

Division of Laboratory Systems



Risk Assessment in Clinical Laboratories

Crystal Fortune, MPH, MLS(ASCP)CM, RBP(ABSA)

March 27, 2024



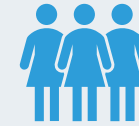
Agenda

- Introduction
 - *New and relevant OneLab™ Resources*
 - *Today's Presenter*
- *Risk Assessment in Clinical Laboratories*
- Q&A
- Upcoming Events

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CDC Introduction to Laboratory Risk Management (LRM) Course

Introduction to Laboratory Risk Management (LRM)

Introduction to Laboratory Risk Management (LRM) is the first in a series of courses focused on developing risk management strategies for laboratory settings.



[Course](#)

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Presenter



Crystal Fortune MPH, MLS(ASCP)CM, RBP(ABSA)

Biosafety and Outreach Specialist
Montana Public Health Laboratory



A Unified Response to Training Needs

Risk Assessment for Clinical Laboratories

Crystal Fortune, MPH, BSCLS, MLS (ASCP)^{CM} RBP (ABSA)

03/27/2024

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Today's Agenda



Risk Assessment for Clinical Laboratories

During this hour, we will discuss

- Incidence of laboratory-associated infections, and how they might have been prevented
- Factors to consider when conducting a risk assessment
- Laboratory design and engineering controls
- Resources where you can find out more

Learning Objectives



At the end of the one-hour panel discussion, attendees will be able to:

- Apply a general overview of the risk assessment process
- Recognize hazards inherent in the laboratory environment
- Describe biosafety controls that can help to mitigate risk
- List resources that staff can use to guide the risk assessment process in their environment

Icebreaker

Please share in the chat a city you would like to visit and why.



Summary

When science perceivably threatens safety outside of our environment, important work can be threatened. We have seen recently that errors, inconsistencies, and lack of transparency can threaten our credibility and dilute important messaging. Laboratory staff help to reduce this threat by using safety controls and mitigations to ensure dangerous pathogens stay contained where they do no and will not pose harm to others.

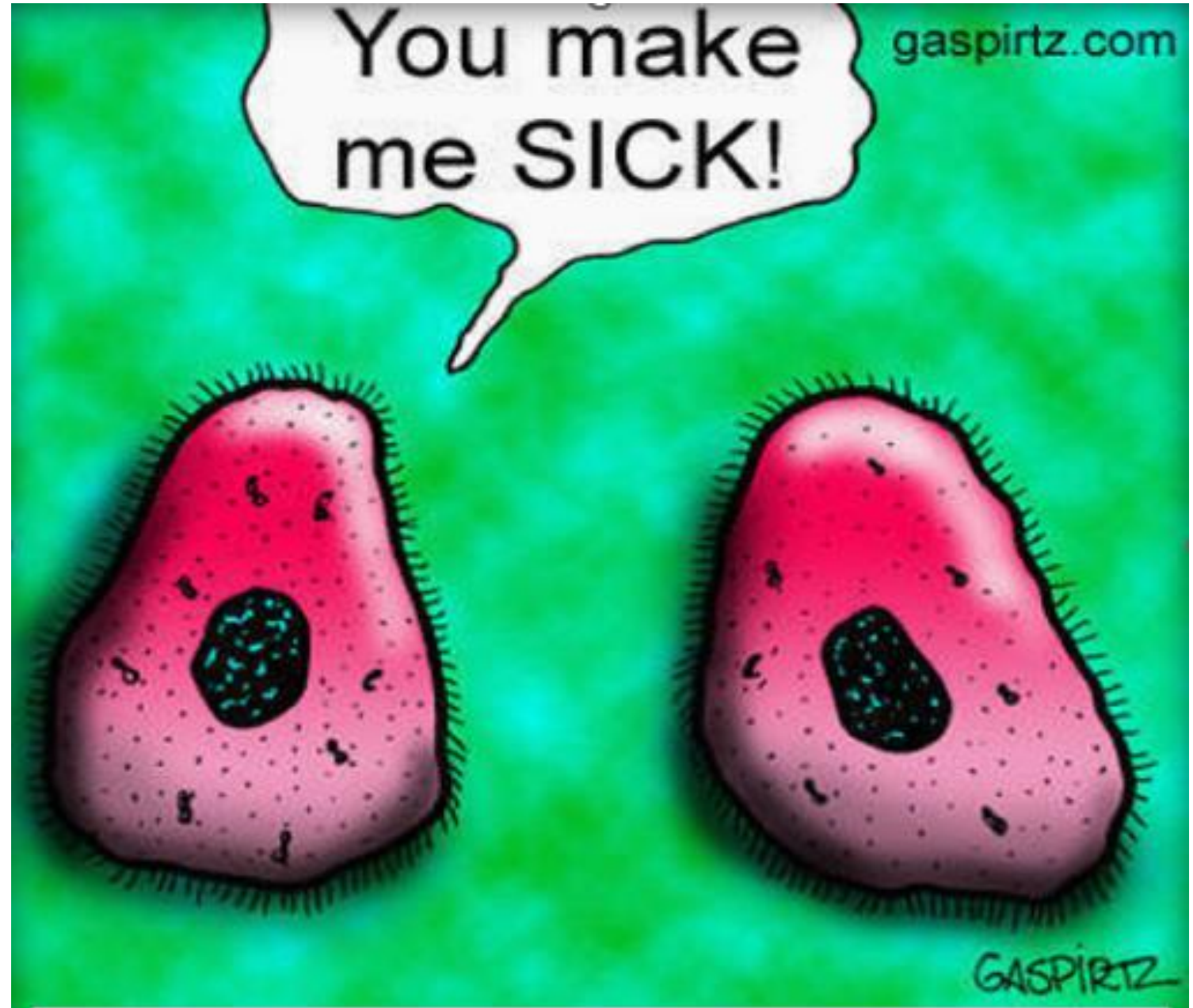


Image from Lab Manager "The Best Accident Response Plan for Your Lab, December 4, 2016
<https://www.labmanager.com/the-best-accident-response-plan-for-your-lab-4132>

Biosafety/ Risk Assessment Overview

- **Pathogens/Laboratory-associated infections**
- **Biosafety program/principles**
- **Hierarchy of Controls**
- **Risk Assessment**
- **Additional resources**

**Pathogens...
What's
(Not) for
Dinner**



LAI 1930-2004 (Pike, 1978; Harding and Byers, 2006)

Infection	No. of Cases	No. of Deaths
Brucellosis (<i>Brucella</i> spp.)	569	9
Q fever (<i>Coxiella burnetii</i>)	459	2
Tuberculosis (<i>Mycobacterium</i> spp.)	393	4
Hepatitis B	350	4
Typhoid fever (<i>Salmonella</i> spp.)	322	22
Tularemia (<i>Francisella tularensis</i>)	225	2
Arboviruses	192	3
Dermatomycosis	162	0
Venezuelan equine encephalitis	146	1
Psittacosis (<i>Chlamydia psittaci</i>)	116	10
Coccidioidomycosis (<i>Coccidioides</i>)	93	2
Shigellosis (<i>Shigella</i> spp.)	66	0
Hepatitis C	32	1
<i>Neisseria meningitidis</i>	31	11
Total	3309	72

Commonly Encountered Pathogens

Organism	Infectious Dose	Route of Exposure	Laboratory Impact
Brucella	10-100 organisms	Inhalation	(Once) most commonly reported LAI
Coccidioides	1-10 arthroconidia	Inhalation	Manipulate in BSL-3
E. Coli O157:H7	~10 organisms	Ingestion	
N. meningitidis	Unknown	Inhalation	13/100k micro vs 0.2/100k gen. public
Salmonella spp.	10 ³ -10 ⁵ organisms	Ingestion	
Shigella spp.	10-200 organisms	Ingestion	High-virulence, low infectious dose
M. tuberculosis	<10 organisms	Inhalation	3 to 100 times general public
Hepatitis B	Unknown	Percutaneous or mucous membrane	Laboratorians 3 x other healthcare, 7-10 times general public

309 LAI Cases worldwide, 2000-2021 (*interpret w/caution)

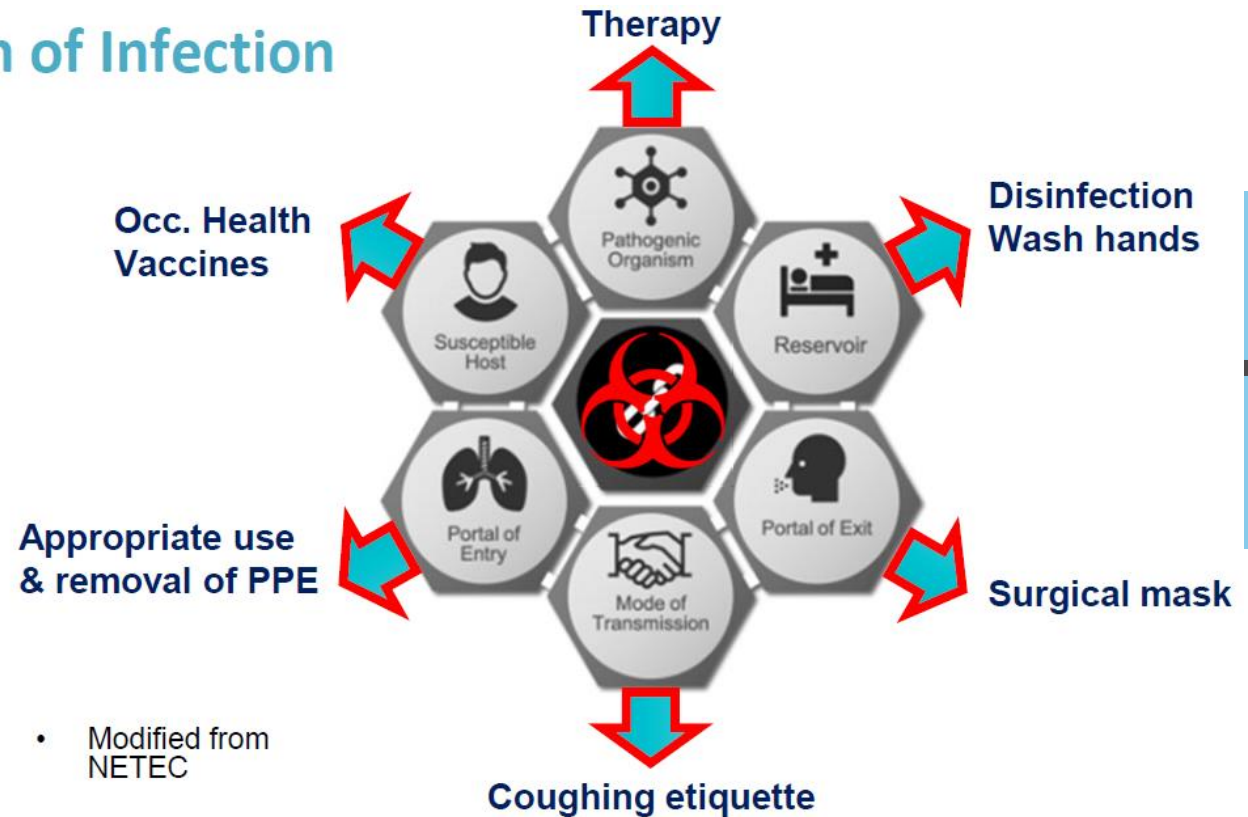
- 238 (77%) bacterial
- 154 (49.8%) *Salmonella enterica* Typhimurium
- 251 (81.2%) risk group 2
- 69.3% procedural errors (unknown, needlestick, spills, splashes)
 - Accounted for 62.5% of fatal outcomes
- 154 (49.8%) in the United States
 - 109 students and employees in clinical microbiology laboratories across 38 states
 - 150 (97.4%) procedural errors

LAI Cases

- January 1996: 6/19 microbiologists, *Shigella sonnei*
- September 2009: 60 y/o Chicago researcher, *Yersinia pestis*
- April 2012: 25 y/o California researcher, *Neisseria meningitidis*
- 2015-2017: Ten exposure events in New York, 219 workers, *Brucella spp.*

Goal: Break the Chain of Infection

Chain of Infection



- Modified from NETEC

Biosafety/ Principles

- **What is Biosafety?**
- **Hierarchy of Controls**
- **Principles of Containment**
- **Risk Assessment**

What's Wrong With This Picture?

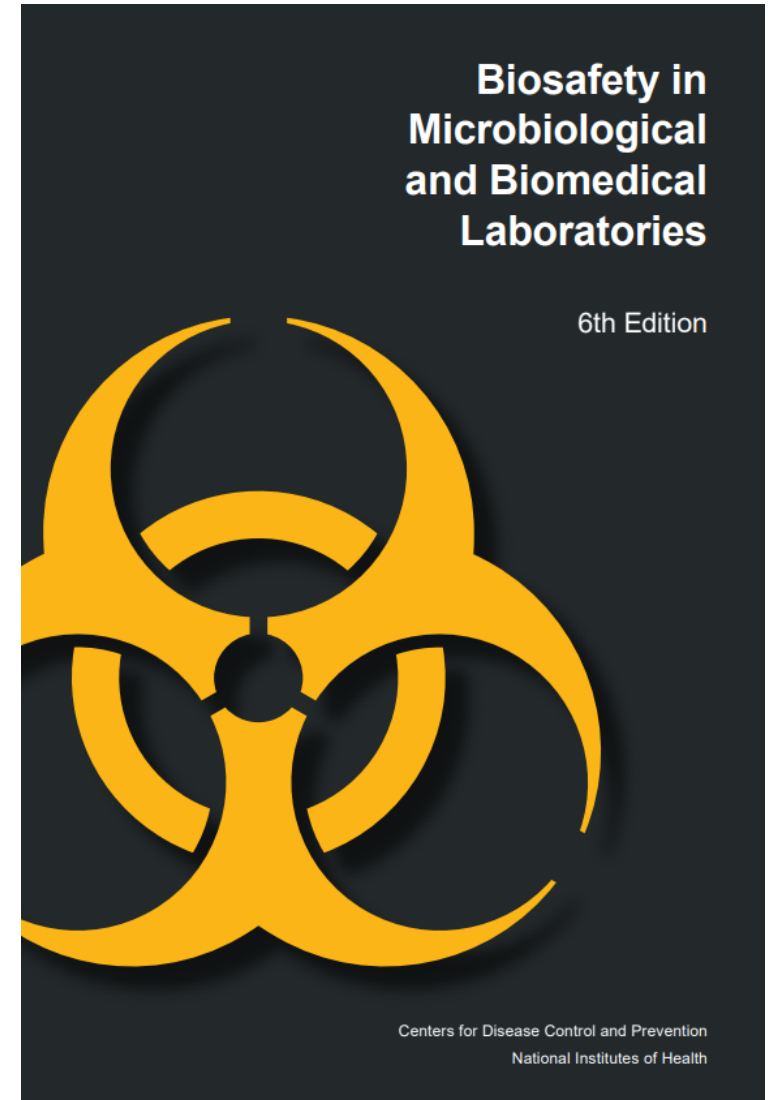


Discussion
Question/
Knowledge
Check



What is Biosafety?

- Biosafety in Microbiological and Biomedical Laboratories (BMBL): the mechanism for addressing the safe handling and containment of infectious microorganisms and hazardous biological materials.
- The principle is containment and risk assessment



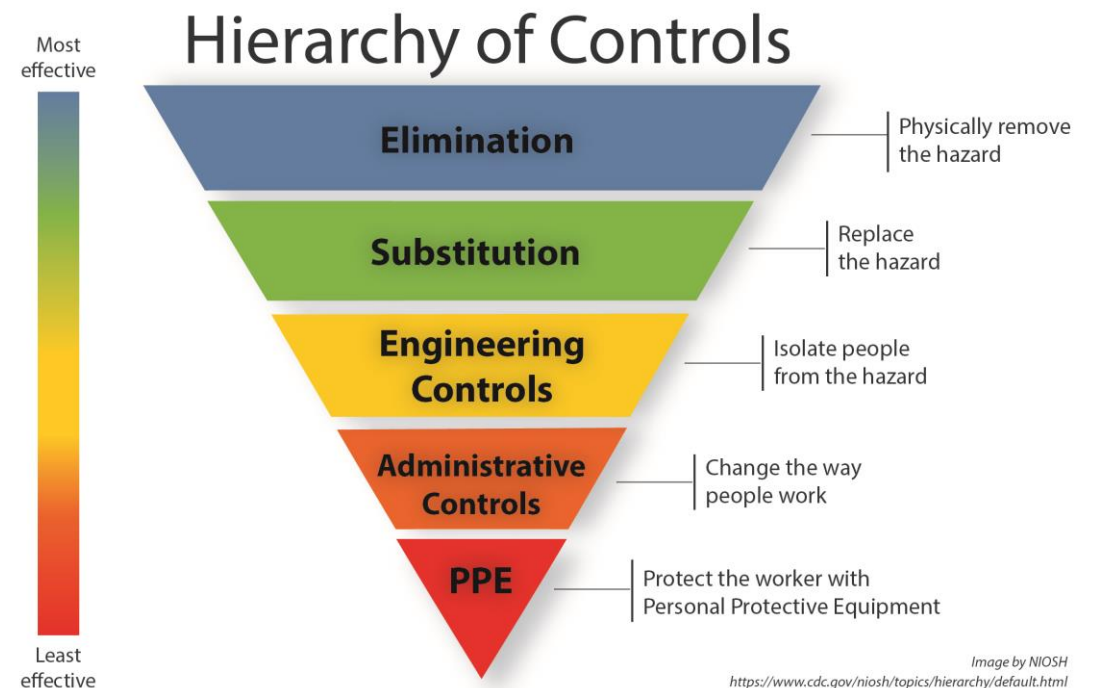
Containment

- Primary-you and your immediate area
 - Good microbiological technique
 - Appropriate use of safety equipment and personal protective equipment
- Secondary-external environment
 - Restricted access
 - Facility design (directional airflow, biosafety levels)
 - Decontamination (autoclave)



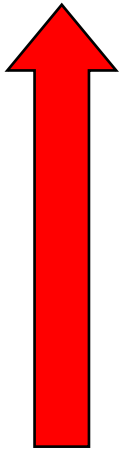
Hierarchy of Controls

- Remove the hazard (safer equipment, plastic instead of glass)
- Substitute (attenuated strains), isolate (robotic devices)
- Engineering (lab design, airflow, biosafety cabinet)
- Administrative (work practices, procedures to reduce exposure)
- PPE (worn to provide a barrier)



Potential Hazard

Highest



Lowest

Biosafety Levels

- BSL-4: Dangerous or exotic agents of life-threatening nature
- BSL-3: Indigenous or exotic agents associated with human disease and with potential for aerosol transmission
- BSL-2: Agents associated with human disease
- BSL-1: Agents not known to cause disease
- Not to be confused with risk groups (1-4)

Standard Microbiological Practices for all Biosafety Levels

- Ensure staff are properly trained
- Post biohazard signs where infectious agents are present or in use
- Limit access when work is in progress
- No eating, drinking, applying cosmetics, etc. in the lab
- Decontaminate work surfaces and potentially infectious waste

Additional Practices for Increasing Levels

- Additional signage indicating biosafety levels, infectious agents, emergency contact information
- Limited access, visitor training and sign-in
- Medical surveillance and immunizations
- Primary containment (limit work to biosafety cabinet, supplemental PPE)
- Secondary containment (negative air, sealed rooms, HEPA exhaust, pass-through autoclave, validated decontamination or inactivation)



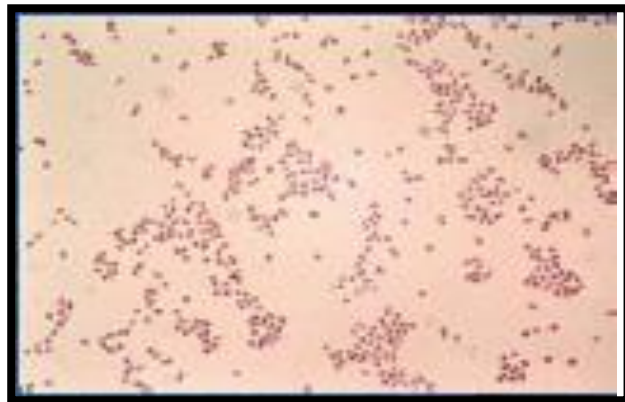
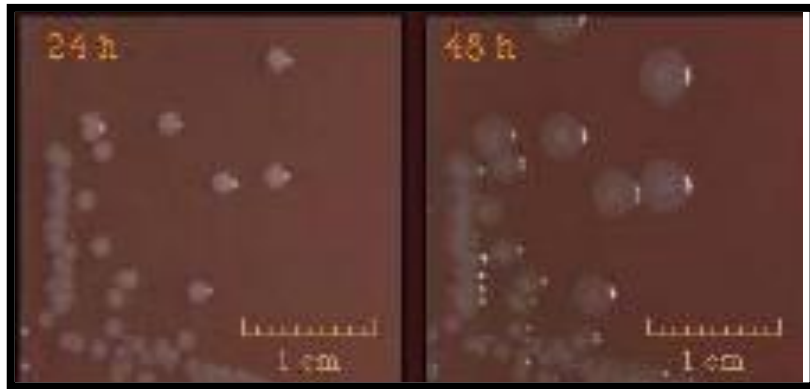
Safety Standards

- Establish policies for glove use and handling phones, keyboards, microscopes, etc.
- Qualified staff
 - Competent supervisor, trained and proficient staff, safety officer
- Updated policies, procedures, guidelines
 - Enforcement!
- Review, Test, Update your safety program!

Plan, Do, Check, Act



Trigger Points



- Determine points at which a sample or culture should be handled under heightened precaution
 - Gram-negative diplococci from sterile sources
 - Slow growth on blood/no growth on MacConkey
- Work in BSC, inactivate prior to automated instrument



Handwashing

- Wet and apply soap
- Lather and scrub for 20 seconds
- Rinse for 10 seconds
- Dry your hands and turn off tap with a paper towel
- At least 60% alcohol-based hand sanitizer

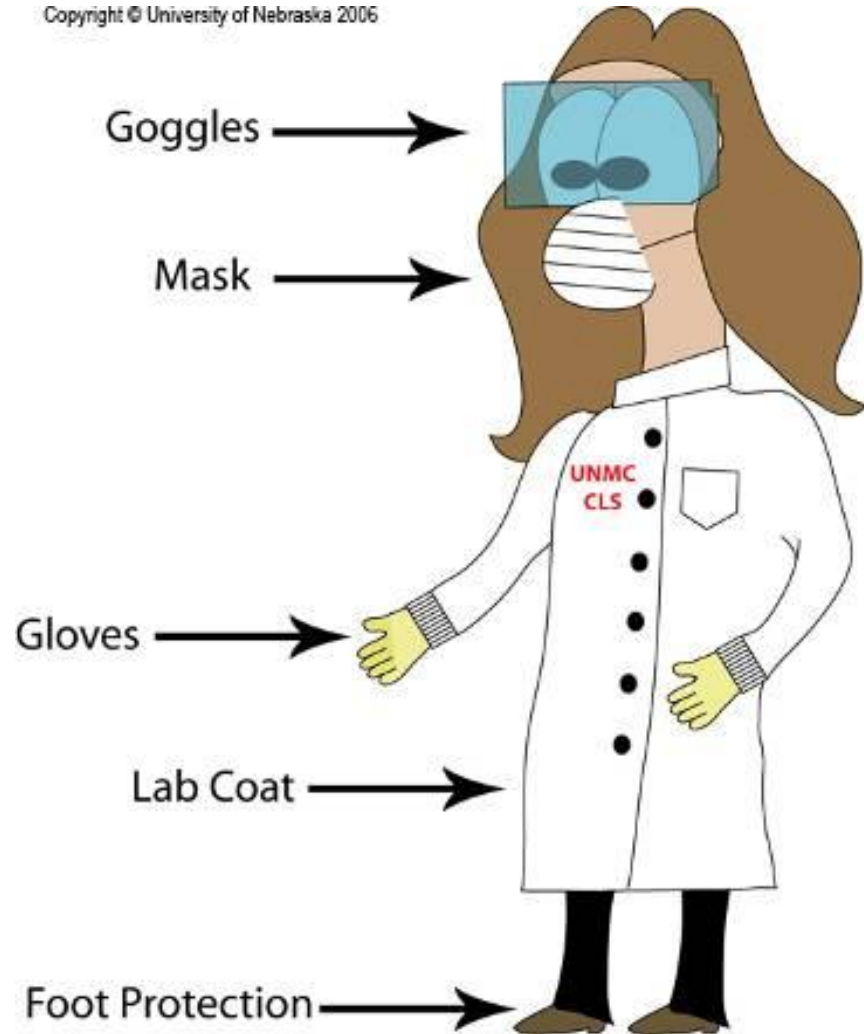
In Addition...

- Immunize staff (i.e. Hepatitis B and *N. meningitidis*)
- Remind providers to notify the lab concerning suspected highly infectious patients
- Establish a relationship with public health-report rule-outs and exposures



Personal Protective Equipment

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Engineering controls, i.e., BSC



THIS UNIT HAS BEEN TESTED AND CERTIFIED TO:

<input checked="" type="checkbox"/> NSF-49, ANNEX F	<input type="checkbox"/> IEST-RP-CC002	<input checked="" type="checkbox"/> CAL OSHA
<input type="checkbox"/> ASME NS10-1989	<input type="checkbox"/> ISO 14644	<input checked="" type="checkbox"/> SAGE-REG

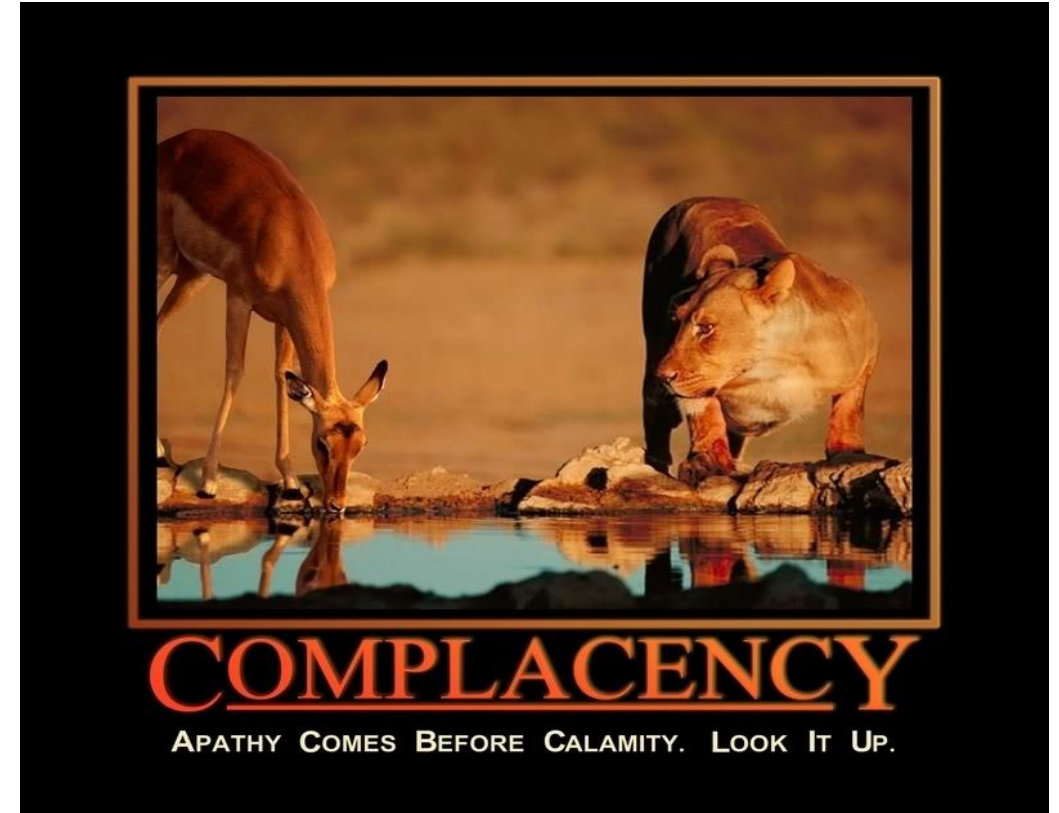
Avg. Vel 107 fpm Δ P 0.39 in. w.g.
Mfg. FORMA Model 118A
SN 164A717A3 TSS DB No. 103052
Facility LPL Location 211A
Comments: F320

TESTED BY: DT, CB TEST NO.: DT753114-021
DATE: 05/31/07 RETEST DUE: 05/08

NO TAG LABEL 10/98

Challenges

- Workload and high stress
- Lack of training/familiarity with the pathogen
- No access or inappropriate use of engineering controls (such as biological safety cabinet)
- Personal protective equipment not used or used incorrectly



What's Wrong With This BSC Picture?

Discussion
Question/
Knowledge
Check



Risk Assessment

- **Risk Evaluation/ Routes of Entry**
- **Task Evaluation**
- **Helpful Resources**

Risk Assessment-Matrix

- Pathogen characteristics (RG 1-4)
- Laboratory tasks
 - Aerosols, spills/splashes, cuts/lacerations
- Likelihood of occurrence
 - Certain, likely, moderate, unlikely, rare
- Severity of consequences
 - Illness? Disease/sequelae? Death?
- Risk is never eliminated

WHO Risk Management Monograph, Table 3.1

		Likelihood of exposure/release				
		Rare	Unlikely	Possible	Likely	Almost certain
Consequences of exposure/release	Severe	Medium	Medium	High	Very high	Very high
	Major	Medium	Medium	High	High	Very high
	Moderate	Low	Low	Medium	High	High
	Minor	Very low	Low	Low	Medium	Medium
	Negligible	Very low	Very low	Low	Medium	Medium

Risk Groups (NIH/CDC Definition)

1. Agents that are not associated with disease in healthy adult humans
2. Agents that are associated with human disease that is rarely serious and for which preventive or therapeutic interventions are often available
3. Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available
4. Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available

Routes of Exposure

- Inoculation
 - Needlesticks, lacerations
- Mucous membranes
 - Splashes to eyes
- Gastrointestinal tract
 - Ingestion, splashes to mouth, hand to mouth exposures (fingers, eating in the lab)
- Respiratory tract
 - Aerosols



What's Wrong With This?

Discussion
Question/
Knowledge
Check



High Risk Activities

- Sniffing plates
- Generating aerosols-anything that imparts energy to a suspension
- Manipulating colonies (subculturing, making slides)
- Biochemicals (catalase)
- Working on the open bench

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Home > Laboratory Biosafety and Biosecurity > Biosafety Programs and Resources > Pathogen Safety Data Sheets and Risk Assessment > Neisseria meningitidis

Agency Information: About the Agency

Diseases & Conditions: Infectious Diseases, Chronic Diseases

Health & Safety: Travel Health, Food Safety, Immunization & Vaccines, Emergency Preparedness & Response, Health Promotion, Injury Prevention, Lab Biosafety & Biosecurity

Research & Statistics: Surveillance

Information: Media Room, Reports & Publications, A-Z Index

Transparency: Completed Access to Information

NEISSERIA MENINGITIDIS

PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

SECTION I - INFECTIOUS AGENT

NAME: *Neisseria meningitidis*

SYNONYM OR CROSS REFERENCE: Meningococci (1), meningococemia, meningococcal infection, meningococcal meningitis.

CHARACTERISTICS: *Neisseria meningitidis* belongs to the family Neisseriaceae (2). It is a Gram-negative, non-spore forming, non-motile, encapsulated, and non acid-fast diplococci, which appears in kidney bean shape under the microscope (1, 2). It requires an aerobic environment with 5% CO₂ and enriched media containing blood for growth (1). Medium-sized, smooth, transparent, non-pigmented, non-hemolytic, and convex colonies are produced on blood agar after overnight incubation at 35-37°C (1, 2). It is oxidase and catalase positive (2). It has at least 12 serogroups, with serogroups A, B, C, W-135, and Y being the most commonly encountered serogroups from invasive disease cases (2, 4).

SECTION II - HAZARD IDENTIFICATION

PATHOGENICITY/TOXICITY: *N. meningitidis* has a wide range of clinical manifestations, ranging from transient mild sore throat to fatal meningitis or meningococcal septicemia (3). Meningitis and septicemia are the most common presentations of the disease (3).

Transient meningococemia: Patients present with mild flu-like symptoms such as fever, joint pain, and occasionally rash. The illness lasts for a few days or weeks (3).

Meningitis (1, 2): Most patients also present with signs of meningeal irritation, including, neck stiffness, bulging fontanelle (in infants), irritability, lying on one side away from light, and inability to extend the knee when hip is flexed in supine position (positive kernig's sign) (3, 4). Convulsions, declining level of consciousness, and coma may occur (3). The petechial rash of meningococemia may also occur (1).

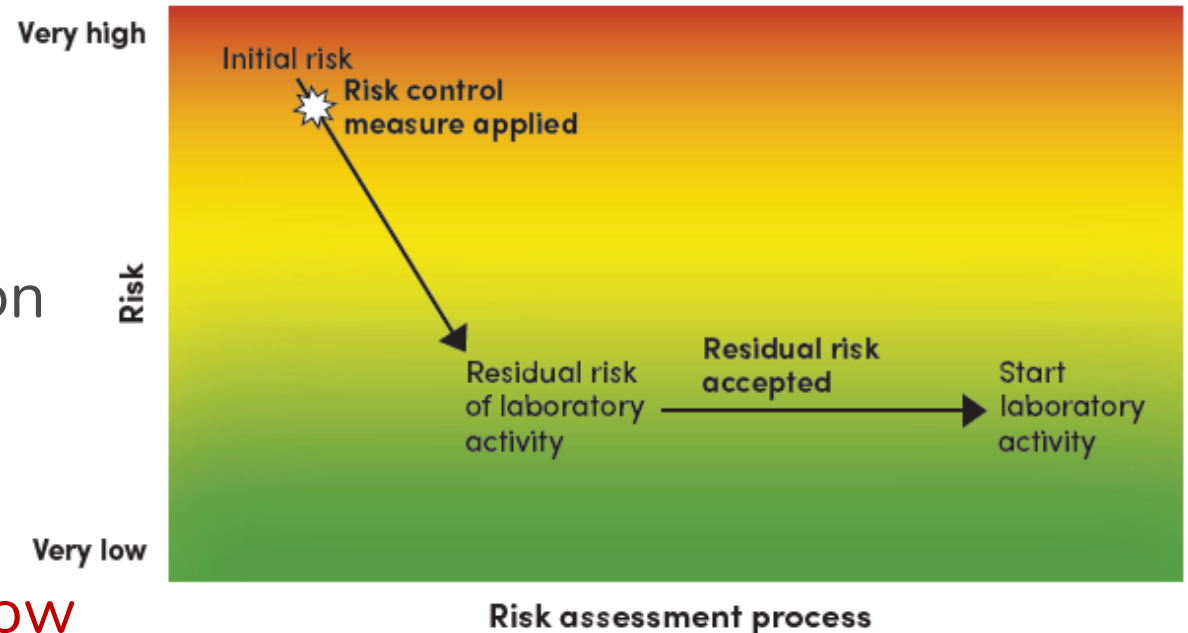
Meningococemia: Patients present with rapid onset of fever, vomiting, photophobia, convulsions, skin rash, lethargy, irritability, drowsiness, diarrhea, muscular pain, arthralgia,

<http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/index-eng.php>

Example-catalase

- Hazard: (daily) creates aerosols, mucous membrane exposure
- Likelihood: Moderate
- Consequence: Colonization/infection
- Risk: Moderate
- Mitigation: perform in biosafety cabinet, closed tube; bring risk to low

WHO Risk Management Monograph, Table 3.1



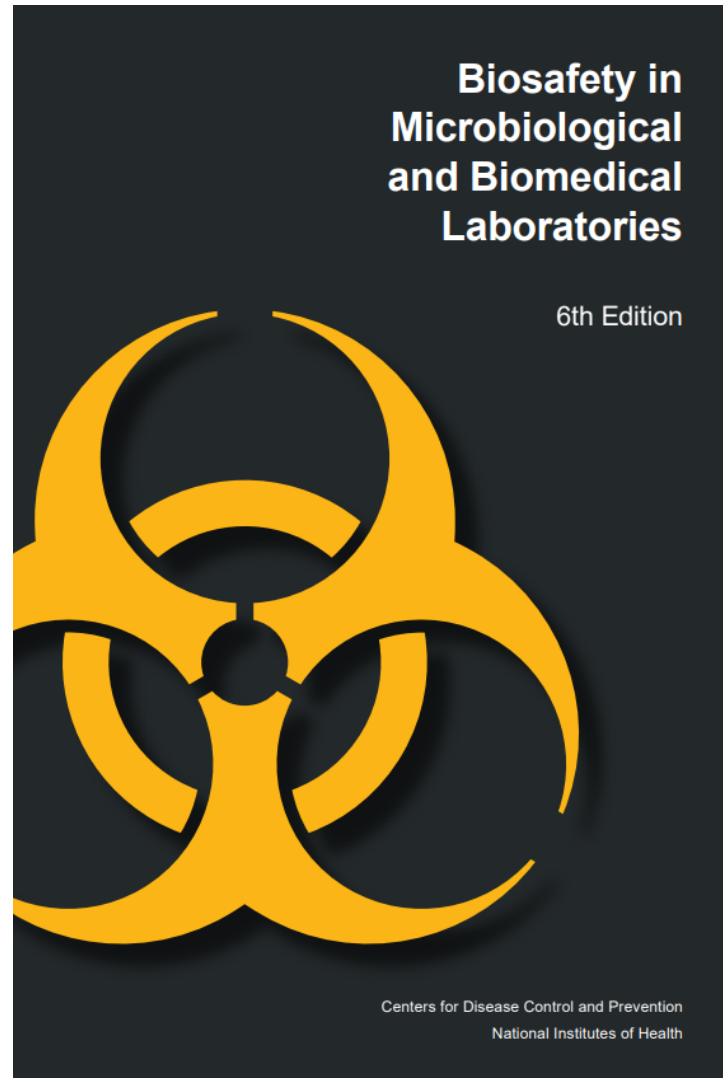
High Risk Activity Evaluation

PROCEDURE or PROCESS	PRINCIPAL STEP(S)	POTENTIAL SAFETY OR HEALTH HAZARD(S) (Pathogen)	RECOMMENDED CONTROL(S) (Place)	EQUIPMENT TO BE USED (PPE)	TRAINING REQUIREMENT(S) (Personnel)
<p>Slide Catalase Test</p>	<ol style="list-style-type: none"> 1. Touch colony of organism with stick or plastic loop 2. Put on slide 3. Add Hydrogen Peroxide 4. Observe for bubbles 	<ul style="list-style-type: none"> • Pathogen (?) • Aerosol generation 	<p>Perform this test in a tube or BSC</p>	<p>BSC, test tubes, PPE</p>	<p>BSC usage; sharps handling; aerosol containment; pipette handling technique; follow SOP and demonstrate competency</p>

Resource Documents

- **CDC BMBL**
- **Guidelines for Safe Work Practices**
- **APHL Risk Assessment Best Practices**
- **APHL Biosafety Checklists**
- **Guidelines for Biosafety Laboratory Competency**
- **CLSI M29**
- **NIOSH Hospital Respiratory Protection Program Toolkit**
- **Clinical Laboratory Preparedness and Response Guide**

CDC BMBL (Hard Copy or Free Download)



Appendix N—Clinical Laboratories

Clinical Laboratory Biosafety

Most contemporary medical decision-making utilizes the result(s) of at least one diagnostic test conducted in a clinical laboratory as a part of evidence-based care.^{1,2} Clinical laboratories are one of the first lines of public health defense because they detect and report epidemiologically important organisms and identify emerging patterns of antimicrobial resistance. The safe, effective operation of clinical laboratories is critical for both the care of individual patients and the health of laboratory professionals, the community, and the environment.

In 2016, following the U.S. Ebola crisis, the U.S. Clinical Laboratory Improvement Advisory Committee (CLIAC) recognized “the matter of biosafety in clinical laboratories as an urgent unmet national need.” In particular, CLIAC indicated the need for concise, understandable guidance to help enable clinical laboratories to assess and mitigate risks when the identity of the infectious agent is unknown or unconfirmed.³ This appendix focuses on biorisk management (BRM) in a clinical laboratory environment and includes considerations to effectively assess and mitigate risks and evaluate the performance of the implemented controls in reducing risks associated with the handling, storage, and disposal of hazardous biological materials.⁴

Conducting Risk Assessments in a Clinical Laboratory Environment

Risk assessment is the process of evaluating the risk(s) that arise from agent and laboratory hazards, taking into account the adequacy of existing controls, prioritizing those risks, and deciding if the risks are acceptable.⁵ The risk assessment generates information that guides the selection of appropriate microbiological practices, safety equipment, and facility safeguards that can reduce Laboratory-associated infections (LAIs). In addition, the integration of the risk assessment process into daily laboratory operations results in the ongoing identification and prioritization of risks and the establishment of risk mitigation protocols tailored to specific situations; this promotes a positive culture of safety.⁶ Please refer to [Section II](#) for additional information.

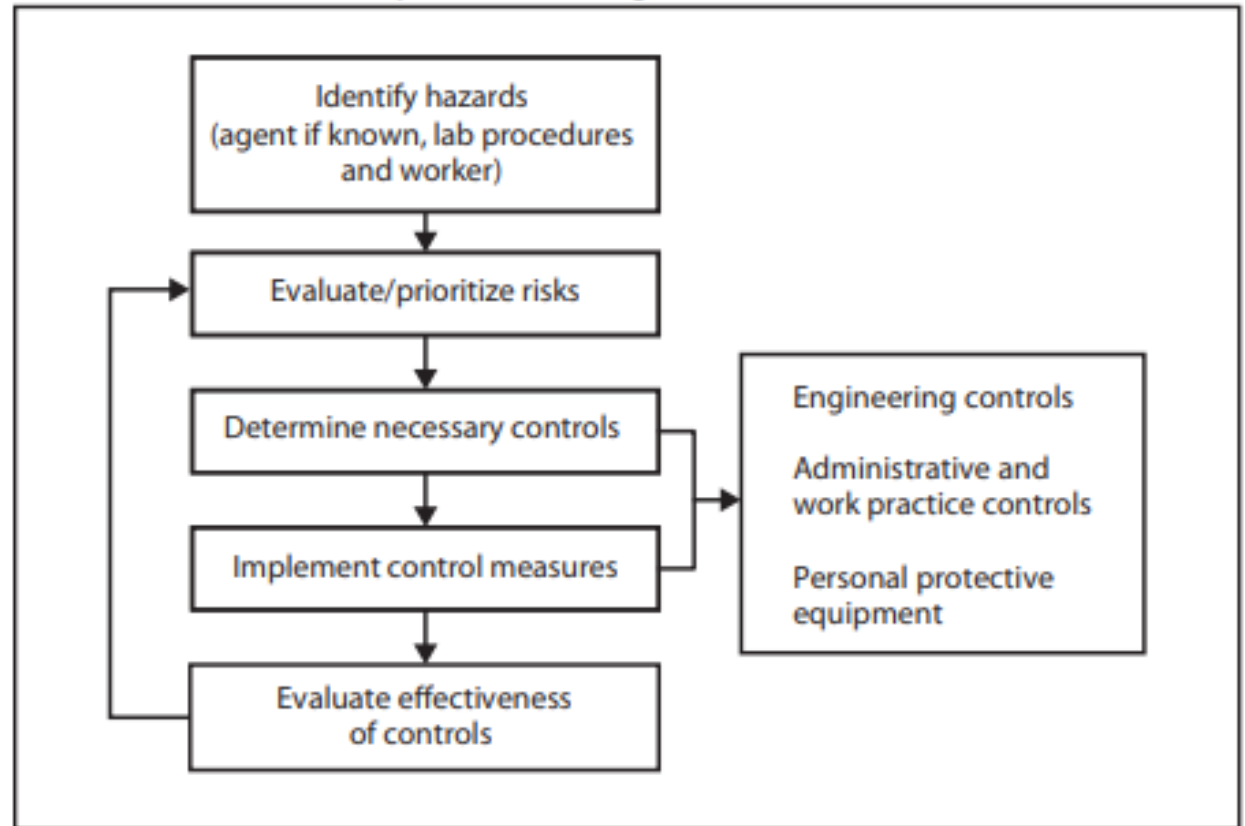
Risk assessment is the foundation of every comprehensive BRM system. The BRM approach is similar to the Quality Management System (QMS) or Individualized Quality Control Plan (IQCP) that clinical laboratories commonly use to establish quality standards for laboratory testing. QMS and IQCP include processes for risk assessment, quality control planning, and quality assessment.⁷ BRM includes processes for risk assessment, risk mitigation and performance evaluation of implemented controls to reduce risks; this has become known as the Assessment Mitigation Performance (AMP) model.⁴ Ideally, BRM and QMS should be integrated and mutually supportive systems in a clinical laboratory.

Blue Ribbon Panel, 2012

Guidelines for Safe Work Practices in Human and Animal Medical Diagnostic Laboratories

Recommendations of a CDC-convened,
Biosafety Blue Ribbon Panel

FIGURE 1. Risk assessment process for biologic hazards



Blue Ribbon Panel, 2012, activities

TABLE 1. Laboratory activities associated with exposure to infectious agents

Routes of exposure/transmission	Activities/practices
Ingestion/oral	<ul style="list-style-type: none"> • Pipetting by mouth • Splashing infectious material • Placing contaminated material or fingers in mouth • Eating, drinking, using lipstick or lip balm
Percutaneous inoculation/nonintact skin	<ul style="list-style-type: none"> • Manipulating needles and syringes • Handling broken glass and other sharp objects • Using scalpels to cut tissue for specimen processing • Waste disposal (containers with improperly disposed sharps)
Direct contact with mucous membranes	<ul style="list-style-type: none"> • Splashing or spilling infectious material into eye, mouth, nose • Splashing or spilling infectious material onto intact and nonintact skin • Working on contaminated surfaces • Handling contaminated equipment (i.e., instrument maintenance) • Inappropriate use of loops, inoculating needles, or swabs containing specimens or culture material • Bites and scratches from animals and insects • Waste disposal • Manipulation of contact lenses
Inhalation of aerosols	<ul style="list-style-type: none"> • Manipulating needles, syringes, and sharps • Manipulating inoculation needles, loops, and pipettes • Manipulating specimens and cultures • Spill cleanup

Source: Sewell DL. Laboratory-associated infections and biosafety. Clin Microbiol Rev 1995;8:389–405 (18).

Blue Ribbon Panel, 2012, prioritization

TABLE 2. Risk prioritization of selected routine laboratory tasks

Task or activity	Potential hazard	Exposure risk		
		Likelihood	Consequence	Risk rating
Subculturing blood culture bottle	Needle stick — percutaneous inoculation	Likely	Infection; medical treatment	High
	Aerosols — inhalation	Moderate	Infection; medical treatment	Medium
	Splash — direct contact with mucous membranes	Moderate	Infection; medical treatment	High
Centrifugation	Aerosols — inhalation	Likely	Infection; medical treatment	High
Performing Gram stain	Aerosols from flaming slides	Moderate	Colonization; infection	Moderate
Preparing AFB smear only	Aerosols from sputum or slide preparation	Likely	Illness; medical treatment; disease	High
Performing catalase testing	Aerosols — mucous membrane exposure	Unlikely	Colonization; infection	Low
AFB culture work-up	Aerosols — inhalation	Likely	Illness; medical treatment; disease	High

Abbreviation: AFB = acid-fast bacillus.

APHL Risk Assessment Best Practices

- Components of a risk assessment
- Risk mitigation
- Examples of risk assessment templates from Alaska, Colorado, Florida, Iowa, and New York
- No one-size-fits-all
- No one-and-done

Biosafety Checklists

BIOSAFETY CHECKLIST

APRIL 2015

A Biosafety Checklist: Developing A Culture of Biosafety



APHL ASSOCIATION OF PUBLIC HEALTH LABORATORIES Clinical Laboratory Biosafety Risk Management Program Assessment Checklist

Background

There is an inherent risk in a laboratory handling any infectious agents. Biosafety practices should be adhered to in all laboratories that receive potentially infectious material in order to ensure laboratory personnel, public and environmental safety. Recent incidents involving biosafety lapses highlight the need to enhance the culture of biosafety across the laboratory community in the United States. The Association of Public Health Laboratories (APHL) has developed *A Biosafety Checklist: Developing A Culture of Biosafety* to serve as a starting point for laboratories to assess the biosafety measures that they have in place.

Intended Use

A Biosafety Checklist: Developing A Culture of Biosafety is intended for any laboratory performing testing on infectious agents or clinical specimens that could contain infectious agents in the United States. It is designed to provide laboratories with the broad recommendations for components that should be considered for inclusion in any laboratory's biosafety policy. The checklist consists of six sections:

1. Risk Assessment
2. Selection of Safety Practices
 - Biosafety Level
 - Engineering Controls
 - Personal Protective Equipment (PPE)
 - Laboratory Practices
3. Biosafety Competencies
4. Safety Orientation and Training
5. Audits, Monitoring and Safety Committee
6. Administrative Controls

This checklist is for your laboratory's internal use only. The questions in this checklist are included to guide biosafety discussion within your laboratory and do not address biosecurity practices. Some questions may not be applicable to every laboratory and some laboratories may want to add additional questions to perform their risk assessments. This tool can be modified to meet your laboratory's needs as necessary and information gained from this tool can be used to help laboratories identify areas for improvement in their biosafety practices.

LAB ID and LABORATORY NAME:	
ASSESSOR NAME:	DATE:

Question	Y	N	NA	Comments
1. ESSENTIAL ELEMENTS FOR MANAGING AN EFFECTIVE BIOSAFETY PROGRAM				
1.1 Responsibility for Managing Biosafety				
Is the laboratory director responsible for ensuring that systems are in place and documented for identifying potential hazards, assessing risks associated with those hazards, and establishing precautions and standard procedures to minimize employee exposure to those risks? Is there a standard operating procedure (SOP) in place to document these?				
Is the laboratory director responsible for providing facilities commensurate with each laboratory's function and the recommended containment level for the agents or materials being handled? Is this written in an SOP?				
Are supervisory staff responsible for the following and are these responsibilities documented? <ul style="list-style-type: none"> • Conducting, reviewing, and approving risk assessment results. • Developing lab-specific safety plans; • Ensuring completion of initial and refresher training of laboratory workers, and for ongoing monitoring and correction of unsafe practices and conditions within the lab. 				
Are employees encouraged to report accidents or incidents and are these reports promoted as nonpunitive and as opportunities for improvement?				
Is compliance with safety policies and completion of safety-related training considered in staff performance evaluations?				

Biosafety Competency

- Use risk assessment to determine which precautions should apply to which tasks
- Consider all phases of testing
- Use biosafety competencies for guidance to ensure individuals at all levels know their responsibilities
- Use checklists to guide in factors to consider

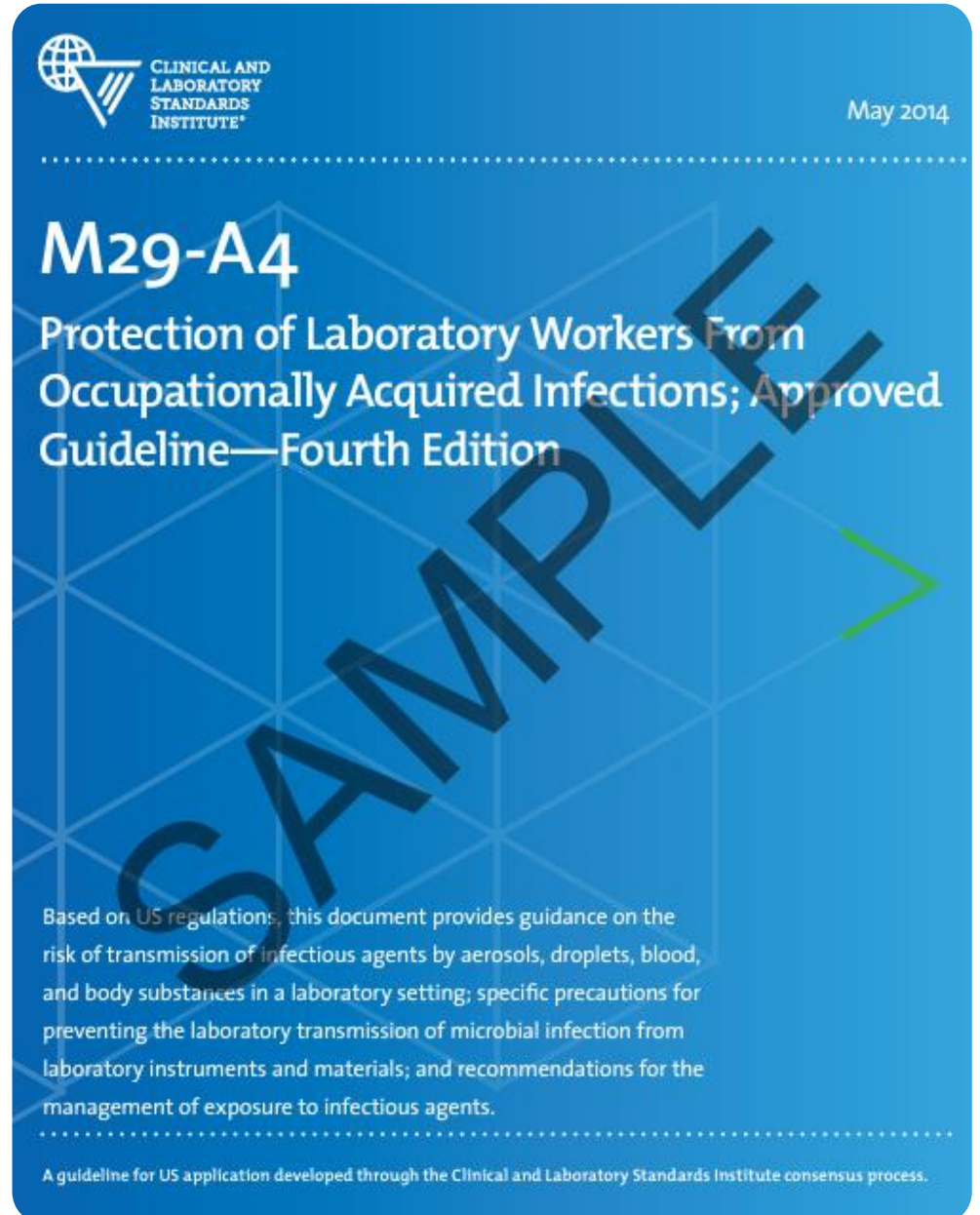
Guidelines for Biosafety Laboratory Competency

CDC and the Association of Public Health Laboratories



CLSI Guideline

- M29-A4
 - Electronic format only
 - Date of Publication: May 29, 2014
 - List Price \$180.00 (discounted for members)



Other Available Resources

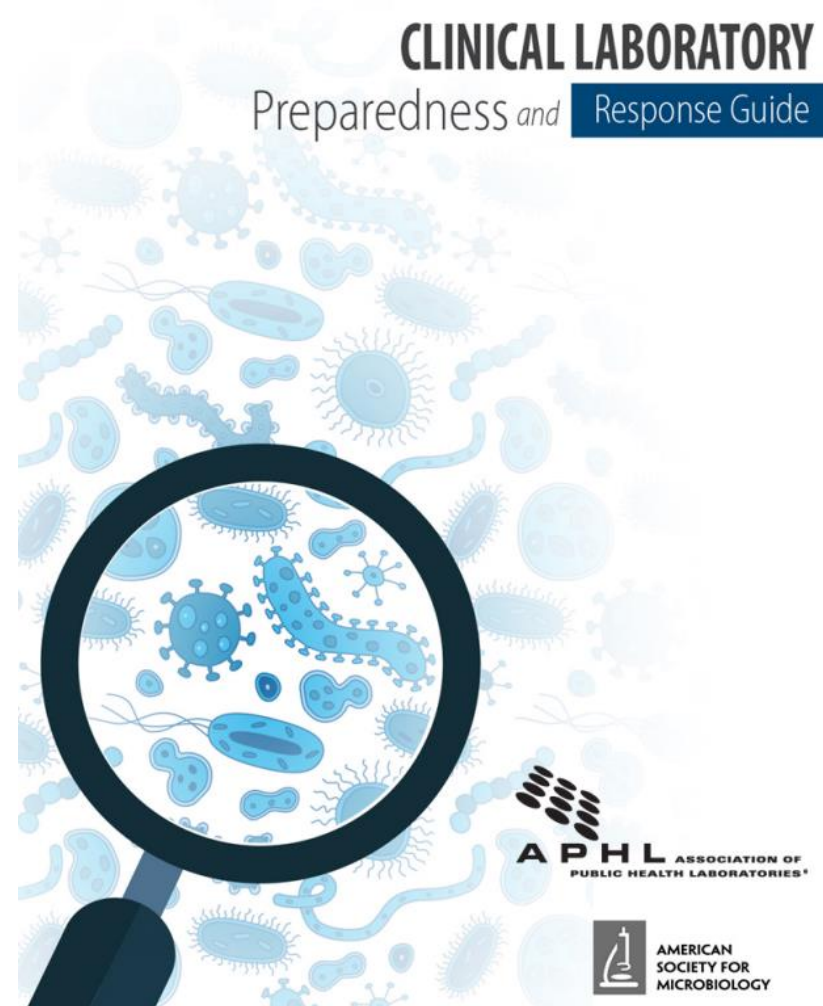
Hospital Respiratory Protection Program Toolkit

Resources for Respirator
Program Administrators

MAY 2015



CLINICAL LABORATORY Preparedness and Response Guide



What's Wrong With This Final Picture?

Discussion
Question/
Knowledge
Check



Additional Resources



- Singh K. Laboratory-acquired infections. Clin Infect Dis. 2009 Jul 1;49(1):142-7. doi: 10.1086/599104. PMID: 19480580; PMCID: PMC7107998.
- Fatal Laboratory-Acquired Infection with an Attenuated *Yersinia pestis* Strain — Chicago, Illinois, 2009; CDC MMWR; February 25, 2011; <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6007a1.htm>
- Fatal Meningococcal Disease in a Laboratory Worker — California, 2012; CDC MMWR; September 5, 2014; <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6335a2.htm>
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Any further discussion or comments?
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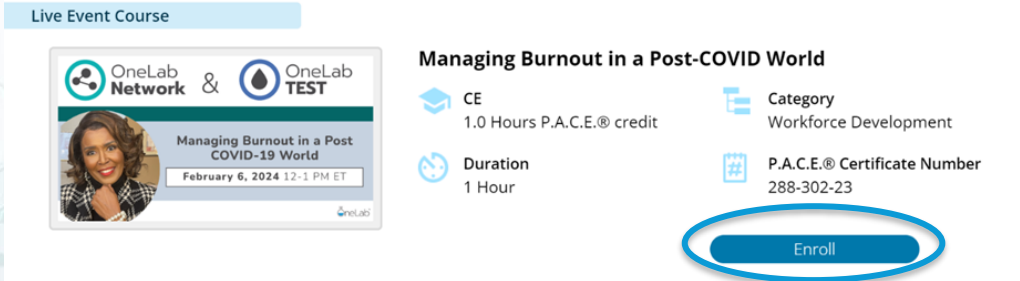
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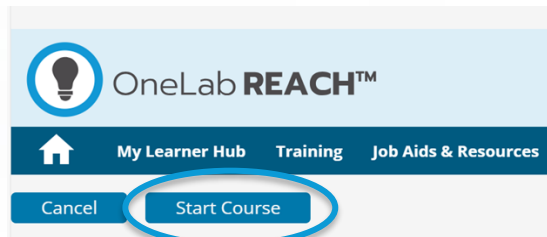
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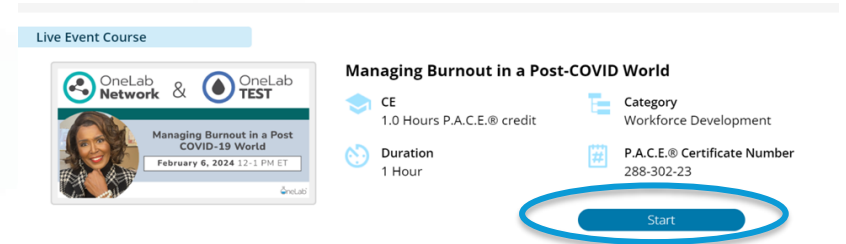
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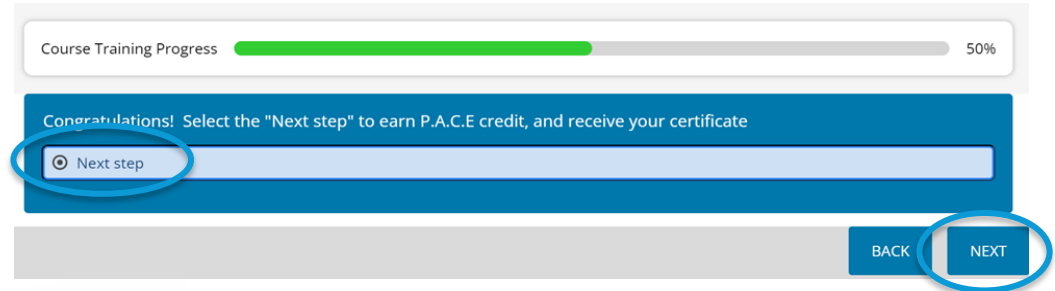
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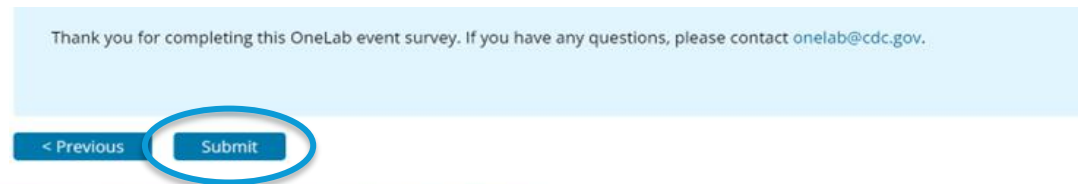
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