



## ***Safety Competencies Roadmap\****

**\*Adapted from a workshop  
developed by a team of biosafety  
professionals**

### **Objectives**

- Identify the appropriate biosafety competencies within the Safety Domain in the MMWR Competency Guidelines for Public Health Laboratory Professionals (Vol. 64/No.1, May 15, 2015) for a specified procedure.
- Use the tools provided to incorporate the identified safety competencies (see above MMWR) into the specified Standard Operating Procedure and into your institutional technical competency assessment program.
- Describe how safety competencies are essential for a safety program.

**Stop 3*****General Tasks to incorporate  
Biosafety Competencies***

1. Review the SOP **Stop 2**
2. Perform the Risk Assessment (RA) **Stop 2**
3. Identify mitigation strategies based on RA **Stop 2**
4. Select applicable competencies from each domain based on the RA **Stop 3**
5. Write competency into safety section of SOP **Stop 3**
6. Determine how competencies will be assessed **Stop 3**
7. Determine how competencies can be extended over time (3-5 years) **Stop 3**
8. Review competencies annually and modify based on changes and identified issues **Stop 3**

**Where to start?**

- First become familiar with MMWR  
Competency Guidelines for Public Health  
Laboratory Professionals *Table 9. Public  
health laboratory competency guidelines:  
Safety domain*
  - Subdomain: potential hazards
  - Subdomain: hazard control
  - Subdomain: administrative controls
  - Subdomain: communication and training
  - Subdomain: documents and records

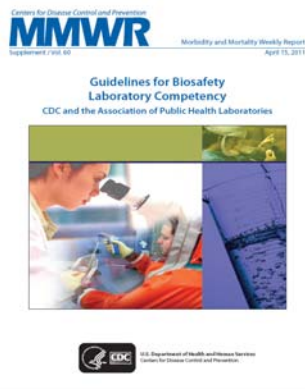


## Competency Definition

- *“Competency is a measurable, documentable factor that involves not only skills that can be taught and developed but also the judgment and ability to recognize the limitations of the work environment and one’s own skills and the skills of others in the laboratory”*

## 2011 Biosafety Competencies

High level view of the required Biosafety Competencies



- Skill Domains
  - I: Potential hazards
  - II: Hazard controls
  - III: Administrative Controls
  - IV: Emergency preparedness and response
  - <https://www.cdc.gov/mmwr/preview/mmwrhtml/su6002a1.htm>

You may find useful information in this version.

## 2015 Table 9. Public Health Laboratory competency guidelines: Safety Domain



Competency Guidelines for Public Health Laboratory Professionals  
CDC and the Association of Public Health Laboratories



- Subdomains (for this workshop)
  - *Potential Hazards*
  - *Hazard Control*
  - *Communication and Training*
- 4 levels of competency
  - Beginner
  - Competent
  - Proficient
  - Expert
- <https://www.cdc.gov/mmwr/pdf/other/su6401.pdf>

## Table 9. Public health laboratory competency guidelines: Safety domain



- Subdomain: *Potential Hazards*
  - SPH 1.0 Physical environment: works safely in the physical environment of the laboratory\*
  - SPH 2.0 Biological materials: works safely with biological materials in the laboratory\*
  - SPH 3.0 Research animals: works safely with research animals
  - SPH 4.0 Chemical Materials: works safely with chemical materials in the laboratory\*
  - SPH 5.0 Radiological materials: works safely with radiological materials in the laboratory

\* Red denotes for this workshop

## ***Subcompetency details for Beginner, Competent, Proficient, and Expert for **Potential Hazards*****



### **SPH 1.0 Physical environment: works safely in the physical environment of the laboratory facility\***

- SPH 1.01 Physical hazards in the laboratory facility
- SPH 1.02 Control measures to be used when physical hazards are present
- SPH 1.03 Work practices to be used when physical hazards are present

\* Only electrical hazards for this workshop

### **SPH 2.0 Biological materials: works safely with biological materials in the laboratory**

- SPH 2.01 Biological materials used in the laboratory
- SPH 2.02 Hazards associated with biological materials handled in the laboratory
- SPH 2.03 Control measures to be used when working with biological materials
- SPH 2.04 Work practices to be used for working with biological materials
- SPH 2.05 Hazards associated with laboratory procedures

## ***Subcompetency details for Beginner, Competent, Proficient, and Expert for **Potential Hazards*****



### **SPH 4.0 Chemical materials: works safely with chemical materials in the laboratory**

- SPH 4.01 Chemicals used in the laboratory
- SPH 4.02 Hazards associated with chemical materials used in the laboratory
- SPH 4.03 Control measures to be used when working with chemicals in the laboratory
- SPH 4.04 Work practices to be used when working with chemicals in the laboratory

## **Table 9. Safety subdomain: Hazard Control**



- SHC 1.00 Engineering controls: implements intervention strategies to control hazards by systematically minimizing isolating, or removing hazards from the workplace
- SHC 2.00 Safe work practices: designs work practices and procedures to minimize exposure to hazards and to adhere to regulatory requirements
- SHC 3.00 Personal Protective Equipment (PPE): employs the selection, use and care of PPE while being continually mindful of its limitations
- SHC 4.00 Systems to track hazards: establishes a system to detect and to control or eliminate the underlying causes of hazards or exposures

## **Subcompetency details for Beginner, Competent, Proficient, and Expert for Hazard Control**

SHC 1.00 Engineering controls: implements intervention strategies to control hazards by systematically minimizing isolating, or removing hazards from the workplace

SHC 2.00 Safe work practices: designs work practices and procedures to minimize exposure to hazards and to adhere to regulatory requirements

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• SHC 1.01 Engineering controls</li> <li>• SCH 1.02 Training on engineering controls</li> <li>• SCH 1.03 Function verification and maintenance of engineering controls</li> <li>• SHC 1.04 Malfunction of engineering controls</li> </ul> | <ul style="list-style-type: none"> <li>• SHC 2.01 Good housekeeping procedures</li> <li>• SHC 2.02 Personal hygiene procedures</li> <li>• SHC 2.03 Safety practices and procedures</li> <li>• SHC 2.04 Work schedules</li> </ul> |
|--|--|

## ***Subcompetency details for Beginner, Competent, Proficient, and Expert for Hazard Control***



SHC 3.00 Personal Protective Equipment (PPE): employs the selection, use and care of PPE while being continually mindful of its limitations

SHC 4.00 Systems to track hazards: establishes a system to detect and to control or eliminate the underlying causes of hazards or exposures

- SHC 3.01 PPE selection
- SHC 3.02 PPE use
- SHC 3.03 PPE inspection
- SHC 4.01 Hazard reporting, tracking and investigation

## ***Safety subdomain: Communication and Training Subcompetency details for Beginner, Competent, Proficient, and Expert***

SCT 1.00. Hazard communication: promotes safety through effective hazard communication

SCT 2.0: Safety training: ensures that safety training needs are identified and training solutions are implemented to meet performance and productivity goals

- SCT 1.01 Safety signage
- SCT 1.02 Safety communication tools
- SCT 1.03 Labeling
- SCT 1.04 Signals and alarms
- SCT 2.01 Safety training
- SCT 2.02 Training documentation

## ***How to Assess Safety Competencies***

- CLIA
  1. Direct observation of test performance
  2. Monitoring the recording and reporting of test results
  3. Review of intermediate test results or worksheets, QC, PT, and preventive maintenance records
  4. Direct observation of performance of instrument maintenance and function checks
  5. Assessment through performance of testing with previously tested specimens
  6. Assessment of problem solving skills
- Safety
  1. Direct observation of safety practices
  2. Review of each exposure or potential exposure
  3. Review of safety practices during work procedures
  4. Direct observation of work in a biosafety cabinet/chemical fume hood
  5. Assessment through exercises and drills
  6. Assessment by quizzes

## ***Exercise Overview***

1. You will complete one group exercise today based on the number on your packet.
2. Work together for 45 minutes.
3. Review the SOP and perform the Risk Assessment and Mitigation (use blank RA template provided).
 

*Note: You are being provided an abbreviated SOP for this workshop that serve as an example. When you return to your laboratory, your institution's SOP may include additional sections such as QC and waste management that may not be included in the abbreviated SOP. Your risk assessment may be different based on your specific laboratory design, procedures and personnel.*
4. Next you will fill-in the "Safety Competencies Table."
5. Go to the list of Safety Competencies and select the appropriate safety competencies for the SOP/RA (column 1).
6. Select the safety competency that you want to use from each of the subdomains for a "competent" individual (column 2).
7. In column 3, you will write what is needed in the safety section of the SOP based on the competencies and RA.
8. Column 4, write down how you will assess the competencies.
9. After 45 minutes, you will share your information with the group by picking a spokesperson to discuss what you found.



### ***SAFETY COMPETENCIES TABLE***

HAZARDS AND MITIGATION FROM SAFETY RISK ASSESSMENT	SAFETY COMPETENCIES IDENTIFIED	WHAT IS NEEDED IN THE SAFETY SECTION OF THE SOP	SAFETY COMPETENCE ASSESSMENTS

### ***Example : Catalase Test***

#### Catalase Test Abbreviated SOP

1. Examine culture media for growth, or screening media for growth of the specific pathogen being screened for.
2. If suspicious colonies are growing, proceed to catalase test.
3. Touch colony with stick or plastic loop.
4. Smear on glass slide.
5. Add drop of Hydrogen peroxide.
6. Observe for bubbles.
7. Discard slide and proceed to other tests as needed.
8. Clean bench with appropriate disinfectant.

## Overall Risk Assessment Process

1. Identify hazards
  - What may happen?
  - How may it happen?
2. Evaluate risks
  - How likely, how severe?
3. Determine controls to mitigate risk
  - To reduce risk if it is not acceptable
  - Evaluate whether the controls are technically and economically feasible
4. Implement controls
5. Review effectiveness of controls and adjust

## Risk Matrix

Risk Assessment Matrix		Hazard Consequence				
		Insignificant	Minor	Moderate	Major	Critical
Hazard Likelihood	Highly likely	Medium	Medium	High	Extreme	Extreme
	Likely	Low	Medium	High	High	Extreme
	Possible	Low	Medium	High	High	High
	Unlikely	Low	Low	Medium	Medium	High
	Rare	Low	Low	Low	Medium	Medium

**Red = HIGH/EXTREME RISK**  
**Yellow = Medium Risk**  
**Green = low risk**

Screening Cultures - General Precautions				
<b>Pathogen(s):</b> There is a potential to be exposed to pathogens that may be isolated on screening media dependent on the patient's health, the type of specimen that is being screened and the screening media that is used.				
<b>Infectious Dose:</b> Dependent on the pathogen.				
<b>Routes of Transmission:</b> <ul style="list-style-type: none"> <li>Parenteral inoculation from a needle stick or other sharps</li> <li>Ingestion from spill or splash into mouth</li> <li>Contact from touching, or a spill or splash onto mucous membrane or non-intact skin</li> <li>Inhalation of infectious aerosol</li> </ul>				
Screening Cultures – Catalase Test Assessment				
<input type="checkbox"/> Perform Screening Cultures. Please select any of the following cultures types: <input type="checkbox"/> Urine <input type="checkbox"/> Throat <input type="checkbox"/> MRSA <input type="checkbox"/> Other (be specific)				
Process Step	Potential Hazards	Initial Risk Level	Control (Mitigation)	Residual Risk Level
1) Examine culture media for growth or screening media for growth of the specific pathogen being screened for. 2) If suspicious colonies are growing, proceed to catalase test. 3) Touch colony with stick or plastic loop. 4) Smear on glass slide. 5) Add drop of Hydrogen peroxide. 6) Observe for bubbles. 7) Discard slide and proceed to other tests as needed. 8) Clean bench with appropriate disinfectant.	<ul style="list-style-type: none"> <li>An aerosol may be created opening the plate and performing catalase test.</li> <li>Risk of contamination by touching growth.</li> <li>Chemical hazard: Hydrogen peroxide - Causes skin irritation. Causes serious eye damage.</li> <li>Chemical hazard - disinfectant - Irritant (look up SDS).</li> <li>Sharps hazard - glass slide.</li> </ul>	Medium	<b>Required:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Follow written procedures (trained and competent).</li> <li><input type="checkbox"/> Perform test in a tube or petri dish.</li> <li><input type="checkbox"/> Wear PPE: lab coat</li> <li><input type="checkbox"/> Sharps container</li> <li><input type="checkbox"/> Disinfectant</li> </ul> <b>Preferred:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Wear gloves and additional eye protection when there is a risk of a splash or spray.</li> <li><input type="checkbox"/> Examine screening media for growth in a Class II BSC.</li> <li><input type="checkbox"/> Perform catalase test on suspicious growth in a Class II BSC.</li> <li><input type="checkbox"/> Use additional BSL-3 practices if patient is known or suspected to have a highly infectious disease transmitted by aerosols, or droplets (i.e. MERS, SARS, avian influenza, mumps, measles, etc.).</li> </ul> <b>Alternative:</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Work behind a full safety shield/face shield and wear eye protection.</li> </ul>	Low
<b>Comments:</b>				

## Applicable competencies for this SOP?

SOP	Potential Competencies
Perform work inside BSC	SHC 1.00 Engineering controls* SHC 3.01 PPE selection* SHC 3.02 PPE use* SHC 3.03 PPE inspection SCT 2.01 Safety training* SCT 2.02 Training documentation*
Inoculation of slide with colony	SHC 2.03 Safety practices and procedures* SPH 2.01 Biological materials used in the laboratory* SPH 2.02 Hazards associated with biological materials handled in the laboratory* SPH 2.03 Control measures to be used when working with biological materials* SPH 2.04 Work practices to be used for working with biological materials* SPH 2.05 Hazards associated with laboratory procedures* Plus above minus SHC 1.00

“\*” Denotes for this workshop

## Applicable competencies for this SOP?

SOP	Potential Competencies
Perform Catalase test (add Hydrogen Peroxide) and observe for bubbles.	SPH 4.0 Chemical materials: works safely with chemical materials in the laboratory* Plus all above minus SHC 1.00
Discard slide	SPH 1.01: Physical hazards in the laboratory facility* SPH 1.02: Control measures to be used when physical hazards are present* SPH 1.03. Work practices to be used when physical hazards are present*
Clean Bench/BSC	SPH 4.0 Chemical materials: works safely with chemical materials in the laboratory*

“\*” Denotes for this workshop

## BIOSAFETY COMPETENCIES TABLE EXAMPLE

### Catalase Test

HAZARDS AND MITIGATION FROM SAFETY RISK ASSESSMENT	SAFETY COMPETENCIES IDENTIFIED	WHAT IS NEEDED IN THE SAFETY SECTION OF THE SOP	SAFETY COMPETENCE ASSESSMENTS

## **BIOSAFETY COMPETENCIES TABLE EXAMPLE**

### ***Catalase Test***

HAZARDS AND MITIGATION FROM SAFETY RISK ASSESSMENT	SAFETY COMPETENCIES IDENTIFIED	WHAT IS NEEDED IN THE SAFETY SECTION OF THE SOP	SAFETY COMPETENCE ASSESSMENTS
<ul style="list-style-type: none"> <li>• Biological Hazards</li> <li>• Engineering Controls</li> <li>• Administrative Controls</li> <li>• Practices and Procedures</li> <li>• PPE</li> </ul>	Safety Subdomains <ul style="list-style-type: none"> <li>• Potential Hazards</li> <li>• Hazard Control</li> <li>• Safety Communication and Training</li> </ul>	<ul style="list-style-type: none"> <li>• What procedures to perform in the BSC</li> <li>• Engineering controls</li> <li>• Administrative controls</li> <li>• Practices and procedures</li> <li>• PPE</li> <li>• Training needs</li> </ul>	<ul style="list-style-type: none"> <li>• Written or Oral Knowledge Assessment</li> <li>• Observation</li> </ul>

### **BIOSAFETY COMPETENCIES TABLE EXAMPLE *Catalase Test***

HAZARDS AND MITIGATION FROM BIOSAFETY RISK ASSESSMENT	SAFETY COMPETENCIES IDENTIFIED	WHAT IS NEEDED IN THE SAFETY SECTION OF THE SOP	SAFETY COMPETENCE ASSESSMENTS
Biological Hazards: aerosols from opening plates, touching colonies, adding Hydrogen Peroxide, spill, potential pathogens Chemical Hazards: Hydrogen Peroxide and disinfectant Physical Hazard: Sharps (glass slide)  Engineering Controls: BSC  Practices and Procedures: Standard Precautions, Work inside BSC, Proper work practices, Clean spills and work area with disinfectant (BSC needs to be cleaned with 70% alcohol after disinfectant)  PPE: Lab coat and gloves and eye protection	SHC 1.00 Engineering controls SHC 3.01 PPE selection SHC 3.02 PPE use SPH 1.01: Physical hazards in the laboratory facility SPH 1.02: Control measures to be used when physical hazards are present SPH 1.03. Work practices to be used when physical hazards are present SPH 2.01 Biological materials used in the laboratory SPH 2.02 Hazards associated with biological materials handled in the laboratory SPH 2.03 Control measures to be used when working with biological materials SPH 2.04 Work practices to be used for working with biological materials SPH 2.05 Hazards associated with laboratory procedures SPH 4.0 Chemical materials: works safely with chemical materials in the laboratory SCT 2.01 Safety training SCT 2.02 Training documentation SHC 2.03 Safety practices and procedures	All catalase tests are to be performed in the biological safety cabinet using appropriate PPE and proper BSC procedures. Sharps containers will be used to discard the glass slides. Hydrogen peroxide and disinfectants will be stored and handled according to the SDS.	Direct observation of work in a biosafety cabinet

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