



Safety in the Laboratory

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OBJECTIVES

- ▶ Describe changes in the revised Bloodborne Pathogens Standard.
- ▶ Identify safety violations in case studies and explain how to remedy the situation.
- ▶ Identify safety violations from photographs from the laboratory.

Occupational Safety and Health Administration (OSHA)

- ▶ A division of the U.S. Department of Labor
- ▶ Charged with protecting all types of workers in all situations, including health care workers.
- OSHA – Law
- CDC – issues guidelines and best practices; makes recommendations

Bloodborne Pathogens Standard

- ▶ First passed in 1991 (20 year anniversary 2021)
- ▶ Implemented the use of Universal (Standard) Precautions.
- ▶ Employers with workers exposed to blood and other potentially infectious materials required to:
 - ▶ Implement exposure control plan with details of employee protection measures
 - ▶ Describe how using Engineering Controls, Work Practice Controls, and Personal Protective Equipment will be used to protect workers
 - ▶ Provide training, surveillance, vaccinations for Hepatitis B, and signs and labels to further protect employees
 - ▶ Record-keeping requirements

Bloodborne Pathogens Standard

- ▶ Centers for Disease Control and Prevention (CDC) estimated that healthcare workers sustained nearly 600,000 percutaneous injuries annually involving contaminated sharps. (in 2001).
- ▶ Safety devices were being marketed that would eliminate risk.
- ▶ CDC estimated 62-88% of sharps injuries can potentially be prevented using safer medical devices.
- ▶ Led to revising the BBP Standard to **Occupational Exposure to Bloodborne Pathogens; Needlestick and other Sharps Injuries, Final Rule 2011.**
- ▶ Set forth in greater detail requirements for employers to identify, evaluate, and implement safer medical devices (engineering controls).

Bloodborne Pathogens Standard (revised)

- ▶ Mandate for employer to maintain a sharps injury log
- ▶ Involvement on non-managerial workers in identifying, evaluating and choosing effective engineering and work practice controls.
- ▶ Defines these safer medical devices as controls that isolate or remove the BBP hazard .
- ▶ Annual review of safety devices, select improved one if necessary and document in Exposure Control Plan.

Bloodborne Pathogens Standard (revised)

- ▶ Applies to all employers with employees who have occupational exposure to blood or other potentially infectious materials (OPIM), regardless of how many workers are employed.
- ▶ 10th Anniversary of Revision including safety devices? Did it help?

Bloodborne Pathogens

- ▶ Infectious Agents
 - ▶ HIV
 - ▶ HBV
 - ▶ HCV
- ▶ Routes
 - ▶ Mucocutaneous
 - ▶ Percutaneous Injury



Risk of HIV Infection After Exposure

- ▶ Risk after single percutaneous exposure to HIV-infected blood is 0.3%

OR

From 300 percutaneous exposures to HIV-infected blood,
approximately 1 will transmit to HCW ($1 / 300 = 0.3\%$)

- ▶ Risk after mucocutaneous exposure is 0.1% ($1 / 1,000$)

Nature and Frequency of Exposure

- ▶ Volume of blood involved in percutaneous exposure
 - ▶ Type and gauge of needle
 - ▶ Depth of penetration
 - ▶ Glove use
- ▶ Titer of virus in blood (clinical stage of disease is crude estimate)
- ▶ Host defense system ?

Risk of Hepatitis B Virus (HBV)

- ▶ Risk of transmission after single percutaneous exposure to HBV-positive blood
 - ▶ Titer of virus
 - ▶ Presence or absence of HBeAg (hepatitis B e antigen)
- ▶ Estimates range from 6% (HBeAg absent) to 30% (HBeAg present)

Hepatitis B Vaccine

- ▶ Bloodborne pathogen standard (1991) directed employer to provide vaccine
- ▶ Reduced occupationally acquired HBV from 8,700 cases in 1987 to 400 new cases in 1995.
- ▶ Compliance still not optimal

Vaccination for hepatitis B

- ▶ Employer must offer within 10 days of initial assignment to a job with occupational exposure.
- ▶ No cost to worker
- ▶ Must sign waiver if employee chooses to refuse vaccination

Hepatitis C Virus (HCV)

- ▶ Formerly called non-A, non-B hepatitis
- ▶ Nearly 4 million people in U.S. are infected (1997, NIH)
- ▶ Est 2.4 million people living with HCV in U.S.; many are Baby Boomers (born between 1945-65.)
- ▶ Of these, 50-85% develop chronic HCV infection and the potential to transmit to others
- ▶ Chronic infection leads to increased risk for cirrhosis and hepatic cancer (More deaths in recent years due to HCV than HIV).
- ▶ CDC recommends all adults 18 and over get tested for HCV
- ▶ New infections increased by 30% from 2010 and 2017.
- ▶ ADD How it is spread.

Risk of Hepatitis C Virus (HCV)

- ▶ Risk after single percutaneous exposure to HCV-positive blood is 1.8% (0% - 7%)
- ▶ Needlestick injuries are most common cause of occupational HCV exposure
- ▶ No effective vaccine
- ▶ New drugs are effective but expensive

Safety Devices

- ▶ OSHA: Evaluate and adopt anti-needlestick devices
- ▶ Each facility select and evaluate device in its unique setting
- ▶ Key points
 - ▶ Device must decrease injuries
 - ▶ Device must be acceptable to users
 - ▶ Passive devices are more effective

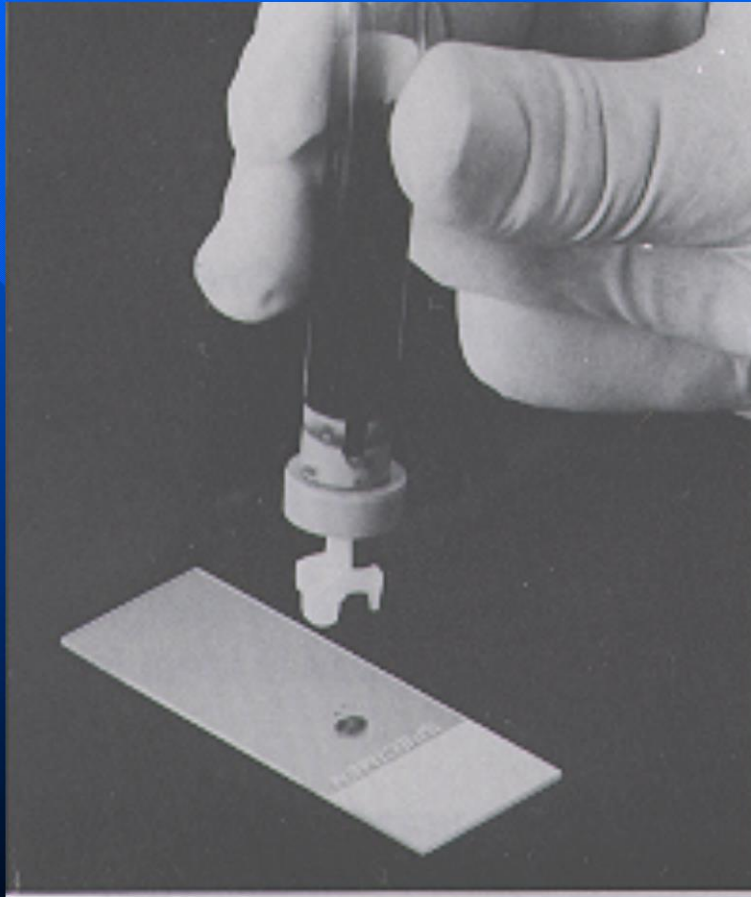
Vacutainer Urine Collection Kit

Becton Dickinson



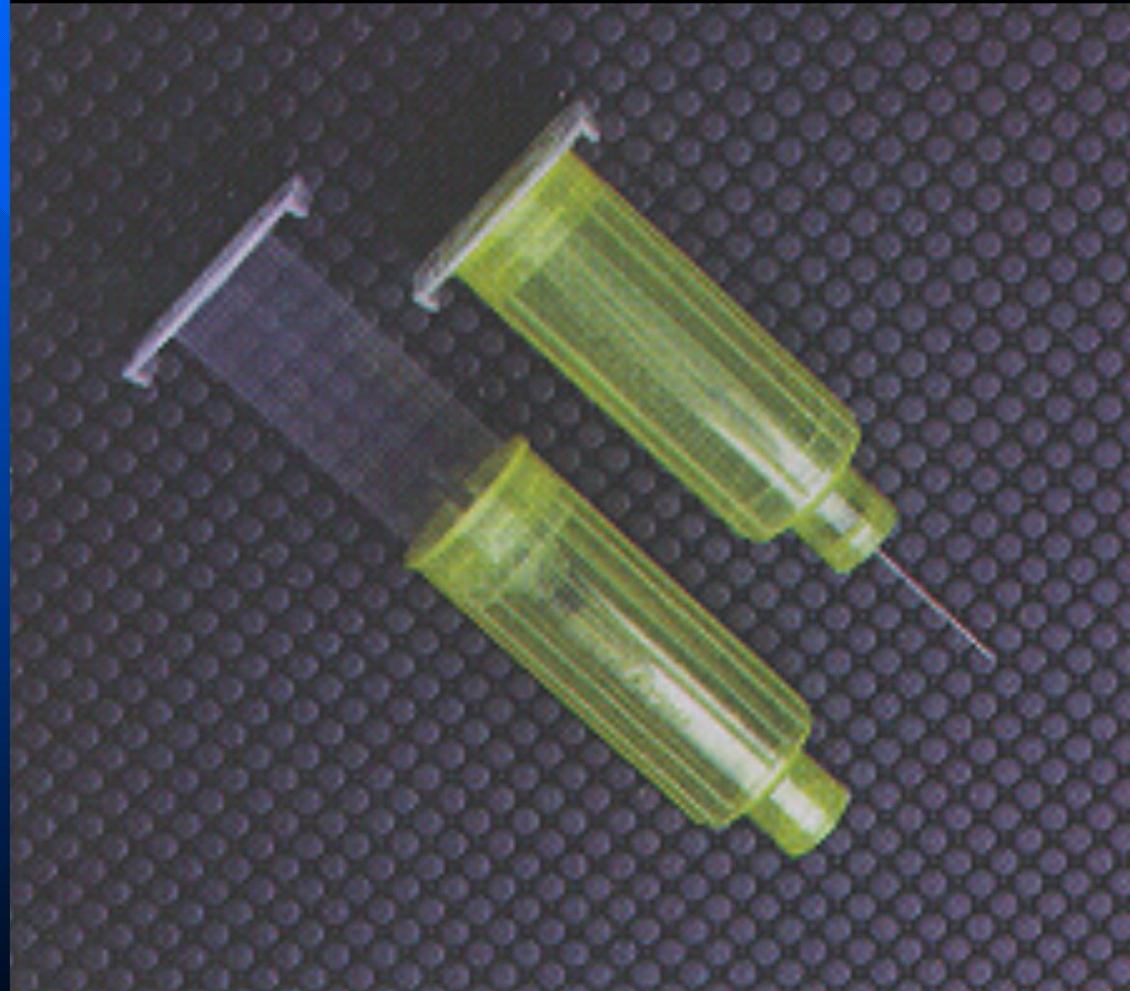
Blood Dispenser

Diff-Safe, Alpha Scientific



Safety-Lok™ Needle Holder

Becton-Dickinson

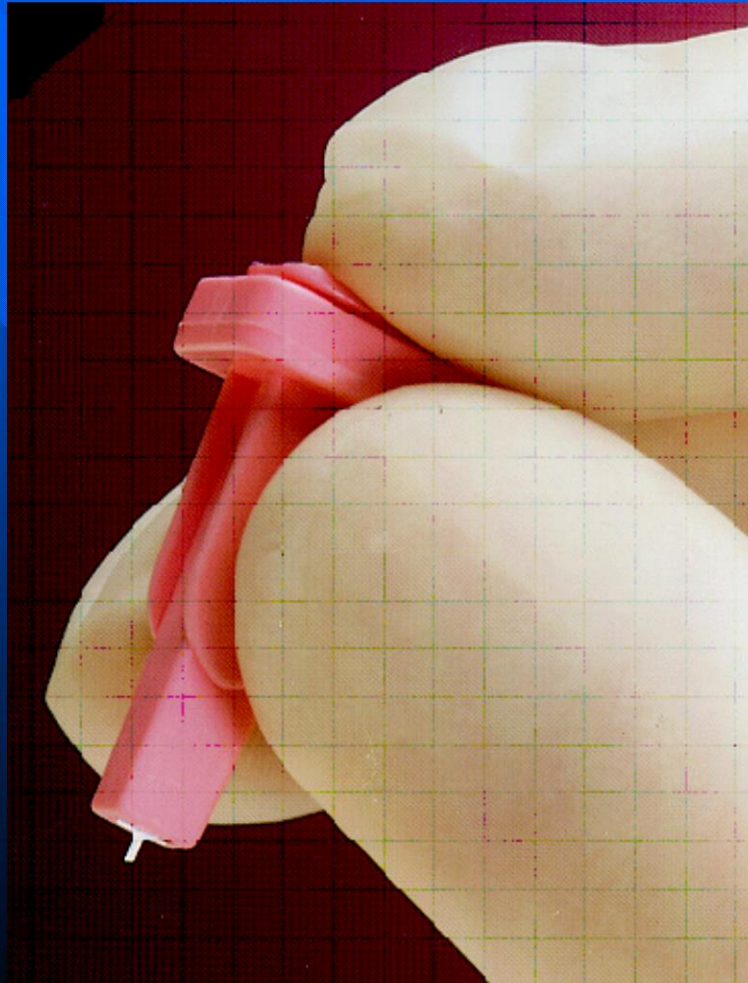


Safety-Lok™ Needle Holder

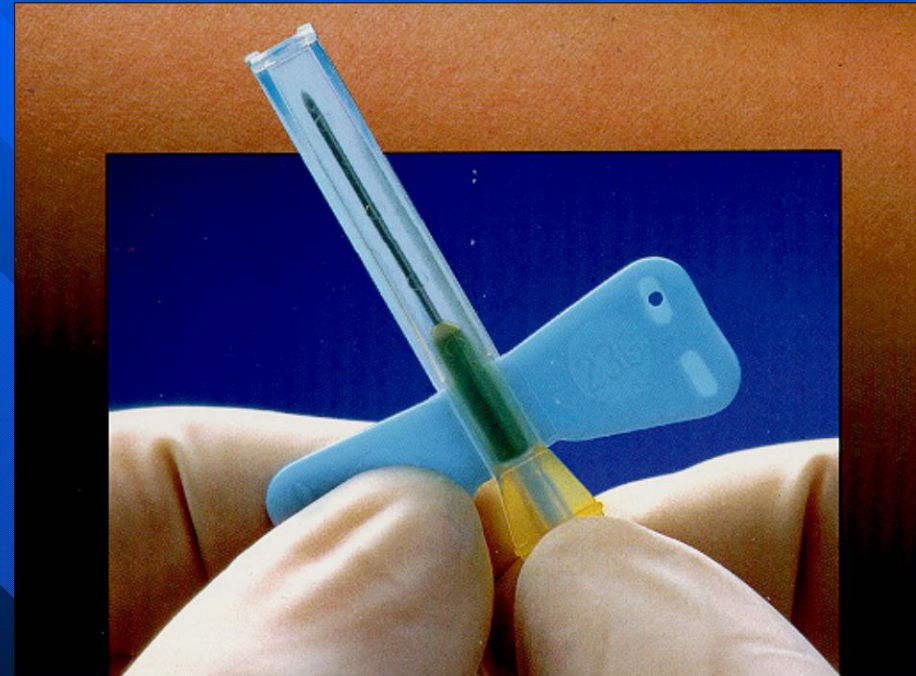
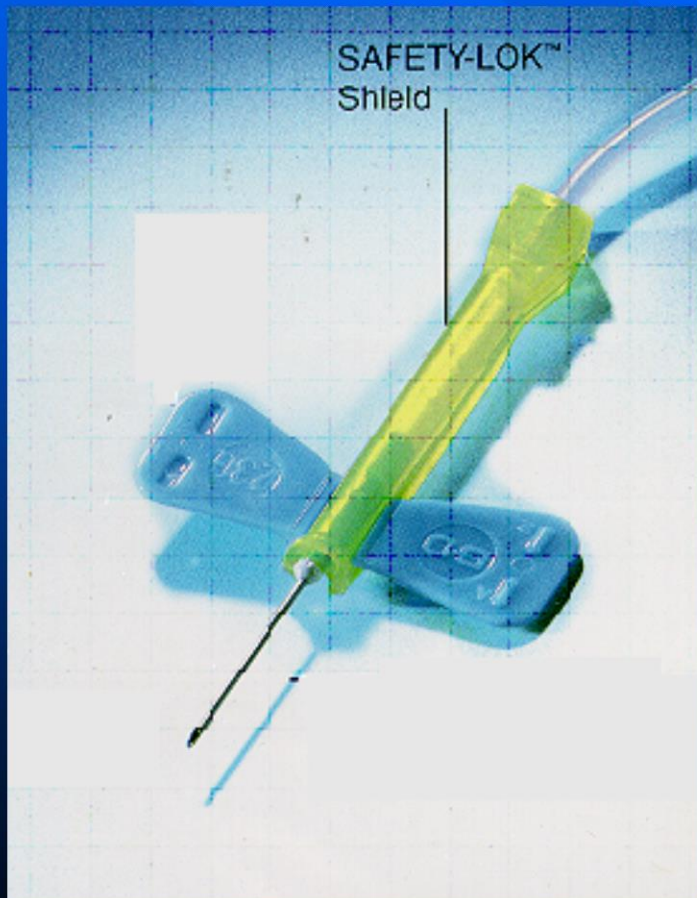
Becton-Dickinson



Automatic Retractable Lancet Microtainer, Becton Dickinson

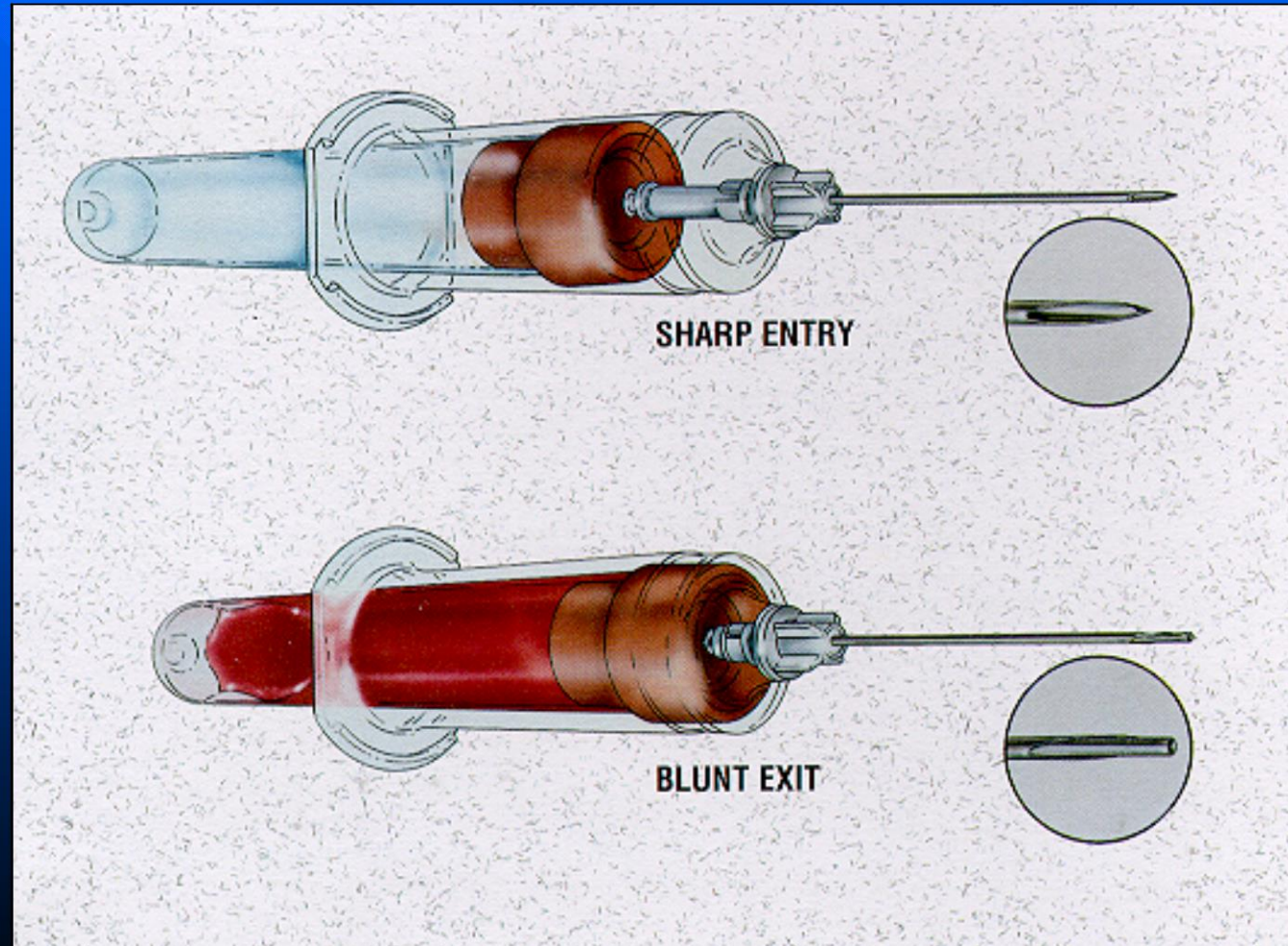


Resheathable Butterfly Safety-Lok™, Becton Dickinson



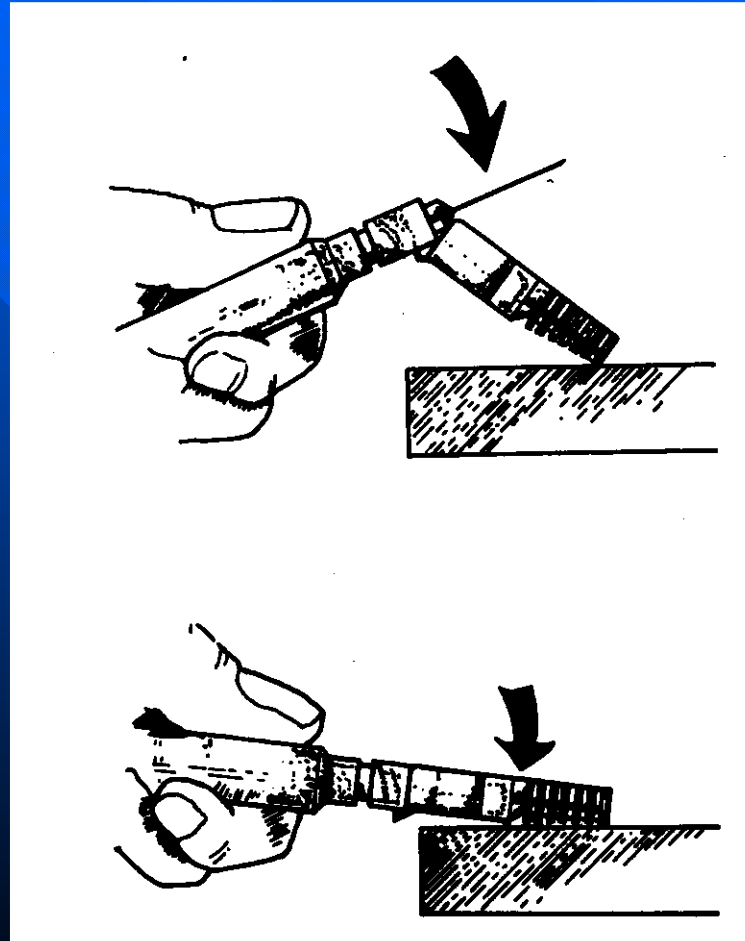
Bluntable Needle

PuncturGuard™, Bio-Plexus



Resheathable Needle

Needle-Pro, Smiths Industries





- ▶ The BD Vacutainer® push button blood collection set offers a clinically demonstrated, split second retracting safety needle to help reduce costly needlestick injuries. It is available with a preattached holder for added convenience and to help meet the Occupational Health and Safety Administration's (OSHA) single-use standards



B-D Safety
Loc



BD Eclipse



BD Eclipse
with Pre-
Attached
One-Use
Holder

Other Engineering Controls

- ▶ Rigid sharps disposal containers
 - ▶ Located conveniently
 - ▶ Replaced when 2/3 full
- ▶ Plastic capillary tubes
- ▶ Bottle carriers
- ▶ Chemical spill kit
- ▶ Broken glass container

Work Practice Controls

- ▶ Practices that reduce the possibility of exposure by changing the way a task is performed, such as appropriate practices for handling and disposing of contaminated sharps, handling laundry, and cleaning contaminated surfaces and items.
- ▶ Examples:
 - ▶ Single most effective infection control practice: WASH HANDS
 - ▶ Decontaminate work surface at least once per day with 10% bleach
 - ▶ Do not recap needles
 - ▶ Do not eat, drink, smoke, apply cosmetics or handle contact lenses in lab
 - ▶ Do not store food or drink in same refrigerator as reagents/specimens

Personal Protective Equipment

- ▶ Gloves
- ▶ Gowns or lab coats
- ▶ Eye protection
- ▶ Masks
- ▶ Employer must provide, maintain, repair and replace at no cost to worker.

Post-exposure Follow-Up

- ▶ Employer must make available to any worker who experiences an exposure incident.
- ▶ “Exposure Incident” defined as specific eye, mouth, or other mucous membrane, non-intact skin or parenteral contact with blood or OPIM.
- ▶ Follow-up at no cost to employee; includes documenting route or exposure and circumstances under which incident occurred.
- ▶ Identification and testing the source individual for HBV and HIV if the source individual consents or the law does not require consent
- ▶ Testing exposed worker’s blood, if worker consents

Post-exposure Follow-up

- ▶ If source patient tests positive or is unknown, prophylaxis is given to employee and testing for BBP is repeated at 6 weeks, 3 months, and 6 months.
- ▶ Offering counseling
- ▶ Evaluating reported illnesses
- ▶ Healthcare professional will provide a limited written opinion to the employer and all diagnoses must remain confidential.

Additional Requirements

- ▶ Provide information and training to workers on initial assignment and annually after that, and when new or modified tasks or procedures affect a worker's exposure.
- ▶ Use labels and signs to communicate hazards; warning labels affixed to containers of regulated waste; contaminated sharps; refrigerators or freezers containing blood or OPIM, red bags for contaminated waste or laundry, etc.
- ▶ Maintain worker medical and training records.

Sharps Injuries in 2019

Job Title	Number	Percent
Phlebotomist	49	3.7%
Clinical Laboratory	14	1.1%
Nurse	483	36.5%
Purpose of Sharp	Number	Percent
Draw venous blood sample	51	6.5%
Fingerstick/Heelstick	14	1.8%
Device Causing Injury	Number	Percent
Winged steel needle	36	28%
Vacuum tube blood collection/needle	26	2.0%
Lancet	13	1.0%
Capillary tube	2	0.2%

Sharps Injuries 2019

Was device “safety design” with shielded, recessed, retractable, or blunted needle?

	Number	Percent
Yes	217	52.2%
No	164	39.4%
Unknown	35	8.4%
If yes, was safety mechanism activated?	Number	Percent
Yes, fully	13	6.4%
Yes, partially	40	19.6%
No	146	71.6%
Unknown	5	2.5%

Sharps Injury Data 2019

Reference

“International Safety Center. U.S. EPINet Sharps Injury and Blood and Body Fluid Exposure Surveillance Research Group. Sharps Injury Data Report for 2019; 36 hospitals contributing data, 1,324 total injuries. Report available at [Sharps Injury & Blood and Body Fluid Exposure Reports | ISC \(internationalsafetycenter.org\)](https://www.internationalsafetycenter.org/sharps-injury-reports).”



Safety During the COVID-19 Pandemic

CDC GENERAL GUIDELINES

All laboratories should perform a site-specific and activity-specific risk assessment to identify and mitigate risks. Include the following:

- ▶ Analyze number of people that the laboratory space can realistically and safely accommodate while maintaining social distancing.
- ▶ Assess the flow of personnel traffic. Where possible, design one-way paths for staff to walk through the space.
- ▶ Assess procedures for cleaning and sanitizing commonly shared equipment and areas
- ▶ Review emergency communication and operational plans, including how to protect staff at higher risk for severe illness from COVID-19.

GENERAL GUIDELINES

Every institution should have a COVID-19 health and safety plan to protect employees. Ideally, plan would include:

- ▶ Steps to help prevent the spread of COVID-19 if an employee is sick.
- ▶ Instruct sick employees to stay home and not return to work until criteria for isolation are met
- ▶ Provide information on whom employees should contact if they become sick.
- ▶ Implement flexible sick leave and supportive policies and practices.
- ▶ Provide employees with accurate information about COVID-19, how it spreads and the risk of exposure.

GENERAL GUIDELINES

- ▶ Ensure employees have access to PPE, disinfectant products, soap, clean running water, drying materials for handwashing or alcohol-based hand sanitizer that contains at least 60% ethanol or 70% isopropanol,
- ▶ Where possible, adhere to social distancing recommendations by adjusting staff schedules, adding additional shifts, or implementing non-overlapping teams to minimize personnel contact
- ▶ Reconfigure workspaces and locations of shared equipment to reducing crowding. Declutter workspaces and dispose of unnecessary items to help with reconfiguration.
- ▶ Minimize traffic and interactions by limiting visits from vendors and other external partners.

GENERAL GUIDELINES

- ▶ Wear face coverings in settings where social distancing measures are challenging to maintain. Any face covering worn in the laboratory where personnel work with potentially infectious material should not be worn outside the laboratory area.
- ▶ High-touch locations and equipment with a high frequency of handling and contact present a higher probability of contamination in the work area and should be disinfected frequently.
- ▶ Use visual reminders, such as posters displayed throughout the laboratory environment, common areas, and restrooms, to emphasize the importance of hand hygiene and to encourage frequent hand washing.

ROUTINE DIAGNOSTIC TESTING

- ▶ Routine diagnostic testing of specimens, such as the following activities, can be handled in a BSL-2 laboratory using Standard Precautions:
 - ▶ Using automated instruments and analyzers
 - ▶ Processing initial samples
 - ▶ Staining and microscopic analysis of fixed smears
 - ▶ Examination of bacterial cultures
 - ▶ Molecular analysis of extracted nucleic acid preparations

PROCEDURES WITH HIGH LIKELIHOOD OF GENERATING AEROSOL

- ▶ These procedures should be done using either a Certified Class II Biological Safety Cabinet (BSC) or additional precautions to provide a barrier between the specimen and personnel.
- ▶ Examples of these additional precautions include
 - ▶ PPE, such as surgical mask or face shield
 - ▶ Other physical barriers, such as splash shield, centrifuge safety cups, and sealed centrifuge rotors to reduce the exposure to laboratory personnel

LABORATORY WASTE MANAGEMENT

Handle laboratory waste generated during testing for SARS-CoV-2 patients as all other biohazardous waste

Currently there is not evidence to suggest that this laboratory waste needs any additional packaging or disinfection.

POINT OF CARE TESTING

Laboratories should consider the following when using POC instruments for SARS-CoV-2 diagnostic purpose:

- Use the instrument in a location associated with a current CLIA certificate
- Perform a site-specific and activity-specific risk assessment to identify and mitigate safety risks.
- Train staff on proper use of the instrument and ways to minimize risk of exposures.
- Follow Standard Precautions when handling specimens, including hand hygiene and use of PPE
- Change gloves after adding patient specimen to instrument.
- Decontaminate the instrument after each run.

SAFETY CULTURE (CLIMATE)

SAFETY CULTURE - Shared commitment of management and employees to ensure the safety of the work environment.

- ▶ Permeates all aspects of the work environment
- ▶ Encourages every individual to project a level of awareness and accountability for safety.
- ▶ Employees perceive a culture of safety based upon:
 - ▶ Actions taken by management to improve safety
 - ▶ Worker participation in safety planning
 - ▶ Availability of written safety guidelines and policies
 - ▶ Availability of appropriate safety devices and protective equipment
 - ▶ Socialization processes around safety that personnel experience when they first join an organization.
 - ▶ Safety is valued even at the expense of "production" or "efficiency"
 - ▶ Management involved in safety at the highest levels
 - ▶ Strong safety training and safety communications programs

SAFETY CULTURE

To create a culture of safety, organizations must address factors that influence employees' attitudes and behaviors.

- ▶ Include safety related statements in the organization's mission, vision, values, goals and objectives.
- ▶ Give high priority and visibility to safety committees
- ▶ Require action plans for safety in ongoing planning processes.
- ▶ Encourage reporting and elimination of sharps injury hazards.

KEY POINTS

Factors that Influence a Culture of Safety

- Management commitment to safety
- Healthcare personnel involved in safety decisions
- Method of handling safety hazards in the work environment
- Feedback on safety improvements
- Promotion of individual accountability

What's New in Safety

OSHA COVID-19 Standard Still Pending

- ▶ Through an executive order, President Biden has required OSHA to create an Emergency Temporary Standard (ETS) for COVID-19 that was to be published by March 15, 2021. The proposed standard would require employers to create a plan to mitigate worker exposure to COVID-19. The rule would include mandates such as mask-wearing, social distancing, hand-washing breaks, and communication for workers during outbreaks. OSHA was then to consider the creation of a permanent standard. However, as of this writing, no ETS has been published by OSHA. Some states have an ETS already, but the federal version is still pending.

OSHA Raises Fines Again

- ▶ After almost forty years of unchanged fine rates, OSHA began increasing rates for inflation every year starting in 2015. The 2021 penalty rates are posted, and a single serious violation can now cost an organization \$13,653 per violation. A willful or repeated violation can hold a fine of up to \$136,532 per violation. Violations that last several days can cost a lab or facility a great deal. While these fine amounts are designed to improve the effectiveness of civil monetary penalties and maintain their deterrent effect, not all violations are fined those full amounts.

OSHA Cites for Poor Pandemic Safety Practices

- ▶ As the pandemic continues, OSHA is working to ensure workplaces do what is necessary to protect employees. Inspections specific to COVID-19 safety practices have resulted in over \$2 million in fines for US employers this year. Citations have resulted from unsafe practices such as inappropriate PPE storage, a lack of medical evaluations for workers using respirators, and inadequate tracking of workplace injuries and exposures. Poor management of respiratory protection programs tops the list of issues noticed with healthcare facilities during the pandemic. Make sure all the appropriate pieces of your program are in place for the continued protection of your staff.



SAFETY CASE STUDIES

CASE # 1

It is 10:30 p.m. on a busy Friday night. A MLS working alone in the chemistry department has several STAT orders pending. She runs out of reagent on one of her instruments. As she is searching for another bottle of reagent on a storage shelf above her head, she knocks over a 500 mL bottle that breaks on the floor and lightly splashes her legs. A strong odor begins to emanate from the spilled chemical. She picks up the bottle pieces with her bare hands and notices that there is no label on the bottle. The chemical fumes begin to burn her eyes and nose. She holds her breath, gathers some paper towels, and soaks up the spill. She places the wet paper towels in the biohazard trash. She washes her hands, which by now are slightly irritated and red. The MLS notices that her legs are also slightly red and irritated where the chemical splashed them. Because she is so busy and her hands and legs do not hurt, she decides not to report the incident and goes back to work.

CASE # 1

- ▶ What factors caused this accident?
- ▶ Did the MLS act correctly?
- ▶ What steps should be taken when a chemical spill occurs?

Case # 1 Answers

- ▶ Reagent stored above eye level; especially potentially toxic chemicals that are to be kept in a secure area.
- ▶ Bottle that broke was not labelled.
- ▶ Attempted to pick up broken glass with bare hands.
- ▶ She should have left the area to obtain help.
- ▶ She should have not attempted to clean up a chemical she could not identify – could not know what spill equipment, PPE, or waste disposal procedures to use
- ▶ She did not seek medical attention; did not report her exposure to the chemical

CASE # 2

A new table-top Biological Safety Cabinet was purchased and installed in the laboratory quickly in order to implement COVID-19 PCR testing. Once testing began, many staff members began complaining to the manager about sore backs and necks. Neither the chair nor the counter were adjustable, and when one employee attempted to jump up to the high chair, he slipped off and fell to the floor.

What should be done to avoid this situation?

Case # 2 Answers

- **Perform a complete risk assessment that includes an ergonomics assessment when new equipment is installed in the laboratory.**
- **Make sure counters or chairs are adjustable in order to accommodate workers of all sizes.**
- **Ask Employee Health to assist in ergonomics assessments if there are employee complaints about physical discomfort at work.**

Case # 3

It was the first slow day in a while at the lab outpatient draw center, and Marlene wanted to sit and talk to her co-worker, Darla. She went into Darla's room and sat next to her to show her some pictures on her phone. They removed their masks and chatted for a while. A few days later, Darla and her family members became sick. They were later diagnosed with COVID-19. She learned later that Marlene's husband was sick the week before.

What happened here?

Case # 3 Answers

- Continue social distancing at work and wearing masks to prevent the spread of viruses to co-workers.
- Do not use cell phones in labs and outpatient draw centers. You may bring pathogens home to family members.
- Talk to your staff about PPE-fatigue and monitor the continued proper use of PPE at all times.

Case # 4

The Emergency Department was busy, and the number of COVID-19 swabs collected was high. After placing the swabs in the transport media, the staff decided they did not have time to walk the specimens to the lab. They placed many tubes in one bag and sent them to the lab via the pneumatic tube system. When the lab received the carrier, they discovered that a couple of the media tubes leaked out all over the bag and into the carrier. When one of the samples tested positive, the lab staff in the processing area were considered exposed and had to quarantine for many days.

Answers Case # 4

- Per CDC guidelines, do not transport respiratory specimens via the pneumatic tube system.
- Never place more than one patient's samples in the same specimen transport bag.
- When receiving carriers, be sure all appropriate PPE (including face protection) is in use in case a leaky or spilled specimen is encountered.
- Be sure all transport carriers are lined with foam when used for specimen transport.

Case # 5

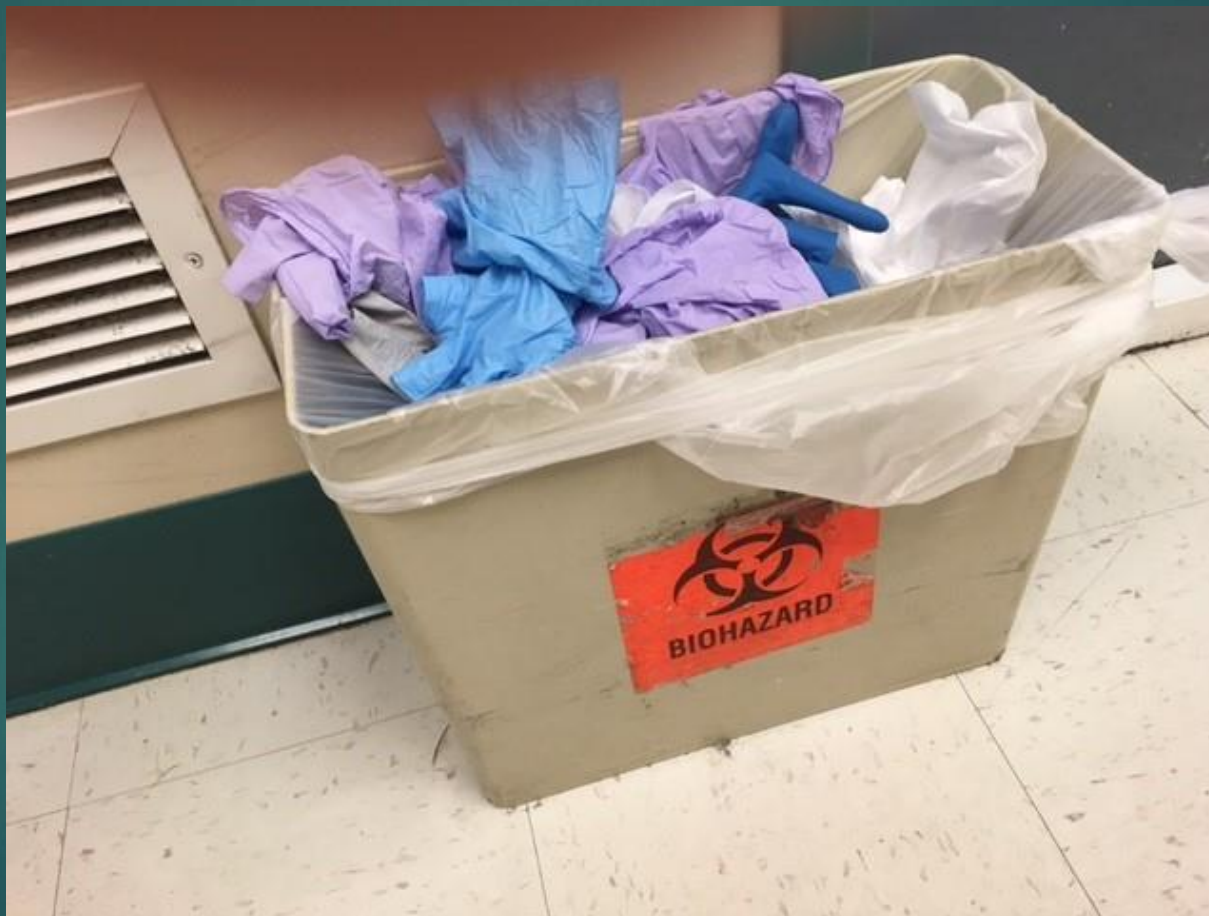
Anna was working the night shift and was very busy. She went to the break room for a sip of water, but the lab doorbell rang to indicate a specimen drop off. When she moved to rush back to the lab, she spilled water on the floor. Figuring no one else was around, she left the spill thinking she would clean it up later. When co-worker Carmen came in the lab back door for the next shift, she did not see the water. Carmen slipped and fell on her bad knee. She needed surgery, and the injury ended her lab career.

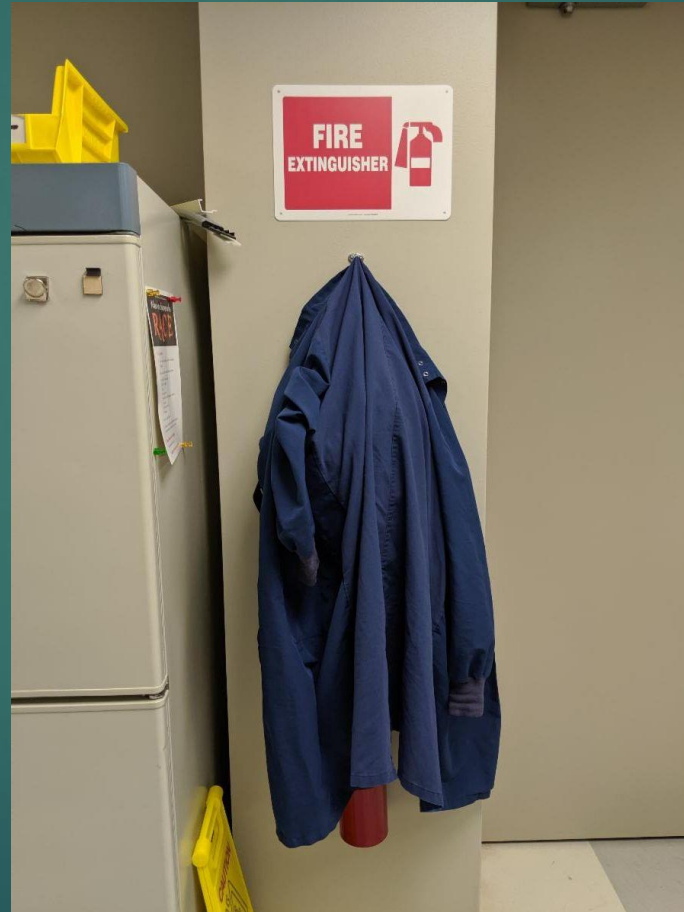
Answers Case # 5

- Clean up all lab spills immediately, even if it is only water.
- If you need to gather clean-up supplies and leave the spill area, put up a warning sign or have someone stand guard.
- Properly dispose of all spill clean-up material. Use a sharps container if there is broken glass in the spill.















Reference

► Dan the Lab Safety Man

Dan Scungio, MT (ASCP), SLS, CQA (ASQ)

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