



THIRD EDITION

COMPLETE GUIDE TO

Laboratory Safety

TERRY JO GILE, MT(ASCP), MA Ed.



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Laboratory
Safety

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HCPPro

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About the Author

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Terry Jo Gile, MT(ASCP), MA Ed., has more than 40 years of experience as a certified medical technologist and educator. She has a bachelor's degree in biology from Drake University in Des Moines, IA, and a master of arts in education from Central Michigan University in Mount Pleasant. For 20 years, she was a member of the management team at Barnes-Jewish Hospital Department of Laboratories in St. Louis, and served as the safety officer as well as a laboratory safety consultant to the BJC Health System.

As president of her own consulting firm, Safety Lady, LLC, she lectures and consults worldwide on the proper implementation of safety programs and is the author of many publications about safety training, among them *Lab Safety Training Made Simple* (HCPro, 2006). She may be reached through her website, www.safetylady.com.



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—Terry Jo Gile, MT(ASCP), MA Ed.

North Fort Myers, FL, June 2010



Preface

Safety is similar to flossing your teeth—you know you need to do it, but some people do not want to take the time. Occasional neglect will result in a cavity or two, but consistent lack of maintenance can cause real problems. It's the same with safety. Failing to implement and monitor even an adequate safety program can be devastating.

I am honored to provide you with a third edition of *Complete Guide to Laboratory Safety*. It has been three years since the second edition and six years since the first edition. Although safety initiatives have remained consistent, it is important to address current best practices. The content for this third edition will reflect the same quality and thoroughness you have come to know in the previous editions, with a focus on regulations and compliance. However, I have added the following:

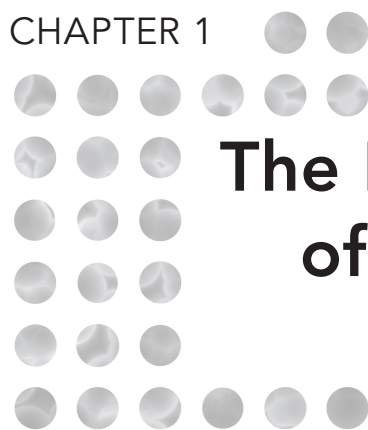
- Many new case studies and safety-savvy tips in each chapter to bring out the important points
- Safety blog posts that provide real-world anecdotes, questions and answers, and clarifications
- News and trends that pertain to the subject matter
- References to applicable checklist questions from the College of American Pathologists and applicable citations and standards from The Joint Commission, the Centers for Disease Control and Prevention, the Occupational Safety & Health Administration, and the International Standards Organization
- A searchable PDF that includes links to relevant standards
- An updated safety audit checklist

Preface

- Lots of tables and figures, and more tools that will make your job easier
- More cartoons to bring fun and humor to safety training education in the lab

This book is all about results—informing you about the current lab safety issues, demonstrating how the regulations play out in reality, and keeping you in the loop and in compliance. The book summarizes the best practices for your safety program and provides operational details. You will learn the day-to-day safety routines that must be a part of every employee’s work schedule so that they are done properly and completely—and, ideally, without a second thought—every single time.

—Terry Jo Gile, MT(ASCP), MA Ed.
North Fort Myers, FL, June 2010



The Law and Science of Laboratory Safety

Lucy was the laboratory safety officer and worked in a laboratory that had an open room concept—chemistry, hematology, urinalysis, and the send-out bench all in one big room. Bob was doing electrophoresis and noticed that the reagent was expired, so he dumped it down the drain with lots of water and made up a new dilution. In the past, any chemical that could be disposed of down the drain was done so under the fume hood, however; the fume hood normally used was closed and labeled not for use.

Two hours later, the smell in the lab was becoming noticeable, and employees were feeling light-headed and sick to their stomach. Lucy was called and immediately knew this chemical should have been sent out to the hazardous waste handler. She called the hospital safety officer, who said the amount dumped (40–50 ml) should not be a concern, but the lingering odor was puzzling. The hospital plumber came into the lab and noticed the empty open bottle was in the central processing department's bucket, which gets picked up daily, cleaned, and returned the next day. The odor was worse in the area where the bucket was located, far away from the sink used for the disposal. This would account for the smell filtering down to the administrative offices.

Lucy brought the completely covered bin, surrounded by a heavy biohazard bag that was taped shut with the material safety data sheet (MSDS) on top of it, to the hospital safety officer, who in turn brought it to the hazardous waste shack for pickup. Lucy made a colorful label for future use for the 2-mercaptoethanol and included proper disposal instructions. She also submitted an injury/illness report to have the incident on file for reference, just in case any of the staff had future medical problems associated with the chemical.

Lessons learned from this experience:

- Never dump chemicals down the drain without checking the MSDS and lab protocol for disposal
- Do not leave empty chemical containers open
- Educate the staff using the incident as a safety lesson
- Use labels to educate the staff on proper disposal protocol

This incident is an Occupational Safety and Health Administration (OSHA) or Environmental Protection Agency citation just waiting to happen. Although we are used to dealing with the science of laboratory safety, we often overlook the law. In today's world, resources are as easy to access as the Internet. However, the prudent lab safety officer recognizes that resources vary and that it's important to use Internet sources that are accurate and trustworthy. Throughout this book, we will provide you with online sources that are known to be reliable. In addition, you can also use the free HCPro resource, OSHA Healthcare Advisor (www.oshahealthcareadvisor.com), which publishes regular blog posts on interpreting OSHA standards, where OSHA's jurisdiction starts and stops, and frequently asked regulatory questions.

ISO 15190

In 2003, the International Organization for Standardization (ISO; www.iso.org) published its ISO 15190 standard to help establish policies and processes that make the laboratory a safer place to work. The standard is designed specifically for safety issues in medical laboratories and covers all aspects of laboratory safety, from management requirements and personnel responsibilities to radiation safety and fire precautions. The standard addresses specific requirements for the most common issues that lead to accidents and injuries. ISO 15190 is intended for use in all types of medical laboratories, from major research and teaching institutions to field laboratories with limited resources. Like ISO's well-known standards for manufacturing quality, ISO 15190 focuses on process, setting standards for equipment, and safe work procedures intended to minimize the risk of accidents, spills, and other adverse incidents. The standard does not address the special needs of laboratories that work with exotic infectious agents requiring elevated levels of containment.

ISO will not inspect or cite your facility for violations at this time; however, adhering to this standard will provide a safe work environment for your employees and help you comply with many required OSHA standards. ISO 15190 will be revised at some point between 2010 and 2012 and will be incorporated as part of future Clinical Laboratory Standards Institute documents. Many labs are more familiar with ISO 15189 (revised in 2007), which deals with the operations of the laboratory. Again, ISO 15190 is not mandated, but it is used worldwide as a parameter of the quality of the laboratory structure and results. This includes how testing is to be provided in a medical emergency and the lab's role in the education and training of healthcare staff.

OSHA

The Occupational Safety and Health Act of 1970—hereafter referred to in this chapter as “the Act”—governs safety in all types of workplaces, including labs. It was enacted in response to the outcry resulting from reports of deplorable conditions in the meat-packing industry. The Act created OSHA to enforce federal rules on workplace safety. The agency has issued specialized standards under 29 *CFR* 1910, which addresses standards for chemical hygiene and exposure to bloodborne pathogens for healthcare workers. You can find more information, including the full text of all OSHA regulations in a searchable database, on the OSHA website (www.osha.gov).

The OSHA requirements with the greatest day-to-day impact for laboratories are the following:

- OSHA's Form 300 Log, for recording and reporting workplace accidents, injuries, or illnesses (see Chapter 2).
- The Hazard Communication standard (1910.1200), specifying how workers must be made aware of hazardous materials in the workplace. A key hazard communication requirement is that the lab must maintain an up-to-date compilation of MSDSs for all hazardous chemicals used or stored (see Chapter 7). Each MSDS spells out the properties of the substance, as well as procedures to follow after a possible worker exposure.
- Standards for chemical hygiene, including occupational exposure to hazardous chemicals in laboratories (1910.1450) (see Chapter 8).
- The Bloodborne Pathogens standard (1910.1030), intended to minimize the risk of exposure to bloodborne pathogens (see Chapter 9).

The Joint Commission

For accredited facilities, The Joint Commission has various laboratory-related standards under Environment of Care, Quality Control, and Infection Control.

The Joint Commission covers a broad spectrum of requirements, but many include appropriate employee safety considerations, such as tepid water for eyewash stations and appropriate personal protective equipment for lab employees. There are a number of survey preparation tools offered by The Joint Commission, including a 2010 survey activity guide for laboratory services and FAQs.

Other Federal Laws

A number of other federal regulatory agencies issue and enforce regulations that affect labs, as listed in Figure 1.1. In addition, a number of other government organizations and industry groups publish regulations and guidelines that affect laboratory safety, as listed in Figure 1.2.



FIGURE 1.1

Federal regulations affecting labs

Regulatory agency	Website	Lab activities affected
<p>Department of Transportation (DOT)</p> <p>Enforces regulations it issues about transporting all types of hazardous materials.</p>	<p>www.dot.gov</p>	<p>Transport of lab specimens</p>
<p>Environmental Protection Agency (EPA)</p> <p>Enforces regulations under the Clean Air Act, the Resource Conservation and Recovery Act, and other environmental statutes.</p>	<p>www.epa.gov</p>	<p>Ventilation Air contamination Disposal of hazardous waste</p>
<p>Department of Labor (DOL)</p> <p>Enforces regulations under the Americans With Disabilities Act (ADA), Fair Labor Standards Act, and other federal labor laws. The Bureau of Labor Statistics is a division of the DOL that compiles and publishes employment data.</p>	<p>www.dol.gov</p> <p>www.ada.gov (for compliance information about the ADA)</p> <p>www.bls.gov (for employment and pay data)</p>	<p>Lab design Ergonomics Human resources, payroll, and benefits</p>
<p>Food and Drug Administration (FDA)</p> <p>Approves new medicines and medical devices for safe use.</p>	<p>www.fda.gov</p>	<p>Toxicology Transfusion medicine Apheresis</p>



FIGURE 1.2

Other sources of lab safety guidelines

Organization	Website	Lab activities affected
<p>Centers for Disease Control and Prevention (CDC)</p> <p>A lead federal agency for protecting the health and safety of people at home and abroad, providing credible information to enhance health decisions. Investigates illnesses and potential epidemics; issues rules and standards for practitioners.</p>	www.cdc.gov	Bloodborne pathogens
<p>National Institute for Occupational Safety and Health (NIOSH)</p> <p>Division of CDC that focuses on prevention of workplace injuries and illnesses.</p>	www.cdc.gov/niosh/homepage.html	All safety activities
<p>Clinical and Laboratory Standards Institute (CLSI)—formerly NCCLS</p> <p>A global organization of laboratories that develops consensus documents for additional audiences beyond the clinical laboratory community.</p>	www.clsi.org	All
<p>International Air Transportation Association (IATA)</p> <p>Membership organizations of airlines and cargo carriers; IATA's standards have the force of law for international shipments.</p>	www.iata.org	Shipping lab tests by air
<p>College of American Pathologists (CAP)</p> <p>Membership organization of board-certified pathologists that serves and represents the interest of patients, pathologists, and the public by fostering excellence in the practice of pathology and laboratory medicine.</p>	www.cap.org	All, if the lab is CAP-accredited
<p>The Joint Commission</p> <p>Membership organization that issues standards and conducts regular surveys and site visits to award accreditation to hospitals and other healthcare providers.</p>	www.jointcommission.org	All, if the lab is Joint Commission-accredited

State and local laws

Figure 1.3 lists the OSHA regional offices. Although every state is covered by one of the 10 regions, section 18 of the Act encourages states to develop and operate their own job safety and health programs. Many states have their own requirements that may affect safety processes in your lab. As with most federal statutes, OSHA preempts state laws that impose less stringent requirements, but states may enact more stringent rules if they wish. A detailed discussion of the 50 states' rules is beyond the scope of this book, but the directory information in Figure 1.4 may be helpful in ensuring that your lab's safety program complies with your state's laws as well as federal rules.

Regional and local laws such as those imposed by city or county fire marshals, water authorities, or waste disposal agencies also may affect laboratory safety. To find online information specific to your state, point your Web browser to *www.[your state's postal initials].gov* to find laws that apply. For example, in Indiana, go to *www.in.gov*; on the left side of the opening screen, click on the button labeled "Law-Justice." In California, go to *www.ca.gov* and click on "Government" on the tab at the top of the page. In Wisconsin, go to *www.wi.gov* and click on "Government" on the left of the page. Because websites are not always complete and up to date, always ask your attorney to review your safety policies for compliance with state, local, and federal laws.



FIGURE 1.3

OSHA regional offices

Region 1

JFK Federal Building, Room E340
 Boston, MA 02203
 Telephone: 617/565-9860
 Fax: 617/565-9827

States include: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Region 2

201 Varick Street, Room 670
 New York, NY 10014
 Telephone: 212/337-2378
 Fax: 212/337-2371

States and territories include: New Jersey, New York, Puerto Rico, and the Virgin Islands.

Region 3

U.S. Department of Labor/OSHA
 The Curtis Center—Suite 740 West
 170 S. Independence Mall West
 Philadelphia, PA 19106-3309
 Telephone: 215/861-4900
 Fax: 215/861-4904

States and districts include: Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia.

Region 4

61 Forsyth Street, SW Room 6T50
 Atlanta, GA 30303
 Telephone: 404/562-2300
 Fax: 404/562-2295

States include: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

Region 5

230 South Dearborn Street, Room 3244
 Chicago, IL 60604
 Telephone: 312/353-2220
 Fax: 312/353-7774

States include: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin.

Region 6

525 Griffin Street, Room 602
 Dallas, TX 75202
 Telephone: 972/850-4145
 Fax: 972/850-4149

States include: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Region 7

Two Pershing Square Building
 2300 Main Street, Suite 1010
 Kansas City, MO 64108-2416
 Telephone: 816/283-8745
 Fax: 816/283-0547

States include: Iowa, Kansas, Missouri, and Nebraska.

Region 8

1999 Broadway, Suite 1690
 Denver, CO 80202
 Telephone: 720/264-6550
 Fax: 720/264-6585

States include: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming.

Region 9

90 7th Street, Suite 18100
 San Francisco, CA 94103
 Telephone: 415/625-2547
 Fax: 415/625-2534

States and territories include: Arizona, California, Guam, Hawaii, and Nevada.

Region 10

1111 Third Avenue, Suite 715
 Seattle, WA 98101-3212
 Telephone: 206/553-5930
 Fax: 206/553-6499

States include: Alaska, Idaho, Oregon, and Washington.



FIGURE 1.4

Directory of states with OSHA-approved occupational safety and health plans

Alaska Department of Labor and Workforce Development

P.O. Box 111149
1111 W. 8th Street, Room 304
Juneau, AK 99801-1149
Telephone: 907/465-2700 Fax: 907/465-2784

Industrial Commission of Arizona

800 W. Washington
Phoenix, AZ 85007-2922
Telephone: 602/542-5795 Fax: 602/542-1614

California Department of Industrial Relations

455 Golden Gate Avenue, 10th Floor
San Francisco, CA 94102
Telephone: 510/286-7000 Fax: 510/286-7037

Connecticut Department of Labor/Conn-OSHA

38 Wolcott Hill Road
Wethersfield, CT 06109
Telephone: 860/263-6900 Fax: 860/263-6940

Hawaii Department of Labor and Industrial Relations

830 Punchbowl Street
Honolulu, HI 96813
Telephone: 808/586-8842 Fax: 808/586-9099

Indiana Department of Labor

State Office Building
402 West Washington Street, Room W195
Indianapolis, IN 46204-2751
Telephone: 317/233-3605 Fax: 317/233-3790

Iowa Workforce Development

Division of Labor Services
1000 E. Grand Avenue
Des Moines, IA 50319-0209
Telephone: 515/281-3469 Fax: 515/281-7995

Kentucky Department of Labor

1047 U.S. Highway 127 South, Suite 4
Frankfort, KY 40601
Telephone: 502/564-3070 Fax: 502/564-2248

Maryland Department of Labor, Licensing and Regulation

Division of Labor and Industry
1100 North Eutaw Street, Room 613
Baltimore, MD 21201-2206
Telephone: 410/767-2190 Fax: 410/767-2986

Michigan Department of Labor and Economic Growth

Michigan Occupational Safety and Health Administration
P.O. Box 30643
Lansing, MI 48909-8143
Telephone: 517/322-1817 Fax: 517/322-1775

Minnesota Department of Labor and Industry

443 Lafayette Road North
St. Paul, MN 55155-4307
Telephone: 651/284-5310 Fax: 651/284-5741

Nevada Division of Industrial Relations

Occupational Safety and Health Administration
1301 North Green Valley Parkway, Suite 200
Henderson, NV 89074
Telephone: 702/486-9020 Fax: 702/990-0260

New Jersey Department of Labor and Workforce Development

Office of Public Employees Occupational Safety and Health (PEOSH)
1 John Fitch Plaza
P.O. Box 386
Trenton, NJ 08625-0386
Telephone: 609/292-0501 Fax: 609/292-3749



FIGURE 1.4

Directory of states with OSHA-approved occupational safety and health plans (cont.)

New Mexico Environment Department

525 Camino de los Marquez, Suite 3
 P.O. Box 26110
 Santa Fe, NM 87502
 Telephone: 505/476-8700 Fax: 505/476-8734

New York Department of Labor

New York Public Employee Safety
 and Health Program
 State Office Campus Building 12, Room 158
 Albany, NY 12240
 Telephone: 518/457-3518 Fax: 518/457-5545

North Carolina Department of Labor

1101 Mail Service Center
 Raleigh, NC 27699-1101
 Telephone: 919/807-2861 Fax: 919/807-2855

Oregon Occupational Safety and Health Division

Department of Consumer and Business Services
 350 Winter Street, NE, Room 430
 Salem, OR 97309-0405
 Telephone: 503/378-3272 Fax: 503/947-7461

Puerto Rico Department of Labor

Prudencio Rivera Martínez Building, 21st Floor
 505 Muñoz Rivera Avenue
 Hato Rey, PR 00918
 Telephone: 787/754-2172 Fax: 787/754-2171

South Carolina Department of Labor, Licensing, and Regulation

Synergy Business Park, Kingstree Building
 110 Centerview Drive
 P.O. Box 11329
 Columbia, SC 29211
 Telephone: 803/896-4300 Fax: 803/896-4393

Tennessee Department of Labor and Workforce Development

220 French Landing Drive
 Nashville, TN 37243
 Telephone: 615/741-2793 Fax: 615/741-3325

Utah Labor Commission

160 East 300 South, 3rd Floor
 P.O. Box 146650
 Salt Lake City, UT 84114-6650
 Telephone: 801/530-6901 Fax: 801/530-7606

Vermont Department of Labor and Industry

5 Green Mountain Drive
 P.O. Box 488
 Montpelier, VT 05601-0488
 Telephone: 802/828-2765 Fax: 802/828-0408

Virgin Islands Department of Labor

3012 Golden Rock, Christiansted
 St. Croix, VI 00820
 Telephone: 340/773-1994 Fax: 340/773-1858

Virginia Department of Labor and Industry

Powers-Taylor Building
 13 South 13th Street
 Richmond, VA 23219-4101
 Telephone: 804/786-2391 Fax: 804/371-6524

Washington Department of Labor and Industries

General Administration Building
 Mailing address:
 P.O. Box 44001
 Olympia, WA 98504-4001
 Location:
 7273 Linderson Way SW
 Tumwater, WA 98501-5414
 Telephone: 360/902-4805 Fax: 360/902-5619

Wyoming Department of Employment

Workers' Safety and Compensation Division
 1510 East Pershing Boulevard–West Wing
 Cheyenne, WY 82002
 Telephone: 307/777-7786 Fax: 307/777-3646

Types of controls

All OSHA standards have three types of controls that pertain to that particular standard.

Engineering controls minimize the exposure by either reducing or removing the hazard at the source or isolating employees from the hazard, such as a needle with a safety-engineered device attached.

Administrative controls minimize exposure levels by defining or restricting job functions or scheduling production and tasks. A chemical hygiene plan and a bloodborne pathogen exposure control plan that clearly lay out safety precautions for employees are examples of administrative controls.

Work practice controls alter the manner in which a task is performed. Washing your hands after glove removal is a work practice control.

Fires, Explosions, and Other Risks

The nature of lab work and equipment creates risk from fire, explosion, toxic chemicals, and infectious agents. Chapter 11 addresses fire issues, Chapter 8 covers chemical hygiene, and Chapter 9 covers infectious substances. Those chapters further delineate risks to employees working in a laboratory. Safety must remain first and foremost in the minds of management to protect staff from unnecessary risk.

Standard precautions and body substance precautions

Universal Precautions is OSHA's required method of control to protect employees from exposure to all human blood and body fluids. The term refers to a concept of bloodborne disease control, which requires that all human blood and body fluids be treated as if they were known to be infectious for HIV, hepatitis B, hepatitis C, or other bloodborne pathogens, regardless of the perceived "low-risk" status of a patient or patient population.

As indicated by the Centers for Disease Control and Prevention in the 2007 document *Guideline for Isolation Precautions in Hospitals*, "Standard Precautions synthesize the major features of Universal (Blood and Body Fluid) Precautions (designed to reduce the risk of transmission of bloodborne pathogens) and Body Substance Isolation (designed to reduce the risk of transmission of pathogens from moist body substances). Standard Precautions apply to 1) blood; 2) all body fluids, secretions,

and excretions, *except sweat*, regardless of whether they contain visible blood; 3) nonintact skin; and 4) mucous membranes. Standard Precautions are designed to reduce the risk of transmission of microorganisms from both recognized and unrecognized sources of infection in hospitals.”

The OSHA Bloodborne Pathogens standard allows healthcare facilities to use acceptable alternatives to Universal Precautions. These alternative concepts include *Body Substance Isolation* and *Standard Precautions*. These methods incorporate the fluids and materials covered by the standard and expand coverage to include all body fluids and substances. OSHA considers these concepts acceptable alternatives to Universal Precautions, provided that facilities using them adhere to all other provisions of the standard. OSHA offers instructions and clarification to ensure uniform inspection and enforcement of the Bloodborne Pathogens standard.

OSHA’s Bloodborne Pathogens standard was written specifically to apply to risks from bloodborne pathogens, but the concept behind it—treating all lab substances as potentially hazardous—should be central to your lab’s safety program.

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