

INSTRUCTOR'S GUIDE, FORMS, AND SIGNS

Chemical Laboratory Safety and Security

A Guide to Prudent Chemical Management

Committee on Promoting Safe and Secure Chemical Management
in Developing Countries

Board on Chemical Sciences and Technology

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The *Instructor's Guide, Forms, and Signs* are meant to be used with *Chemical Laboratory Safety and Security: A Guide to Prudent Chemical Management*. These materials are based on two reports from the National Research Council of the National Academies:

- *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*, which serves as a seminal reference book on chemical laboratory safety in the United States and was prepared by the Committee on Prudent Practices in the Laboratory: An Update; and
- *Promoting Chemical Laboratory Safety and Security in Developing Countries*, prepared by the Committee on Promoting Safe and Secure Chemical Management in Developing Countries.

All of these materials are available on the Internet at www.nap.edu.

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INSTRUCTOR'S GUIDE



FOREWORD

Global success of chemistry education and research depends on the safe and secure management of chemicals. However, fostering a culture of safety and security can be challenging. Local social and cultural barriers or other factors may keep a laboratory manager, laboratory personnel, student, or others from using the best safety and security practices.

The book *Chemical Laboratory Safety and Security: A Guide to Prudent Chemical Management* provides detailed guidance on best practices in purchasing, handling, storing, and disposing of chemicals in small-scale research and teaching laboratories. This *Instructor's Guide* aims to help laboratory managers encourage good safety and security behaviors and practices among everyone in the laboratory.

Chemical Laboratory Safety and Security: A Guide to Prudent Chemical Management and the *Instructor's Guide* were drafted and reviewed by a committee made up of experts and scholars with diverse perspectives, including chemists from the University of Karachi, Pakistan, and the University of San Carlos, Cebu City, Philippines. Laboratory managers and other instructors should be aware that *Chemical Laboratory Safety and Security: A Guide to Prudent Chemical Management* and the *Instructor's Guide* reflect the views of many people in the scientific community around the world, but not all.

INTRODUCTION

In this *Instructor's Guide*, there are ten lessons to be used in training laboratory managers and three lessons for laboratory personnel. Each lesson contains the following parts:

- an overview;
- objectives, or concepts that all participants should master after studying the lesson;
- a case study, which includes example barriers to following good safety and security practices;
- one or more lesson segments that build on the case study and describe additional problematic situations in a laboratory;
- questions for participants to answer and discuss as a group; and
- commentary on each question for instructors to use in guiding participants in their discussions.

At the end of the lessons, there are participant worksheets. The worksheets do not contain the introduction or commentary text for each lesson. These worksheets should be handed out to participants if possible. The lessons that contain the introduction and commentary text are for use by the instructor *only* and should *not* be distributed to participants. The introduction and commentary are available to help the instructor lead the discussion, ask the appropriate questions, and make the experience useful for all participants.

Discussing lessons is a way to involve participants in familiar and relevant issues. The purpose of the lessons in this guide is to ask participants to consider the choices they face as they attempt to promote a culture of safety and security in the laboratory.

These lessons are directed toward laboratory managers or others who supervise laboratories and laboratory staff and students. Discussion begins with participants thinking about what might be going on in the minds of the fictional individuals featured in the lessons. Every lesson includes reflective questions that aim to encourage participants to consider the following concerns: *Could this happen in our laboratory? Does this happen here? What strategies could we develop to deal with this issue in our workplace?*

Below are tips for instructors on how to successfully use the lessons. The following guidance contains information from Kenneth D. Pimple's article "Using Case Studies in Teaching Research Ethics."¹

¹Adapted from Pimple, Kenneth D., "Using Case Studies in Teaching Research Ethics" (2007). Resources. Paper 293. <http://www.ethicslibrary.org/resources/293>.

- Prepare in advance to lead the lesson discussion. Decide what goals to accomplish, how to discuss the situations presented, and how much time to spend on each lesson.
- Set rules for the discussion at the beginning of the session. Remind participants to be open, honest, and respectful.
- Offer participants broad strategies and tactics for considering lessons before beginning the discussion. Some of these tactics include:
 - 4 thinking about immediate, near-future, and long-term steps to take;
 - 4 considering what the fictional people featured in the lesson might be thinking;
 - 4 considering strategies to deal with the problem in the laboratory; and
 - 4 taking a personal role in the problem—*What would I do in this situation?*

For each lesson discussion, follow these suggested procedures:

- Before starting each lesson discussion, distribute copies to participants to make it easier for them to participate.
- Ask one of the participants to read the lesson aloud. This allows participants to be engaged at an early stage.
- Give participants about five minutes to think about the lesson individually, write down any thoughts they may have, and answer the questions before discussing them aloud.
- After participants have been given time to work independently, have them share short responses to the lesson. Then allow participants to discuss answers to the questions.
- As instructors, listen to the discussion without actively participating unless the discussion becomes disorderly or off-point.

The goal of instructors is to build trust and encourage honest reflection. Encourage participants to work independently or as a group to devise concrete strategies for dealing with the issues presented in the lessons. Strategies should include immediate steps, near-future, and long-term steps.

At the end of each lesson, participants should recognize some of the barriers that prevent laboratory personnel from behaving safely or securely and should be able to list steps for overcoming those barriers. Only by addressing barriers can a laboratory promote a culture of safety and security. In addition, participants should leave the training session feeling empowered to think creatively in response to safety issues. Finally, it is important for all participants to leave the session understanding that everyone is responsible for the safety and security of the laboratory, not just certain people.

LESSONS FOR LABORATORY MANAGERS

With italicized comments for instructor

LESSON 1: ENSURING THE USE OF SAFETY EQUIPMENT IN THE LABORATORY

Overview: This lesson describes the challenges a new laboratory manager faces in making sure laboratory personnel use appropriate personal protective equipment (PPE), especially safety goggles.

Objectives:

- Recognize the importance of PPE for all men and women working in laboratories.
- Identify barriers to the safe and consistent use of PPE in laboratories.
- Identify actions that laboratory managers can use to encourage the use of PPE among laboratory workers and visitors.
- Identify methods for convincing supervisors and other institutional leaders of the importance of PPE and its regular use.
- Recognize that there are many ways to encourage the adoption of safe practices in a laboratory.

Reasons for not wearing the goggles in this lesson could include

- cost and/or unavailability of goggles;
- a lack of habit;
- a lack of understanding of the importance of wearing PPE or of the hazards posed by the work;
- a sense of invincibility;
- a lack of confidence or respect in the new laboratory manager;
- a cultural acceptance of risk and destiny;
- feeling of resistance, since the new laboratory manager is an outsider;
- workers wanting to rebel against the changes to traditional practices;
- anticipation of the goggles being uncomfortable to wear;
- attitude of higher-level management; and
- feeling of unattractiveness.

Please note: The women in the laboratory may have additional or different reasons than the men for not wearing goggles. For example, they may believe their tasks are less risky than the ones performed by men. It is also possible that women may feel that their health is less important than that of men, and, as a result, they are choosing not to diminish the supply of available goggles for their male colleagues.

SEGMENT 1

A recent graduate of a well-respected institution is hired as a laboratory manager for a small chemical company. Soon after starting work, the manager notices that many laboratory personnel do not have safety goggles. To fix the problem, the manager orders pairs for everyone and invites the staff to pick them up from central inventory. A few weeks later, the manager notices that many pairs of goggles are still in central inventory. On a walk-through of the laboratories, the manager notices that many of the goggles are

displayed on laboratory shelves but still in boxes. The manager also notices that many of the female employees have not even picked up their goggles from central inventory.

1. Why might the laboratory personnel be reluctant to wear the safety goggles?

Instructor: Encourage participants to share why there is a disregard for safety and consider what could be influencing the workers' actions. For possible reasons for not wearing the goggles please refer to the bulleted list above.

2. What should the manager do?

Instructor: Lead a discussion to find the best course of action. Participants' suggestions might include

- 4 hold a training session for all laboratory personnel that focuses on the importance of PPE and its regular use;*
- 4 hold a meeting to ask people why they are not using the goggles; respond to their comments and concerns with specific actions meant to address the issues they raise;*
- 4 post signs in the laboratory to remind personnel of the importance of PPE, especially goggles, and its correct use;*
- 4 regularly remind personnel to use goggles, and check on their proper use;*
- 4 distribute uncollected goggles to personnel;*
- 4 praise and thank people for properly wearing PPE; and*
- 4 create penalties for noncompliance. For example, if people do not wear goggles there may be consequences in their annual review.*

SEGMENT 2

As an attempt to correct the situation, the laboratory manager hands out the remaining goggles to those who had not picked them up and reminds laboratory personnel of the importance of using safety goggles while working in the laboratory. The manager is reassured because everyone agrees with him. However, when walking through the laboratories a few days later, the manager notices that many personnel still are not wearing their goggles.

1. What should the manager do now? List the strategies the manager could use in the table below. Note the advantages and disadvantages of each option.

Instructor: Encourage participants to think about immediate, near-term, and long-term strategies. An example is provided in the first row of the table.

Barrier	Strategies to address barrier	Advantages	Disadvantages
goggles are uncomfortable to wear	remind personnel of the need for goggles to prevent eye injuries	demonstrates a consistent culture of safety in the laboratory	does not address the specific problem of discomfort

2. What kind of help might the manager need? From whom?

Instructor: Help participants recognize that it is much harder to make changes alone. Some solutions might include seeking help from peers, supervisors, or professional societies.

3. Would the situation be different if the laboratory manager were an older, established researcher?

Instructor: Encourage participants to share what they would do if the laboratory manager were an established, older researcher. Ask questions to help participants understand the difficulties faced by younger managers, such as: Do workers listen to older, more experienced managers more than someone who is younger and recently graduated?

4. If the laboratory manager were a woman, would the situation be different? How?

Instructor: Have participants discuss the impacts of having a female laboratory manager in their own laboratory. Encourage participants to recognize any special challenges that a female manager might face that a male manager might not face. Lead participants to brainstorm ways that a female manager might overcome these challenges.

SEGMENT 3

After many weeks of work, the manager succeeds in getting laboratory personnel to wear their goggles consistently. One day, as part of a review of the institution, the manager's supervisor takes a tour of the laboratories. When offered goggles before entering the laboratory, the supervisor waves them off, saying, "I will only be in there for a few minutes. I'm sure I'll be fine."

1. What impact could the supervisor's behavior have on the laboratory staff?

Instructor: Help participants recognize that the supervisor acts as a role model. Not wearing goggles may undo the work put in place by the laboratory manager.

2. What should the laboratory manager do now?

Instructor: Ask participants to discuss the position the laboratory manager is in. Lead the discussion with questions such as: What is the manager thinking? Should the manager publicly challenge the supervisor, or is it best for the manager to talk to the supervisor in private?

Suggestions might include discussing the situation in private with the supervisor, trying to gently encourage the supervisor to wear the goggles, pointing out that the entire laboratory staff wears goggles regularly, or reminding the supervisor that, as a leader, it is important to set an example for others.

Remind participants that the manager's goal is to have the supervisor support the manager and the culture of safety throughout their institution.

3. How is this case relevant to your laboratory?

Instructor: Ask participants to draw from their own experiences. Ask questions such as: Have you ever been in a situation similar to this? What did you do?

4. Are safety goggles required in your laboratory at all times? Why or why not?

Instructor: This is a reflective question for participants. Encourage participants to think about reasons why they choose not to wear goggles. Ask: Are there times when it is not necessary to wear goggles? Discuss how to address noncompliance.

5. Do laboratory personnel at your laboratory follow other similar important safety measures? Why or why not?

Instructor: This is a reflective question for participants. Ask participants to write down answers, as this is a way to reflect on their performance as managers.

6. What strategies should laboratories put in place to better promote a culture of safety?

Instructor: Write down participants' suggestions on a board or large piece of paper. Ideas may include training, signs, better practices by laboratory leaders, or investment in PPE and other safety equipment.

7. To better promote a culture of safety, what support will laboratory managers need? From whom?

Instructor: Ask participants to think about what resources they will need to successfully implement the strategies suggested in number 6 above. Encourage participants to seek help from supervisors, peers, other institutions, and professional societies.

8. What is the best way to secure that support for a culture of safety?

Instructor: The answer to this question will be different for each individual institution. Some countries may not have ample resources to implement all safety strategies, but often creative solutions can be found.

VIGNETTE

In one country, one of our committee members noticed that laboratory workers and students were not complying with goggle policies. To get people to comply, he told all of the individuals to bring in a picture of family members and hang it up in their work-space. Once everyone brought pictures, he told them to "wear goggles, so you can always be able to see your family members." After this reminder, the committee member said that almost all, if not all, laboratory workers and students were using goggles in the laboratory.

Is this something that you can use in your laboratory?

LESSON 2: FOLLOWING UP ON SUSPICIOUS BEHAVIORS

Overview: In this lesson, the laboratory manager notices a security guard taking a different route than he was assigned to take during the morning, afternoon, and evening rounds.

Objectives:

- Identify the elements of suspicious behavior in a laboratory.
- Understand the importance of recognizing and addressing suspicious behavior in order to promote a safe and secure laboratory environment.
- Recognize the challenges faced by laboratory management in addressing suspicious behavior.
- Generate ideas on how to handle suspicious behavior in a laboratory.
- Cultivate a willingness “to do the right thing” even when it is hard to do so.

Reasons for not reporting suspicious behavior could include

- friendship with the worker;
- not wishing to cause someone to lose his or her job;
- fear of retribution if criminal activity is occurring;
- fear of falsely accusing a coworker; and
- general fear of consequences.

SEGMENT 1

A medium-sized laboratory hires a security guard because of concerns about outside theft. The guard is given specific duties. Although he is not given access to the rooms used for chemical storage, the guard is instructed to walk a specific route through the facility in the morning, afternoon, and evening and to check badges to make sure that nonlaboratory personnel and other visitors do not gain entrance.

Everything goes smoothly for the first few weeks, but then the laboratory manager notices the security guard taking a different route. The manager sees the guard stopping in front of some of the chemical storage rooms. For a few days, the laboratory manager monitors the security guard's behavior. The manager does not see the guard take any chemicals; however, the manager does see the guard checking some of the locks on the doors. This behavior troubles the laboratory manager.

1. Should the laboratory manager be concerned by the guard's behavior? Why or why not?

Instructor: Start the discussion by asking participants to consider the reasons for the guard's behavior. Some participants may suggest that the guard doesn't understand rules or that he is trying to be especially helpful and go beyond his assigned duties. Others may suggest that the guard is trying to steal chemicals or act as a lookout for someone else who wants to steal. Guide participants to recognize that, no matter what his motives are, behavior out of the ordinary should be investigated.

2. What should the laboratory manager do? What is the best action the manager could take?

Instructor: Encourage participants to think about immediate, near-term, and long-term strategies. Some possible answers include confronting the security guard, continuing to watch the guard's behavior, and alerting other laboratory personnel to the possible threat.

3. What might prevent the manager from taking any action?

Instructor: Guide participants to have an open and honest discussion about barriers that may come into play in this situation. Some additional questions that may facilitate the discussion include: If you saw this behavior, would it be difficult for you to act on this? What are some of the reasons why taking action would be difficult? For possible barriers, refer to the bulleted list above.

SEGMENT 2

The laboratory manager decides to confront the security guard. However, the guard denies there is a problem. He says that he “was given instructions by his boss to use the new route,” but the laboratory manager is still uneasy about the situation.

1. What should the manager do now?

Instructor: Possible responses include talking with the guard's supervisor to discover the truth of the guard's claim, reporting the incident to a higher-level supervisor or the institution's security team, telling other coworkers, or doing nothing. Write down each response and discuss the advantages and disadvantages of each course of action.

SEGMENT 3

The laboratory manager sees the security guard bringing nonlaboratory individuals into the facility. The guard and the strangers are seen convening near the locked storage rooms. The manager decides to talk to the security guard's supervisor. The supervisor brushes off the concern, saying, “Oh, I'll talk to my nephew, but I am sure he means well. There is nothing to worry about.”

1. How does this information change the situation?

Instructor: Have participants discuss the new information. Ask participants: Does this new information seem realistic? Have you ever experienced a similar situation? Then ask participants to discuss how the new information affects the options the laboratory manager has now. Some participants may note that since the security guard is the supervisor's nephew, the supervisor's judgment may be biased.

2. What should the laboratory manager do?

Instructor: Ask participants to develop a list of appropriate immediate and near-term actions to take. Responses may include reporting the incident to the laboratory supervisor or other institutional leaders.

LESSON 3: SOLVING SAFETY AND SECURITY PROBLEMS RAISED BY PURCHASING PRACTICES

Overview: This lesson describes the challenges faced by a newly hired chair of a university who must make sure that chemical fume hoods are used properly and chemicals are stored safely.

Objectives:

- Distinguish safe from unsafe chemical storage practices.
- Identify the risks of improper storage of chemicals.
- Discuss the consequences of improper storage.
- Recognize the importance of safe chemical storage practices.
- Recognize the barriers to safe chemical storage and develop strategies for overcoming these barriers.
- Develop a list of safe purchasing and storage practices.

Reasons for not adopting safe chemical storage could include

- lack of storage space;
- lack of understanding of the hazards associated with storage in chemical fume hoods;
- a sense of invincibility; and
- insufficient training.

A newly hired chair of a university inspects the laboratories and notices that students and staff are performing experiments that produce hazardous vapors on the laboratory bench. When asked why they are not doing the work in a chemical fume hood, the staff members reply that there is no hood space available. A quick check reveals that the hoods are being used for chemical storage rather than for laboratory work. The chair speaks to other faculty members and finds that this is common practice in the university. Bulk chemicals can only be ordered once a year under purchasing rules, and they must be stored somewhere. The faculty members assure the chair that, though it seems haphazard, finding chemicals when they are needed is not a problem because they are stored alphabetically within each hood.

1. What are the risks posed by this situation? Why are they serious?

Instructor: Encourage participants to think about short-term and long-term risks associated with the situation. Ask: What is the worst-case scenario? In this lesson, it is important to emphasize the importance of working in a hood. Also, be sure participants note the storage concern—alphabetical storage can lead to incompatible chemicals in close proximity.

2. What may be some of the barriers to safer chemical purchasing and storage at this institution?

Instructor: Guide participants to draw on their own situations to answer this question. Encourage participants to write down why they believe the chemicals are being stored in the hoods, why they are arranged alphabetically, and then discuss these answers. For some reasons why laboratory managers are storing chemicals in hoods and alphabetically, please see the bulleted list above. Reasons for bulk procurement practices, which lead to this unsafe storage situation, might include small institutional budgets, a mandate from institutional leadership to cut costs, or difficulty in purchasing chemicals as needed in a timely fashion.

3. What should the chair do?

Instructor: Ask participants to discuss how they would handle this situation. What are some immediate steps that need to be taken? What kind of help does the chair need to remedy this situation? Talk about the risks from question number one. Encourage participants to brainstorm strategies to promote safe storage of chemicals. Responses might include better training, better storage facilities, a change in the purchase process, signage on safe chemical storage, and regular inspections.

4. What relevance does this lesson have for your laboratory?

Instructor: Elaborate on this question by asking participants if they have ever been in this situation or a similar one. Then ask them to elaborate on how they handled the situation.

5. What are some strategies that your laboratory might employ to purchase and store chemicals more safely and securely?

Instructor: The answer to this question will vary among individual laboratories. In some countries, the only option is to buy chemicals annually. However, it is important for laboratory facilities to try not to accumulate too many chemicals or a large quantity of any hazardous chemical. Point out that manager's may need the support of their supervisor to change purchasing practices.

VIGNETTE

In many countries, chemicals are bought in bulk quantities, sometimes purchased once a year. A guest speaker told the committee that chemicals are purchased once a year in his laboratory. However, to make sure excess chemicals are stored safely and securely, they house the chemicals in an off-site secure facility and remove the chemicals as needed.

Is this something your laboratory could do?

LESSON 4: CREATIVE PROBLEM SOLVING IN A RESOURCE-POOR ENVIRONMENT

Overview: In this lesson, a new chair of a chemistry department conducts an inspection and notices that the teaching laboratories do not have chemical fume hoods. The research laboratories do have hoods, but they are not working properly.

Objectives:

- Recognize the importance of maintaining a safe laboratory environment.
- Identify the reasons for installing, maintaining, and using chemical hoods in all laboratories.
- Identify the barriers to the safe and proper use of chemical hoods.
- Identify limited resources as a barrier to the safe and proper use of chemical hoods.
- Develop strategies for overcoming barriers to the safe and proper use of chemical hoods, even with limited resources.

Reasons for not having hoods in teaching laboratories and nonfunctional hoods in research laboratories include

- lack of available funds;
- believing students in teaching laboratories are at less risk than those in research laboratories;
- corroded fans in the hoods; and
- insufficient space to put chemical fume hoods in teaching laboratories

The new chair of a chemistry department conducts an inspection and notices that the student teaching laboratories do not have hoods, while the research laboratories do. The chair also notices that, in the research laboratories, hood space is shared by several people, and each person is working on a different project. In addition, it appears that the hoods are not working properly. The chair asks the department's laboratory manager about the situation. The manager explains that the fans have corroded due to the high humidity and he assures the chair that the lack of properly functioning hoods is "not a problem" because laboratory personnel are not handling "very hazardous" chemicals.

1. What are the dangers of the situation discovered by the chair?

Instructor: Discuss with participants the safety hazards involved in working without hoods or with malfunctioning hoods. Responses should include possible exposure of laboratory staff and students to hazardous substances, higher risks of accidents, and the potential for serious emergencies such as explosions.

2. What should the chair do about the malfunctioning and missing hoods?

Instructor: Ask participants to think of immediate and near-term steps that the chair may want to take. Responses might include repairing the broken hoods, installing new hoods, replacing fans regularly, sharing the research hoods with students, restricting the use of functioning hoods to work with hazardous chemicals done by researchers and students alike, and installing climate-control measures to reduce the amount of humidity in the laboratory.

3. Should laboratory work stop in the research laboratories? Should laboratory work stop in the teaching laboratories?

Instructor: Guide participants to recognize that it may be necessary to halt laboratory work. Emphasize that a lot of the laboratory work should not be conducted without hoods and that laboratory staff and students should not compromise on issues relating to safety.

4. What is the relevance of this lesson for your laboratory?

Instructor: Ask participants to take a few minutes to think about the relevance of this situation to their own laboratories. Ask participants to share their answers with the group.

5. Do all staff and students in your laboratory use hoods each time they should? Why or why not?

Instructor: Have participants reflect on this question by themselves since it regards their own laboratory management practices. You may want to ask participants to explain why staff and students in their laboratories do not always use hoods. This may help point out past unsafe practices and lead to better safety practices for the future.

6. What are the barriers to consistent use of hoods?

Instructor: Write down participant responses and discuss them as a group. Responses may include broken equipment, lack of knowledge about the use of hoods, lack of understanding of the danger of working without hoods, difficulty in accessing or operating hoods, and perceived lack of time to use hoods.

a. What are some steps you could take to improve the use of hoods at your laboratory?

Instructor: Encourage participants to think of immediate, near-term, and long-term actions that could improve hood use, including maintaining equipment, posting signs on proper hood use, better training in hood use, frequent inspections, and use of incentives and sanctions.

b. Whose support and what kind of help would be necessary?

Instructor: Point out to participants that it is much harder to make changes alone. Guide participants to suggest seeking help from peers, supervisors, other institutions, or professional societies.

LESSON 5: MANAGING INTERPERSONAL CONFLICTS IN THE LABORATORY

Overview: In this lesson, a female worker publicly shouts and berates another worker for conducting a hazardous experiment outside of a hood. The manager and supervisor of the manager get involved in this situation to help resolve it.

Objectives:

- Identify possible situations that may cause conflicts between coworkers in a laboratory.
- List appropriate measures that workers and managers should use when they notice unsafe practices in a laboratory.
- List appropriate methods that managers and supervisors should use when handling conflicts between personnel in the laboratory.
- Recognize effective communication techniques for resolving conflicts in a laboratory.

Reasons for the female worker's outburst could include

- shock at the experiment being conducted outside a hood;
- fearing for her life and other coworkers' lives;
- feeling of insecurity in the laboratory;
- feeling of helplessness;
- unable to communicate properly with coworkers; and
- belief that as a woman she is unnoticed by others, so she must shout.

SEGMENT 1

A recent graduate of a well-known foreign university is hired by a company to do chemical synthesis. She works in a laboratory with two other experienced researchers and a few laboratory technicians. One day, she looks across the bench to see one of her coworkers about to perform a dangerous procedure outside of a hood and without warning the rest of the laboratory personnel about the risk. Believing that everyone is in danger, she shouts for the other researcher to stop his work and berates him for not taking the precautions necessary to protect himself and others in the laboratory.

A few days later, with tensions still high in the laboratory, the manager of the two researchers goes to the department supervisor for advice. In explaining the situation, he says, "This procedure has been run many times before with no problems. Sure, we've had the odd accident here or there—what laboratory hasn't—but nothing serious has ever happened. After this outburst, no one is comfortable working with the new researcher. What am I supposed to do with this woman?"

1. Did the female researcher raise legitimate concerns?

Instructor: Have participants discuss safe practices in the laboratory, including the importance of performing dangerous procedures in a chemical hood and notifying coworkers of potential hazards.

Note that laboratory managers should encourage workers to report unsafe practices and reward those who raise red flags about unsafe practices.

2. Why do you think the female researcher reacted the way she did to the situation?

Instructor: Encourage participants to draw on their own experiences and think about how the researcher felt. For examples of reasons for the outburst, see the list above.

3. Did the researcher raise her concerns in the most appropriate way for the circumstances? If not, how should she have expressed herself?

Instructor: Encourage participants to recognize the problems with the researcher's method of talking to her coworker. Participants should acknowledge that shouting at a coworker in front of others in the laboratory may make people uncomfortable, angry, or embarrassed. Have participants think of other ways the female researcher could have raised her concerns. Responses should include walking over to the coworker and addressing the person in a more respectful tone of voice.

4. What do you think of the laboratory manager's actions in this situation?

Instructor: Encourage participants to discuss their views openly with each other. Participants may comment on the manager's lack of concern for unsafe practices, his decision to speak with his supervisor before approaching the researchers themselves, or his apparent negative attitude toward the female researcher.

5. Do you think the manager is concerned about this situation primarily because the researcher is a woman?

Instructor: Encourage participants to be honest about their response to this question. Ask participants to elaborate on their answers and to explain their reasoning. The manager's last statement to his supervisor and his apparent tone of voice may lead participants to believe the manager is primarily concerned about the situation because the researcher is female.

6. What do you think the department supervisor should advise the laboratory manager to do?

Instructor: Encourage participants to think about how their department supervisor would act and what the best advice would be. Participants may suggest that the supervisor tell the manager to talk to the female researcher about her reaction, hold a meeting with both researchers to resolve any conflicts, and remind all laboratory workers about the safety procedures in the laboratory, including the proper use of chemical hoods.

7. If this happened in your laboratory, what would you do as a manager or supervisor? What help would you need?

Instructor: Encourage participants to share what they would do. Lead the discussion to find the best course of action, including some of the suggestions from number 3 above. Guide participants to recognize the value of seeking help from peers, professional societies, and supervisors. Also, it is important to note that laboratory managers should encourage their staff to report unsafe behavior in the laboratory and appreciate workers who do so. In this case, the female worker's shouting might have been appropriate, but she went too far by also berating her coworker.

SEGMENT 2

After a few weeks, tension continues to be high in the laboratory, so the manager decides to bring both of the researchers to speak to the department supervisor. After hearing the story, the department supervisor tells the female researcher, “You need to control your temper and mind your own business in the laboratory.”

1. What could be the consequence, if any, from the way the department supervisor handled this situation?

Instructor: As participants respond to the question, make a list all of the consequences and discuss each. Possible responses are listed below.

Consequences from the way the department supervisor handled the situation:
The female researcher feels isolated and afraid to speak up in the future about unsafe practices.
The female researcher decides to simply leave the laboratory for another institution in order to continue her research work.
Laboratory workers will continue to practice unsafe procedures in the laboratory, since there are no consequences.
Other workers in the laboratory will be afraid to report unsafe procedures in the laboratory.
There will not be an effective system in place for handling interpersonal conflicts that arise in the laboratory in the future.

Guide participants to recognize that the department supervisor may have lost his credibility with some segment of the laboratory staff, especially when it comes to safety. Even those he supported by his action will likely not believe that he really cares about their safety. He has failed to lead by example.

2. Did the supervisor handle the situation appropriately? Why do you think this?

Instructor: Encourage participants to think about the consequences of the supervisor’s actions, as listed in number one above. Have participants discuss their reasons for agreeing or disagreeing with the supervisor’s actions. Help participants see the long-term negative effects of the supervisor’s actions.

3. If you were the department supervisor, what would you do?

Instructor: Help participants find the best course of action. List all possible steps the supervisor could take. Have participants discuss each step. Possible responses are listed below.

Possible actions a supervisor could take:
State clearly the desire for all laboratory personnel to speak up when they see unsafe practices, and explain that people who do speak up will be appreciated for doing so.
Establish a policy for conflict resolution among laboratory coworkers.
Reinforce safety procedures in the laboratory through retraining or posting of signs. Require the laboratory manager to enforce safety procedures.
Discuss the laboratory manager’s attitude toward female employees and remind the manager to treat all workers fairly.

LESSON 6: PRESSURES TO TAKE SHORTCUTS IN THE LABORATORY

Overview: In this lesson, the supervisor pressures laboratory personnel to complete experiments at a faster rate than is reasonable. The employees begin skipping steps and taking unsafe shortcuts to complete experiments.

[Note that Segment 1 presents the laboratory employee's perspective and Segment 2 presents the laboratory manager's perspective. Discuss and answer questions as they relate to each perspective.]

Objectives:

- Identify reasons that laboratory personnel may take unsafe shortcuts or skip steps in procedures.
- Identify the consequences of taking shortcuts in laboratory procedures.
- Recognize the ways in which the actions and attitudes of laboratory managers may lead laboratory personnel to take unsafe shortcuts.
- List steps that laboratory managers can take to reinforce the importance of safe laboratory procedures.
- Recognize the importance of encouraging laboratory staff to avoid and report unsafe practices, such as skipping steps and taking shortcuts.
- Generate several action steps the laboratory manager could take to remedy these kinds of situations.

Reasons for skipping steps and taking shortcuts could include

- pressure from the laboratory manager or the laboratory manager's attitude;
- pressure from coworkers;
- pressure from local culture (e.g., a female researcher should not stay late in a laboratory);
- feeling pressure from family to come home early;
- not wanting to be known as the slowest worker in the laboratory;
- not feeling responsible for the work being done in the laboratory;
- disregard for laboratory safety practices;
- lack of understanding of the importance of carrying out experiments properly; and
- a sense of invincibility.

SEGMENT 1: LABORATORY EMPLOYEE'S PERSPECTIVE

A new employee has been hired by a university laboratory. Within a few months, the employee has adjusted to the laboratory and begun conducting research. After some time, the laboratory manager begins pressuring the new employee to complete experiments at a faster rate. The manager says things like, "The holidays are upon us, and we have to get these experiments completed before we close for the break" and "Do whatever it takes to get the work done."

The new employee speaks to a few of his coworkers and finds that, in response to similar pressure from the manager, they are omitting steps and taking shortcuts that are not safe.

The employee feels uncertain about taking shortcuts to complete the work faster, but he is feeling pressure from his boss. He asks himself, “What should I do?”

1. Why might the laboratory employees skip steps and take shortcuts?

Instructor: Encourage participants to draw from their own experiences. For possible reasons, please go to the Overview.

2. What is the appropriate course of action the new employee should take?

a. Should the employee tell the laboratory manager that he cannot work any faster without compromising safety?

Instructor: Ask participants to think about all the consequences that may occur from this course of action. Responses may include that the manager will reprimand the employee or that the employee may even lose his job. Ask participants to consider what they would do if the manager gives an ultimatum.

b. Should the employee start omitting steps as the other coworkers do, since none of them have been hurt yet from taking shortcuts?

Instructor: Lead participants to discuss the benefits and risks of skipping steps and taking shortcuts. Benefits may include completing work faster. Risks may include possible injury, harm to others, damage to equipment, and compromised results. Ask participants whether the benefits outweigh the risks of taking shortcuts and help them recognize that they do not.

SEGMENT 2: LABORATORY MANAGER’S PERSPECTIVE

A laboratory manager at a university is feeling some pressure. His laboratory does multistep syntheses, and one of the intermediate products is temperature sensitive. When stored at room temperature, the material loses its reactivity and cannot be used in any further syntheses. To prevent this loss of reactivity, the material is stored in the laboratory refrigerator. However, recently the refrigerator broke down, and there is no money in the budget to purchase a new one.

In addition, an experienced employee recently moved to a new job, and, though a new employee has been hired recently as a replacement, it has taken some time for him to become productive in the laboratory. The manager now faces a situation where, if the current set of syntheses is not completed by the time that the university shuts down for the holidays, the laboratory may lose months of work. The manager encourages his employees to work as quickly as possible to try to complete the work before the deadline and reminds them often that the holidays will be upon them soon.

One day, the manager walks into the laboratory to find one of his employees in the middle of taking an unsafe experimental shortcut. Looking around, the manager realizes that the benchtops are covered in debris, and, as he walks near the sink, he smells solvent fumes from the drain. Shocked by the unsafe behavior, he confronts his employees. They respond by saying, “We’re just working as quickly as we can. You told us to ‘do anything it takes’ to finish up this round of syntheses before the holidays.”

1. Does this change your perception of the situation? If so, how? Who is responsible for the unsafe behavior?

Instructor: Encourage participants to discuss the different pressures felt by the manager and the employees. Ask participants to consider the roles of managers and employees in their own organizations and what responsibility managers have in creating and maintaining a safe laboratory. Encourage participants to discuss if there is ever a time when safe practices can be ignored for speed.

- 2. Consider the communication that occurred between the manager and his employees. What role does communication play in developing a culture of safety within a laboratory?**

Instructor: Encourage participants to discuss ways in which the manager might have better communicated his concerns about speed while preserving a culture of safety in the laboratory. Also discuss whether it would be appropriate for the new employee to bring his concerns to the laboratory manager. Guide participants to recognize the importance of clear and precise communication in the laboratory and to suggest ways they can improve communication in their own facilities, such as holding staff meetings, posting signs, or distributing memoranda.

- 3. What steps can a manager take to discourage unsafe practices?**

Instructor: Help participants draw on their own experiences to create a list of steps they can take to discourage unsafe practices and to maintain a safe laboratory environment under pressure. Responses might include helping workers develop safe ways to meet deadlines, shifting the workload when employees are unable to safely meet deadlines, and reminding workers of safety practices in the laboratory.

- 4. Could the manager have done anything to prevent this situation from occurring? What should he do now?**

Instructor: Guide participants to recognize that the manager needed to clearly express his concerns about the schedule while he continued to emphasize safe practices. Encourage participants to consider practical solutions for material storage as well as methods to address the employees' behavior. Practical solutions might include borrowing space in another laboratory or department's chemical refrigerator or arranging a short-term rental of a refrigerator to remove the deadline pressures. Help participants consider immediate and long-term actions for addressing the employees' behavior and correcting the perception that safety can be sacrificed for speed.

LESSON 7: IMPROVING LABORATORY SAFETY AND SECURITY

Overview: This lesson deals with improper installation of a portable eyewash station.

Objectives:

- Recognize the importance of eyewash bottles in laboratories where splash hazards are present.
- Recognize the importance of making sure that eyewash bottles are visible and properly mounted near hazardous chemicals and first aid kits.
- List the steps for properly installing eyewash bottles.
- Identify the people responsible for handling the proper installation of eyewash bottles.
- Determine a timetable for correcting a problem with the mounting of an eyewash bottle.

An eyewash bottle is normally readily accessible, because it is mounted on the wall of a dispensing room. However, when the door to the room is opened, the eyewash bottle is almost completely concealed behind the door.

1. What should be done about this situation? Who is responsible for taking these actions?

Instructor: Guide participants to recognize that eyewash bottles must be readily accessible at all times for safety reasons. Ask participants to develop action steps to remedy the situation and identify the people responsible.

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSON 8: IMPROPER USE OF A CHEMICAL HOOD

Overview: In this lesson, the chemical hoods in a laboratory are not being used properly.

Objectives:

- Recognize the dangers of storing chemicals in hoods.
- Recognize the importance of maintaining hoods that are fully functioning and free of obstructions.
- Devise methods for safely storing and securing hazardous chemicals that do not involve storage in hoods.
- Identify the people and create a timetable for creating proper chemical storage areas and repairing hoods.

Chemicals, including strong acids and bases of different concentrations, are left inside a hood. The hood is located outside of the dispensing room and is accessible to students in a teaching laboratory. One door of the cabinet is off the hinge and the hood sash is partially covered by a poster with a taped sign that says, "Off Limit to Students." When the fan is turned off, the hood has zero air flow.

1. What should be done about this situation? Who is responsible for taking these actions?

Instructor: Guide participants to recognize the hazards of this situation, including the location of the hood, its disrepair, and its accessibility by students. Ask participants to develop action steps to remedy the situation and identify the people responsible.

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSON 9: UNEVEN AIR FLOW IN A CHEMICAL FUME HOOD

Overview: This lesson presents the problem of uneven air flow in a chemical fume hood.

Objectives:

- Recognize the dangers of having a chemical fume hood with uneven air flow.
- Recognize the importance of maintaining hoods that are fully functioning and free of obstructions.
- Identify the people responsible for maintaining hoods.
- Create a timetable for checking chemical fume hoods regularly.

A chemical fume hood has uneven air flow, even with the sash closed. For example, sometimes the flow is 120 feet per minute in the right quadrant and as low as 50 feet per minute in the left quadrant. The reason for the uneven flow is a shelf of chemicals that is partially blocking the left side of the hood.

1. What should be done about this situation? Who is responsible for taking these actions?

Instructor: Guide participants to recognize the hazard of operating a hood with uneven air flow. Ask participants to develop action steps to remedy the situation and identify the people responsible for maintaining hoods.

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSON 10: IMPROPER USE OF A LABORATORY FREEZER

Overview: In this lesson, the freezer in a research laboratory has not been properly maintained, and ice has accumulated.

Objectives:

- Identify the hazards associated with the improper maintenance of a laboratory freezer.
- List the steps for properly maintaining a laboratory freezer.
- Identify the people responsible for maintaining the laboratory freezer.
- Create a timetable for solving problems with a laboratory freezer.

The freezer in a research laboratory has not been defrosted for a long time, and ice has accumulated in the freezer space. The ice has coated and covered several chemicals that were orphaned by a researcher who does not work in the laboratory anymore.

1. What should be done about this situation? Who is responsible for taking these actions?

Instructor: Guide participants to recognize the hazards of the situation in the freezer. In addition, help them understand the importance of removing all chemicals associated with former laboratory workers. Ask participants to develop action steps to remedy the situation and identify the people responsible.

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSONS FOR LABORATORY STAFF AND STUDENTS

with italicized comments for instructor

LESSON 11: UNWILLINGNESS TO CONFRONT COWORKERS OR SUPERIORS

Overview: This lesson describes the challenges a young employee faces when he sees a coworker stealing from the laboratory.

Objectives:

- Identify the reasons a person might steal chemicals from a laboratory.
- List the reasons why removing chemicals from a laboratory is considered dangerous and illicit behavior.
- Recognize the barriers that might prevent laboratory personnel from reporting suspicious or illicit behavior such as stealing.
- List the steps laboratory personnel may take to report suspicious or illicit behavior.

Reasons for stealing chemicals could include

- lack of understanding of the consequences associated with stealing;
- sense of immunity from the consequences;
- lenient consequences for stealing;
- peer pressure;
- personal gain; and
- harmful intent.

SEGMENT 1

A young employee has just walked into a laboratory when he notices a coworker quickly slip a small bottle of a chemical into his backpack. The young man has known the coworker for a long time, trusts him, and decides that there must be a good reason for what he has just seen. However, he is still concerned and contemplates what to do. He worries that he might offend the coworker if he asks about the bottle.

1. Should the young employee be worried about the actions of the coworker? Why?

Instructor: Ask participants to suggest why the coworker's behavior is cause for concern. Guide participants to recognize that removing chemicals from a laboratory is considered dangerous and illicit behavior. Have participants explain why this behavior is prohibited. Responses should include that removing chemicals is stealing, and stolen chemicals may be put to harmful uses.

2. Why might the coworker have taken the chemical from the laboratory?

Instructor: Have participants suggest all the possible reasons the coworker may have taken the chemicals. See the bulleted list above for some possible reasons.

3. What should the young man do?

Instructor: Encourage participants to write down all of the ways the young man can handle this situation and the advantages and disadvantages of each. Then ask participants to share results with one another and come up with the best way to handle the situation. Write responses in a table like the one below. Possible responses are included. Guide participants to recognize that one or both of the first two strategies are the best possible courses of action.

Strategy	Advantages	Disadvantages
<ul style="list-style-type: none"> Confront coworker 	<ul style="list-style-type: none"> Gives the coworker the opportunity to explain himself Gives the coworker the opportunity to correct the action without facing consequences May protect the coworker's job Avoids creating a commotion with other coworkers or supervisors 	<ul style="list-style-type: none"> Coworker may avoid taking responsibility or lie about his actions May harm the personal relationship between the young employee and the coworker Coworker may take action against the young man to prevent him from reporting to authorities May cost the coworker his job
<ul style="list-style-type: none"> Report the situation to a supervisor 	<ul style="list-style-type: none"> Allows supervisor to take appropriate action Protects the safety and security of the laboratory May be done anonymously to protect the reputation and personal relationships of the young man 	<ul style="list-style-type: none"> May strain the relationship with the coworker May create an unwanted reputation for the young man as a person who sides more with management than coworkers May cost the coworker his job
<ul style="list-style-type: none"> Do nothing, but continue to watch the coworker for more suspicious behavior 	<ul style="list-style-type: none"> Gives the coworker the benefit of the doubt and assumes he had good reason for removing the chemical Avoids conflict and confrontation Preserves the friendly relationship between the coworker and the young man Protects the coworker's job 	<ul style="list-style-type: none"> Makes the young man an accessory to stealing May allow for further illicit behavior by the coworker May damage the safety and security of the laboratory if the chemical is put to harmful use Costs the laboratory money to replace the stolen chemical

4. As laboratory personnel, have you seen something like this happen in the laboratory before?

Instructor: Ask participants to share stories of similar theft incidents that have occurred in their laboratories and to explain how the situations were resolved. If there are no stories of thefts, expand the discussion to include incidents of unsafe laboratory behavior, such as improperly storing chemicals, etc.

a. If you witnessed or were aware of the incident, did you take the appropriate action?

b. If you did not, what would you do if a similar situation arose again?

Instructor: Questions 4(a) and 4(b) are reflective. Participants should not be asked to share answers unless they want to, as they may not be comfortable acknowledging their mistakes publicly. Focus the discussion on what participants should do in the future if a situation like this arose again.

SEGMENT 2

The young employee decides to confront the coworker. The coworker tells him that there was only a small amount left in the bottle and that one of his friends needed it for an experiment. He proceeds to tell the young man not to worry because his friend is a “good guy.”

1. How does this new information change the situation? What risks does this situation pose?

Instructor: Guide students to recognize that removing even small amounts of a chemical from a laboratory is stealing and that there are risks associated with passing chemicals to other individuals. Ask participants to write down all of the possible problems and risks in this situation, such as the cost to the laboratory, the possibility that more chemicals might be stolen in the future, and the possibility that the friend of the coworker could put the chemical to a harmful and illicit use.

2. What is the next step that the young employee should take? Should he ignore the topic or tell his supervisor?

Instructor: Have participants review their answers to question 3 in Segment 1 above. Encourage participants to draw from their own experiences. How have they handled similar situations? If participants have never been in this situation, ask them to think about how they would handle a similar circumstance. Discuss all answers to find the best course of action. Lead participants to recognize that the young man has a responsibility to protect the safety and security of the laboratory and other coworkers and should report the incident to a supervisor.

LESSON 12: NOTICING AND REPORTING SAFETY ISSUES

Overview: This lesson describes a situation where a student notices that incompatible chemicals are being stored in close proximity to each other and must decide whether to report the issue.

Objectives:

- Recognize the importance of paying attention to safety issues in the laboratory.
- Recognize the importance of reporting and correcting laboratory safety issues.
- Identify the barriers that might prevent laboratory personnel from noticing, reporting, and correcting safety issues.
- Develop methods for overcoming barriers to reporting and correcting safety issues.

Reasons why a person may not notice, report, or correct safety issues could include

- feeling pressure from laboratory coworkers not to say anything;
- feeling helpless to make changes in a laboratory;
- feeling unsupported by superiors in reporting and correcting safety issues; and
- feeling uncomfortable challenging coworkers and superiors.

SEGMENT 1

At a university, nitric acid is stored in a plastic bottle on top of a steel container containing sodium hydride. One day a student notices this situation and remembers a story of a laboratory where the nitric acid bottle leaked and mixed with the sodium hydride, causing a fire. The student decides to speak to one of her classmates about the situation. The classmate tells the student not to worry. He says, “It has been shelved like that for the past year at least, and nothing has happened.” The classmate also warns the student that if she tells a supervisor and the storage is a safety issue, the laboratory will have to be closed. Chemicals will have to be reshelved, resulting in the cessation and possible invalidation of all their experiments. The classmate says, “No one is going to be happy about the laboratory being closed.”

1. Is the student taking appropriate action? Why or why not?

Instructor: Guide participants to recognize that the student is taking appropriate action by noticing and reporting safety concerns in the laboratory. Help participants recognize that the key lesson is the importance of noticing concerns and reporting them to coworkers and supervisors, regardless of the possible consequences.

2. Why does the classmate respond the way he does?

Instructor: Ask participants to draw on their own experiences to understand the reasons the classmate discourages the student from reporting her concern. Possible responses may include not wanting to shut down the laboratory, not wanting to reshelve chemicals, and not wanting to lose important results because experiments are invalidated. It would also be appropriate to consider any gender-based biases when discussing this lesson.

3. How do you believe the student feels after talking to the classmate? How might this affect her next step?

Instructor: Encourage participants to draw on their own experiences. Participants may say the student feels discouraged and ignored. Guide participants to recognize that these feelings could cause the student to keep her concerns to herself and lead to the safety issue remaining unaddressed.

4. What is the next step the student should take?

Instructor: Encourage participants to be honest about what they would do in this situation and why. Ask: What are the advantages and disadvantages of each possible solution? Guide participants to recognize that despite the barrier of being discouraged by her classmate, the student should take further action, such as reporting the situation to the laboratory manager or other supervisor. Help participants identify ways that the student might overcome the barriers to reporting the safety issue, such as discussing the situation with a supervisor in private or submitting her concern anonymously.

SEGMENT 2

The student decides to talk to the person in charge of the chemical storage room. The storage room manager becomes offended and dismisses the student's concern. He says that he has been working in the institution for more than 15 years and knows what he is doing.

1. Should the student drop her concern or talk to someone else on the laboratory staff, such as the laboratory manager?

Instructor: Guide participants to recognize that the student should continue to report the situation to others until the safety issue is remedied. The important message that participants should take away is that unsafe situations should be reported. Reporting safety issues protects everyone in the laboratory.

LESSON 13: PROTECTING ONESELF AND OTHERS

Overview: This lesson describes a situation in which laboratory workers and students complain about using goggles in the laboratory due to hot temperatures and avoid wearing the necessary protective eyewear.

Objectives:

- Recognize the importance of wearing personal protective equipment (PPE) like goggles in the laboratory.
- Identify the barriers to wearing PPE such as goggles.
- Develop strategies for encouraging the proper use of PPE among coworkers.

Reasons why students may not want to wear goggles could include

- a sense of invincibility to harm;
- believing rules are not enforced or are lenient;
- discomfort from wearing goggles;
- cultural reasons; and
- concern for fashion.

SEGMENT 1

At a university in a country where temperatures get higher than 43°C, laboratory managers and supervisors have been having problems with laboratory personnel complaining about using goggles at all times in the laboratories. Laboratory personnel complain that it is extremely hot, and they cannot bear to wear goggles much of the time. The laboratory managers and supervisors decide that **only** during written exams, quizzes, and postlaboratory discussions are students not required to wear their goggles in the laboratory. The new rules and regulations are given to all students and workers, who are asked to sign a form to confirm that they have read and agreed to the rules and regulations.

About three weeks later, two students start working on an experiment together. Student A wears goggles, while Student B does not. Student A tells Student B to put on his goggles because they are starting the experiment. Student B replies, “It’s too hot to wear goggles. Besides, the experiment will only take 30 minutes, and then we can take off the goggles for postlaboratory discussion.”

1. **Besides discomfort, why might Student B not wear goggles during an experiment? Are any of these good reasons to avoid wearing goggles?**

Instructor: Guide participants to identify reasons people might not wear goggles in the laboratory. See bulleted list above for some reasons. Help participants recognize that there are no very good reasons for refusing to wear safety goggles to protect one’s eyes.

2. What should Student A do?

Instructor: Encourage participants to write down all of the ways Student A can handle this situation and the advantages and disadvantages of each. Then ask participants to share results and come up with the best way to handle the situation. Write responses in a table like the one below. Possible responses are included. Guide participants to recognize that any of the strategies in the table may be good courses of action to take.

Strategy	Advantages	Disadvantages
<ul style="list-style-type: none">Continue to encourage Student B to wear goggles	<ul style="list-style-type: none">Treats Student B with respectAvoids reporting Student B to a supervisor	<ul style="list-style-type: none">Student B may continue to refuseDelays the experiment
<ul style="list-style-type: none">Refuse to begin the experiment until Student B puts on goggles	<ul style="list-style-type: none">Forces Student B to adopt a safe practiceProtects Student B from injury	<ul style="list-style-type: none">Delays the experimentMay cause tension between the students
<ul style="list-style-type: none">Report Student B to a supervisor	<ul style="list-style-type: none">Forces Student B to adopt a safe practiceProtects Student B from injury	<ul style="list-style-type: none">May cause Student B to face consequencesMay cause tension between the students

3. Does your laboratory consistently follow the rules regarding the use of PPE? Why or why not?

Instructor: This is a reflective question. Participants may not want to share answers about themselves or name others who break the rules, but they should be encouraged to discuss laboratory practices in general. It is important to reinforce that all laboratory personnel should follow and promote safe practices in the laboratory at all times.

4. How can peers in laboratories promote the use of goggles and other PPE among themselves?

Instructor: Encourage participants to write down ways they can promote goggle and PPE use in their own laboratories. Encourage participants to think about the resources they may need and other types of help that will be needed to promote safety, such as support from supervisors and clear and consistently reinforced rules.

SEGMENT 2

Student A decides to tell Student B one more time to put on his goggles, saying, “You are required to wear your goggles during the experiment. If the solution falls or splashes on you, you may have permanent eye damage. What will happen to your family if you get injured?”

- 1. Is this type of scare tactic an appropriate way for Student A, or any laboratory worker, to convince peers to abide by safety regulations?**

Instructor: Have participants discuss the effects of Student A's statements. Guide participants to recognize that sometimes fear for one's personal well being can motivate a person to follow safety procedures. If necessary, provide the following example of a motivational tactic used by someone to promote laboratory safety: The person went to a laboratory where goggle use was nonexistent, so he told each worker to bring in a picture of his or her family. These pictures were hung near everyone's laboratory bench and served as a reminder: "If you do not wear goggles, you may not see your family again."

- 2. If Student B continues to refuse to wear goggles, what is the next step that Student A should take? Should Student A ignore the infraction and continue with the experiment?**

Instructor: Help participants brainstorm other steps Student A can take, referring back to the answers in question 2 of Segment 1. Guide participants to recognize that it may be a good idea to go to a supervisor, such as a professor, for help and delay the experiment.

PARTICIPANT WORKSHEETS

LESSONS FOR LABORATORY MANAGERS

LESSON 1: ENSURING THE USE OF SAFETY EQUIPMENT IN THE LABORATORY

Overview: This lesson describes the challenges a new laboratory manager faces in making sure laboratory personnel use appropriate personal protective equipment (PPE), especially safety goggles.

SEGMENT 1

A recent graduate of a well-respected institution is hired as a laboratory manager for a small chemical company. Soon after starting work, the manager notices that many laboratory personnel do not have safety goggles. To fix the problem, the manager orders pairs for everyone and invites the staff to pick them up from central inventory. A few weeks later, the manager notices that many pairs of goggles are still in central inventory. On a walk through of the laboratories, the manager notices that many of the goggles are displayed on laboratory shelves but still in boxes. The manager also notices that many of the female employees have not even picked up their goggles from central inventory.

1. Why might the laboratory personnel be reluctant to wear the safety goggles?

2. What should the manager do?

SEGMENT 2

As an attempt to correct the situation, the laboratory manager hands out the remaining goggles to those who had not picked them up and reminds laboratory personnel of the importance of using safety goggles while working in the laboratory. The manager is reassured because everyone agrees with him. However, when walking through the laboratories a few days later, the manager notices that many personnel still are not wearing their goggles.

- 1. What should the manager do now? List the strategies the manager could use in the table below. Note the advantages and disadvantages of each option.**

Barrier	Strategies to address barrier	Advantages	Disadvantages

- 2. What kind of help might the manager need? From whom?**

- 3. Would the situation be different if the laboratory manager were an older, established researcher?**

- 4. If the laboratory manager were a woman, would the situation be different? How?**

SEGMENT 3

After many weeks of work, the manager succeeds in getting laboratory personnel to wear their goggles consistently. One day, as part of a review of the institution, the manager's supervisor takes a tour of the laboratories. When offered goggles before entering the laboratory, the supervisor waves them off, saying, "I will only be in there for a few minutes. I'm sure I'll be fine."

- 1. What impact could the supervisor's behavior have on the laboratory staff?**
- 2. What should the laboratory manager do now?**
- 3. How is this case relevant to your laboratory?**
- 4. Are safety goggles required in your laboratory at all times? Why or why not?**
- 5. Do laboratory personnel at your laboratory follow other similar important safety measures? Why or why not?**
- 6. What strategies should laboratories put in place to better promote a culture of safety?**

7. To better promote a culture of safety, what support will laboratory managers need? From whom?

8. What is the best way to secure that support for a culture of safety?

VIGNETTE

In one country, one of our committee members noticed that laboratory workers and students were not complying with goggle policies. To get people to comply, he told all of the individuals to bring in a picture of family members and hang it up in their work-space. Once everyone brought pictures, he told them to “wear goggles, so you can always be able to see your family members.” After this reminder, the committee member said that almost all, if not all, laboratory workers and students were using goggles in the laboratory.

Is this something that you can use in your laboratory?

SEGMENT 2

The laboratory manager decides to confront the security guard. However, the guard denies there is a problem. He says that he “was given instructions by his boss to use the new route,” but the laboratory manager is still uneasy about the situation.

- 1. What should the manager do now?**

SEGMENT 3

The laboratory manager sees the security guard bringing nonlaboratory individuals into the facility. The guard and the strangers are seen convening near the locked storage rooms. The manager decides to talk to the security guard’s supervisor. The supervisor brushes off the concern, saying, “Oh, I’ll talk to my nephew, but I am sure he means well. There is nothing to worry about.”

- 1. How does this information change the situation?**

- 2. What should the laboratory manager do?**

5. What are some strategies that your laboratory might employ to purchase and store chemicals more safely and securely?

VIGNETTE

In many countries, chemicals are bought in bulk quantities, sometimes purchased once a year. A guest speaker told the committee that chemicals are purchased once a year in his laboratory. However, to make sure excess chemicals are stored safely and securely they house the chemicals in an off-site secure facility and remove the chemicals as needed.

Is this something your laboratory could do?

5. Do all staff and students in your laboratory use hoods each time they should? Why or why not?

6. What are the barriers to consistent use of hoods?

a. What are some steps you could take to improve the use of hoods at your laboratory?

b. Whose support and what kind of help would be necessary?

Consequences from the way the department supervisor handled the situation:

2. Did the supervisor handle the situation appropriately? Why do you think this?

3. If you were the department supervisor, what would you do?

Possible actions a supervisor could take:

SEGMENT 2: LABORATORY MANAGER'S PERSPECTIVE

A laboratory manager at a university is feeling some pressure. His laboratory does multistep syntheses, and one of the intermediate products is temperature sensitive. When stored at room temperature, the material loses its reactivity and cannot be used in any further syntheses. To prevent this loss of reactivity, the material is stored in the laboratory refrigerator. However, recently the refrigerator broke down, and there is no money in the budget to purchase a new one.

In addition, an experienced employee recently moved to a new job, and though a new employee has been hired recently as a replacement, it has taken some time for him to become productive in the laboratory. The manager now faces a situation where, if the current set of syntheses is not completed by the time that the university shuts down for the holidays, the laboratory may lose months of work. The manager encourages his employees to work as quickly as possible to try to complete the work before the deadline and reminds them often that the holidays will be upon them soon.

One day, the manager walks into the laboratory to find one of his employees in the middle of taking an unsafe experimental shortcut. Looking around, the manager realizes that the benchtops are covered in debris, and as he walks near the sink, he smells solvent fumes from the drain. Shocked by the unsafe behavior, he confronts his employees. They respond by saying, "We're just working as quickly as we can. You told us to 'do anything it takes' to finish up this round of syntheses before the holidays."

- 1. Does this change your perception of the situation? If so, how? Who is responsible for the unsafe behavior?**
- 2. Consider the communication that occurred between the manager and his employees. What role does communication play in developing a culture of safety within a laboratory?**
- 3. What steps can a manager take to discourage unsafe practices?**
- 4. Could the manager have done anything to prevent this situation from occurring? What should he do now?**

LESSON 7: IMPROVING LABORATORY SAFETY AND SECURITY

Overview: This lesson deals with improper installation of a portable eyewash station.

An eyewash bottle is normally readily accessible, because it is mounted on the wall of a dispensing room. However, when the door to the room is opened, the eyewash bottle is almost completely concealed behind the door.

1. What should be done about this situation? Who is responsible for taking these actions?

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		
5.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSON 8: IMPROPER USE OF A CHEMICAL HOOD

Overview: In this lesson, the chemical hoods in a laboratory are not being used properly.

Chemicals, including strong acids and bases of different concentrations, are left inside a hood. The hood is located outside of the dispensing room and is accessible to students in a teaching laboratory. One door of the cabinet is off the hinge and the hood sash is partially covered by a poster with a taped sign that says, "Off Limit to Students." When the fan is turned off, the hood has zero air flow.

1. What should be done about this situation? Who is responsible for taking these actions?

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		
5.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSON 9: UNEVEN AIR FLOW IN A CHEMICAL FUME HOOD

Overview: This lesson presents the problem of uneven air flow in a chemical fume hood.

A chemical fume hood has uneven air flow, even with the sash closed. For example, sometimes the flow is 120 fpm in the right quadrant and as low as 50 fpm in the left quadrant. The reason for the uneven flow is a shelf of chemicals that is partially blocking the left side of the hood.

1. What should be done about this situation? Who is responsible for taking these actions?

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		
5.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSON 10: IMPROPER USE OF A LABORATORY FREEZER

Overview: In this lesson, the freezer in a research laboratory has not been properly maintained, and ice has accumulated.

The freezer in a research laboratory has not been defrosted for a long time, and ice has accumulated in the freezer space. The ice has coated and covered several chemicals that were orphaned by a researcher who does not work in the laboratory anymore.

1. What should be done about this situation? Who is responsible for taking these actions?

Action Steps	Person Responsible	Timetable
1.		
2.		
3.		
4.		
5.		

Please use the back of the sheet if additional action steps are required.

Classify the overall action plan in terms of:

	Low			Medium			High		
Priority									
Cost									

LESSONS FOR LABORATORY STAFF AND STUDENTS

LESSON 11: UNWILLINGNESS TO CONFRONT COWORKERS OR SUPERIORS

Overview: This lesson describes the challenges a young employee faces when he sees a coworker stealing from the laboratory.

SEGMENT 1

A young employee has just walked into a laboratory when he notices a coworker quickly slip a small bottle of a chemical into his backpack. The young man has known the coworker for a long time, trusts him, and decides that there must be a good reason for what he has just seen. However, he is still concerned and contemplates what to do. He worries that he might offend the coworker if he asks about the bottle.

- 1. Should the young employee be worried about the actions of the coworker? Why?**
- 2. Why might the coworker have taken the chemical from the laboratory?**
- 3. What should the young man do?**

Strategy	Advantages	Disadvantages

4. As laboratory personnel, have you seen something like this happen in the laboratory before?

a. If you witnessed or were aware of the incident, did you take the appropriate action?

b. If you did not, what would you do if a similar situation arose again?

SEGMENT 2

The young employee decides to confront the coworker. The coworker tells him that there was only a small amount left in the bottle and that one of his friends needed it for an experiment. He proceeds to tell the young man not to worry because his friend is a “good guy.”

1. How does this new information change the situation? What risks does this situation pose?

2. What is the next step that the young employee should take? Should he ignore the topic or tell his supervisor?

LESSON 12: NOTICING AND REPORTING SAFETY ISSUES

Overview: This lesson describes a situation where a student notices that incompatible chemicals are being stored in close proximity to each other and must decide whether to report the issue.

SEGMENT 1

At a university, nitric acid is stored in a plastic bottle on top of a steel container containing sodium hydride. One day a student notices this situation and remembers a story of a laboratory where the nitric acid bottle leaked and mixed with the sodium hydride, causing a fire. The student decides to speak to one of her classmates about the situation. The classmate tells the student not to worry. He says, "It has been shelved like that for the past year at least, and nothing has happened." The classmate also warns the student that if she tells a supervisor and the storage is a safety issue, the laboratory will have to be closed. Chemicals will have to be reshelved, resulting in the cessation and possible invalidation of all their experiments. The classmate says, "No one is going to be happy about the laboratory being closed."

- 1. Is the student taking appropriate action? Why or why not?**
- 2. Why does the classmate respond the way he does?**
- 3. How do you believe the student feels after talking to the classmate? How might this affect her next step?**
- 4. What is the next step the student should take?**

SEGMENT 2

The student decides to talk to the person in charge of the chemical storage room. The storage room manager becomes offended and dismisses the student's concern. He says that he has been working in the institution for more than 15 years and knows what he is doing.

- 1. Should the student drop her concern or talk to someone else on the laboratory staff, such as the laboratory manager?**

LESSON 13: PROTECTING ONESELF AND OTHERS

Overview: This lesson describes a situation in which laboratory workers and students complain about using goggles in the laboratory due to hot temperatures and avoid wearing the necessary protective eyewear.

SEGMENT 1

At a university in a country where temperatures get higher than 43°C, laboratory managers and supervisors have been having problems with laboratory personnel complaining about using goggles at all times in the laboratories. Laboratory personnel complain that it is extremely hot, and they cannot bear to wear goggles much of the time. The laboratory managers and supervisors decide that **only** during written exams, quizzes, and postlaboratory discussions are students not required to wear their goggles in the laboratory. The new rules and regulations are given to all students and workers, who are asked to sign a form to confirm that they have read and agreed to the rules and regulations.

About three weeks later, two students start working on an experiment together. Student A wears goggles, while Student B does not. Student A tells Student B to put on his goggles because they are starting the experiment. Student B replies, “It’s too hot to wear goggles. Besides, the experiment will only take 30 minutes, and then we can take off the goggles for postlaboratory discussion.”

1. Besides discomfort, why might Student B not wear goggles during an experiment? Are any of these good reasons to avoid wearing goggles?

2. What should Student A do?

Strategy	Advantages	Disadvantages

3. Does your laboratory consistently follow the rules regarding the use of PPE? Why or why not?

4. How can peers in laboratories promote the use of goggles and other PPE among themselves?

SEGMENT 2

Student A decides to tell Student B one more time to put on his goggles, saying, “You are required to wear your goggles during the experiment. If the solution falls or splashes on you, you may have permanent eye damage. What will happen to your family if you get injured?”

1. Is this type of scare tactic an appropriate way for Student A, or any laboratory worker, to convince peers to abide by safety regulations?

2. If Student B continues to refuse to wear goggles, what is the next step that Student A should take? Should Student A ignore the infraction and continue with the experiment?

FORMS



EMERGENCY PREPAREDNESS PLAN FOR WORKING WITH A CHEMICAL

Name _____ Contact Information _____
Building _____
Supervisor _____

1. SUBSTANCE INFORMATION

- A. Chemical name _____ CAS number _____
B. Carcinogen Reproductive toxin High acute toxicity
C. Estimated rate of use (e.g., g/month) _____
D. MSDS reviewed and readily available Yes No

2. HAZARDS

Physical Hazards

- A. Flammable Yes No B. Corrosive Yes No
C. Reactive Yes No D. Temperature-sensitive Yes No
E. Stability (e.g., decomposes, forms peroxides, polymerizes, shelf-life concerns) Stable Unstable
F. Known incompatibilities _____

Health Hazards

- G. Significant routes of exposure
 Inhalation hazard Yes No
 Skin absorption Yes No
H. Sensitizer Yes No I. Medical consultation needed Yes No

3. PROCEDURE

- A. Briefly describe how the material will be used _____

- B. Vacuum system used Yes No
C. If yes, describe method for trapping effluents _____

4. EXPOSURE CONTROLS

Ventilation, Isolation

- | | | |
|--------------------------------|-----|----|
| A. Chemical hood required | Yes | No |
| B. Glove box required | Yes | No |
| C. Vented gas cabinet required | Yes | No |

5. PERSONAL PROTECTIVE EQUIPMENT (PPE) (Check all that apply)

- | | | |
|------------------------------|-------------------------|-------------|
| Safety glasses | Chemical-splash goggles | Face shield |
| Gloves (type _____) | Lab coat | Apron |
| Respirator | | |
| Other, please describe _____ | | |
-

6. LOCATION, DESIGNATED AREA

- A. Building _____ B. Room _____
- C. Describe below the area where substance(s) will be used _____
-
- D. Location where substances will be stored _____
- E. Storage method, precautions
- | | |
|----------------------------------|-----------------------|
| Refrigerator/freezer | Hood |
| Special security (describe) | Vented cabinet |
| Flammable liquid storage cabinet | Other, describe _____ |
-

7. SPILLS AND DECONTAMINATION

- | | | |
|--|-----|----|
| A. Spill-control materials readily available | Yes | No |
| B. Require special decontamination procedures? If yes, describe. | Yes | No |
-

8. WASTE DISPOSAL

- | | | |
|--|-----|----|
| A. In-lab neutralization | Yes | No |
| B. Used up in process (e.g., no waste) | Yes | No |
| C. Dispose of as hazardous waste | Yes | No |

INSPECTION CHECKLIST

Department, group, or laboratory: _____

Inspector: _____

Date: _____

Building and room: _____

Laboratory supervisor: _____

LABORATORY ENVIRONMENT

Work areas illuminated	Y	N	NA
Storage of combustible materials minimized	Y	N	NA
Aisles and passageways clear and unobstructed	Y	N	NA
Trash removed promptly	Y	N	NA
No evidence of food or drink in active laboratory areas	Y	N	NA
Wet surfaces covered with nonslip materials	Y	N	NA
Exits illuminated and unobstructed	Y	N	NA

COMMENTS:

Other elements that the checklist can include

EMERGENCY EQUIPMENT AND PLANNING

Fire extinguishers mounted and unobstructed	Y	N	NA
Fire extinguishers fully charged with tamper indicators in place	Y	N	NA
Fire extinguisher inspection up to date	Y	N	NA
Eyewash unit and safety shower within 10 seconds of hazard	Y	N	NA
Eyewash unit and safety shower inspection up to date	Y	N	NA
Fire alarm pull stations unobstructed	Y	N	NA
Spill control materials available and adequate for potential spills	Y	N	NA

COMMENTS:

PERSONAL PROTECTIVE EQUIPMENT

Personnel wearing appropriate eye and face protection	Y	N	NA
Personnel wearing appropriate gloves	Y	N	NA
Shoes appropriate to the hazard	Y	N	NA
Clothing appropriate to the hazards posed in the laboratory	Y	N	NA

COMMENTS:

SIGNS, LABELS, PLANS, AND POSTINGS

Emergency action plan available	Y	N	NA
Material-safety data sheets accessible	Y	N	NA
Chemical-hygiene plan available	Y	N	NA
Contact sheet posted and up to date	Y	N	NA
Telephones labeled with emergency number	Y	N	NA
Building evacuation routes posted	Y	N	NA
Ice-making machines labeled “Not for human consumption”	Y	N	NA
Chemical refrigerators labeled “No food”	Y	N	NA
Food refrigerators labeled “Food only—no chemicals”	Y	N	NA
Lasers properly labeled	Y	N	NA
High-voltage equipment properly labeled	Y	N	NA
Emergency equipment labeled with highly visible signs	Y	N	NA

COMMENTS:

ELECTRICAL HAZARDS

Flexible cords in good condition	Y	N	NA
Cords not on surfaces where flammable liquids may pool	Y	N	NA
Cover plates in place for outlets and switches	Y	N	NA
Circuit-breaker panels unobstructed	Y	N	NA
Multiplug adapters have overload protection	Y	N	NA
No extension cords in use	Y	N	NA
Ground-fault circuit interrupters (GFCI) used for wet areas	Y	N	NA
Guards or covers in place for electrophoresis devices	Y	N	NA

COMMENTS:

STORAGE

Heavy items on lower shelves	Y	N	NA
Storage at least 46 centimeters below sprinkler heads	Y	N	NA
Storage at least 61 centimeters below ceiling	Y	N	NA
Means available to reach items stored above shoulder level	Y	N	NA
Shelving adequate for loads imposed	Y	N	NA
Chemicals stored by compatibility and hazard class	Y	N	NA
Chemical containers clearly labeled with contents	Y	N	NA
Corrosive chemical stored below eye level	Y	N	NA
Materials with shelf-lives dated on receipt	Y	N	NA
Secondary containment used near sinks and drains	Y	N	NA
Waste containers sealed except during transfers	Y	N	NA
Waste containers labeled with contents, "Hazardous Waste"	Y	N	NA
Storage limited to less than 1 quart of acutely hazardous waste	Y	N	NA
Storage limited to less than 208 liters hazardous waste	Y	N	NA

COMMENTS:

COMPRESSED GASES AND CRYOGENICS

Toxic, flammable, corrosive gases used in chemical-fume hood	Y	N	NA
Stored upright, secured from tipping	Y	N	NA
Regulator compatible with gas cylinder	Y	N	NA
Cylinder carts used for transport	Y	N	NA
Valve caps in place when not in use	Y	N	NA
Empty or unused cylinders returned to supplier	Y	N	NA
Gases and cryogenic liquids dispensed with good ventilation	Y	N	NA
Cryogenic dewars vented or have pressure-relief devices	Y	N	NA
Glass dewars shielded	Y	N	NA

COMMENTS:

PRESSURE AND VACUUM SYSTEMS

Vacuum glassware in good condition	Y	N	NA
Vacuum pressure-relief devices in place and inspected	Y	N	NA
Glass vessels shielded or enclosed	Y	N	NA
Temperature and pressure measuring devices in place where needed	Y	N	NA

COMMENTS:

CHEMICAL HOODS AND VENTILATION

Each chemical fume hood tested within last year	Y	N	NA
Sash closed when not in active use	Y	N	NA
Chemical-fume hood vents (baffles) unobstructed	Y	N	NA
Chemical-fume hood used with sash in appropriate position	Y	N	NA
Chemical storage limited in actively used hood	Y	N	NA
Chemicals and equipment at least 15 centimeters from the sash	Y	N	NA

COMMENTS:

SECURITY

Doors to lab operate, close, and lock properly	Y	N	NA
Windows operate, close, and lock properly	Y	N	NA
Alarm systems operating properly	Y	N	NA
Keys and access cards kept in secure area out of sight	Y	N	NA

COMMENTS:

TRAINING AND AWARENESS

Workers have attended all appropriate training	Y	N	NA
Training has been documented	Y	N	NA

Laboratory personnel know...

What to do in event of an emergency, such as fire or injury	Y	N	NA
How to clean up chemical spills	Y	N	NA
Location and contents of the chemical hygiene plan	Y	N	NA
Chemical hygiene officer or safety manager	Y	N	NA
What MSDSs are and where to find them and other safety info	Y	N	NA
What type of personal protective equipment to use and when to use it	Y	N	NA
What to do with chemical waste	Y	N	NA
What are the most hazardous materials they use and what precautions to take	Y	N	NA
Where and how to use safety showers and eyewash units	Y	N	NA
To question unfamiliar visitors in the lab	Y	N	NA
How and when to report injuries, illnesses, or incidents	Y	N	NA

COMMENTS:

INCIDENT REPORT

PERSONAL DATA			
Employee/Student Name			Case No.
		Employee/Student Phone No.	
Employee/Student Dept.		Investigation Date	
Employee Supervisor		Investigator Name	

EVENTS DETAILS

Employee/Student Statement (Description of event—before, during, and after)

Work Related?	Yes No	Body Part Injured	
Event Date/Time	/	Event Location	(lab, corridor, stairs, outside, etc.)
Reported Inquiry Date/Time	/	Specific Location	(building, floor, room, column)

Injury Severity	Observation/Near Miss	First Aid
	Work Restrictions	Lost Time Restrictions

Accident Type	Allergen Exposure	Bitten By	
	Car/Truck/Motorized Vehicle		
	Caught In/Between	Contact with Chemical	Contact with Hot Surface
	Environmental Exposure	Ergonomic	Needle Stick
	Pushing/Pulling	Slip/Trip/Fall	Struck Against
	Struck By	Twist/Turn	Other

	Device Type	Device Brand
Contaminated Sharp Involved		
Needle Stick		

Allergic Agent _____

Chemicals or Biohazards Involved _____

Equipment Involved / ID Number _____

DESCRIBE POSSIBLE CAUSES

Equipment _____

Tools / PPE _____

Environment _____

Procedure _____

Personnel _____

Other _____

CAUSAL FACTORS

RECOMMENDATIONS

Corrective Actions/Preventative Actions	Person Responsible	Due Date

LABORATORY EMERGENCY INFORMATION SHEET

Department	Room	Date			
Manager Responsible for Lab	Office Phone	Home Phone			
Alternate Contact	Office Phone	Home Phone			
Alternate Contact	Office Phone	Home Phone			
Emergency Coordinator: Building or Department/School	Office Phone	Home Phone			
<p>IN CASE OF EMERGENCY, tell your laboratory manager and call _____.</p> <p>For fire, pull alarm; evacuate building; stay outside to meet with fire department official.</p> <p>For hazardous vapors or gases, inform others to evacuate the area; close doors; call _____.</p> <p>For gases or vapors spreading to other areas, pull fire alarm; evacuate the building; WHEN IN DOUBT, GET OUT.</p> <p>For injuries, call _____ for ambulance.</p> <p>For poison and other chemical toxicity information, call _____.</p> <p>For simple spills, call _____ for cleanup advice.</p>					
Institutional Emergency Coordinator:		Ambulance/Fire/Police/Spill:			
Hospital Emergency Room:		Poison Control Center:			
LOCATION		LOCATION			
Nearest Fire Extinguisher:		Nearest Fire Alarm:			
Nearest Spill Control Material:		Nearest Safety Shower:			
BIOHAZARDS	LAB LOCATION	CHEMICALS	LAB LOCATION	RADIATION	LAB LOCATION
Biosafety Level 1 <input type="checkbox"/> <i>Low</i>		<input type="checkbox"/> Flammable Liquid		<input type="checkbox"/> Laser	
Biosafety Level 2 <input type="checkbox"/>		<input type="checkbox"/> Air/Water Reactive		<input type="checkbox"/> Irradiator	
Biosafety Level 3 <input type="checkbox"/>		<input type="checkbox"/> Toxics/ Carcinogens		<input type="checkbox"/> Rad. Sealed Source	
Biosafety Level 4 <input type="checkbox"/> <i>High</i>		<input type="checkbox"/> Conc. Acids/Bases		<input type="checkbox"/> Radioactive Waste	
Pathogens:		<input type="checkbox"/> Gas Cylinders		<input type="checkbox"/> Rad. Materials	
<input type="checkbox"/> Human		<input type="checkbox"/> Strong Oxidizers		<input type="checkbox"/> Other:	
<input type="checkbox"/> Animal		<input type="checkbox"/> Waste Solvents			
<input type="checkbox"/> Toxins		<input type="checkbox"/> Other:			
<input type="checkbox"/> Other:		<input type="checkbox"/> Other:			

Complete and post next to your laboratory door, with a second copy next to your phone.

LABORATORY HAZARD ASSESSMENT CHECKLIST

I. Pre-Operational Planning

- | | |
|--|--|
| <input type="checkbox"/> Toxicity | What is the level of toxicity? What are the routes of exposure (inhalation, skin absorption, ingestion, injection) and which of these are likely under the conditions of use? What are the signs and symptoms of overexposure? |
| <input type="checkbox"/> Flammability | Is the material flammable or explosive under the conditions of use? |
| <input type="checkbox"/> Warning Properties | Can odor or irritation adequately warn of over-exposure before it becomes dangerous? |
| <input type="checkbox"/> Laboratory Equipment | Is laboratory equipment in good condition? Are machine guards or interlocks in place and functioning? |
| <input type="checkbox"/> Storage Precautions | Does the material need isolated storage, refrigeration or other special conditions for storage? |
| <input type="checkbox"/> Incompatible Materials | Should certain materials be segregated (e.g., flammables and oxidizers)? |
| <input type="checkbox"/> Reagent Stability | Should materials be dated for disposal (e.g., ethers); should materials be kept refrigerated (possibly in an explosion proof refrigerator) to prolong shelf life? |
| <input type="checkbox"/> Protective Clothing | Is a lab apron or clothing made of resistant material needed or is a lab coat adequate? |
| <input type="checkbox"/> Gloves | What glove material is needed? Is the right type, thickness, glove length and size available? |
| <input type="checkbox"/> Eye Protection | What type of eye protection is needed—safety glasses for impact, chemical splash goggles for chemicals? Is a face shield needed in combination with the goggles? |
| <input type="checkbox"/> Heat Sources | Is heating needed? Is there an alternative to open flames? Are heating mantles in good condition? |
| <input type="checkbox"/> Electrical Equipment | Is equipment it grounded properly? Are electrical cords insulated? Is ground fault circuit interruption (GFCI) needed? |
| <input type="checkbox"/> Vacuum/Pressure Systems | Have connections been leak tested, hydrostatically tested, properly vented, and traps installed when necessary |
| <input type="checkbox"/> Ventilation/Containment | Does the work need to be done in a chemical hood, ventilated cabinet or a glove box to provide the needed level of containment? |

II. Experimental Scale and Design

- | | |
|---|--|
| <input type="checkbox"/> Quantity | Are there ways to minimize the amount of materials used without affecting results (e.g. microscale)? |
| <input type="checkbox"/> Ambient Conditions | Are special conditions necessary to carry out the reaction (e.g., cold room or dry box)? |
| <input type="checkbox"/> Time Constraints | Can the experiment be completed while lab workers are present? If not, can the experiment be safely run unattended or overnight? |

III. Spill/Emergency Planning

- | | |
|--|--|
| <input type="checkbox"/> Lab Personnel | Are others in the laboratory aware of what you are doing? |
| <input type="checkbox"/> Fire Extinguishers | Are special types required; are you aware of their location and proper use (e.g., Class D for metals)? |
| <input type="checkbox"/> Emergency Response | Do you have a response planned in the event of a spill; would evacuation be necessary? |
| <input type="checkbox"/> Spill Cleanup | Are materials on hand to absorb/neutralize; is the needed protective equipment on hand and have you been trained on its use? |
| <input type="checkbox"/> Safety Shower/Eyewash | Are you aware of the locations and methods Fountain of operation? |

IV. Waste Disposal

- | | |
|--------------------------------------|--|
| <input type="checkbox"/> Method | Is there an approved method for treating the waste in the laboratory |
| <input type="checkbox"/> Labeling | Are containers clearly, indelibly and accurately labeled as to the contents? |
| <input type="checkbox"/> Segregation | Are incompatible wastes kept segregated? |
| <input type="checkbox"/> Containers | Are suitable containers with adequate closures available? |
| <input type="checkbox"/> Recycling | Is it feasible to safely recover/recycle used chemical? |

SIGNS





LABORATORY SHOWER



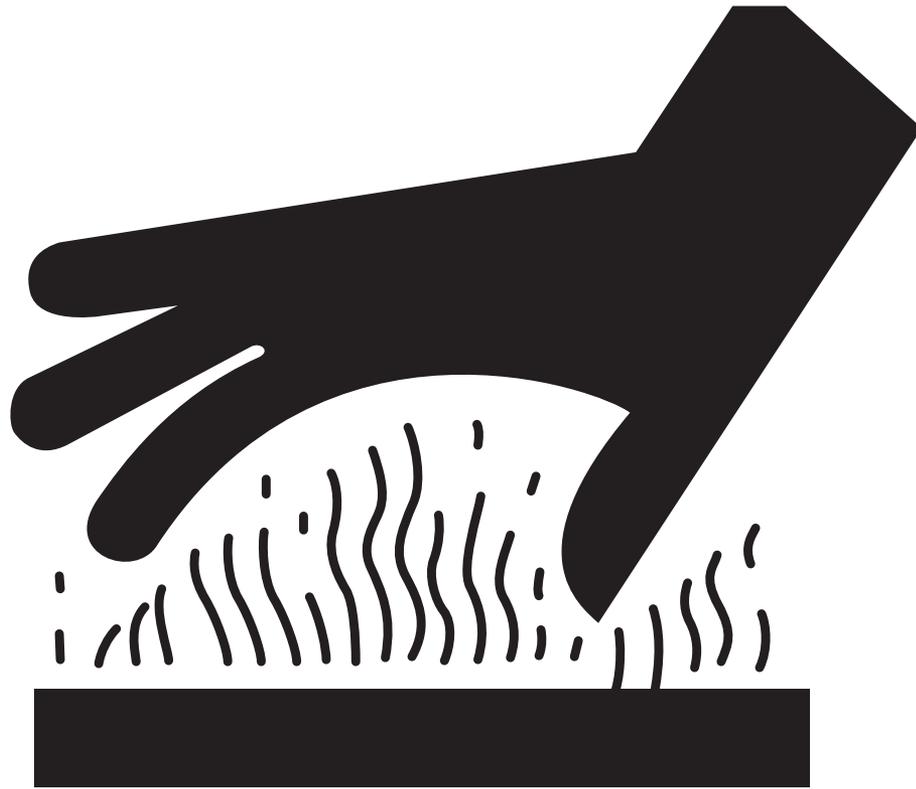
EYE WASH



**CHEMICAL
STORAGE
ONLY**



**FOOD AND
DRINK ONLY**



CAUTION
HOT SURFACE

CAUTION

**Do Not Enter
Risk of Explosion**



CAUTION

Flammable Materials





**Eye protection required
beyond this point**



WARNING

**Report ALL
Incidents to Your
Supervisor**

Signed by: _____

Date: _____

