acrolein
- Aniline
- Arsine
- Bromine
- Carbon Monoxide[1]
- Dimethylaniline
- Dimethyl Sulfate
- Hydrogen Cyanide
- Hydrogen Fluoride
- Hydrogen Selenide
- Hydrogen Sulfide
- Methanol
- Methyl Bromide
- Methyl Chloride
- Methylene Bisphenyl Isocyanate
- Nickel Carbonyl
- Nitro Compounds:
  - Nitrobenzene
  - Nitrogen Oxides
  - Nitroglycerin
  - Nitromethane
- Ozone
- Phosgene
- Phosphine
- Phosphorus Trichloride
- Stibine
- Toluene Diisocyanate (TDI)
- Vinyl Chloride

[1] Even though cartridges for carbon monoxide are available, chemical cartridges are generally not recommended because they have no warning properties.

Other Air-Purifying Respirators

Gas masks are a special type of APR that consist of a full facepiece and a canister containing sorbent material. These masks typically protect against organic vapors, acid gases, ammonia, and certain combinations. Gas masks usually have more purifying elements in the canister than regular cartridge filters.

Another special type of APR is a **Powered Air-Purifying Respirator** (PAPR), which pulls air through the filters and blows it into the mask. PAPRs consist of a hood or helmet, filter, power source, and facepiece. PAPRs can be used only in environments where the oxygen concentration ranges from 19.5% to 23.5%.

A single use dust mask is a paper filter, held to the face by two straps and fit to the nose by a self-molding metal strip. These do not provide a high level of protection, but will decrease the inhalation of dusts. They provide no protection against gases or vapor exposures.

In the 40-hour HAZWOPER program, you learned about supplied-air respirators (SAR) and Self Contained Breathing Apparatus (SCBA). These are not used often at meth lab cleanups. Ask your instructor for additional information if you may be using either SAR or SCBA.

Respirator Fit

A respirator will be effective only if there is a good seal between the facepiece and the wearer's face. Therefore, all persons wearing respirators must first be fit-tested. Fit-testing includes qualitative and quantitative testing, as well as routine positive-and negative-pressure tests.

Because many different face shapes exist, the manufacturers have a number of sizes. The purpose of fit testing is to find the manufacturer/size combination which offers the best protection. Factors such as beards, weight loss or gain, dentures, dental work, or facial injury can change the shape of the face, thus potentially changing the fit and efficiency of the respirator. If any of these factors exist, retesting is required.

A protection factor has been determined in the laboratory for each type of respirator (APR, PAPR, SCBA, etc.) and mask (half or full-face). Never assume you will get this much protection. That is why fit-testing is required.

Periodic Fit-Tests

Two types of fit-testing, **qualitative** and **quantitative**, may be used to determine the size and model of respirator that an individual should wear, as well as how good the face-to-facepiece seal is. These tests should be repeated periodically to document the respirator's effectiveness.

Qualitative Testing (with irritant or smelly substance)

Purpose:	Checks effectiveness of respirator in preventing substances from entering the facepiece.
Method:	While wearing a respirator, an individual enters a chamber or atmosphere where a test substance has been released. The test substance could be smelly (banana oil) or an irritant (special smoke tube). The wearer should not be able to detect the substance.
Requirements:	This test or its equivalent is required by OSHA 1910.134 (e) (5) at least once a year.

There are several important cautions to qualitative fit-testing.

- Some of the test substances may irritate the eyes or cause coughing.
- A poor sense of smell or taste may result in an inaccurate test.
- Fit-testing is often done in "ideal" environments. The fit may change after wearing the respirator several hours or during strenuous activity.

Quantitative (Numerical) Testing

Purpose: Measures effectiveness of the respirator in preventing a substance from entering the facepiece.

Methods: While wearing a respirator modified with a probe, an individual enters a chamber. A test substance is released, and the concentrations in the air inside and outside of the respirator are measured. (Another version of this method is available which does not require a chamber or a test substance. The dust which naturally occurs in the air is measured both inside and outside the respirator.) The test is repeated while the person performs specific tasks (speaking, running in place, etc.) that may affect fit.

Requirements: This test is not required by OSHA, but it should be done at least annually if the service is available.

This test provides an objective assessment of the effectiveness of the respirator for the person who will wear it. This test measures the fit factor (FF), which is a comparison of the concentration of the substance outside of the mask to the concentration of the substance inside of the mask. This FF is useful in determining whether the respirator will effectively protect the wearer from specific chemicals. A disadvantage to this test is that special equipment and trained personnel are needed to administer it, although a microcomputer and software accessories can perform the calculations required.

Routine User Checks

Two types of checks, **positive**- and **negative**-pressure checks, should be done each time a respirator is donned and before each use in the field to check the seal of the respirator. They do not replace yearly fitting but provide a routine assessment as to whether the fit is still adequate.

Positive-Pressure Check

Purpose: Checks the apparatus for leaks at valves or other points.

Method: Wearer covers the exhalation valve with hand and blows out. Air should escape only from around the facepiece.

Requirements: Should be done before each use.

Negative-Pressure Check

Purpose: Checks the facepiece-to-face seal.

Method: SCBA wearer disconnects the hose mask and places hands over the intake valve and inhales. APR wearer places hands over cartridges and inhales. No outside air should be felt leaking into the facepiece.

Requirements: Should be done before each use.

Positive- and negative-pressure checks can be done quickly and easily in the field. They do, however, have the disadvantage of relying on the wearer's ability to detect the leaks.

Respirator Protection Factors

Respirators are selected by using respirator protection factors. These protection factors are set after testing by NIOSH and are subject to change. Protection factors vary according to the particular respirator type, with lower numbers indicating a lower degree of protection. Following is a list of respirator protection factors:

- Single use APR = 10
- 1/2-face APR = 10
- Full-face APR = 50
- PAPR = 100

Protection factors also exist for combinations of the above respirators.

In using these protection factors, you assume that the facepiece has been properly selected to provide the best possible fit. These factors do not apply for persons with beards.

Fit Factor Calculation

Proper selection of respirators can be accomplished by dividing the known chemical concentration by the protection factor. The resulting value needs to be compared to the exposure limit used by your corporation.

If the calculated ppm is higher than the exposure limit, then that type of respiratory protection would be inadequate. If the calculated ppm is lower than the exposure limit, then that type of respiratory protection should be sufficient, provided that the measured concentration will not increase.

Example:

You are working at a meth lab where toluene may be present. The safety and health supervisor measured a maximum concentration of 400 ppm of toluene, but OSHA's PEL allows only 200 ppm for an 8-hour work shift. Because engineering controls cannot be implemented at the site, respiratory protection must be used. What type of respiratory protection would provide adequate protection against this contaminant?
Formula:

$$\frac{\text{measured chemical concentration in ppm}}{\text{respirator protection factor (pf)}} = \text{parts per million (ppm)}$$

First, see if a 1/2-face APR can be used:

$$\frac{400\text{ ppm}}{10\text{ pf}} = 40\text{ ppm}$$

The resulting answer is 40 ppm, which means that 40 ppm of toluene will be present inside the facepiece of a properly fitted respirator. A concentration of 40 ppm is less than OSHA's 200 ppm PEL, so this type of respiratory protection would be adequate. However, the safety and health supervisor questions the fit for all people in the hot sun. See if a full-face APR provides better protection:

$$\frac{400\text{ ppm}}{50\text{ pf}} = 8\text{ ppm}$$

The resulting answer is 8 ppm. Because 8 ppm is less than 40 ppm, a properly fitted full-face APR would protect better than the 1/2-face APR, even though both would be below OSHA's 200 ppm limit. 200 ppm limit.

Respirator Protection Factor Exercise

Protection Factors: Single use APR = 10
1/2 face APR = 10
full face APR = 50

1. You are working where sampling indicates 2000 ppm acetone. The PEL for acetone is 1000 ppm. What is the minimum type of respiratory protection that can be *safely* used?

2. You are working when a container spills and the ammonia concentration reaches 300 ppm. The PEL for ammonia is 50 ppm. What is the minimum type of respiratory protection that can be *safely* used?

Medical Fitness to Wear a Respirator

Before an employee receives clearance to wear a respirator, a medical exam must be performed by a licensed physician. The exam helps assure that the employee is physically capable of working with the added stress of a respirator. Medical examinations are required for all employees who may work in atmospheres containing overexposure to hazardous substances for 30 days or more a year or as required by OSHA 1910.134.

Examinations should be conducted at least once every twelve months for each employee, unless the physician believes a longer interval (not greater than two years) is appropriate. It is important that the physician understands the worker's job tasks.

Some medical conditions which may prevent an individual from wearing a respirator include:

- Lung disease.
- Claustrophobia.
- Severe high blood pressure.
- Heart disease.

Other circumstances which may prevent a worker from wearing a specific type of respirator include:

- Contact lenses.
- Eyeglasses.
- Mustache.

Special eyeglass kits are available for full-facepiece respirators.

Facial Hair and Respiratory Protection

Section 29 CFR1910.134/1926.103b, Definitions, states:

> Tight fitting facepiece means a respiratory inlet covering that forms a complete seal with the face.

Additionally, Appendix A of 1910.134 (mandatory), states:

> The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble, beard growth, beard, mustache, or sideburns which cross the respirator sealing surface.

OSHA's interpretation of this section is that there cannot be any facial hair when using any respirator which relies upon a good face-to-facepiece seal, such as any tight-fitting (as opposed to helmet or loose-fitting hood) air-purifying respirator. Even several days' beard growth or a heavy stubble can reduce the possibility of a face-to-facepiece seal.

The question often comes up, "Can an employer force a worker to shave his beard because he will have to wear a respirator?" The answer depends in part on whether the workplace is unionized. There have been cases where arbitration has decided on this question in the favor of the employer as well as cases that were settled in the worker's favor. The decision will turn on the facts of each individual case. You should consult your employee representative for more information.

In a non-union workplace, the employer is free to impose work rules on the employee and change them at any time consistent with the employment contract. Nothing in OSHA regulations prevents the employer from making such a change and, in fact, the law requires employees to obey OSHA standards.

In a unionized workplace, the employer cannot normally change working conditions unilaterally unless the collective bargaining agreement gives him or her that right or unless the union clearly gives up that right. Where this is not the case, the employer must normally bargain with the union for changes in wages, hours and working conditions that occur during the life of the collective agreement.

Inspection, Maintenance, and Storage of Respirators

Proper inspection, maintenance, and storage is essential to assure that the respirator is always ready for use. Inspect before and after each use and check at least monthly, even if the respirator has not been in use. A company policy may include more frequent inspections. For inspecting all respirators:

- Check the condition of the facepiece.
- Check the hose and the points where it attaches to the facepiece and to the air tank.
- Check the headbands to make sure that they can be tightened to provide a good fit.

For inspecting ASRs:

- Check the head and tank harnesses for cracks, tears, or other defects.
- Check the regulator according to the manufacturer's directions.
- Check the air tanks or compressor for damage.
- Report defects or unusual conditions immediately.
- Practice putting on the respirator routinely if it is used infrequently or for emergency purposes only.

Cleaning and disinfecting are essential elements of the respirator program. To clean and disinfect all respirators:

- Inspect each piece.
- Wash the facepiece.
- Air dry.
- Re-inspect.

To clean and disinfect ASRs:

- Remove the air tank or hoses.
- Inspect each piece.
- Wash the facepiece, hose, and harness with disinfectant soap and water.
- Air dry.
- Reinspect the pieces as they are put back together.
- Do not submerge SCBAs in water.
- Store away from dust, sunlight, heat, extreme cold, high humidity, and chemicals.
- Store so as to prevent mechanical damage.
- Follow the manufacturer's specialized instructions.

Consult the site-specific respirator program for detailed requirements.

Minimum Requirements for a Respirator Program

OSHA requires that employers who make respirators available to their employees have a written respirator program with work-specific procedures. The program should be evaluated and updated at least annually or as requirements change and modified to reflect changes in the workplace.

A respirator program must include the following points:

- Medical evaluations of employees required to use respirators.
- Fit testing procedures for tight-fitting respirators.
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations.
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators.
- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators.
- Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations.
- Training of employees in the proper use of respirators, including putting on and removing them, any limitations on their use, and their maintenance.
- Procedures for regularly evaluating the effectiveness of the program.

The employer shall designate a program administrator who is qualified to oversee the respiratory protection program and conduct the required evaluations of its effectiveness. Respirator training and the required medical evaluations are provided to the employee at no cost.

The respirator program also may include:

- Need for corrective lenses in full-facepiece respirators.
- Restriction of use of contact lenses.
- Communication needs.
- Guidelines for use in dangerous atmospheres, including confined spaces.
- Guidelines for use in extreme temperatures.

The respirator program will include a description of who is responsible for the various aspects of the program including selection, periodic and routine fit-testing, inspection, cleaning, repair, and maintenance. Persons using respirators under unusual conditions (e.g., a high concentration of acid vapor) should review special requirements with supervisors or the employee safety and health representatives.

Respiratory Protection Lab

The purpose of this laboratory is to give you the opportunity to wear and become familiar with air-purifying respirators (APRs), equipment cleaning, and inspection procedures. This lab is broken down into four rotating stations:

- Donning and doffing APRs.
- Fit-testing an APR.
- Inspecting and cleaning respirators.
- Single-use respirators.

Copies of Lab Performance Checklists for this exercise are provided in this student manual on the following pages. However, the instructor will hand out duplicates of these checklists which you will complete, have signed by the instructor, and turn in at the end of the lab. The training center retains this information with your other training records. Therefore, you may want to record your lab results in your manual for your personal records.

Name _____

Respiratory Protection Lab Performance Checklist
Station 1: Donning and Doffing an APR

1. What brand of APR and size did you wear?

   Brand _____ Size _____

2. Please list the brands and sizes you tried that could not pass the negative-pressure fit test.

   Brand _____ Size _____

   Brand _____ Size _____

   Brand _____ Size _____

3. Before donning the APR, did you check your:

   a. Straps? ..... ☐ Yes ☐ No

   b. Cartridge/filter? ..... ☐ Yes ☐ No

   c. Facepiece for cracks? ..... ☐ Yes ☐ No

4. Did you don the APR as you were instructed? ..... ☐ Yes ☐ No

5. While wearing the APR, did you:

   a. Wear the APR for at least 7 minutes? ..... ☐ Yes ☐ No

   b. Try to communicate with your buddy? ..... ☐ Yes ☐ No

Name _____

Respiratory Protection Lab Performance Checklist Station 1 (cont.): Donning and Doffing an APR

6. While wearing the APR, did you do an assigned task? ..... ☐ Yes ☐ No

   If yes, describe the task: _____

   _____

   _____

7. After doffing the APR, did you:

   a. Extend the straps? ..... ☐ Yes ☐ No

   b. Return to designated location? ..... ☐ Yes ☐ No

8. How long did you wear the APR? _____ minutes

Date _____ Instructor's Signature _____

Name _____

Respiratory Protection Lab Performance Checklist
Station 2: Fit-Testing an APR

1. Please check any of the following items that you wear.

   ☐ Prescription glasses

   ☐ Dentures

   ☐ A beard

   ☐ Contact lenses

   ☐ Hairstyle that prohibits a good face seal

2. Did you do a negative-pressure fit check? ..... ☐ Yes ☐ No

3. Did you do a positive-pressure fit check? ..... ☐ Yes ☐ No

4. Did you go into a test chamber? ..... ☐ Yes ☐ No

   If yes, which type of chamber?

   ☐ "Banana oil"

   ☐ Smoke

   ☐ Both

   ☐ Other

5. What brand and size of air-purifying respirator did you wear?

   Brand _____ Size _____

   Full-face _____ Half-face _____

Name _____

Respiratory Protection Lab Performance Checklist Station 2 (cont.): Fit-Testing an APR

6. Please list the brands and sizes of respirators you tried that could not pass the fit test.

   Brand _____ Size _____

   Brand _____ Size _____

   Brand _____ Size _____

   Brand _____ Size _____

7. Did you wash your respirator during this lab? ..... ☐ Yes ☐ No

   If yes, check the supplies that you used.

   ☐ Towelette

   ☐ Wash basin

   ☐ Other

8. How long did you wear the respirator? _____ minutes

Date _____ Instructor's Signature _____

Name _____

Respiratory Protection Lab Performance Checklist
Station 3: Inspecting and Cleaning Respirators

Daily Maintenance of Your Respirator:

1. Did the instructor tell you how to wash your respirator? ..... ☐ Yes ☐ No
2. Did you clean your respirator? ..... ☐ Yes ☐ No
3. Did you see a disassembled respirator and all its parts? ..... ☐ Yes ☐ No
   If yes, did someone in the lab reassemble the respirator? ..... ☐ Yes ☐ No
4. Did someone in your lab inspect a respirator? ..... ☐ Yes ☐ No
5. Were defects found during the inspection? ..... ☐ Yes ☐ No

   If yes, describe the defects: _____

   _____

   _____

Date _____ Instructor's Signature _____

Name _____

Respiratory Protection Lab Performance Checklist
Station 4: Single Use Respirators

1. Did the station leader have several different masks? ..... ☐ Yes ☐ No
2. Did you try at least one mask? ..... ☐ Yes ☐ No
3. Did you experience any discomfort? ..... ☐ Yes ☐ No

   If Yes _____

4. Did you observe damage to any mask used by a group member?

Date _____ Instructor's Signature _____

Scenarios: Selecting Respiratory Protection

Scenario 1:
You and your colleagues are about to enter a meth lab to begin cleanup activities. A uniformed police officer has informed you that there are still fumes in the building, and chemical residue is everywhere. No one knows the contaminants present or the concentrations. What respiratory protection should you select? Why?

Scenario 2:
Later that month, you are called again to clean up a meth lab. There were some sticky legal proceedings surrounding the case, so the police kept the area cordoned off for several weeks to document all the contamination properly and to allow the defense time to examine the evidence for themselves. What respiratory protection should you select? Why?

Scenario 3:
After completing a thorough cleanup of the meth lab in Scenario 2, you must take samples from various surfaces to ensure that safe levels have been reached. What respiratory protection should you select? Why?

Summary - Respiratory Protection

Respirators are used to prevent toxic materials from entering the body. Situations which may require the use of respiratory protection include:

- Oxygen deficiency.
- Hazardous substances in the air.
- An atmosphere immediately dangerous to life and health (IDLH).
- Confined-space entry.
- A skin/eye absorption hazard.

APRs consist of a facepiece with an exhalation valve and one or two filtering units through which the air enters. Filters may be for dust, vapors, or both.

A respirator should be selected for use after either qualitative or quantitative fit-testing. Before each use, the wearer should conduct positive- and negative-pressure checks.

Persons assigned to wear a respirator must be examined by a physician to ensure fitness.

Care of respirators includes diligent cleaning, disinfecting, and storing. Units should be inspected before and after each use or monthly if not used routinely.

A **written program** is required in any workplace where respirators are or may be used. Special considerations in use of respirators include the need for corrective lenses, communication requirements, and use in dangerous atmospheres.

Important acronyms include:

- APR—Air-Purifying Respirator.
- IDLH—Immediately Dangerous to Life and Health.
- PAPR—Powered Air-Purifying Respirator.
- PEL—Permissible Exposure Limit.
- STEL—Short-Term Exposure Limit.

Key Terms - Respiratory Protection

Identify or define the following:

- APR
- PAPR
- Particulate filters
- Chemical cartridges
- Qualitative fit-testing
- Quantitative fit-testing
- Protection factor
- Positive-pressure test
- Negative-pressure test

Review Questions - Respiratory Protection

1. List situations in which respiratory protection would be required.

2. Why are routine positive- and negative-pressure checks important?

3. Why are medical exams required for persons who use respirators?

4. Why is proper maintenance of respirators important?

5. List items that must be included in a written respiratory protection program.

Section II - Protective Clothing

Personal Protective Equipment (PPE) provides protection against hazardous substances. PPE includes respirators, chemical-protective clothing (CPC), hard hats, boots, safety goggles, and face shields. PPE provides an important barrier between chemicals or other hazards in the environment and your body. Although PPE cannot provide protection from all exposures, when properly selected and worn, it can prevent unnecessary, harmful exposures. This section will describe the levels of PPE that are designated by OSHA and EPA and chemical-protective clothing.

Chemical-Protective Clothing

Chemical-Protective Clothing (CPC) consists of special clothing worn to prevent chemicals from coming into contact with the body. CPC generally includes eye/face protection, aprons, boots, gloves, and suits/coveralls. CPC is used to protect employees from both chemical and physical hazards that they are likely to encounter while working. The proper use of CPC can prevent or reduce exposure to a harmful substance. CPC is an important part of a meth lab remediation worker's personal protective equipment (PPE).

Chemical-protective clothing includes suits, booties, boots, gloves, and hoods which are made of special materials. These special materials are chemical-resistant, which means they act as a barrier to keep chemicals from coming in contact with the wearer's skin. Different materials provide protection from different types of chemicals. It is important to select CPC which is designed to protect against the specific chemical or type of chemical that may be encountered during routine work in the facility. Otherwise, you might not be protected, even when you think you are.

Types of Chemical-Protective Suits

Chemical-protective suits are of two general types, totally encapsulating and partially encapsulating.

- Totally Encapsulating Chemical-Protective Suit (TECP): Provides head-to-toe coverage to protect the wearer from chemicals. These are the large “moon suits” which have special seams and zippers to prevent chemicals from leaking into the suit. These suits have a face shield which is made as part of the hood. They are very bulky to wear, and the wearer can become very hot while working. TECPs are the only vapor-resistant suits. TECP suits protect workers from hazards which are identified during site characterization. TECP suits must pass specific positive-air pressure tests and be capable of preventing inward test gas leakage of more than 0.5%. Specific information about pressure tests can be found in OSHA 1910.120, Appendix A.

- Partially Encapsulating Suit: Provides good protection from chemicals and may or may not have face shields. These suits are used when less skin protection is needed. The hood can either be part of the suit or detached. This type of CPC includes suits which look like totally encapsulating suits but have not passed the manufacturer’s pressure test.

Disposable suits, which provide limited protection from chemicals, can be used in conjunction with these chemical-protective suits. These disposable suits can be worn either on top of other suits to protect them or on the inside of other suits to protect the wearer from chafing.

Employees are generally not responsible for CPC purchase or selection; however, it is important for them to understand the considerations which go into selecting CPC. The selection process should be detailed in the employer’s safety and health plan. Questions about CPC selection may be addressed to the person responsible for the selection. The type of chemical-protective suits selected will depend on the type and nature of potential exposure. For example, totally encapsulating suits may be required for persons initially entering the lab, whereas partially encapsulating suits may be acceptable for the bulk of the work. Generally, the level of protection provided will be re-evaluated as additional information is gained. Guidelines for selection of PPE, including CPC suits, are presented in the table on the following page.

CPC Selection Guidelines

Chemical resistance: Different materials are resistant to different chemicals. Management should provide CPC which will provide protection against the chemicals likely to be encountered at the site. This rule is true for whole-body as well as hand and foot protection.

Physical integrity: Construction of the suit is important for the proper functioning of the CPC. Seams and zippers should provide solid barriers to chemicals and should be constructed to provide some flexibility.

Resistance to temperature extremes: Heat and cold can adversely affect CPC. Clothing which will be worn in cold temperatures could crack or become ineffective against chemicals. Likewise, heat may destroy the chemical resistance of clothing or even melt it.

Ability to be cleaned: Clothing must be able to be cleaned and decontaminated after each use. If this is not possible, the clothing must be disposed of after use.

Cost: Initial and ongoing costs of purchasing PPE can be important considerations for management. However, buying less expensive, inferior products which do not adequately protect employees can be more expensive in the long run due to medical costs, lost work time, or, at worst, loss of human life.

Flexibility: Materials need to be flexible enough for the wearer to move and work safely. Overly rigid suits can result in unnecessary accidents from slips, trips, and falls. Gloves which are too rigid may create gripping problems that may lead to other hazards.

Size: CPC should be available in a variety of sizes to accommodate the height and weight of the worker. Suits that are too small will tear easily and provide no protection. Suits that are too large will make walking and/or working difficult. Safety boots that are too big will create both tripping and comfort problems.

Design: CPC should be designed so that all required respiratory PPE can be used at the same time.

Levels of PPE

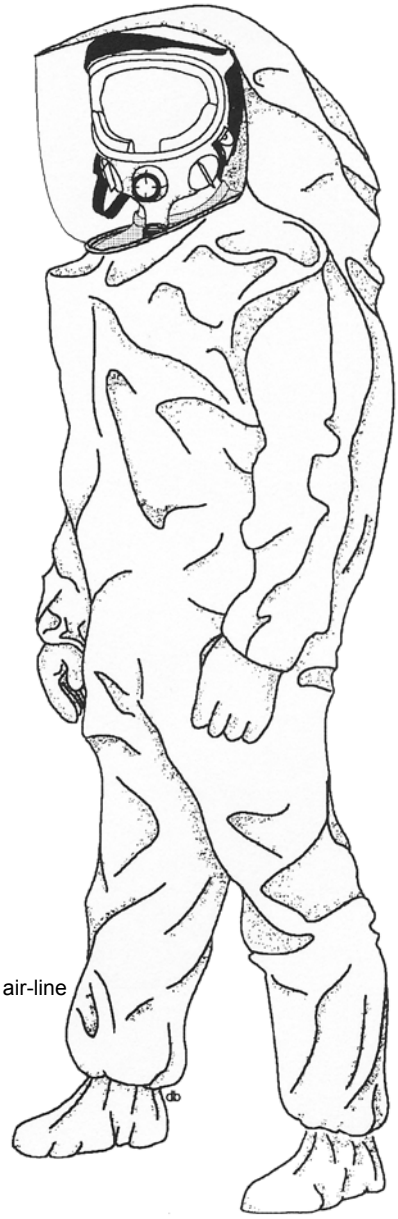
Level A

Level A is the highest level of protection which can be worn by a site worker. It is unlikely that any meth lab cleanup worker would wear level A protection, unless the chemicals had not been removed from the lab.

When Is Level A Protection Needed?

Level A protection is required when:

- The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and respiratory system.
- There is potential for splash, immersion, or exposure to unexpected vapors, particulates, or gases that are harmful to the skin or may be absorbed through the skin.
- Confined-space entry may be involved and the need for Level A cannot be ruled out (but explosion hazard has been ruled out).
- The skin absorption hazard may likely result in immediate death or serious illness/injury or impair the ability to escape.



What Is Level A Protection?

The following list constitutes Level A equipment; it may be used as appropriate:

- Positive-pressure, pressure-demand, full-facepiece SCBA or positive-pressure, supplied-air to full-face piece with escape SCBA (NIOSH-approved).
- Totally encapsulating chemical-protective suit (gas tight or vapor tight).
- Inner and outer chemical-resistant gloves.
- Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally encapsulating suit).
- Coveralls*.
- Long underwear*.
- Hard hat (under suit)*.
- Chemical-resistant boots with steel toe and shank.
- Cooling system (ice vest, water/air circulation)*.

- *Optional as applicable

Note: Suit must be properly equipped with a pass-thru air-line connection, referred to as an air-line

Level B

Level B is used when maximum respiratory protection is desired but the skin/eye hazards do not require Level A. If all of the chemicals have been removed from the meth lab site and it has been aired out, it is also unlikely that level B protection would be needed at a clean up.

When Is Level B Protection Needed?

Level B protection is required when:

- The highest level of respiratory protection is needed but a lower level of skin protection is acceptable.
- The type of substances have been identified.
- An SCBA is required.
- Less skin protection is needed. (Vapor and gases are not believed to contain high levels

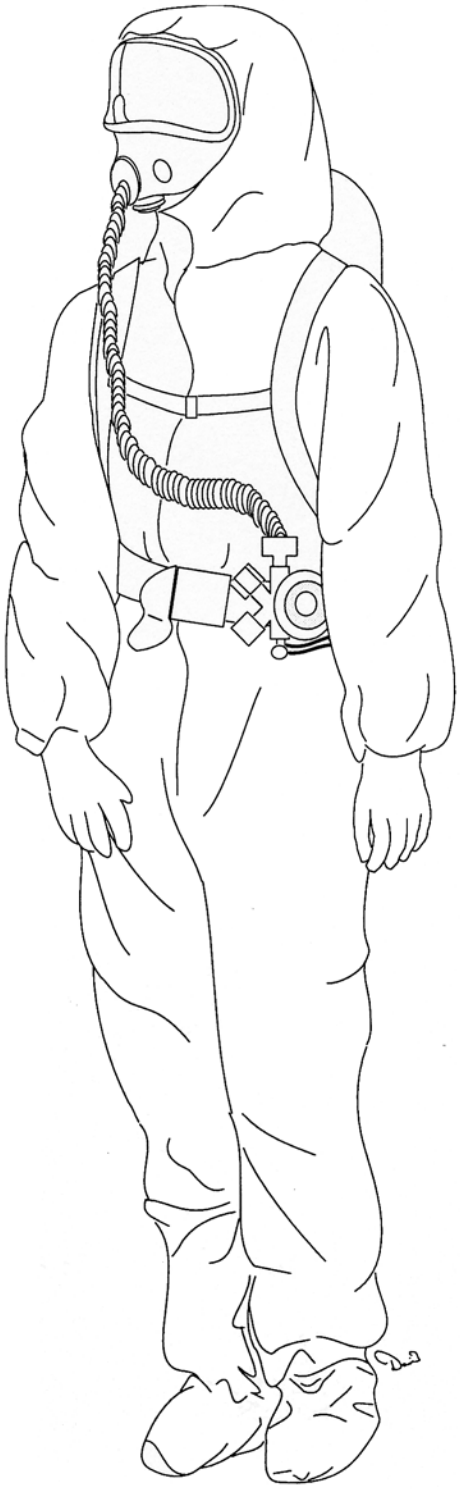
of chemicals harmful to skin or capable of being absorbed through intact skin.)

What Is Level B Protection?

The following constitutes Level B equipment; it may be used as appropriate.

- Positive-pressure, full-facepiece SCBA or positive-pressure, pressure-demand, supplied-air to full-face piece with escape SCBA (NIOSH approved).
- Hooded chemical-resistant clothing or total encapsulating chemical suit (not gas tight or vapor tight).
- Inner and outer chemical-resistant gloves.
- Outer chemical-resistant boots with steel toe and shank.
- Boot covers: outer, chemical-resistant (disposable)*.
- Hard hat*.
- Face shield*.
- Cooling system (ice vest, water/air circulation)*.

New Level B chemical-resistant clothing is designed to go over the SCBA tank. If appropriate for the potential exposures, this CPC should be used to protect the SCBA and prevent its contamination.



*Optional as applicable

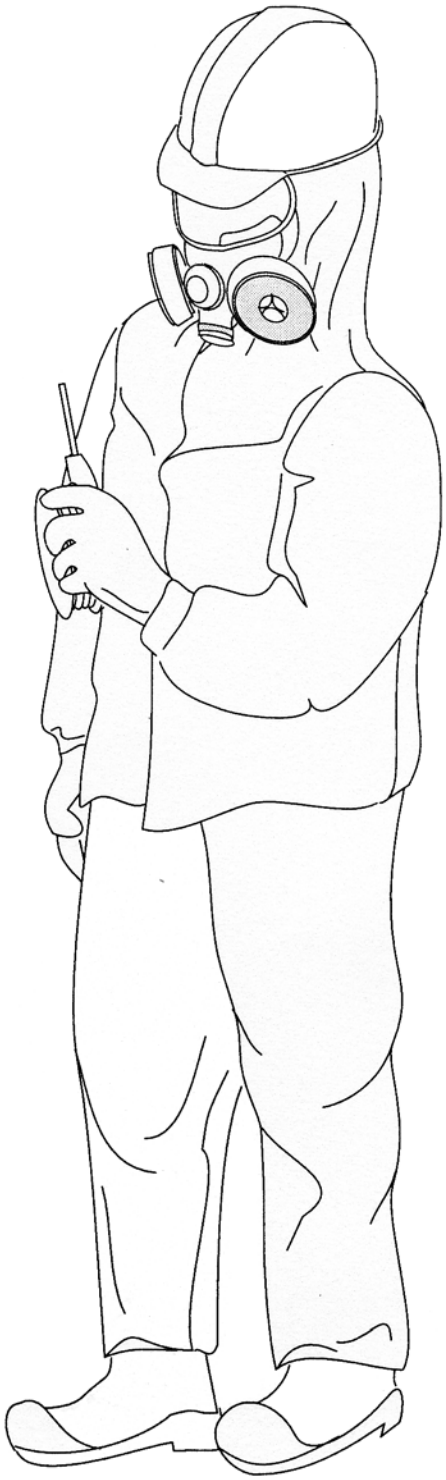
Level C

Level C provides less skin and respiratory protection than other levels.

When Is Level C Protection Needed?

Level C provides protection when:

- The concentration(s) and type(s) of airborne substance(s) are known and the criteria for using an air-purifying respirator are met.
- Direct contact with the hazardous substance will not harm the skin or the substance will not be absorbed through any exposed skin.
- Air contaminants have been identified, concentrations measured, and an air-purifying respirator is available that can remove the contaminants.
- An adequate level of oxygen (> 19.5%) is available and all other criteria for the use of air-purifying respirators are met.



What Is Level C Protection?

The following list constitutes Level C equipment; it may be used as appropriate.

- A full-face or half-mask air-purifying respirator (NIOSH-approved).
- Hooded chemical-resistant clothing.
- Inner and outer chemical-resistant gloves.
- Coveralls*.
- Boots (outer), chemical-resistant steel toe and shank*.
- Boot covers: outer, chemical-resistant (disposable)*.
- Hard hat*.
- Escape mask*.
- Face shield*.

*Optional as applicable

Level D

This level offers no respiratory protection and low skin protection.

When Is Level D Protection Needed?

Level D is required when:

- Minimal protection from chemical exposure is needed. It is worn to prevent nuisance contamination only when:

  The atmosphere contains no known hazards.

  Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

What Is Level D Protection?

The following list constitutes Level D equipment; it may be used as appropriate.

- Coveralls (work uniform).
- Chemical-resistant boots or shoes with steel toe and shank.
- Hard hat*.
- Gloves*.
- Outer, chemical-resistant boots (disposable)*.
- Safety glasses or chemical splash goggles*.
- Escape mask*.
- Face shield*.

*Optional as applicable

Typical Uses of Level D Equipment

Level D protection is worn by personnel who may be exposed only to nuisance contamination while working with hazardous materials. Typically, workers involved with support activities such as equipment supply, maintenance, off-site vehicle operation, or supervision/management will wear Level D.

Level D may appear similar to “typical work clothes.” Differences include the chemical-resistant boots with steel shank.

A general rule for which level of protection to use is: **“The less you know, the higher you go.”**

Remembering Levels of Protection

A helpful way to remember the levels of protection is:

- Level A—”A”ll Covered
- Level B—”B”reathing Air
- Level C—”C”artridge Respirator

Characteristics and Properties of CPC

- PPE is effective only if it's properly selected, worn, and maintained. SOPs for these aspects of PPE are included in the safety and health plan.
- Whenever possible, a variety of suit sizes should be on hand to fit the various sizes of personnel.
- The adhesive on the tape may degrade the suit.
- Materials used to make most suits do not "breathe." Rapid heat and moisture build-up will occur in the suit during use.
- All suits have limits as to the temperature at which they can be worn without damage. This information may be particularly important for emergency response or hot-work activities. Check the manufacturer's data.
- Suits offer no fire protection and in some cases increase the possibility of injury because they will melt and may burn.

Penetration, Degradation, and Permeation

Chemicals can reduce the effectiveness of CPC garments through penetration, degradation, or permeation.

Penetration	The flow of a chemical through zippers, stitched seams, or pores or imperfections in the material.
Degradation	A reduction in one or more physical properties of a protective material due to contact with a chemical.
Permeation	The process by which a chemical moves through a protective material on a molecular level. The rate of permeation is dependent on five major factors: • Contact time. • Concentration. • Temperature. • Size of the contaminant molecules and pore space. • Physical state of wastes.

The table on the following page lists and describes some chemical-resistant materials used in CPC and their advantages and disadvantages.

Chemical-Resistant Materials

The following list describes some commonly used chemical-resistant materials and their advantages and disadvantages. This list should not be used to select materials; manufacturer's guidelines and other references should be consulted.

Butyl Rubber

Use Mainly in encapsulating suit, but some gloves, boots, and splash gear.

Advantages Good for bases and many organics. Very resistant to gas/vapor permeation. Readily releases contamination. Good heat and ozone resistance.

Disadvantages Poor for aliphatic and aromatic hydrocarbons, gasoline, halogenated hydrocarbons, and abrasion resistance. More expensive than PVC or neoprene.

Chlorinated Polyethylene (CPE)

Use Only in fully encapsulating suits from ILC Dover.

Advantages Good for aliphatic hydrocarbons, acids and bases, alcohols, and phenols. Resists abrasion and ozone.

Disadvantages Poor for amine, esters, ketones, and halogenated hydrocarbons. Becomes very rigid when cold.

Natural Rubber

Use For boot covers because of durability and for disposable inner and outer gloves.

Advantages Good for bases, alcohols, and dilute acids. Inexpensive. Flexible.

Disadvantages Poor for organic chemicals. Ages (affected by ozone).

Neoprene

Use In all types of protective clothing.

Advantages Better than polyvinyl chloride (PVC) for organics. Durable. Abrasion- and cut-resistant.

Disadvantages Not as good as PVC for acids and bases. Poor for chlorinated aromatic solvents, phenols, and ketones. More expensive than PVC.

continued on the following page

Chemical-Resistant Materials, cont.

Nitrile Rubber

Use	In gloves and boots and one encapsulating suit.
Advantage	Made specifically for petroleum products. Abrasion- and cut-resistant. Flexible. Good for bases, peroxides, PCBs, phenols, and alcohol.
Disadvantage	Poor for aromatic and halogenated hydrocarbons, amines, ketones, and esters. Loses flexibility in cold weather.

Polyurethane

Use	In boots and splash gear.
Advantage	Good for bases and organic acids, oils, and alcohols. Abrasion-resistant. Flexible (especially in cold weather).
Disadvantage	Poor for inorganic acids and other organic solvents.

Polyvinyl Alcohol (PVA)

Use	For gloves only.
Advantage	Excellent (the best) for oils, aromatic solvents, and chlorinated hydrocarbons. Ozone-resistant.
Disadvantage	Degraded by water. Not flexible. Expensive.

Polyvinyl Chloride (PVC)

Use	All types of protective clothing.
Advantage	Excellent for acids and bases. Very durable. Relatively inexpensive.
Disadvantage	Poor for chlorinated and aromatic solvents. Difficult to decontaminate.

Viton

Use	In fully encapsulating suits and gloves.
Advantage	Good for most organics including chlorinated hydrocarbons. Fair durability. Good for acids. Good for decontamination. Good for physical properties.
Disadvantage	Poor for oxygenated solvents—aldehydes, ketones, esters, and ethers. Expensive.

continued on the following page

Chemical-Resistant Materials, cont.

Teflon

Use	In fully encapsulating suits.
Advantage	Excellent chemical resistance against most chemicals.
Disadvantage	Limited permeation test data. Expensive.

Nomex

Use	For firefighters' turnout gear and a base fabric for some suits.
Advantage	Acid- and fire-resistant. Durable.
Disadvantage	Readily penetrated.

Tyvek

Use	Predominantly for coveralls.
Advantage	Dry particulate and dust protection. Disposable, lightweight, and inexpensive.
Disadvantage	Penetrable if not chemically treated. Poor durability.

Polyethylene (coated Tyvek)

Use	Predominantly for coveralls, but also gloves and booties. It can be worn over CPC to prevent gross contamination of non-disposables.
Advantage	Good for acids and bases, alcohols, phenols, and aldehydes. Good for decontamination (disposable) and lightweight.
Disadvantage	Poor for halogenated hydrocarbons, aliphatic and aromatic hydrocarbons. Not very durable. Easily penetrated (stitched seams).

Effectiveness of Protective Materials Against Chemical Degradation

Generic Class	Butyl Rubber	Polyvinyl Chlorine	Neoprene	Natural Rubber
Alcohols	4	4	4	4
Aldehydes	3–4	2–3	3–4	2–4
Amines	2–4	2–3	3–4	2–3
Esters	2–3	1	2	1–2
Ethers	2–3	3	3–4	2–3
Halogenated Hydrocarbons	1–3	1	2	1
Hydrocarbons	1–2	2	2–3	1–2
Inorganic Acids	2–3	4	3–4	1–2
Inorganic Bases and Salts	4	4	4	4
Ketones	4	1	2–3	2–4
Natural Fats and Oils	2–3	3	3–4	2–3
Organic Acids	4	4	4	4

4 = Excellent 3 = Good 2 = Fair 1 = Poor

Source: *Survey of Personal Protective Clothing and Respiratory Apparatus*. DOT, USCG, Office of Research and Development (September, 1974) of material and thickness.

A general rule of thumb is that the permeation rate is inversely proportional to the thickness (2 x thickness = 1/2 x permeation rate). Other important factors are chemical concentration, contact time, temperature, material grade, humidity, and solubility of the material in the chemical.

Precautions When Wearing CPC

Every level of chemical-protective clothing has limitations. The following precautions should be considered.

- Hearing and speaking are difficult in CPC with respiratory protection. It is important to establish other ways to communicate with each other. Hand signals or audio signals such as horns, sirens, and whistles can be used to communicate. Communication can also be improved by using two-way radios, such as a portable radio with microphone or radio with a microphone and speaker combination attached to the full-face respirator. Remember, any radio must not add a hazard to the area.
- Due to the size and weight of some suits, motion is restricted, especially when climbing, working in tight areas, or using hand tools.
- Look for signs of heat stress (dizziness, headache, nausea, perspiration ceases), especially at temperatures over 70ºF.
- Always wear the correct size of footwear in order to prevent accidents. You should also make certain that the soles provide a proper grip for the surfaces that you will be encountering. Steel shanks, toes, and shin guards help to prevent puncture wounds and/or crushing injuries.
- Disposable booties may be slippery. Use caution when walking to prevent slips and falls.
- Care should be taken when donning and doffing inner and outer gloves. When donning gloves, make sure that no cracks or tears are present. When doffing gloves, take care not to spread contamination.
- All joints such as suit-to-boots and suit-to-gloves in Levels B and C protection should be secured with tape. Fold the end of the tape back under to make a tab for easy removal. Use special care when removing tape.
- Goggles and eye/face protection may become clouded due to moisture condensation during use. Use some sort of anti-fog film or spray when needed. When wearing Level A, you may want to keep a cloth inside the suit to wipe fog off the inside face shield.
- Avoid placing your hands or knees on the ground when in the Hot Zone to prevent contamination by chemicals and abrasion to the suit material.
- When removing a suit, open and fold into itself as it is removed to prevent contamination of internal clothing.
- Suits have weak seams, especially if they are disposable. Be careful not to strain and split them. If splitting occurs, report it and follow the appropriate SOP (standard operating procedure).
- Use caution when suits are used in potential fire areas. If fire occurs, get out of the area.

Inspection, Maintenance, and Storage of CPC

It is important to inspect CPC, for evidence of chemical damage. CPC which is torn, degraded, or otherwise non-functional will not offer adequate protection to the wearer. The safety and health plan should describe or reference SOPs for CPC inspection, maintenance, and storage.

CPC should always be inspected when it is:

- Received from the distributor.
- Issued to workers.
- Put into storage.
- Taken out of storage.
- Used for training.
- Used for work or an emergency response.
- Sent for maintenance.

An inspection checklist should be developed for each item. Factors to consider are:

- Cuts, holes, tears, swelling, and abrasions in seams of fabric.
- Weakness in zipper or valve seals.
- Signs of contamination such as discolorations or visible chemical.
- Signs of malfunctioning exhaust valves.

Note: CPC may be contaminated even though it doesn't appear discolored.

Proper **maintenance** can prevent CPC deficiencies and prolong its life. A detailed SOP must be developed and followed rigorously.

Proper **storage** is important in order to prevent suit failures. The written SOP should describe storage before the CPC is issued to the wearer (in a warehouse, on-site, etc.), as well as storage after use. Check the manufacturer's data, as most CPC used now has a shelf life.

Testing Guidelines

The following table lists guidelines for testing different types of personal protective equipment:

Protective Equipment	Testing Guidelines
Hard Hats	ANSI Z89.1-1997, Industrial Head Protection
Shoes	ANSI Z41-1991, Personal Protection—Footwear
Eye/Face	ANSI Z87.1-1989, Occupational and Educational Eye and Face Protection
Levels A and B Suits	29 CFR 1910.120, Appendix A—PPE Test Methods ASTM F23.50.01, Practice for Pressure Testing of TECP NFPA 1991, Standard on Vapor-Protective Suits for Hazardous Chemical Emergencies (EPA Level A) NFPA 1992, Standard on Liquid Splash-Protective Suits for Hazardous Chemical Emergencies (EPA Level B) ANSI/ISEA-101-1996, Limited-Use and Disposable Coveralls—Size and Labeling Requirements
Chemical-Resistant Clothing	ASTM F739, Permeation ASTM F903, Penetration

High-Temperature Clothing

High-temperature clothing may be referred to as flash-over protective suits. Such clothing consists of a one- or two-piece overgarment with boot covers, gloves, and hood made of aluminized or cotton fabric.

High-temperature clothing is normally worn over other protective clothing, such as CPC, firefighters' turnout gear, or flame-retardant coveralls.

Although high-temperature clothing protects against brief exposure to heat, it generally does not protect against damage caused by chemical exposure. Some of this clothing can be made by the manufacturer to protect against some hazardous materials.

Typical Protective Clothing and Equipment Worn During Meth Lab Cleanup Activities

There are three basic hazards found at a meth lab cleanup site that PPE protects against: inhalation hazards, injection hazards, and skin or eye contact hazards.

During a meth lab bust - typically no cleanup workers will be present yet, just police - inhalation hazards are a big problem. The process of cooking methamphetamine involves large amounts of solvents, which release toxic fumes, and other gases and vapors. People present during a bust should wear appropriate respiratory protection based on the levels of chemicals present.

During cleanup activities, inhalation hazards are not a major concern. By the time cleanup workers arrive, most vapors and gases will have evaporated and dissipated into the atmosphere. However, there may be dust and residual odors at the lab from human waste, trash, or chemicals that voluntary use of a simple dust mask will help with.

Meth users often inject the drug into their blood stream with hypodermic needles. These needles may be discarded in strange places, so workers should be aware when they examine furniture or trash piles. Used needles can be contaminated with the AIDS-causing HIV virus and/or hepatitis. PPE to protect against injections would include leather gloves and leather work boots. Hepatitis vaccines would also be a good protective measure.

The most common hazards that meth lab cleanup workers will need to guard against are skin and eye contact. Chemical residues left from the meth manufacturing process will contaminate practically every surface in the meth "kitchen". These chemicals. typically strong acids and bases, can be absorbed into the body through the skin and eyes. To protect against exposure, workers should wear a splash apron or coated disposable coveralls, safety glasses or a face shield, boots and chemical-protective gloves.

Scenarios: Selecting Protective Clothing

Scenario 1:
As an industrial hygienist, you are going with a unit investigating a suspected drug lab. What PPE should you and your colleagues wear?

Scenario 2:
You and your colleagues are entering a meth lab to perform cleanup activities. You see fishing line tied across the porch and suspect a booby trap. What PPE should you wear to protect yourself from this trap and others which may be waiting inside?

Scenario 3:
You are volunteering to do roadside cleanup along a highway. You notice an overturned picnic cooler, empty plastic bottles and the smell of cat urine. You suspect someone has dumped meth lab waste. What should you do? What PPE should emergency responders wear before approaching?

Name _____

Buddy's Name _____

PPE Performance Checklist
Donning and Doffing Level C

1. List the size that you chose for all of the following equipment. If you did not wear the listed equipment, put an "X" on the line.

   a. Chemical-protective clothing Size_____
   b. Air-purifying respirator Size_____
   c. Boots Size_____ Brand _____
   d. Inner gloves Size_____
   e. Outer gloves Size_____
   f. Hard hat Size_____

   List any equipment for which you could not find a proper size, and state whether you needed a larger or smaller size.

   Type of Equipment _____ Size _____

   Type of Equipment _____ Size _____

2. Did you inspect the equipment before donning it? ..... ☐ Yes ☐ No

3. Did your buddy:
   a. Make pull tabs when taping your boots/pants?..... ☐ Yes ☐ No
   b. Make pull tabs when taping your gloves/sleeves?..... ☐ Yes ☐ No
   c. Review the communications system with you?..... ☐ Yes ☐ No

4. Did you do an assigned task?
   If yes, describe the task: _____
   _____

5. Did you take off the suit in a manner that would protect you and the other workers around you from contamination? ..... ☐ Yes ☐ No

6. Did you remove your inner gloves properly? ..... ☐ Yes ☐ No

7. When removing your respirator:

   a. were you wearing your inner gloves?..... ☐ Yes ☐ No
   b. did you extend your facepiece straps?..... ..... ☐ Yes ☐ No
   c . did you wash the respirator?..... ☐ Yes ☐ No

8. How long did you stay in Level C? _____ minutes

Date _____ Instructor's Signature _____

Name _____

Buddy's Name _____

PPE Performance Checklist
Donning and Doffing Level D

1. List all of the following that you wore and put an "X" on the line. Describe the hazard this protects against at a meth lab cleanup.

Clothing:	Used (put X if yes)	Hazard
a. Coveralls	_____	_____
b. Hard hat	_____	_____
c. Chemical-resistant boots, with steel toe and shank	_____	_____
d. Outer, chemical resistant boots (disposable)	_____	_____
e. Gloves	_____	_____
f. Safety glasses or chemical splash goggles	_____	_____
g. Escape mask	_____	_____
h. Face Shield	_____	_____

2. Did you inspect the equipment before donning it? ..... ☐ Yes ☐ No
3. Did you do an assigned task?
   If yes, describe the task: _____
   _____
4. Did you take off the protective gear in a manner that would protect you and the other workers around you from contamination? ☐ Yes ☐ No
5. Did you remove your boot covers properly? ..... ☐ Not used ☐ Yes ☐ No
6. How long did you stay in Level D? _____ minutes

Date _____ Instructor's Signature _____

Summary - Chemical-Protective Clothing

PPE includes respirators, chemical-resistant suits, boots, gloves, chemical goggles, and face shields. PPE is required by OSHA regulations and protects workers from:

- Chemical contact with skin and eyes.
- Noise.
- Temperature.
- Respiratory hazards.

Levels of PPE

Level A provides the most protection and includes:

- A positive-pressure, full-facepiece SCBA or supplied-air respirator with escape unit.
- A totally encapsulating chemical-protective suit.
- Inner and outer chemical-resistant gloves.
- Chemical-resistant boots with steel toe and shank.

Level B includes:

- A positive-pressure, full-facepiece SCBA or supplied-air respirator with escape unit.
- Hooded, chemical-resistant clothing.
- Inner and outer chemical-resistant gloves.
- Chemical-resistant boots with steel toe and shank.

Level C includes:

- Full- or half-face air-purifying respirator (APR).
- Hooded, chemical-resistant clothing.
- Inner and outer chemical-resistant gloves.
- Chemical-protective boots with steel toe and shank.

Level D includes:

- Coveralls.
- Chemical-resistant boots with steel toe and shank.

PPE must be properly maintained. Wearers should know the requirements of PPE. Written programs about selection, care, and use of PPE should be referenced or included in the safety and health plan.

Key Terms - Chemical-Protective Clothing

Identify or define the following:

- Totally encapsulating chemical-protective suit
- Chemical-resistant suit
- Level A protection
- Level B protection
- Level C protection
- Level D protection
- Penetration
- Degradation
- Permeation

Review Questions - Chemical-Protective Clothing

1. What are some general types of PPE?

2. List three situations at a work site that require PPE. What level of protection (A, B, C, or D) is required for each situation?

3. List some precautions to take while wearing PPE.

4. When should PPE be inspected?

5. When should PPE be replaced?

Background Reading Material - Personal Protective Equipment

Occupational Safety and Heath Guidance Manual for Waste Sites, 1989. (NIOSH # 85-115)

Chapter 8 Personal Protective Equipment, p. 1–24

Appendix D Decontamination of Levels A, B, C

EPA's Standard Operating Safety Guides, July 1988.

Part 5 Site Entry—Levels of Protection, p. 1-14

Part 7 Decontamination, p. 9-11 and Annexes

*Pocket Guide to Chemical Hazard*s, June 1990. (NIOSH # 90-117)

p. 19-21, column 9 of text—Personal Protection and Sanitation.

Hazardous Waste Operations and Emergency Response Standard Federal Register, Final Rule.
March 6, 1989. (29 CFR, 1910.120)

.120 (g) (3) Personal Protective Equipment

.120 (g) (5) Personal Protective Equipment Program

.120 (e) (1) (iii) Use of Personal Protective Equipment

.120 (f) (1) (ii) Medical Program for Respirator Wearers

Ergonomic Criteria for the Selection of Chemical Protective Clothing, J.O. Stull, Washington D. C., Workplace Health Fund, 1991

"Meth Lab Waste Makes Roadside Cleanup Risky." *The Cincinnati Post*. 3.20.2006

Web Resources:

- www.whitehousedrugpolicy.gov
- www.methamphetamine.com
- www.michigan.gov/meth
- www.nationaljewish.org/news/health-news/y2005/meth_research_results.aspx

Appendix B: Decontamination

Decontamination is the process of removing and disposing of or neutralizing contaminants that have accumulated on personnel and equipment. The decontamination standard operating procedure describes a decontamination plan, methods of decontamination, and what to do if an emergency occurs.

Chapter Objectives

When you have completed this chapter, you will be better able to:

- Understand the necessity and importance of proper decontamination methods.
- Outline methods to prevent contamination of personnel, PPE, and other equipment.
- Describe the purpose of work zones and outline considerations for establishing them.
- Describe basic methods used in physical and chemical decontamination.
- Participate in a decontamination line.

Introduction

Decontamination is the process of removing and/or neutralizing contaminants that may have accumulated on PPE, personnel, and other equipment. Proper decontamination procedures include:

- Controlling hazards.
- Protecting workers from exposure to hazardous materials.
- Preventing continued contamination and perneation of the hazardous material into PPE, other equipment, and tools.
- Protecting personnel outside the response area by minimizing the transfer of harmful materials into clean areas.
- Preventing mixing of incompatible materials.
- Preventing the uncontrolled transfer of contaminants to the community.

Pre-Planning for Decontamination

Decontamination is the process of removing and/or neutralizing contaminants that may have accumulated on PPE and equipment. Proper decontamination or replacement of protective clothing or equipment is critical in controlling hazards and ensuring the health and safety of workers. The need for decontamination is documented in the employer's safety and health plan. Details of decontamination procedures are also listed there.

Proper decontamination procedures must:

- Be developed, communicated to employees, and implemented before employees or equipment enter the work site.
- Control hazards.
- Protect workers from exposure to hazardous substances or contaminated equipment.
- Prevent continued contamination and permeation of the hazardous substance into PPE, other equipment, and tools.
- Locate decon areas where they limit the transfer of harmful exposures to employees in clean areas.
- Prevent the mixing of incompatible substances.
- Prevent the uncontrolled transfer of contaminants to the community.
- Be monitored by the safety and health supervisor and revised as necessary.

When Is Decontamination Required?

Each decontamination site has different risks of contamination. The company-specific safety and health plan should specify when, where, and how decontamination will occur. The following examples illustrate situations when decontamination may be required:

- When PPE or clothing becomes contaminated.
- Before personnel go from a “dirty” to “clean” work area.
- Before workers eat, drink, smoke, or use restroom facilities.
- Before transport trucks leave the site.
- Before other equipment leaves the site.

Site management must describe a decontamination plan in the required safety and health plan. The plan must be operational before any personnel or equipment enters areas with potentially hazardous substances. The plan must also be monitored by the site safety and health supervisor.

Situations at a meth lab cleanup that require decontamination of work clothing, tools or personnel include:

Testing shows that the contents of the plastic jug hidden above the ceiling that came do during demolition, splashing you and two others, has a pH of 13.

Tools fell into a cistern that was used for chemical disposal by the cookers, and you want to save the tools for the next job.

A plastic bag of contaminated debris broke as you tried to hoist it into the dumpster. Now you look like a snowman.

Include the following in a decontamination plan:

- A description of the location and layout of potential decontamination stations for the site.
- A list of the decontamination equipment needed for the possible hazards (for example, water for removal and brushes for scrubbing).
- The appropriate PPE for persons assisting with decontamination.
- Specific procedures for decontamination of substances that may be encountered on the site.
- Methods and procedures for preventing contamination of clean areas.
- Methods and procedures for minimizing worker contact with contaminants during removal of PPE.
- Safe disposal methods for clothing and equipment which are not completely decontaminated.
- Revisions whenever the type of personal protective clothing or equipment changes, the site conditions change, or the site hazards are reassessed based on new information.

Protective clothing and equipment must be decontaminated, cleaned, laundered, maintained, or replaced as often as necessary to protect the worker effectively.

Preventing Contamination

It is important to establish a set of standard operating procedures (SOPs) that minimize contact with any hazardous substances. All workers who may be exposed should be informed of, understand, and practice the written SOPs.

SOPs are established to maximize worker protection. For example, proper procedures for donning PPE will minimize the potential inhalation or absorption of contaminants. Some examples of proper PPE donning procedures include:

- Inspecting PPE before each use to ensure it is in proper condition.
- Closing zippers, buttons, and snaps fully.
- Wearing a third pair of tough outer gloves over the sleeves.
- Tucking boots under the legs of outer clothing.
- Wearing hoods, if not attached, outside the collar.
- Taping all junctures (if tape adhesive is compatible with suit materials) to help prevent contaminants from running inside gloves, boots, and jackets.

Other precautionary measures can help reduce the amount of contamination during routine work activities, such as:

- Following SOPs that minimize contact with hazardous substances.
- Not walking through puddles, plumes, or areas of obvious contamination.
- Properly disposing of equipment and solvents used for decontamination.
- Not directly touching potentially hazardous substances.
- Using remote sampling, handling, and container-opening techniques and devices such as drum grapplers and impact wrenches.
- Covering monitoring and sampling instruments (plastic bags with openings for sensors that must contact hazardous substances).
- Wearing disposable outer garments and using disposable equipment where appropriate.
- Containing the source of the hazardous substance.
- Covering equipment and tools with a coating which can be stripped away during decontamination.

Work Zones

It is critical to prevent movement of contaminated materials and contaminants from the incident scene. This movement may be prevented by establishing work zones. Three work zones should be established:

- The **Hot Zone**, which is the area contaminated by the spill or release.
- The **Warm Zone or Contamination Reduction Zone (CRZ)**, which is the area surrounding the hot zone where decontamination occurs.
- The **Cold Zone or Support Zone**, which is the area free of contamination where support activities occur.

Primary Activities in Each Work Zone

Different activities are performed by authorized responders in each zone of the decontamination line. These activities and the personnel required to conduct them should be restricted to the appropriate zones.

Exclusion Zone

The Exclusion Zone refers to the area where the hazard is present. The size of the zone is determined by the characteristics of the emergency and access points. The “Hot line” is the outer boundary and should be clearly marked with hazard tape, lines, signs, or ropes. Further subdivision of the area may be necessary depending on the hazard and incompatibility of substances spilled or released. The level of PPE necessary will be determined by type of substance, monitoring, and the Emergency Response Plan. It will usually be Level A or Level B, as Level C is used only when the exposures are known.

Hot and Warm Zones (also called the Transition Zone)

Decontamination takes place in a designated area called the Contamination Reduction Corridor (CRC). The degree of contamination decreases as the line moves away from the Hot Zone. PPE for Warm Zone workers is usually one level lower than that used in the Hot or Exclusion Zone. Depending on the substance, however, the same level of PPE as used in the Exclusion Zone may be needed.

Cold Zone (also called the Support Zone)

The Cold Zone is the area free of contamination. In the Cold Zone, the worker is made free of all PPE and medically assessed. Final determinations should be made here as to the effectiveness of the decontamination line and the medical status of the responder by physical examination and use of monitoring equipment. This zone is where administrative and other support functions are located that keep the Cold, Warm, and Exclusion Zones running smoothly. No PPE should be needed in this area.

The graphic shown later in this chapter illustrates a typical decontamination layout. Three graphics representing maximum and minimum decontamination layouts for Levels A, B, and C follow. These procedures were derived from the U.S. EPA and the Office of Emergency and Remedial Responses.

Decontamination Procedures

All personnel, clothing, equipment, and sample containers leaving contaminated areas must be decontaminated to remove any hazardous materials that may have adhered to them. Decontamination can be accomplished by:

- Physically removing contaminants.
- Chemically removing contaminants.
- Rinsing off contaminants.
- Disinfecting and sterilizing (infectious materials).
- Combining of the above methods.

Physical Removal of Contaminants

Some contaminants stick to the surface of PPE and equipment. These contaminants can be removed by scraping, brushing, washing, and wiping.

Dust and vapors that cling to PPE and equipment may become trapped in small openings, such as the weave of the fabric, and can be removed with water or a liquid rinse.

Volatile liquid contaminants can be removed from protective clothing or equipment by evaporation followed by a water rinse. Care must be taken to prevent inhalation of the vaporized chemicals.

Chemical Removal of Contaminants

Removing contaminants with a chemical requires special planning and training. The solution must be chemically compatible with the clothing and equipment being cleaned.

Rinsing off Contaminants

A soap and water solution is most frequently used to help remove contaminants. Such solutions are called surfactants.

Rinsing is an important method. Multiple rinses with clean solutions will remove more contaminants than a single rinse with the same volume of solution.

Disinfecting and Sterilizing

Chemical disinfectants provide a means of deactivating infectious agents. Disposable PPE is recommended for use with infectious agents.

All equipment and solvents used for decontamination must be decontaminated and disposed of properly.

Decontamination Line

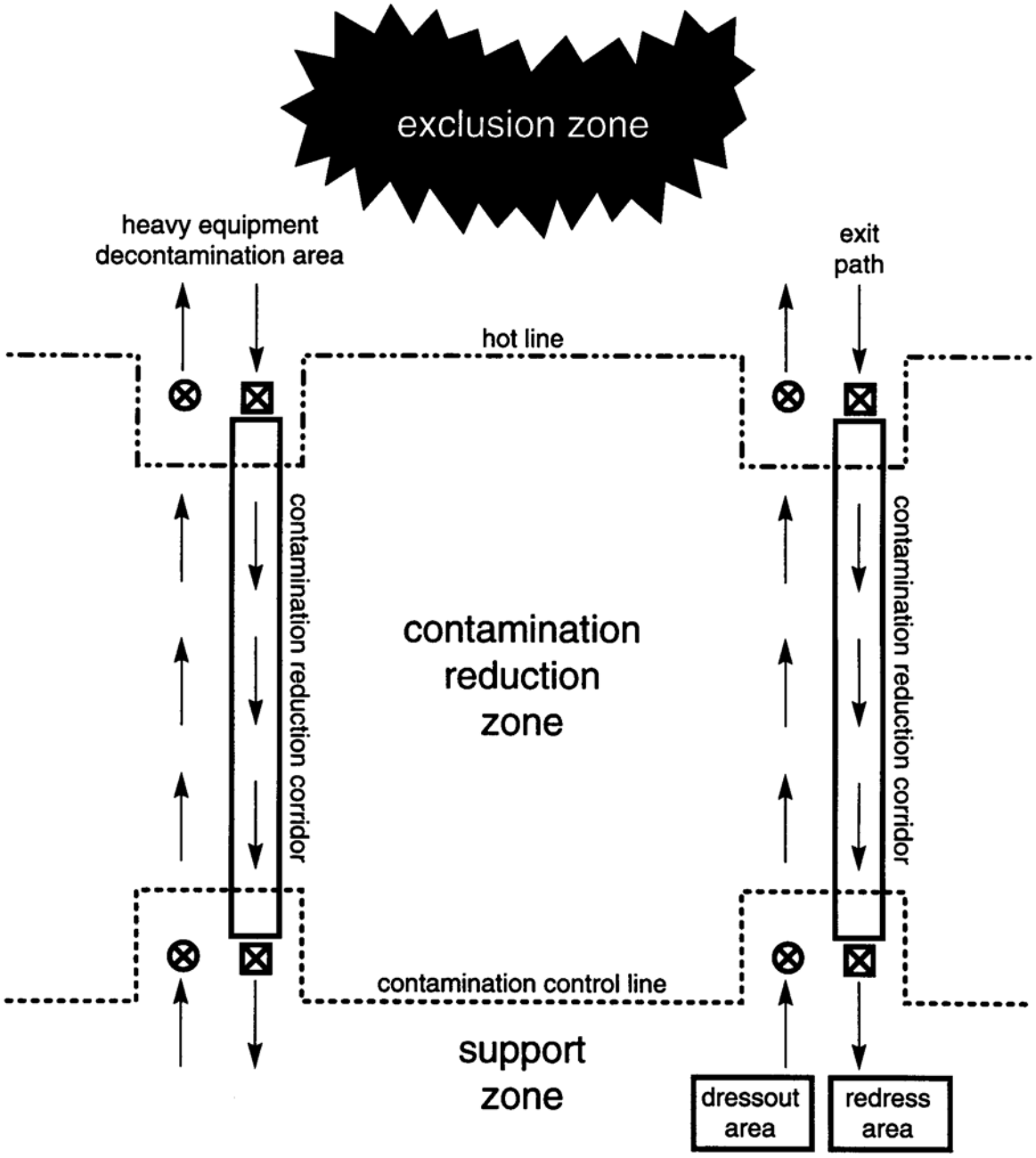
Decontamination must occur before personnel enter any clean areas. Decontamination procedures will vary depending on the nature and extent of contamination. Procedures must be specified in the company's safety and health plan.

The decontamination line is an organized series of procedures performed in a specific sequence to reduce levels of contamination on personnel, PPE, and equipment until no contaminant is present. Each procedure is performed at a separate station. The stations are arranged in order of decreasing contamination, preferably in a straight line. All decontamination activities are located in the Contamination Reduction Corridor (CRC). Almost all of the CRC is located in the Contamination Reduction Zone (CRZ).

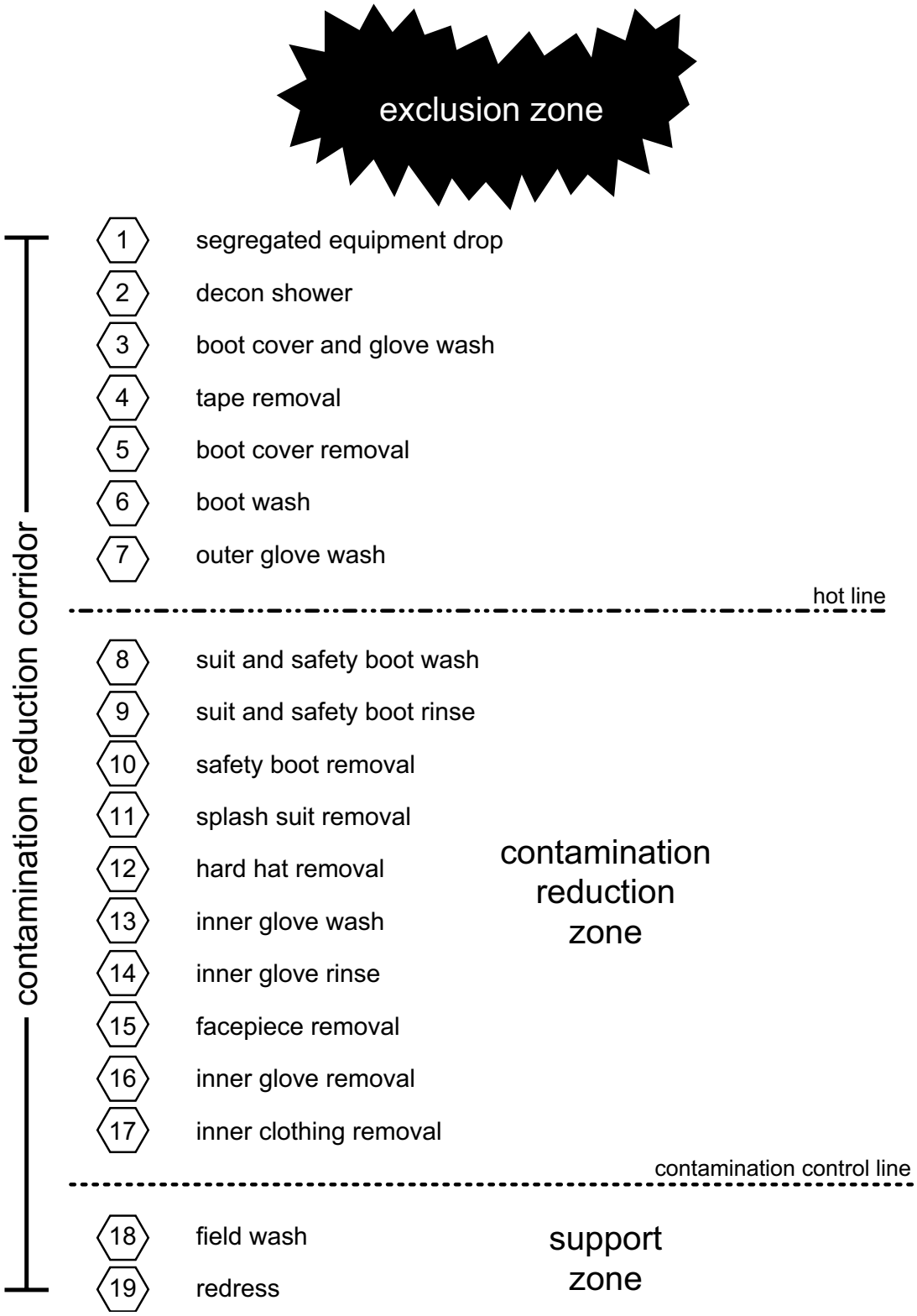
Outer, more heavily contaminated items such as boots, gloves, and suit should be decontaminated and removed first, followed by the decontamination and removal of inner, less-contaminated items (inner boots and gloves).

See the sample decontamination line shown in the next few pages.

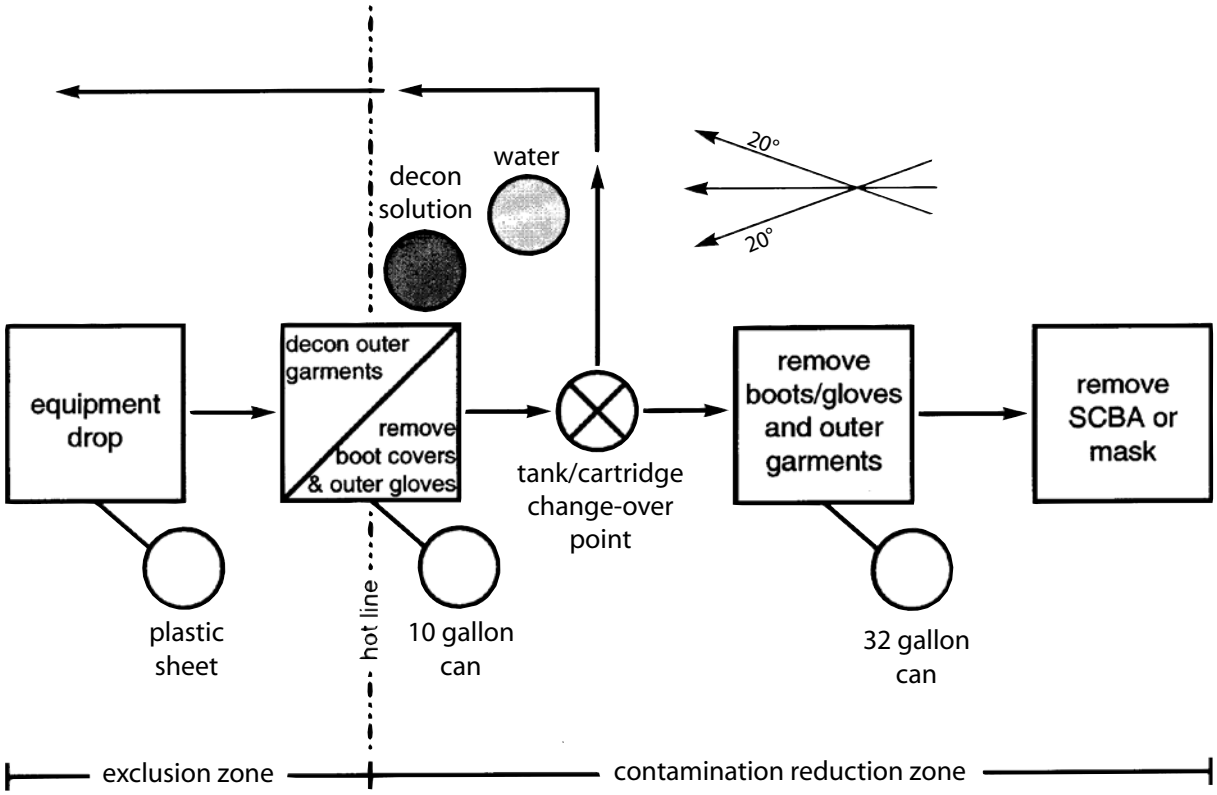
Typical Decontamination Layout



Level C Decontamination Layout



Minimum Decontamination Layout
Level C



Protecting Decontamination Line Workers

Workers may be stationed in the CRZ to assist in decontaminating those who have performed duties in the Exclusion Zone. Decontamination workers at the beginning of the line (in the Hot Zone) will require more protection from contaminants than decontamination workers who are assigned to the last station in the line. The first workers on the decontamination line should wear protection one level below that of personnel in the Hot Zone. For example, if Level B is worn in the Hot Zone, Level C may be appropriate for decontamination workers. In some cases, decontamination personnel should wear the same level of PPE as workers in the Hot Zone. All decontamination personnel must be decontaminated before re-entering the Cold Zone. The safety and health plan should specify the level of PPE to be worn at all positions by decon line workers.

Decontamination of Equipment and Breathing Apparatus

Decontamination of equipment is an important method of preventing deterioration and controlling the spread of hazardous substances.

- **Monitors**: If monitoring equipment becomes contaminated, it will require special cleaning. EPA regional laboratories or the manufacturer can provide information on proper decontamination methods.
- **Tools**: Metal tools should be cleaned, as appropriate, by chemical or physical means. EPA regional laboratories may be consulted for specific decontamination methods. Wooden tools and tools with wooden handles are difficult to decontaminate because they absorb chemicals. They should be discarded if contamination is suspected.
- **Respirators**: Certain parts of contaminated SCBAs and other respirators, such as the harness assembly and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may need to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush, depending on the contaminant. Regulators must be maintained according to the manufacturer's recommendations.

Persons responsible for decontaminating respirators should be thoroughly trained in respirator maintenance. The safety and health plan must detail the methods to be used to decontaminate SCBAs and other respirators.

Preventing Spread of Contamination

Contaminated wash and rinse solutions must be contained by using step-in containers or other methods. Tools that were used in the Exclusion Zone must not be removed without proper decontamination.

Disposal of Contaminated Materials

All contaminated material and equipment used for decontamination must be discarded. Clothing, tools, buckets, brushes, and any other contaminated equipment must be secured in drums or other containers and properly labeled. The spent solutions must be transferred to properly labeled drums and disposed of according to local, state, and federal regulations.

Safety Precautions for Decontamination

- Decontamination solutions must be compatible with the hazardous substances being removed to prevent a reaction which could produce an explosion, heat, or toxic products.
- Include adequate personnel to help each person through the line.
- Provide hand-holds while boots are being washed or boot covers removed.
- If plastic sheeting is used or other slippery surfaces may be encountered, “gripper” decals or other material should be applied to reduce the likelihood of slips.
- Provide stools (not wooden unless they will be disposed of after the job) for personnel to sit on at stations where boots or suits are removed.
- Be sure all areas are cleaned.
- Shower and change rooms provided outside of a contaminated area must meet the requirements of OSHA 29 CFR 1910.141.
- Unauthorized employees must not remove protective clothing or equipment from change rooms.

Assessing Effectiveness of Decontamination

There is not a reliable test to determine the effectiveness of decontamination immediately; but an estimation of effectiveness can in some cases be made by visual observation. More exact information on effectiveness can be gained by sending the PPE to be analyzed for the presence of contamination. Another way to analyze the contaminant is by sampling the final rinse, but it may take several days to receive the results.

Name _____

Buddy's Name _____

Decon Lab Performance Checklist
Decontamination Line

Think about when you were on the decon line, then answer the following questions by checking the appropriate line.

1. Was all of the needed decon equipment assembled? ..... ☐ Yes ☐ No
2. Was the decon team ready when the work team arrived? ..... ☐ Yes ☐ No
3. Did all of the equipment work properly? ..... ☐ Yes ☐ No
4. Were the decon workers wearing appropriate level(s) of protection? ..... ☐ Yes ☐ No
5. Did the decon team stay in communication with the work team? ..... ☐ Yes ☐ No
6. Did the work team follow the decon team's instructions? ..... ☐ Yes ☐ No
7. Were all work team members fully decontaminated? ..... ☐ Yes ☐ No
8. Were waste water and materials controlled? ..... ☐ Yes ☐ No
9. Were the reusable supplies and equipment decontaminated? ..... ☐ Yes ☐ No
10. Did the decon team decontaminate themselves before leaving the area? ..... ☐ Yes ☐ No

Date _____ Instructor's Signature _____

Summary - Decontamination

Decontamination is important for preventing the spread of hazardous substances beyond the site. Proper procedures must be developed prior to beginning the decontamination of a meth lab. Precautions should be taken to prevent contamination of personnel and expensive equipment such as monitors. During the development of the work plan, work zones should be established to control the spread of contaminants. There are three zones:

- The Exclusion Zone/Hot Zone/Danger Zone is where contamination may occur. Only personnel in adequate PPE should be in this zone.
- The Contamination Reduction Zone/Warm Zone/Decontamination Zone is where most of decontamination occurs.
- The Support Zone/Cold Zone/Clean Zone is where there is no contamination and support activities occur.

Methods to decontaminate personnel, PPE, and other equipment will vary depending on the substance at the site. Basic methods include:

- Rinsing or dissolving.
- Scraping, brushing, and wiping.
- Evaporating then rinsing.
- Using surfactants like soap.
- Disinfecting with chemicals.
- Combining the above methods.

The decontamination line is:

- An organized series of procedures.
- Performed in a specific sequence.
- Used to reduce levels of contamination on personnel, PPE, and other equipment.
- In operation until no contaminant is present.

Each procedure is performed at a separate station. Stations are arranged in order of decreasing contamination, preferably in a straight line.

Decontamination activities are located in the Contamination Reduction Corridor (CRC). All personnel working the decon line must be decontaminated before leaving the CRC. All equipment must be decontaminated or disposed of properly.

Key Terms - Decontamination

Identify or define the following:

- Decontamination.
- Decontamination Line.
- Exclusion Zone/Hot Zone/Danger Zone.
- Contamination Reduction Zone/Warm Zone/Decontamination Zone.
- Support Zone/Cold Zone/Clean Zone.
- Contamination Reduction Corridor.

Review Questions - Decontamination

1. Why is it important to decontaminate yourself, PPE, and other equipment before re-entering the clean zone?

2. How can contamination be prevented?

3. Describe basic methods of decontamination.

4. What is the benefit of an established decontamination line?

Background Reading Material - Decontamination

Hazardous Waste Operations and Emergency Response; Final Rule

March 6, 1989 (29 CFR 1910.120)

.120 (b) (3)	Site Control Plan
.120 (d)	Site Control
.120 (c)	Site Characterization
.120 (k)	Decontamination

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

(NIOSH #85-115) October, 1985

Chapter 9	Site Control, p. 1–7
Chapter 10	Decontamination, p. 1–7