

# New Intern Safety Orientation

**Environmental Health & Safety (EHS)  
Office of Research Compliance and Quality Management (ORCQM)**

# Why This Take-Home?



- To provide an overview of biological and chemical hazards found in the lab.
- To understand how to mitigate those hazards.
- To provide you with a resource document you can utilize during your internship.
- The more you know, the better you'll perform in real situations.
- This take-home will be complemented by a safety training to be held during orientation, bring your questions!



NOTE: Hyperlinks to the employee intranet, TGen Hub, will not work until you are onsite



# Part I: Bloodborne Pathogen and Exposure Control Training

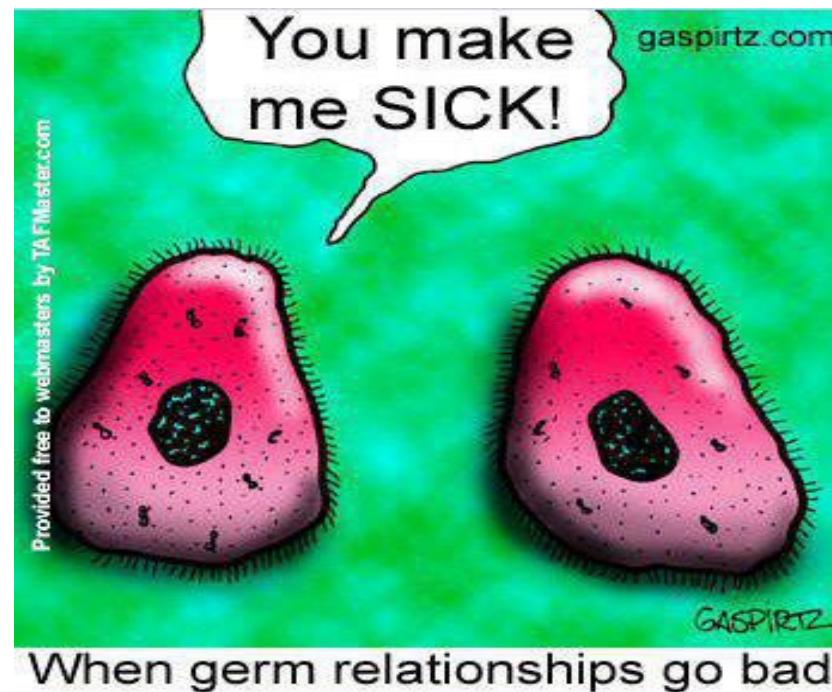
# Bloodborne Pathogen Exposure Control Plan

- The Bloodborne Pathogen Exposure Control Plan or BBP/ECP is the institutional policy for working safely with bloodborne pathogens and other potentially infectious materials (OPIM).
- The TGen BBP/ECP is located on the TGen Intranet (SharePoint®) in the EHS Policies folder and includes:
  - An overview of the BBP standard and definitions
  - The scope and application of the policy
  - Responsibilities and training
  - Information, labels and signs
  - Biohazardous waste disposal
  - Hazard controls
  - Emergency response procedures
  - Occupational health (vaccinations, post-exposure care)



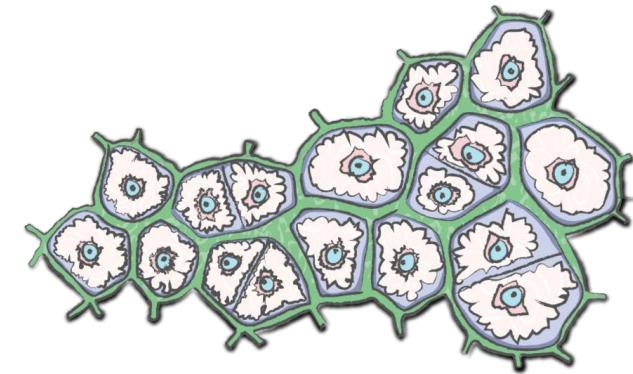
# What is a Bloodborne Pathogen?

Bloodborne pathogens are infectious microorganisms found in blood that can cause disease in humans



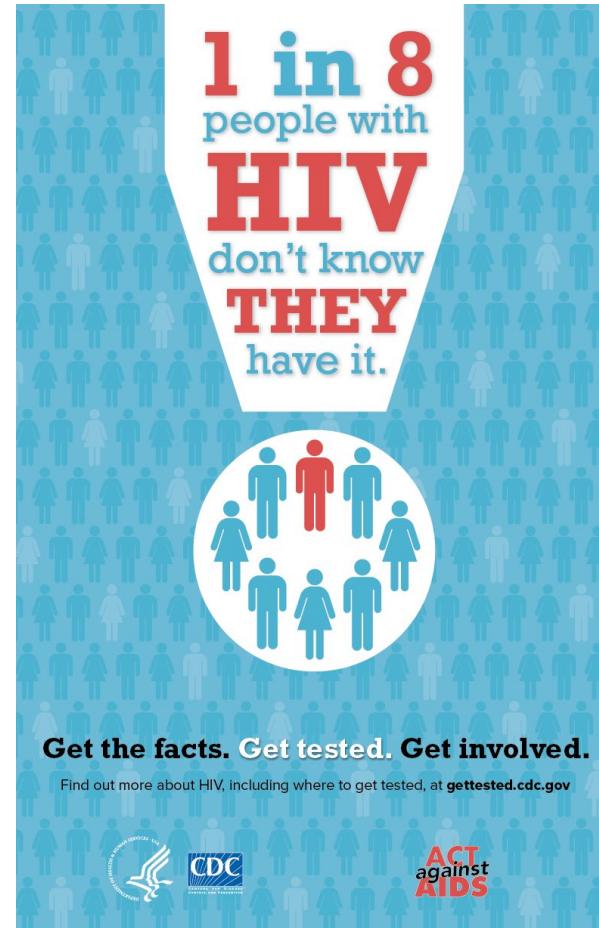
# Other Potentially Infectious Materials (OPIM)

- Unfixed tissue or body organs other than intact skin
- Organs (animal or human), skin
- Tissue or specimens from experimental animals infected with HIV or HBV
- Cell cultures
- Biopsy tissue
- Saliva
- Semen or vaginal secretions
- Cerebrospinal fluid, pleural fluid, any bodily fluid that are visibly contaminated with blood



# Common Bloodborne Pathogen Diseases

- Malaria
- Brucellosis
- Syphilis
- **Human Immunodeficiency Virus (HIV)**
- **Hepatitis B (HBV)**
- **Hepatitis C (HCV)**



# Transmission Potential

How can these pathogens infect us?

- Contact with another person's blood or bodily fluid that may contain blood
- Mucous membranes: eyes, mouth, nose
- Non-intact skin
  - Dermatitis
  - Skin abrasions
- Contaminated sharps/needles



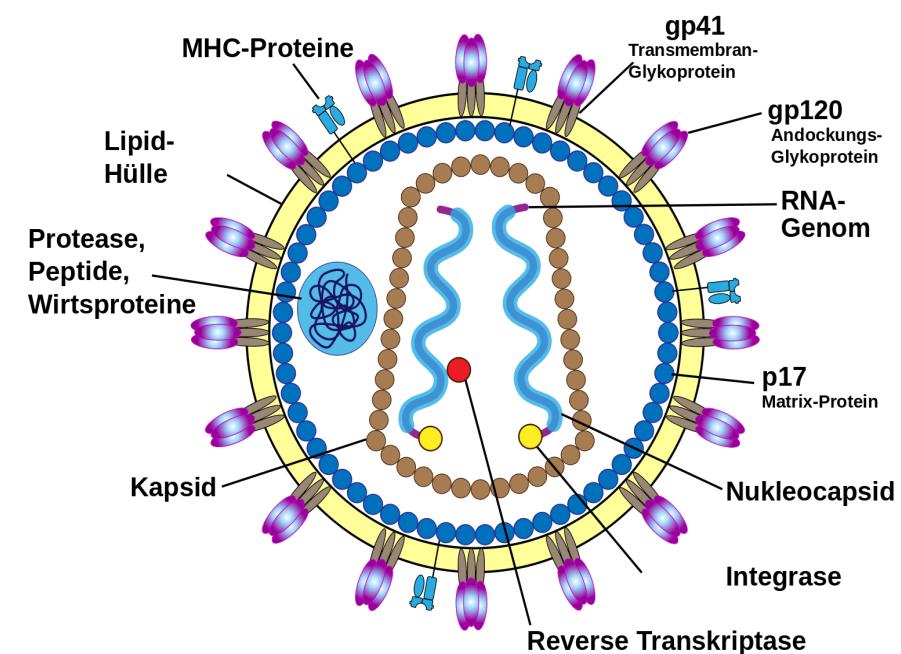
# Human Immunodeficiency Virus (HIV)

## Epidemiology of HIV

Since the beginning of the epidemic, over 70 million people have been infected with the HIV virus and 35 million have died (WHO).

At the end of 2021, an estimated 1.2 million people in the U.S. are living with HIV and 87% knew they had HIV. 36,136 people in the U.S. were diagnosed with HIV in 2021. However, the number of new HIV diagnoses fell 7% from 2017-2021.

New AIDS cases continue to decline in the U.S. and other industrialized countries due to prevention efforts and new drug therapies, which postpones the progression of HIV infection to AIDS.



# Human Immunodeficiency Virus (HIV)

- Transmission occurs through infected blood, OPIM (not urine, sputum unless bloody).
- Risk of conversion following percutaneous injury is approximately 0.3%.
- Risk of conversion from mucous membrane exposure is approximately 0.09%.
- The clinical picture of HIV infection ranges from those who have no symptoms to person with severe immunodeficiency or AIDS.
- No vaccine available.
- HIV is fragile and cannot live very long outside the body.

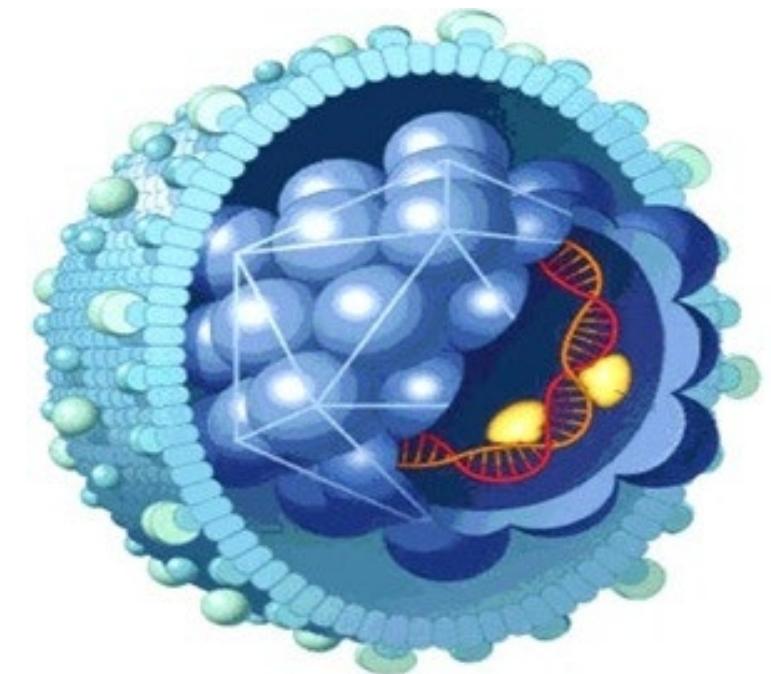
# Hepatitis B Virus (HBV)

## Epidemiology of Hepatitis B Virus

Hepatitis B (HBV) or "serum hepatitis" was first reported in 1833 following the administration of smallpox vaccine containing human lymph to shipyard workers.

A major public health problem with over 240 million people worldwide with a chronic HBV infection, Hepatitis B continues to be a serious hazard for healthcare workers because of exposure to blood and body fluids.

The incidence of HBV has been declining in the U.S. population, due to vaccine prevalence. In 2021, 2,045 new cases of acute hepatitis B were reported. After adjusting for under-reporting, an estimated 13,300 acute HBV cases during in 2021 and 14,229 newly reported chronic Hepatitis B cases.





# Hepatitis B (HBV) & Hepatitis C (HCV)

## Hepatitis B

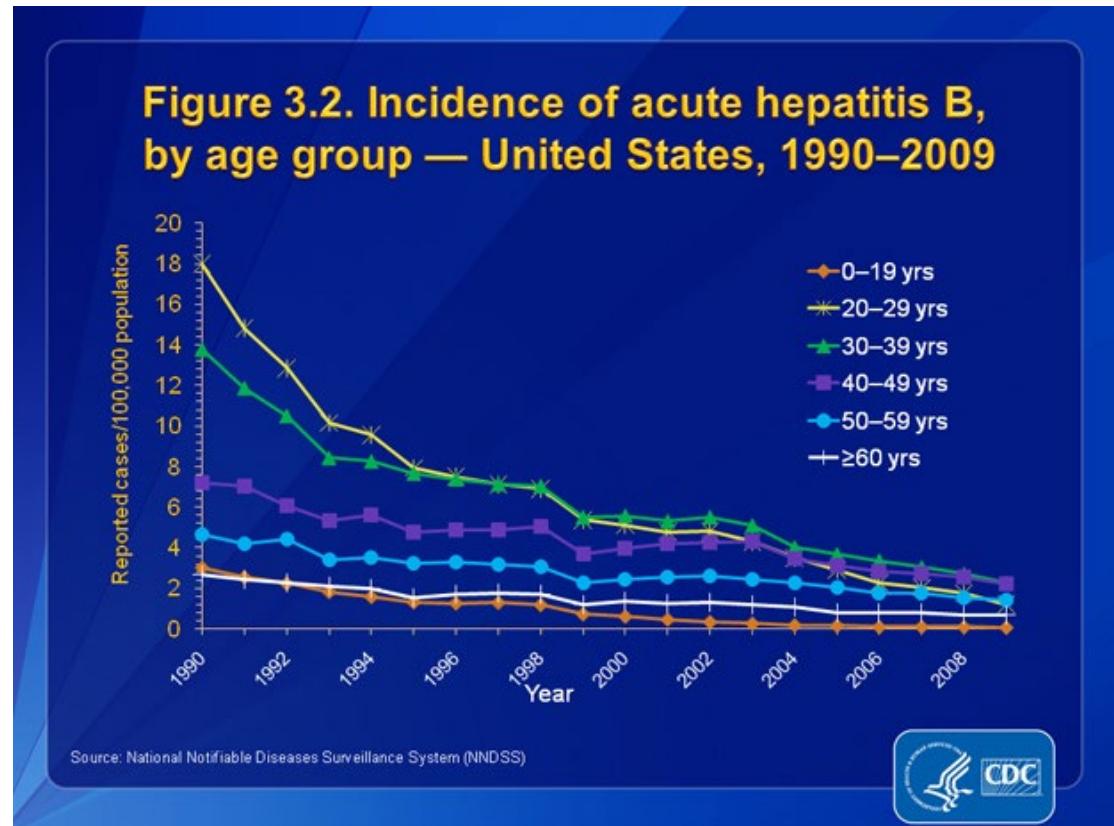
- “A Silent Epidemic” - Approximately 30% of all people who become infected do not have any symptoms of infection.
- HBV can be present in “extraordinary concentrations” in blood ( $10^8$  to  $10^9$  infectious particles per ml). Consequently, the risk of infection is from HBV is 300 times greater than HIV.
- There are an estimated 850,000 – 2.2 million individuals in the U.S. who have a chronic HBV Infection.
- The clinical presentation of acute HBV ranges from asymptomatic illness to liver failure.
- HBV can survive for at least 7 days in dried blood and still be capable of causing an infection.
- **Good News!! There is an effective vaccine for this one!**

## Hepatitis C

- Hepatitis C Virus is another bloodborne pathogen of concern.
  - An estimated 2.4 million people in the U.S. are living with HCV.
  - **There is no vaccine available.**

# HBV Vaccine Available to All at TGen

- Strongly endorsed by the medical community.
- Offered to all potentially exposed employees.
- Vaccine intent form completed at hire.
  - Employee can still get the vaccine even if declined at hire.
- Provided at no cost to employees.
  - Available anytime throughout employment.
  - No reimbursements. Must go through TGen
- 3 Dose Series over 6 months; available through Banner, Concentra and NextCare Urgent Care.
- Questions? Contact EHS.



Vaccine = Drop in Incidence

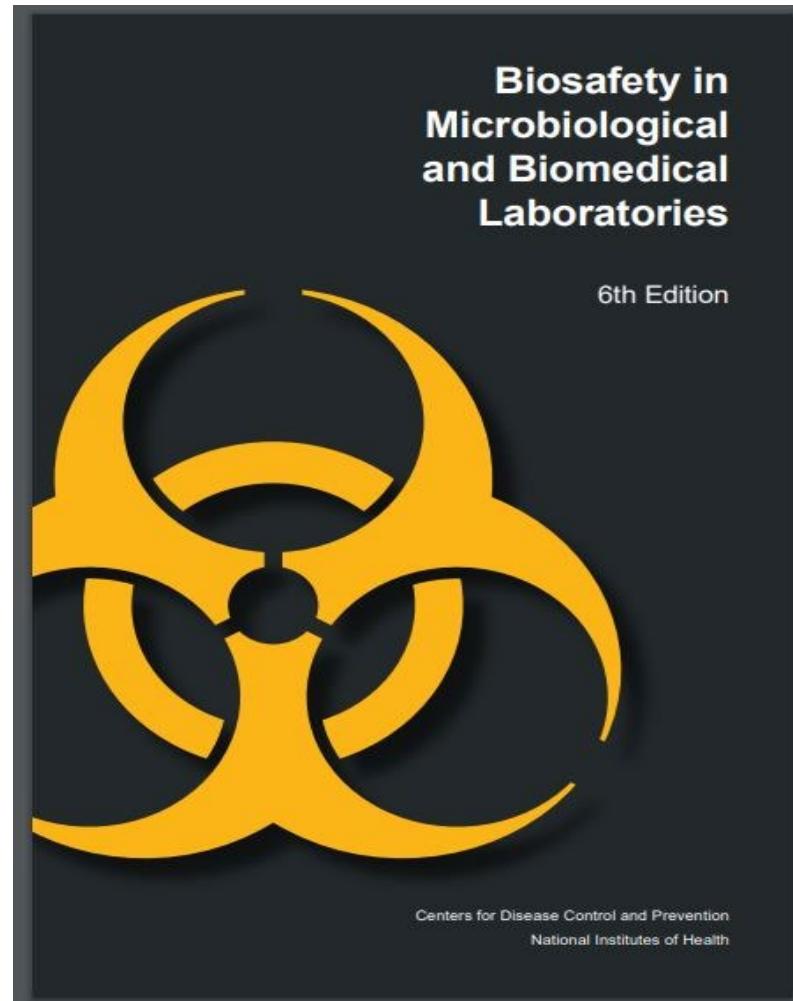
# Other Biohazards



- Consider other biohazards outside of BBPs in your work.
- Lung tissue or fluids: *Mycobacterium tuberculosis*? Coccidioides (fungus)?
- Neural tissue or fluids: Prions?
- Apply universal precautions and hazard controls (part 2 of this training).
  - Treat all biospecimens as infectious = careful handling/minimize aerosols.
  - Use a biosafety cabinet for initial handling (until inactivation of biohazards), wear appropriate PPE, develop lab-specific safe handling and disposal procedures, conduct task specific lab training.
- Work with your mentor who will contact EHS for risk assessment assistance if needed.

# Biosafety in Microbiological and Biomedical Laboratories

## BMBL (6<sup>th</sup> ed.)



The BMBL defines safe handling practices and procedures by assigning organisms/specimens and work to a specific biosafety level.

Biosafety levels dictate minimum levels of PPE to be worn, facility design requirements, training, etc. and range from BSL-1 (low hazard) to BSL-4 (high hazard).

TGen HQ in Flagstaff and TGen North in Phoenix include BSL-1 and BLS-2 laboratories. In addition, TGen North has a BSL-3 laboratory.

# Biosafety in Microbiological and Biomedical Laboratories – BMBL (6<sup>th</sup> edition)

<p><b>BSL-1 applies to genomic material or other microorganisms not known to consistently cause disease in healthy adult humans.</b></p> <p>Examples: Western Blot Analysis. Whole Genome Sequencing, working with <i>B. subtilis</i>, <i>E. coli</i> K-12 strains</p>	<p><b>BSL-1+ Applies To Blood (<u>post extraction*</u>), Unfixed Tissue, Cell Cultures, Other Potentially Infectious Material</b></p> <p>Examples: Urine, sputum and OPIMs without <u>visible</u> blood, fixed tissues, some unfixed tissues (ask your supervisor/mentor) and post-lysis biospecimens</p> <p>Other work may be approved for work at BSL-1+ following a documented risk assessment</p>	<p><b>BSL-2 applies to cell culture or rDNA designated as Risk Group 2. Any work or tasks with a potential for aerosols with infection risk from inhalation of particulates.</b></p> <p>Examples: Working with viral vectors in cell culture, initial handling of whole blood, work with <i>Salmonella</i> spp., <i>Cryptococcus</i>, pathogenic <i>E. coli</i>, etc.</p>
<p><b>Standard Microbiological Practices (SMP)</b></p>	<p><b>SMP plus lab coats/gowns, gloves and face/eye protection as needed. Work with any OPIM must be in a marked area, not be conducted across an open bench from another person, and must not generate aerosols</b></p>	<p><b>SMP plus lab coats/gowns, gloves and face/eye protection as needed AND manipulation of biohazardous material must occur in a Biosafety Cabinet if there is a risk for aerosols.</b></p>

BSL-1/BSL-1+ areas include the main open labs at TGen HQ and specifically signed rooms. Tissue culture/cell culture labs are BSL-2 as are the majority of labs at TGen North. BSL-3 lab requirements are covered in a separate training for TGen North BSL3 users. \* **Initial extractions of whole blood must be conducted at BSL-2 in a Biosafety Cabinet (BSC), exemptions may be granted following a risk assessment.**

# Working with Whole Blood



- Initial work with whole blood must be conducted in a Biosafety Cabinet (BSC) at BSL-2; exemptions may be given following consultation and approval by EHS.
- Spin blood samples using aerosol resistant rotors or safety caps for swinging buckets.
- After the lysis step of an extraction process, work may come out of the BSC and may continue at BSL-2 or BSL-1 within a designated area (referred to as BSL-1+).
  - Lysis reagents must include chaotropic reagents such as ethanol or guanidine chloride, or detergents such as sodium dodecyl sulfate.
  - A designated area must be clearly marked, protected at the back and sides of work area, and include disinfection and waste management procedures.
- Follow the TGen Guide to Working with Blood found on the Policies and Procedures page and the Whole Blood and Blood Products Biological Agent Reference Sheet found on the EHS/Biosafety/BARS page on TGen Hub.

# BSL-1 Requires Standard Microbiological Practices

- Work can be conducted on the open bench.
- Lab coats and gloves are recommended when performing bench-work.
- Persons must wash their hands after performing experiments, removing gloves, and before leaving the laboratory.
- Eating, handling contact lenses, applying cosmetics are not permitted in laboratory areas.
- All pipetting is done with mechanical devices.
- Policies for the safe handling of sharps are instituted.
- All procedures are performed carefully to minimize the creation of splashes or aerosols.
- Work surfaces are decontaminated daily and after any spill of viable material.
- All materials used during experimentation are disposed of properly.
- Work with human blood at BSL-1 must be post-inactivation. Exceptions require a risk assessment and consultation with EHS.



# BSL-2 Requirements

Biosafety Level 2 is similar to Biosafety Level 1 and is suitable for work involving agents of moderate potential hazard to personnel and environment. Standard Microbiological Practices apply. In addition:

- Access to the laboratory is restricted to authorized and trained individuals.
- Lab specific procedures are followed.
- The door/entrance is clearly marked with an appropriate sign to communicate hazards present and precautions observed.
- PPE must be worn at all times in the BSL-2 environment.
- A biosafety cabinet (BSC) is used whenever a potential for infectious aerosols exists.
- Disinfection, decontamination and biohazardous waste management procedures are followed.

See section IV (Laboratory Biosafety Level Criteria) of the BMBL for more information

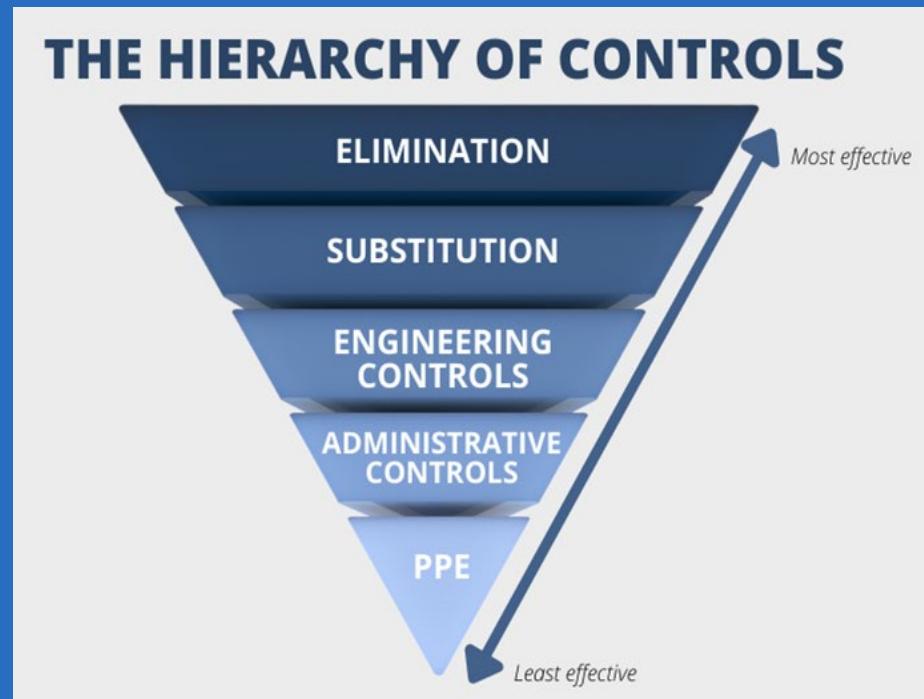
# Minimize Your Risk of Exposure



- Universal Precaution
  - Treat all human blood and certain body fluids as though they are infectious
- Engineering
  - These are devices that isolate or remove the bloodborne pathogen hazard from the workplace
- Work Practices
  - These are practices or procedures that reduce the likelihood of exposure by changing the way a task is performed
- Personal Protective Equipment (PPE)
  - Workplace issued and maintained equipment
- Housekeeping
  - General Maintenance and Organization

## Part 2

# Measures to Control Hazards



# Universal Precautions

**The Mantra: Treat all blood and bodily fluids as if they are infectious (contaminated)**

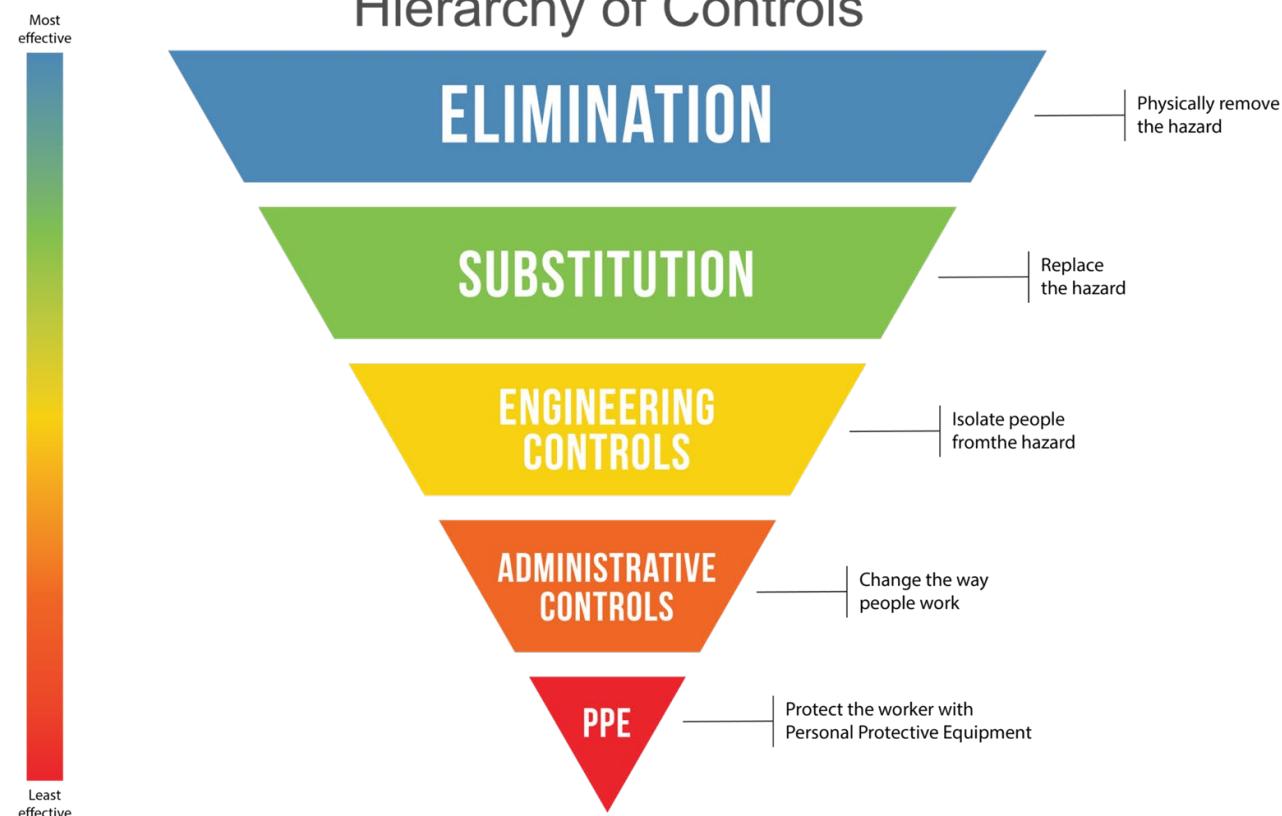
- Therefore, you will:
  - Use appropriate Personal Protective Equipment (PPE)
  - Ensure proper cleanup and decontamination procedures are followed
  - Dispose of all contaminated material in the proper manner
  - Wash your hands after contact with blood, OPIM, contaminated trash, and after removal of gloves



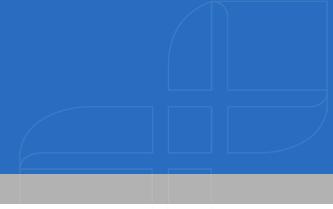
# Hierarchy of Controls



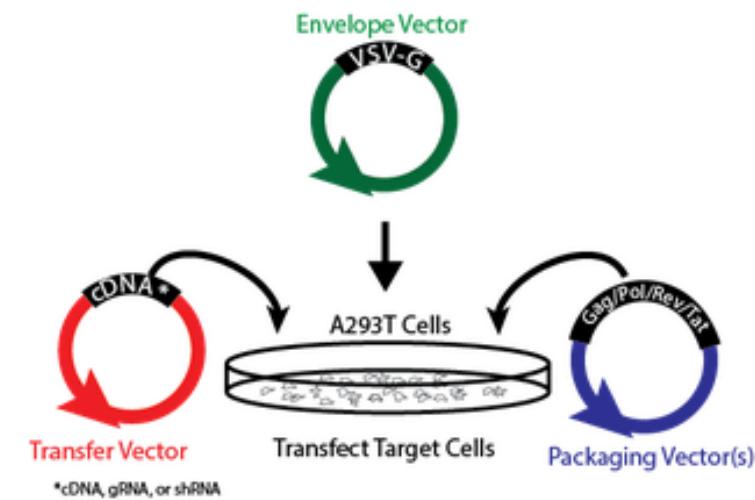
- Eliminate or Substitute the Hazard
- Engineering Controls
  - Devices that isolate or remove the hazard
- Administrative Practices (Including Work Practice Controls)
  - Practices or procedures that reduce the likelihood of exposure by changing the way a task is performed
  - Training, policies/SOPs, and actions
- Personal Protective Equipment (PPE)
  - Workplace issued and maintained equipment



# Elimination/Substitution



- Do you need the biohazardous material, sharp?
  - Elimination is often the hardest of hazard controls to accomplish
  - Needleless systems
- Is there a less hazardous substitution?
  - Purchase biospecimens tested for BBPs
  - Use the safest version of a viral vector system
  - Use an attenuated form of a pathogen
- Chemical Hazard Substitution
  - GelRed instead of Ethidium Bromide
  - Bouin's Fixative without Picric Acid
  - Methanol free transfer buffer



# Engineering Controls

An engineering control is a device or method of control that isolates or removes a hazard from the workplace. Examples of engineering controls:

- Biosafety cabinets (BSC)
- Biosafety enclosures
- Sharps disposal containers
- Splash shields
- Aerosol containment system

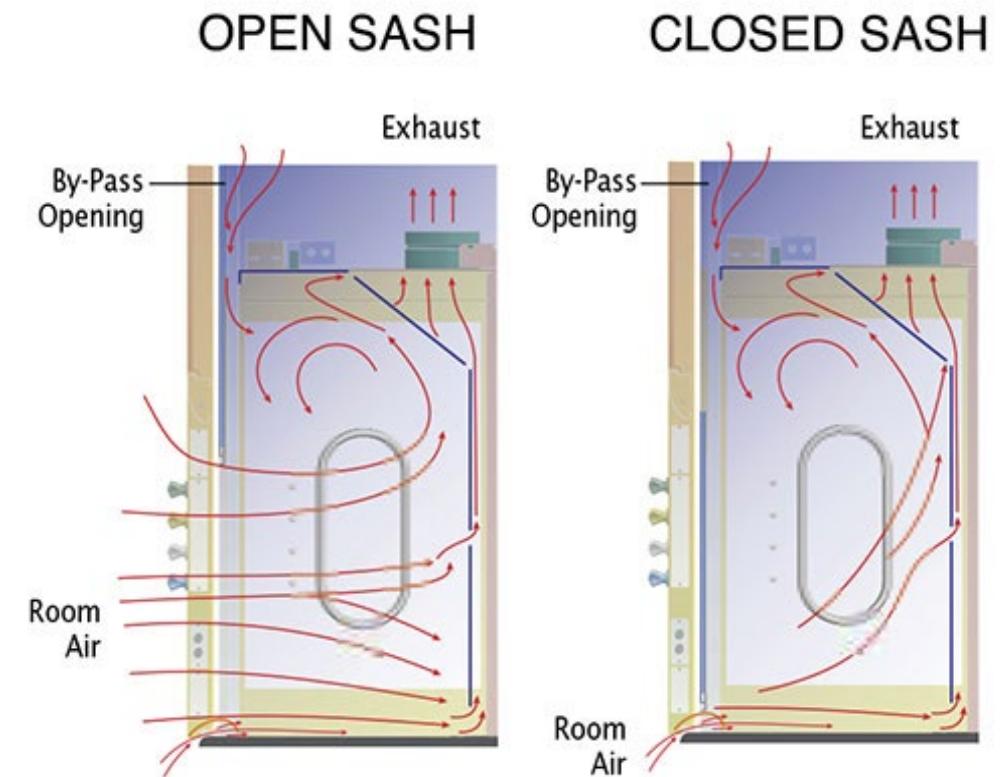
Chemical engineering controls include:

- Powder Weighing Enclosures
- Fume Hoods
- Flammable Cabinets



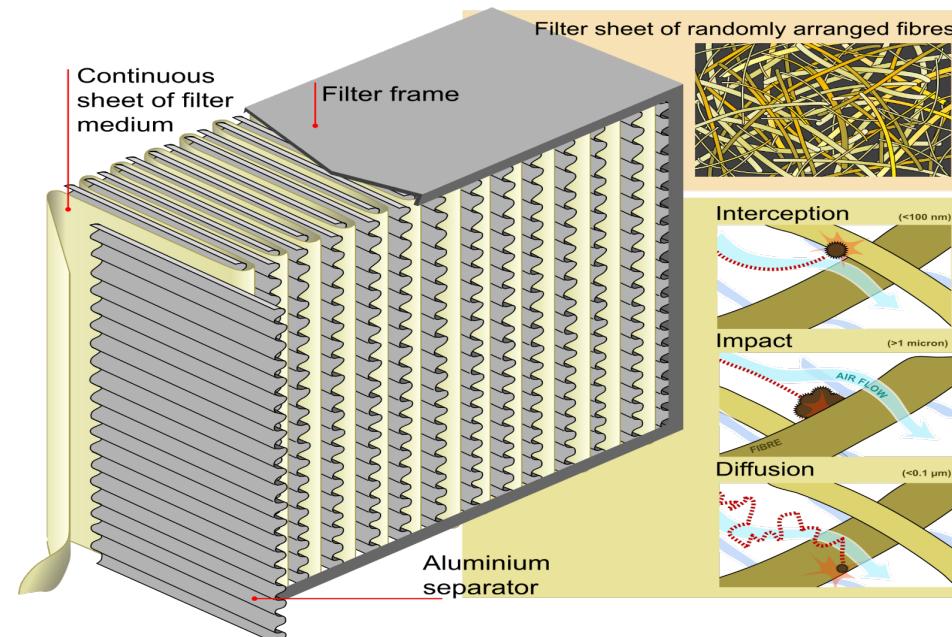
# Engineering Control – Fume Hoods

- Fume Hoods provide personnel but not product protection.
  - Used when working with volatile chemicals
  - Not for use with biohazardous materials
    - Discuss exceptions with your mentor or EHS
- Work safely by:
  - Keeping sash height at prescribed height
  - Working 4-6" back from front
  - Avoiding clutter; too many objects disrupt airflow
  - Using slow and direct movements
  - Minimizing foot traffic behind operator
  - Discontinuing work if the unit is alarming



# Biosafety Cabinets (BSCs)

- Considered the primary method of containment when manipulating material that may pose risk of laboratory acquired infection.
- Protects the worker, the work and the environment from contamination.
- Uses a High Efficiency Particulate Air (HEPA) filtration system to provide a clean work area.



The folded sheets of filter medium trap particles by interception, impaction, and diffusion.

**HEPA filters DO NOT trap chemical vapors or gases.**

# Biosafety Cabinets (BSCs)

- There are 3 classes of BSCs
  - Class I: Protects personnel and the environment, not product. May also be referred to as an enclosure (e.g., such as the Bio-bubble used for the cell sorter).
  - Class II: Protects personnel, product and the environment.
  - Class III: Protects personnel, product and the environment; glove boxes designed for work with high risk pathogens.
- TGen has Class I and Class II BSCs/Enclosures.
- Additional training is required for use of BSCs. If you have not been enrolled in Biosafety Cabinet Essentials, contact EHS or go into Paylocity's Learning Management System and self-enroll.

# Biosafety Cabinet Alarms



- All BSCs have a unit alarm to alert a user when the BSC is not working properly.
  - Cease work if the BSC alarm goes off and notify EHS.
- Ducted BSCs will also have an alarm above the BSC, at the connection to building ventilation. If this alarm goes off, airflow is exhausting back into the room.
  - All BSCs at HQ are ducted; TGen North has ducted and non-ducted BSCSs.
  - Air from BSC is HEPA filtered to contain biohazards, air is still sterile.
  - Chemicals can pass through a HEPA; volatile chemicals may enter the room (e.g., chloroform, 2-mercaptoethanol).
  - In this scenario, work with biohazards may continue but work with hazardous/volatile chemicals must cease until alarm is off.

# Administrative Controls (Work Practice)

Administrative or work practice controls are designed to change the way a task is performed to reduce the likelihood of exposure to Bloodborne pathogens. Examples include:

- Never recapping needles or bend to break sharps
- Transport specimens in secondary containers
- Dispose of contaminated sharps in appropriate containers immediately after use
- Avoid disrupting the protective air curtain in the BSC; limit movements in/out
- Storing chemicals securely
- Writing lab and task specific procedures
- Not eating in the lab

# Administrative Control: Sharps Safety

- **Do**
  - Follow established protocols for handling
  - Keep an appropriate sharps container near work area
  - Use self-retracting blades, plastic Pasteur pipettes
  - Use cut resistant gloves
  - Report any incidents to EHS within 24 hours
- **Do Not**
  - Recap any sharp, ever
  - Leave blades lying on benches, shelves, etc.
  - Rush through your work
  - Dispose of sharps in regular trash or in non-regulated containers
  - Cut toward any body part (hand, finger, wrist)

[Stop the Stick Campaign](#)

National Occupational Research Agenda - CDC

# Administrative Control: Biohazard Labeling

Labels must include the universal biohazard symbol, and the term “Biohazard” and must be attached to:

- Containers of regulated biohazard waste
- Refrigerators or freezers containing blood or OPIM
- Centrifuges used to spin biohazards
- Containers used to store, transport, or ship blood or OPIM



# Administrative Controls: Chemical Safety

Work practice controls change the way people work. This can be accomplished by refining how a task is performed, by implementing safety policies and procedures, and by changing behaviors; all of which work to reduce the likelihood of exposure to hazardous chemicals.

Examples include:

- Following TGen's Chemical Hygiene Plan
- Storing chemicals properly and securely
- Moving purposefully and carefully
- Writing lab and task specific procedures
- Training in the lab, ensuring competency
- Not eating or storing food in the lab



# Personal Protective Equipment (PPE)

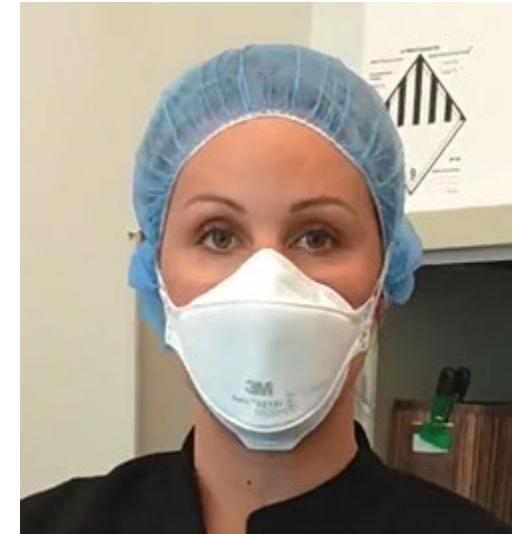
Personal protective equipment (PPE) refers to protective clothing designed to minimize exposure to hazardous materials. Examples include:

- Lab coat or gown
- Protective eyewear
- Face shield and/or surgical mask
- Gloves
- Respiratory protection
  - Requires approval prior to use



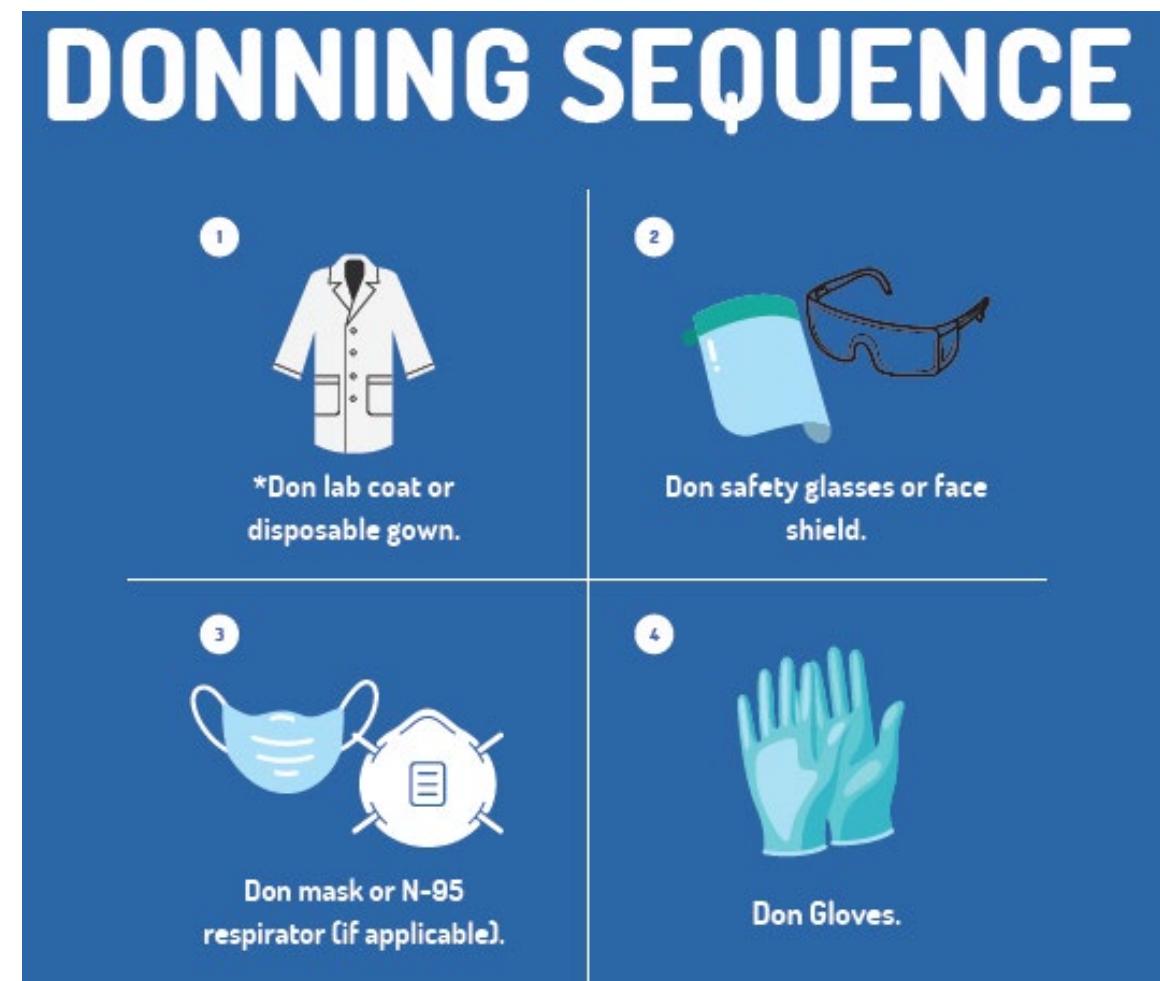
# PPE – General Tips

- PPE choices should be based on the work to be conducted.
  - Gowns impervious to fluids versus re-usable lab coats.
  - Double gloving or singles gloves, extended cuffs or regular.
  - Safety glasses, goggles, a face shield and mask or just a face shield.
  - An N-95 respirator?
- Consult with your mentor or EHS to ensure your PPE choices are correct.
- Minimums for handling human blood and OPIM include lab coat or gown, gloves and safety glasses.
- PPE is available in labs, common areas at HQ and TGen-North and upon request.
- Keep your PPE clean, replace as necessary and store in a clean area.

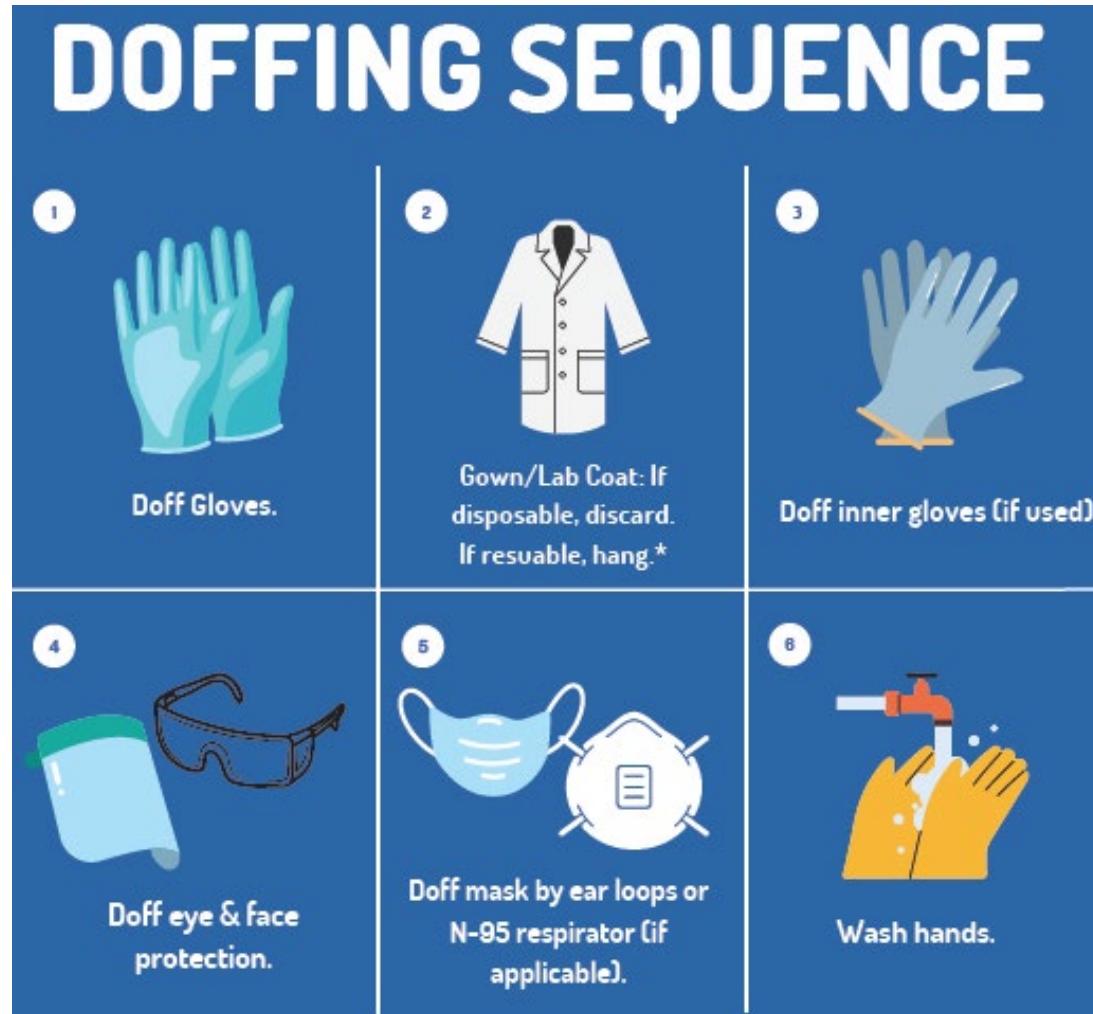


# PPE – Tips, Donning and Doffing

- Lab coats should be fitted, not too loose or with hanging sleeves.
- Consider double-gloving with high risk work.
- Extended cuff gloves can help with gapping at the wrist.
- How you put on (don) PPE will help you remove it with good technique, avoid contamination.



# PPE – Tips, Donning and Doffing



- Gloves are often the most likely contaminated, remove first.
- How you remove gloves is critical to avoid self-contamination.
  - Watch [THIS](#) 1-minute video
- If there is no sink in the immediate area, use hand sanitizer followed immediately by washing hands at the nearest sink to your work area.

## Part 3

# Biohazardous Waste Management



# Regulated Medical Waste (RMW)



- RMW management is governed by federal, state and local regulations.
- TGen staff play a critical role in handling RMW in accordance with regulatory and institutional requirements.
- RMW includes the following (includes materials contaminated with RMW):
  - Blood, blood products (serum, plasma), secretions, excretions, urine, saliva, etc.
  - Human or animal cultures, cultures and stocks of pathogens, vaccines and related.
  - Human or animal tissue, organs, recognizable body parts, animal carcasses.
  - Biohazardous waste contaminated with trace chemotherapeutics.
  - Sharps including needles, blades, glass slides, glass pipettes, glass tubes and contaminated glassware.

# Regulated Medical Waste – Red Bag

Red bag waste includes infectious (or potentially infectious) materials including:

- Cell culture flasks and dishes
- Microbiological cultures
- Tubes, vials and containers in contact with RMW
- Specimen bags, fluid filled containers
- PPE (e.g., gloves, disposable gowns, etc.)
- Items contaminated with RMW such as lab wipes, trays, bags, spill clean-up materials



# Dos and Don'ts for Red Bag Wastes

- Do not over-fill. Change the bag when 2/3<sup>rd</sup> – 3/4<sup>th</sup> full.
- Do not put sharps loose in a red bag (or in the garbage, ever. Must be in an approved sharps container).
- Do not place large volumes (>50 ml per primary container) of liquid biohazard waste in a large general use red-bag. See the slide for liquid biohazard waste handling.
- Do not put hazardous chemicals, drugs or non-biowastes in red bag (no regular trash, empty bleach bottles, empty drug vials or container of chemicals).
- Do bundle serological pipettes and secondarily contain tips.
  - Bundling serologicals will help prevent bag punctures.
  - Use a smaller red bag or empty media bottle to collect tips.
- Double bag your waste where needed; especially when liquids are present.
- Do tie the bag securely and properly (see next slide).

# Tying a Red Bag

2

WHEN BAG IS FULL, TIE A KNOT USING OVERHAND OR GOOSENECK METHOD

## ACCEPTABLE METHOD #1: OVERHAND KNOT

Gather, Twist End 8"-10"



Make Loop with Twisted End



Loop End Through to Create Knot



## ACCEPTABLE METHOD #2: GOOSENECK TIE

Gather, Twist End 8"-10"



Fold Twisted End Over



Seal Tightly with Either  
Duck Tape or Plastic Tie



**NOT  
ACCEPTABLE**

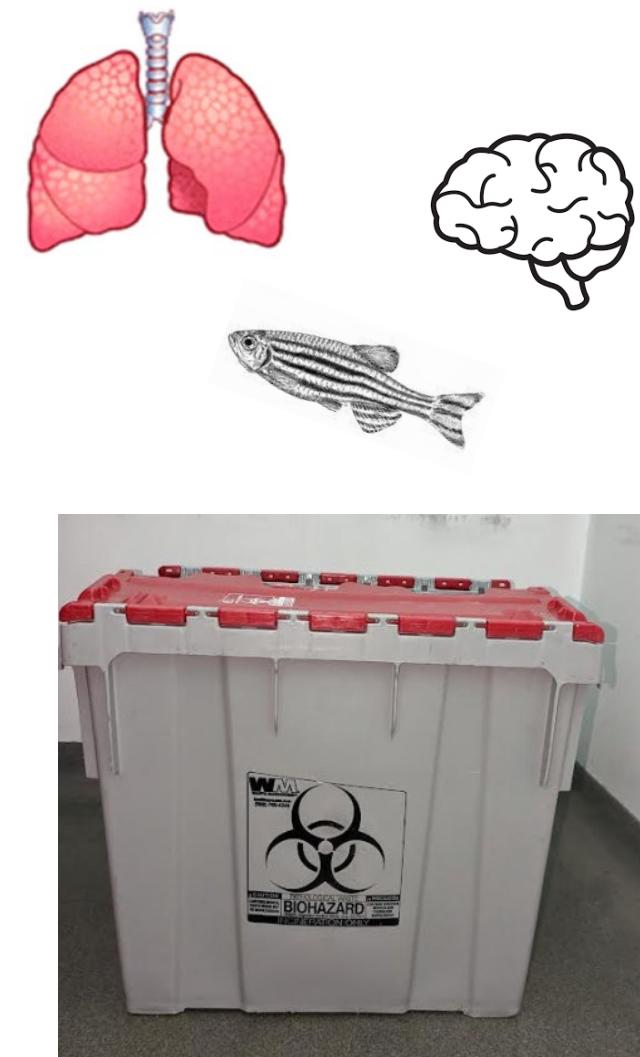
No "Rabbit Ear" Tie



Use of lab tape  
is acceptable

# RMW – Pathological Waste

- RMW that cannot be rendered harmless through autoclaving alone must be incinerated or undergo another treatment method allowed for such wastes.
- Pathological wastes include tissue specimens, organs, animal carcasses (such as zebrafish), recognizable human and animal body parts.
- All pathological waste must be placed in a double-red bag with absorbent material (e.g., paper towel).
- Decant any preservatives (chemical waste).
- Pathological wastes must be placed in a **gray** barrel.
  - HQ has a gray barrel in the 5<sup>th</sup> floor hallway walk-in cold room.
  - Available upon request for TGen North.



# Biohazardous Waste – Liquid

Regulated medical waste in liquid form including cell culture waste, blood, or OPIM must be properly disinfected before it can be flushed down the drain. In some cases, the method of disinfection may also prohibit drain disposal.

- When using bleach to disinfect, use 10% final v/v solution of bleach to waste, mix carefully, and allow bleach to contact material for at least 30 min.
- Ensure compatibility with bleach before mixing.
- Small volumes (< 50mL per primary container) of liquid biohazardous waste can be placed in large red biohazardous bags for sterilization (e.g., conical tubes or tissue culture flasks).
- Large volumes ( $\geq 50\text{mL}$  per primary container or large amounts of liquid in general) of liquid biohazardous waste may be securely closed, placed upright in a double-red bag and placed in the red-barrel upright. Preferably, solidify large volumes of liquid biowaste with Green-Z and then place in the red bag.
- Liquid waste incompatible with autoclaving or bleaching (e.g., wastes containing alcohol) require processing as chemical waste. Contact EHS for assistance.

# Sharps Waste & Disposal

- Place used sharps waste in designated puncture-resistant container.
- Never recap, bend, break or manipulate used sharps before disposal.
- Do not overfill a sharps container.
- Securely close sharps waste containers and place inside a red-bag prior to placing in the red-barrels.
- If the sharps is contaminated with trace chemotherapy agents, it must go in a **yellow** sharps container.



Sharps Container



1. ALL needles, syringes, blades
2. Infectious (or potentially infectious):
  - Pipette tips & serological pipettes
  - Blood vials
  - Glass (broken or unbroken)
  - Slides & cover slips



# Sharps Contaminated with Chemo Agents

- Chemotherapy agents are toxic compounds and must be handled safely (see EHS-111-SOP: Safe Handling of Hazardous Drugs and Carcinogens).
  - Examples include Cisplatin, Methotrexate, Abraxane, Arsenic Trioxide and others.
- Trace chemo wastes include:
  - PPE, cleaning materials, bench paper, etc.
  - Contaminated sharps as described previously.
- Sharps containers must be yellow and bags may be yellow or red. Waste is placed in a yellow-barrel for removal and treatment.
- Contact facilities or EHS for access to yellow barrel and collection containers/bags.

# Laboratory Waste

- Chemical wastes are collected and labeled in accordance with hazardous chemical waste policies and procedures.
- Non-hazardous wastes such as labware, PPE and related that are not contaminated with RMW nor are considered chemical waste may be discarded in normal trash bins, in non-contaminated plastic receptacles or other recycling streams.
- Pipette tips and serologicals free of biohazard must be placed in a box or container prior to disposal in regular trash.
  - A cardboard box or empty media or PBS container, for collection and disposal.
  - Must be labeled “non-hazardous lab waste”.
- See the EHS waste segregation flyer (guidance) on TGen Hub → Policies and Procedures page (see the resources slide at the end).

# Chemical Hazard Awareness



# What is a Chemical Hazard?

- Chemical hazards pose a wide range of health risks such as carcinogenicity, toxicity, irritation, sensitization, and target organ effects.
- Chemical hazards also pose physical hazards such as flammability, corrosivity and reactivity.
- Chemicals may present both health hazards and physical hazards such as fire danger from a flammable liquid that is also toxic and a possible human carcinogen (e.g., methanol) or oxygen displacement and frost bite from liquid nitrogen.



# Hazard Awareness – GHS Pictograms

Pictograms on chemical labels help identify the associated hazards.

- Pictograms offer a quick method of identifying a hazard category for a chemical.
- Always read the Safety Data Sheet associated with the chemical for a full understanding of the hazards.
- Older chemicals in the labs may not have pictograms\*.

\*Contact EHS if you would like pictogram stickers to update your chemical containers!

<b>Health Hazard</b>  <ul style="list-style-type: none"><li>• Carcinogen</li><li>• Mutagenicity</li><li>• Reproductive Toxicity</li><li>• Respiratory Sensitizer</li><li>• Target Organ Toxicity</li><li>• Aspiration Toxicity</li></ul>	<b>Flame</b>  <ul style="list-style-type: none"><li>• Flammables</li><li>• Pyrophorics</li><li>• Self-Heating</li><li>• Emits Flammable Gas</li><li>• Self-Reactives</li><li>• Organic Peroxides</li></ul>	<b>Exclamation Mark</b>  <ul style="list-style-type: none"><li>• Irritant (skin and eye)</li><li>• Skin Sensitizer</li><li>• Acute Toxicity (harmful)</li><li>• Narcotic Effects</li><li>• Respiratory Tract Irritant</li><li>• Hazardous to Ozone Layer (Non-Mandatory)</li></ul>
<b>Gas Cylinder</b>  <ul style="list-style-type: none"><li>• Gases Under Pressure</li></ul>	<b>Corrosion</b>  <ul style="list-style-type: none"><li>• Skin Corrosion/ Burns</li><li>• Eye Damage</li><li>• Corrosive to Metals</li></ul>	<b>Exploding Bomb</b>  <ul style="list-style-type: none"><li>• Explosives</li><li>• Self-Reactives</li><li>• Organic Peroxides</li></ul>
<b>Flame Over Circle</b>  <ul style="list-style-type: none"><li>• Oxidizers</li></ul>	<b>Environment (Non-Mandatory)</b>  <ul style="list-style-type: none"><li>• Aquatic Toxicity</li></ul>	<b>Skull and Crossbones</b>  <ul style="list-style-type: none"><li>• Acute Toxicity (fatal or toxic)</li></ul>

# Hazardous Chemicals in the Lab

## HEALTH HAZARD

- Carcinogens; mutagens; reproductive, target organ, and aspiration toxics; respiratory sensitizers
  - Examples: Chloroform, Methanol, Formalin, Imidazole, Trizol, Drugs (e.g., antineoplastics)

- **Safety Tips**

- Weigh powders in an enclosure
- Use a fume hood for volatile chemicals
- Wear PPE, protect skin and eyes
- Wash hands after removing gloves



# Hazardous Chemicals in the Lab

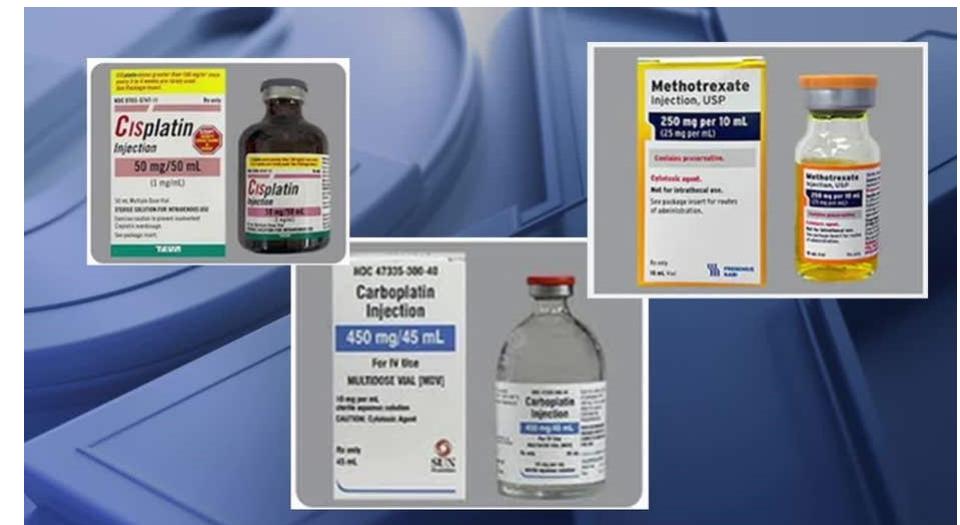
## TOXIC

- Acute toxicity (fatal or toxic)
- Low dose to effect (inhale, skin, oral)
  - Examples: Arsenic Trioxide, Acrylamide, Formaldehyde, Methanol, chemotherapy drugs (e.g., cisplatin, methotrexate, gemcitabine, temozolomide)



## Safety Tips

- Order the minimum qty. needed
- Weigh powders in an enclosure
- Use a fume hood for volatile chemicals
- Wash hands after removing gloves
- Segregate and dispose of waste properly



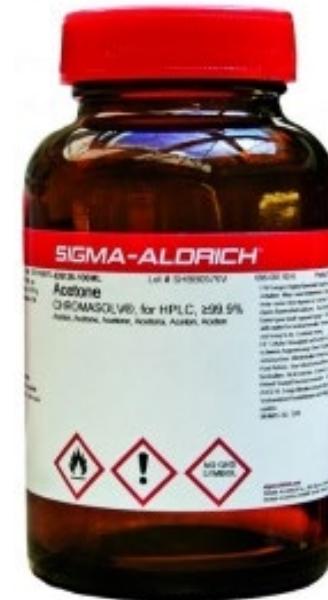
# Hazardous Chemicals in the Lab

## FLAMMABLE

- Flammables, pyrophorics, self-heating, emits flammable gas, self-reactives, organic peroxides
  - Chemical Examples: Alcohols (ethanol, propanol, etc.), Acetone, Ethers, Alkyl Metals

- **Safety Tips**

- Store only what you need at the bench
- Store extra in flammables cabinet
- Keep away from ignition sources
- Check for secondary hazards



# Hazardous Chemicals in the Lab

## CORROSIVE

- Skin corrosion and burns; eye damage; corrosive to metals
  - Chemical Examples: Acids, Bases, Bleach, Buffers such as Restore® stripping buffer
- **Safety Tips**
  - Order in smaller bottles (1L or less)
  - Wear safety glasses, gloves and lab coat
  - Segregate acids from bases
  - Prepare solutions carefully (exothermic or endothermic?)



# Hazardous Chemicals in the Lab

## EXCLAMATION MARK

- Skin, eye, respiratory irritant; skin sensitizer; acute toxicity (harmful\*); narcotic effect

\* Toxicity is based on exposure route and dose.

Ex. Harmful  $\geq 300 \text{ mg/kg}$  oral (in rats)

- Chemical Examples: Many Buffers, Chloroform, Sodium Chloride, Isocyanates, Bleach

## • Safety Tips

- Determine which hazard is present
- Narcotic effect? Use fume hood.
- Skin Irritant? Use gloves and a lab coat
- Do not eat in the lab



# Hazardous Chemicals in the Lab



## GAS CYLINDER

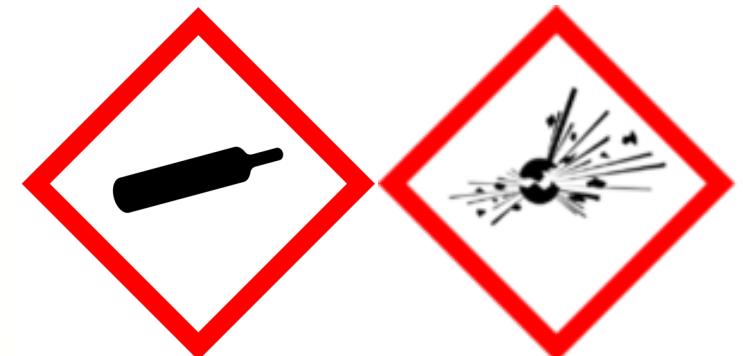
- Gases under pressure
  - Chemical Examples: Carbon Dioxide, Nitrogen, Argon

## EXPLODING BOMB

- Explosives; self-reactives; organic Peroxides
  - Chemical Examples: Picric Acid, Tetrahydrofuran

- **Safety Tips**

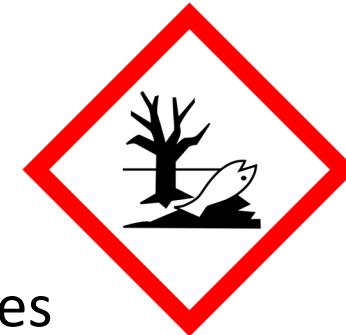
- Contact EHS prior to ordering materials with an explosive hazard!
- Date and track all peroxide formers
- Verify that all gas cylinders are secure



# Hazardous Chemicals in the Lab

## ENVIRONMENTAL (not mandatory)

- Aquatic Toxicity; Pictogram is not required
  - Chemical Examples: Crystal violet, Mercury, Herbicides



## FLAME OVER CIRCLE

- Oxidizers (materials that can fuel a fire)
  - Chemical Examples: Peroxides, Nitric acid, Ammonium persulfate, Perchloric Acid, Oxygen

### Safety Tips

- Store oxidizers away from flammables
- Manage waste prudently



# Safety Data Sheets (SDS)

## Safety Data Sheets (SDS)

- Are used to obtain hazard information
- Describe physical and chemical properties (e.g., liquid, pH, flash point)
- Recommend precautions for handling, storage and disposal
- Provide emergency response information
- Can aid in making waste determinations

The screenshot shows the tgen eBINDER web application. At the top, there is a navigation bar with the tgen logo, 'Chemical Management', 'Dashboard', 'Locations', and 'eBinder' dropdown. Below the navigation is a dark header bar with 'eBINDER for All Locations' and a search bar labeled 'Search eBINDER by' with 'All Categories'. A 'Filters' button is also present. The main content area displays a table titled '4375 products (0) selected' with columns for 'Product Name' and 'Revision Date'. Four product entries are listed:

Product Name	Revision Date
Boron trichloride solution ALDRICH CHEMICAL COMPANY	08/09/2023
BULK, BMS Illumina	08/29/2023
BULK, BRM Illumina	08/29/2023
Ethyl alcohol, pure SIGALD	08/02/2023

# Safety Data Sheets (SDS)



- Safety Data Sheets (SDS) are an online or print resource that provide guidance for the specific chemical, in regard to the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.
- Employees should read and re-read SDS for chemicals they work with paying attention to chemicals new to the user and high hazard chemicals.
- Chemical labels are very helpful at providing basic hazard information, but it is imperative to read the associated SDS for that chemical.
- Review other resources to understand chemical hazards such as the International Chemical Safety Cards, NIOSH pocket guide or visit the American Chemical Society website.

# Safety Data Sheets (SDS)



SDS have 16 sections each containing helpful information for staff and interns to utilize. For more information, go to Hazard Communication page on OSHA's website or visit the TGen SDS website on TGen Hub.

1. Identification;
2. Hazard(s) identification;
3. Composition/information on ingredients;
4. First-aid measures;
5. Fire-fighting measures;
6. Accidental release measures;
7. Handling and storage;
8. Exposure controls/personal protection;
9. Physical and chemical properties;
10. Stability and reactivity;
11. Toxicological information.
12. Ecological information;
13. Disposal considerations;
14. Transport information;
15. Regulatory information; and
16. Other information, including date of preparation or last revision.

# Safety Data Sheets on TGen HUB

**tgenhub** Environmental Health & Safety

Biological Agent Reference Sheets   Recycle bin   Edit

+ New   Page details   Analytics

## About Environmental Health & Safety

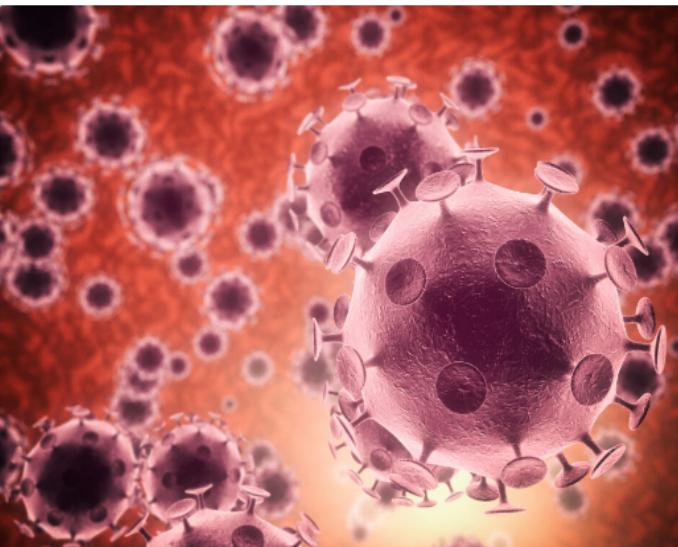
TGen is committed to integrating a sound Environmental Health and Safety (EH&S) program into its research operations. The goal of the EH&S program is to protect employees from job related injuries and illnesses; to recognize and mitigate hazards (biological, chemical, physical and other) in the workplace; and provide employees with training, information and resources to support a safe and healthy work environment.

TGen senior management and supervision support employee's rights for a safe workplace and employees have ongoing responsibility to educate themselves regarding safe laboratory practices, as well as to adhere to all policies and procedures defined by TGen management.

This website is intended to support the objectives outlined above. It provides policies and procedures for employee safety across all departments as well as targeted information for the safe and compliant conduct of laboratory research. This page and related pages are designed to serve as an information resource for all employees. Additional compliance sites are listed below.

If you have any questions regarding lab safety and compliance, or if you have any concerns you would like addressed, please contact Kathleen Kennedy or Tisa Tehranchi by email at [EHS@tgen.org](mailto:EHS@tgen.org).

[Report An Incident](#)   [Go To Policies & Procedures](#)   [Safety Data Sheets](#) (circled in red)   [Ask EHS a Question](#)



### TGen Environmental Health and Safety Team



Kathleen Kennedy  
Manager Sr, Environmental Health and...  
[LinkedIn Profile](#)



Tisa Tehranchi  
Environmental Health and Safety Speci...  
[LinkedIn Profile](#)

# Safety Data Sheets on TGen HUB



The SDS button on the SharePoint page leads to our virtual e-Binder where employees can search chemicals by name, brand, product, number, etc.

The screenshot shows the TGen e-Binder interface. At the top, there is a navigation bar with the TGen logo, Chemical Management, Dashboard, Locations, eBinder (with a dropdown arrow), a gear icon, and a 'nn' button. Below the navigation bar is a dark header with the text "eBinder for All Locations". A search bar is present with the placeholder "Search eBinder by" and a dropdown menu set to "All Categories". To the right of the search bar is a magnifying glass icon. Below the header, a message says "4376 products (0) selected". There are buttons for "Filters" and "Share". At the bottom, there is a table header with columns: Product Name, Revision Date, Product CAS #, and Date Added. The first row of data shows a checkbox, a green document icon, the product name "(S)-1-Boc-3-hydroxypiperidine", the revision date "01/02/2023", the CAS number "—", and the added date "08/23/2023".

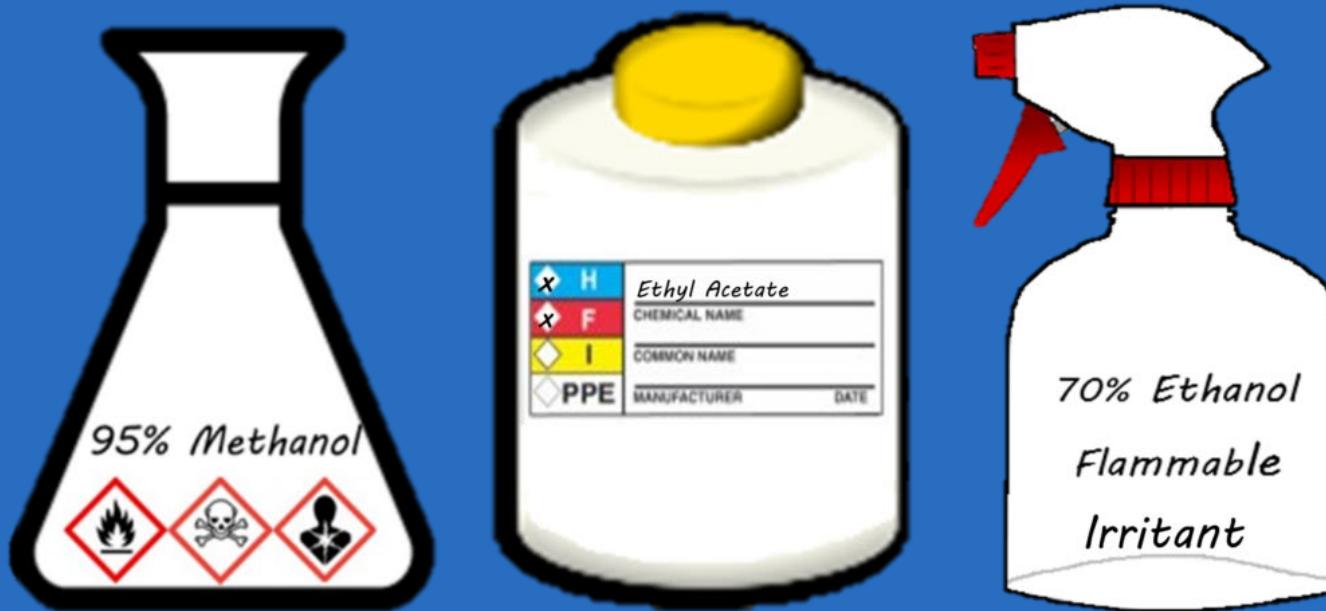
	Product Name	Revision Date	Product CAS #	Date Added
<input type="checkbox"/>	(S)-1-Boc-3-hydroxypiperidine Combi-Blocks, Inc.	01/02/2023	—	08/23/2023

# Safety Data Sheets



- Be sure to view the SDS for the specific manufacturer or vendor for the chemical you are using.
- Kits and/or components of kits will also have SDS; search both the kit and the component if needed.
- If an SDS for a chemical you are using is missing, email EHS.
- **A backup of TGen SDS** may be found on a laptop in the 4<sup>th</sup> floor break-room near the first aid cabinet or on a flash drive, located outside the cell culture room, at TGen North

# Chemical Container Labeling



# Chemical Labels

Labels on chemical containers will help you identify hazards by using a:

- Product Identifier or Chemical Name
- Signal Word: used to indicate the relative level of severity of hazard:
  - "Danger" used for the more severe hazards
  - "Warning" used for the less severe hazards
- Hazard Statement: used to indicate hazard type
- Precautionary Statement: provides information for safe handling, storage, first aid, etc.



# Container Labeling



# Primary Containers

- Primary containers are chemicals that are sent from the manufacturer and bear the manufacturer's label
  - When labeling, include PIs initials/name and date received
    - Please **avoid** acronyms as they are not universally understood and often change
  - Recommended:
    - Include date opened
    - Routine inspection date
    - Expiration date if applicable
      - e.g., peroxide formers, formic acid, etc.
      - Materials that become unstable over time



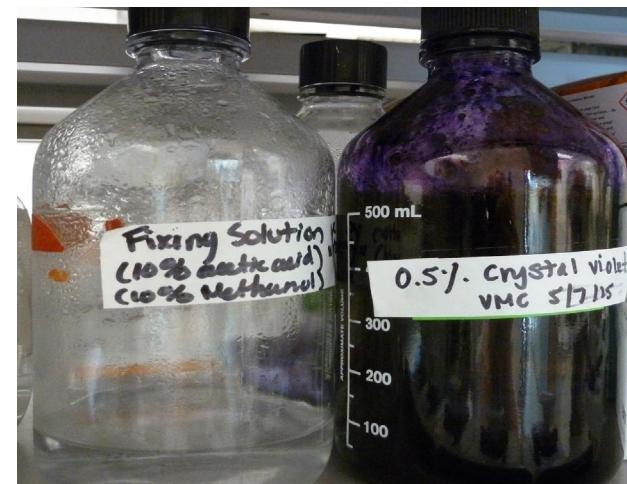
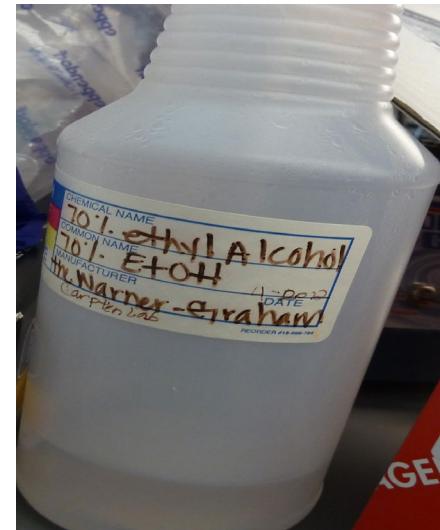
**CAUTION: PEROXIDE FORMER**

Lab/Name:	
Date Received:	
Date Opened:	
Date Expires:	
Inhibitor Added?	Yes / No
Type:	

# Container Labeling

## Secondary Containers

- Secondary containers hold working stocks or dilutions of chemicals.
- Secondary containers include squirt bottles, carboys, aspiration flasks as well as bottles, tubes, etc.
- Label requires:
  - Chemical name(s), no acronyms
  - Concentrations
  - Initials of preparer
  - Date prepared





# Preventing Mistakes

- **Pay Attention** to what you are doing. If you notice an unusual fog, heat, an unexpected reaction...**do not seal the container**. Close the hood sash and notify your supervisor immediately.
- **Always double check the label** before pouring anything (waste or otherwise), ensure compatibility.
- **Use the fume hood correctly**. Keep the workspace free of clutter. Adjust the sash appropriately. Work 4-6 inches back. Do not block vents at back of fume hood. Do not use if the alarm is set off, contact EHS.
- **Properly label your reactions and containers**. A label is not just crossing out "Hydrochloric acid" and writing "waste", "waste acid" etc. Use an appropriate waste label, list the constituents with no acronyms and indicate the hazard class present (e.g., flammable).
- If you see any potentially dangerous situations in your laboratory, **notify your supervisor immediately** and work with EHS to remedy.

# Chemical Storage



# Chemical Storage



## Proper Segregation is Key!

- Separate solids from liquids first.
- Within those groups, separate by hazard class.
  - Flammables (flammable cabinet, liquids segregated from solids). Note: flammable solids often require specialized storage, contact EHS for assistance.
  - Caustics (inorganic acids, organic acids, bases - separated).
  - Oxidizers (separate from flammables).

Review [THIS](#) amazing resource from ACS.  
And review TGen's Chemical Hygiene Plan!

ORGANIC ACIDS (or Carboxylic Acids)	INORGANIC ACIDS (a.k.a. Mineral Acids)	BASES
Definition: An organic acid is an organic compound with acidic properties; substances whose molecules usually possess carbon, hydrogen, and oxygen atoms.	Definition: An inorganic or mineral acid consist of molecules having atoms of hydrogen, an identifying non-metal like chlorine, sulfur or hydrogen and sometimes Oxygen.	Definition: A base is a material that can take in hydrogen ions and protons and have a pH range between 8 and 14.
Examples include: <ul style="list-style-type: none"><li>• Acetic Acid (<math>\text{CH}_3\text{COOH}</math>)</li><li>• Formic Acid (<math>\text{CH}_2\text{O}_2</math>)</li><li>• Lactic Acid (weak acid)</li><li>• Oxalic Acid (weak acid)</li><li>• Phenolics (weak acid)</li></ul>	Examples include: <ul style="list-style-type: none"><li>• Sulfuric Acid (<math>\text{H}_2\text{SO}_4</math>)</li><li>• Nitric Acid (<math>\text{HNO}_3</math>)</li><li>• Hydrochloric Acid (<math>\text{HCl aq.}</math>)</li><li>• Hydrofluoric Acid (<math>2\text{HF aq.}</math>)</li><li>• Phosphoric Acid (<math>2\text{H}_3\text{POY aq.}</math>)</li></ul>	Examples include: <ul style="list-style-type: none"><li>• Sodium Hydroxide (<math>\text{NaOH}</math>)</li><li>• Potassium Hydroxide (<math>\text{KOH}</math>)</li><li>• Calcium Hydroxide (<math>\text{Ca}(\text{OH})_2</math>)</li></ul>

# Chemical Storage, cont.



## Additional Storage Considerations:

- Segregate toxics and health hazards to highlight awareness; label areas of storage.
- Never store liquids above eye level.
- Do not store heavy items high up on shelves.
- If storing anything >4L, use secondary containment.
- Store only cleaning chemicals under the sink.
  - Do not store flammables in cabinets that are not flammables rated.
- Store chemicals and reagents in accordance with temperature requirements
  - Do not store flammables in refrigerators, freezers or walk-in cold rooms. There is one flammables rated freezer for shared use at HQ, 5-East room 526.
  - Except when equipment is rated for flammables (UL rated for flammables storage).



# Chemical Storage, cont.



## **Additional Storage Considerations:**

- Each lab must maintain an up-to-date lab specific chemical inventory!
- Monitor chemicals in accordance with manufacture requirements including expiration dates, testing where applicable and disposal specifications.
- Always purchase the minimum amount necessary to maintain operations.
- Stocks (large containers) of flammable solvents must be stored in a flammable storage cabinet. See Appendix D of the CHP for storage limits in the open labs.
- Storage of hazardous chemicals at the lab bench should be kept to a minimum.
- Chemicals with missing or defaced labels should be removed.
- Storing chemicals with unique hazards (e.g., perchloric acids, air reactives, ethers, peroxide formers) – contact EHS for assistance before use for additional training!

# Waste Management

**Hazardous Chemical Waste**

Date: 4/15/16  
Lab/Name: Dr. Sal M Nella

Complete description of waste contents (% each constituent including solvents such as water; MUST add up to 100%). Avoid uncommon abbreviations.

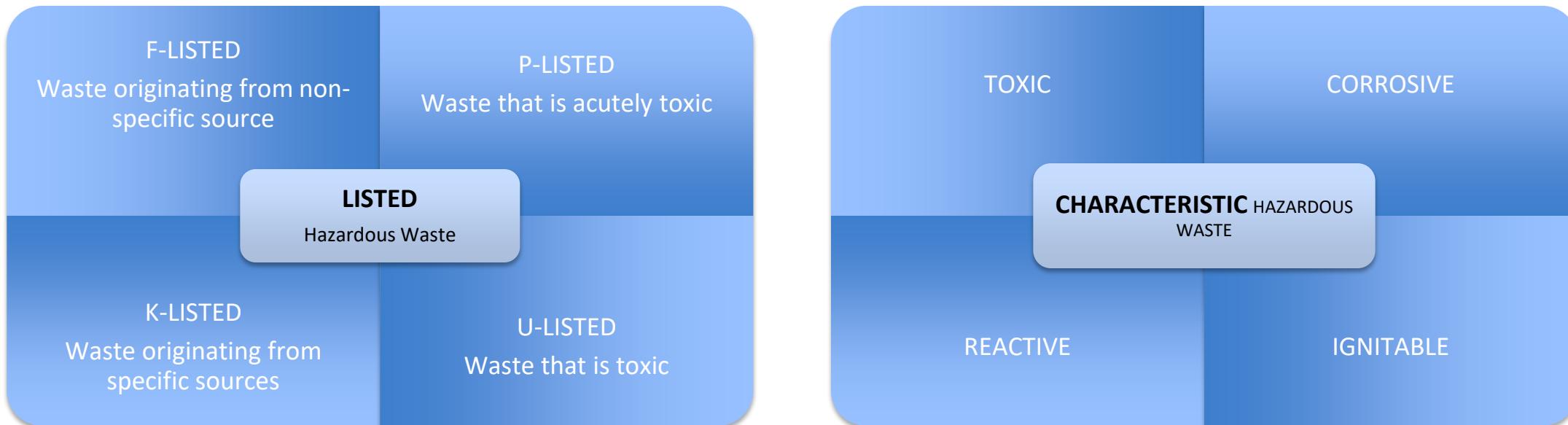
1. 49% Ethanol  
2. 50% Water  
3. < 1% B Mercaptoethanol  
4. < 1% Guanidine thiocyanate

Circle or mark all that are applicable:

Flammable?      Health Hazard?      Corrosive? pH: \_\_\_\_\_  
 Toxic?      Irritant?      Reactive? \_\_\_\_\_



# The Hazardous Waste Universe



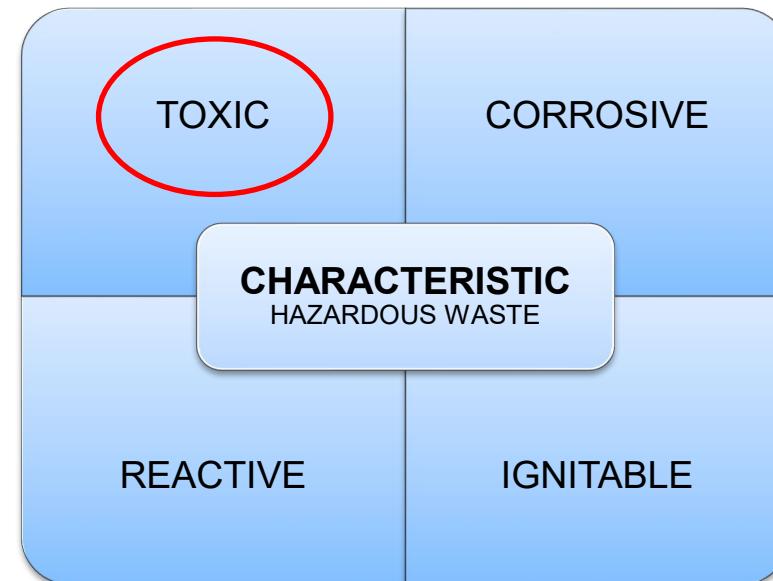
- TGen HQ is a Small Quantity Generator of hazardous waste. TGen North is a Very Small Quantity Generator of hazardous waste. TGen Federal, State and City hazardous waste regulations.
- Potential impacts due to incorrect disposal include:
  - Significant fines and penalties
  - Environmental harm



# Hazardous Waste Management

## TOXICS

- EPA listed acutely toxics (p-list).
- Acutely toxic, fatal - skull and cross bones; always check safety data sheet.
- Include chemicals which indicate a health hazard (carcinogens, mutagens, reproductive toxins).
- Ex: Chloroform, Phenol, Ethidium Bromide, Formaldehyde, Drugs.

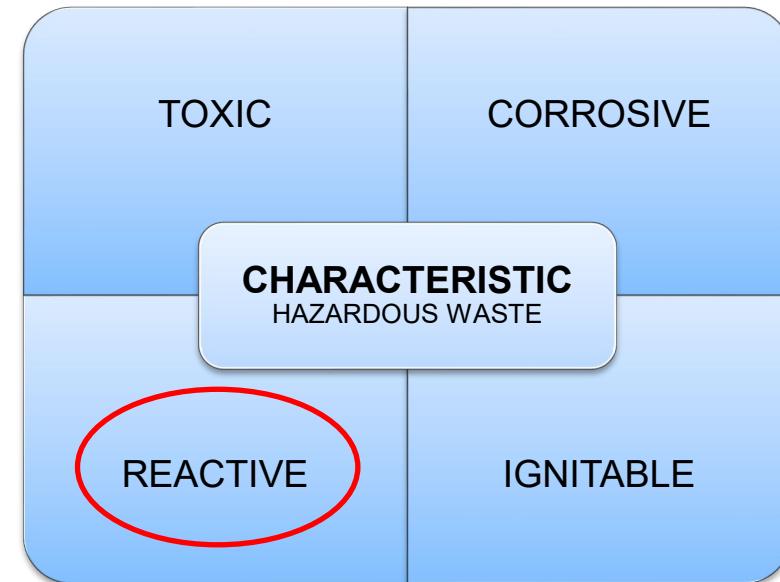


# Hazardous Waste Management

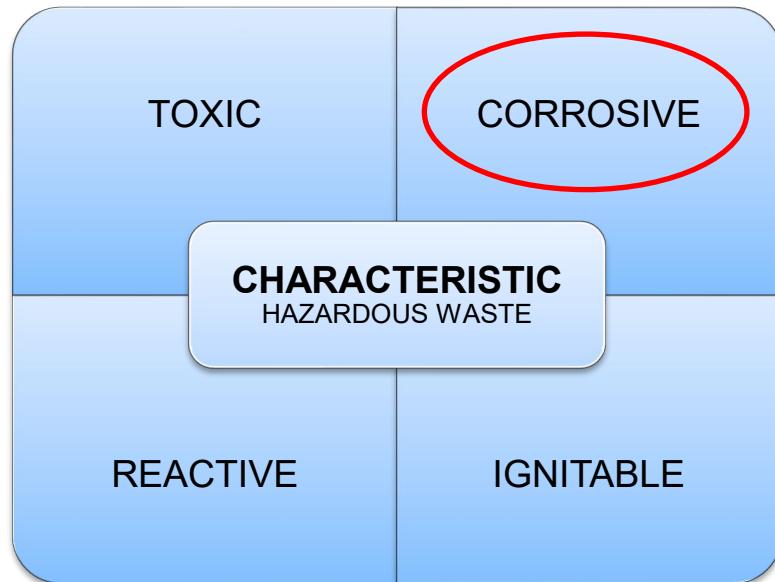


## REACTIVES

- Waste which is unstable under normal conditions.
- Could cause explosions, toxic fumes if heated, water reactive (toxic gas or other).
- Review safety data sheets for indication of materials considered reactive.
- Ex: Sodium Borohydride, Diethyl Ether, Tetrahydrofuran.



# Hazardous Waste Management



## CORROSIVES

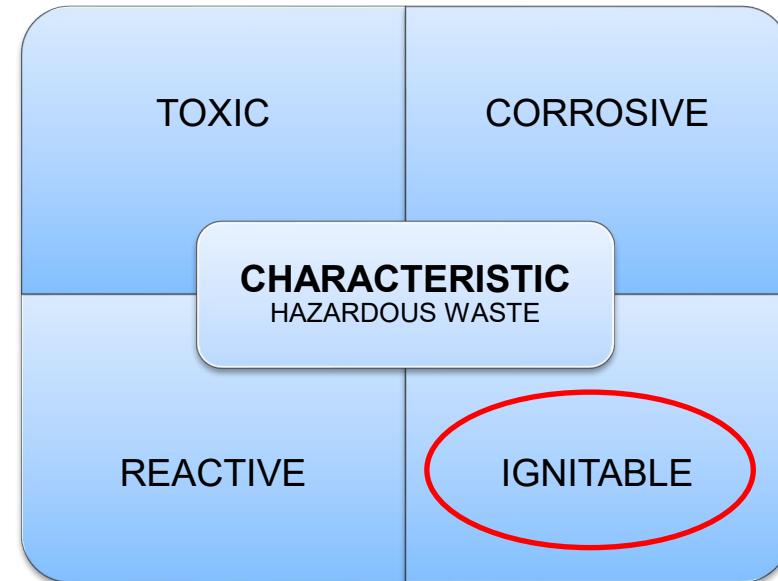
- Acids or bases.
- EPA:  $\text{pH} \leq 2$  or  $\geq 12.5$
- City Code is more restrictive:  $\text{pH} \leq 5$  or  $\geq 10.5$
- **Must follow city code, most restrictive.**
- Ex: Stocks and dilutions of Hydrochloric Acid, Sulfuric Acid, Sodium Hydroxide, Restore Western Strip Buffer, etc.

# Hazardous Waste Management



## IGNITABLE

- Flammables.
- Ignitable wastes, easily burned.
- Closed cup flash point is  $\leq 60^{\circ}\text{C}$  or  $140^{\circ}\text{F}$  (find on safety data sheet or look for flame pictogram).
- Ex: Alcohols (ethanol, 2-propanol, butanol, methanol), Acetyl Chloride, Acetone, Diethyl Ether, Xylene.



# Chemical vs. Biological



## Chemical Waste

- Flammables
- Corrosives
- Toxics (incl. drugs)
- Reactives
- Malodorous, Viscous
- Dyed, Soapy\*
- Mixtures of all the above

\*beyond typical hand soap etc.

## Regulated Medical Waste (RMW)

- RMW = Biohazardous waste
- Cultures and stocks of microorganisms
- Human blood/blood products
- Human pathological waste
- Medical sharps
- Research animal wastes
- Refer to your BBP training for more info!

**Mixed** wastes may include a hazardous chemical and a biohazard. The goal should be to inactivate the pathogen or potential pathogen leaving the waste as a hazardous chemical waste only. Contact EHS for assistance!



# What Happens to TGen's Waste?



## Chemical Waste

- Collected in the Labs (e.g., satellite accumulation areas).
- Facilities/EHS/Ops takes to storage (e.g., central accumulation area).
- A contracted waste company removes waste from TGen-HQ every 6 months and from TGen-North as needed.

## RMW/Biohazard Waste

- RMW/biohazard waste is collected in red biohazard bags.
- Red-bags go into barrels.
- Barrels are collected by a certified regulated medical waste provider.
- See the Bloodborne Pathogens training for details on RMW.
- No or trace amount only of hazardous chemicals.
- Avoid putting regular trash in RMW!

# Hazardous Waste Labeling

- Every hazardous waste container must be labeled “HAZARDOUS WASTE” and include the contents as soon as waste accumulation begins.
  - Complete and attach a *TGen Hazardous Waste Label*.
  - List approximate concentrations of constituents.
  - Circle or note the hazard class.
- The label must be specific (e.g. “Xylene, Acetone, Toluene,” etc.).
  - **Do not** use generic language such as “Non-Halogenated Solvents” alone.
  - **Do not** use abbreviations.
  - “Waste” or “Acetone Waste” are not acceptable forms of supplemental information.

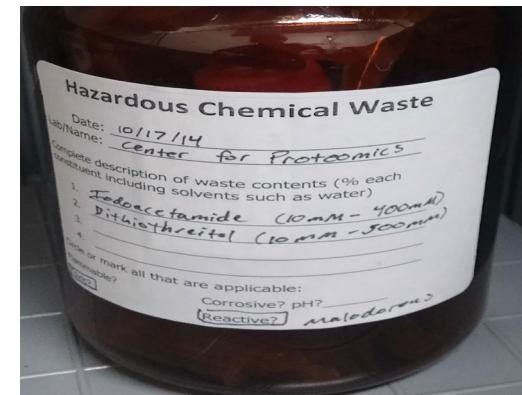
Hazardous Chemical Waste		
Date:		
Lab/Name:		
Complete description of waste contents (% each constituent including solvents such as water; MUST add up to 100%). Avoid uncommon abbreviations.		
1.		
2.		
3.		
4.		
Circle or mark all that are applicable:		
Flammable?	Health Hazard?	Corrosive? pH: _____
Toxic?	Irritant?	Reactive?

# Managing Hazardous Waste

- Characteristically hazardous wastes (noted in preceding slides) cannot go in the drain or trash.
- EPA listed hazardous wastes cannot go in the drain or trash.
  - Listed wastes are either specific chemicals or wastes from specific processes.
  - [EPA listed wastes](#).
- Waste that is viscous (thick) or malodorous (smelly) cannot go in the drain or trash (e.g., glycerol, BME).
- Collect waste in containers for which the waste is compatible.
- Waste containers must be **labeled before the first drop is added.**



Xylene melted a polystyrene container



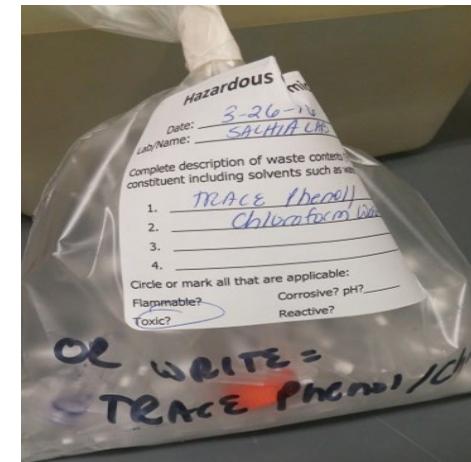
# Tips for Hazardous Waste Management

- Tip #1: Ask yourself the following question: Is the waste material hazardous (e.g., flammable, corrosive, toxic, reactive)?
  - Yes → Collect and label as hazardous waste
  - No → Go to tip #2
- Tip #2: Is the waste material malodorous, viscous, soapy or dyed; or contain a health hazard per SDS?
  - Yes → Collected as hazardous waste
  - No → Dispose of in the sink
- Tip #3: Unsure, Ask EHS! Never assume.



# Tips for Hazardous Waste Management

- Keep waste containers closed between use.
- Waste must be collected in a container that closes.
- Do not discard any powders in the trash.
- Do not evaporate waste in the fume hood as a means of disposal; collect waste instead.
- Non-hazardous tips (no contact with biohazards or toxics) may go in regular trash if containerized first (e.g., empty buffer bottles). Avoid collecting large quantities in a box unless approved through EHS.
- Tips contaminated with trace toxic/malodorous chemicals (e.g., xylene, BME, phenol/chloroform) should be dried overnight in the fume hood, collected in a sealable bag and placed in appropriate blue waste collection barrels for proper disposal.



# Tips and Reminders cont.

- Empty containers are no longer considered hazardous
  - Rinse or dry empty containers
  - Draw an X over the label and mark “empty”
  - Discard in the trash or if glass, in broken glass containers
  - Exception: containers that contained p-listed chemicals
- When waste is ready to be picked up, place in Satellite Accumulation Areas or submit a facilities ticket
  - SAA in 4-East Equipment Room (north-end)
  - SAA in 5-West Fume Hood Alcove
  - SAA in 5-East Fume hood alcove and north end freezer entrance area
  - TGen-N in Storage Area; by EHS or Safety Rep
  - Each lab should have their own SAA



Go to the [Policies and Procedures](#) page on TGen Hub to view the Satellite Accumulation Area SOP (EHS-120-SOP)

# Managing Kit Wastes

- Each kit should have a related set of safety data sheets.
- Read through the protocols for safety alerts and notices (incompatibilities).
- Redistribute no longer need kits.
- Routinely sort and discard expired kits/reagents.
- To determine what is hazardous waste:
  - Refer to SDS, are the components hazardous?
  - Toss tubes, papers, columns, etc.
  - Discard non-hazard wastes in the sink/trash.
  - Collect hazardous reagents; combine compatibles.
  - Collect bottles or small tubes of reagents in baggies; label with hazard identified in SDS.



# Breaking Down Kits



## 1) Drain Dispose the Empty and Non-hazardous Reagents

- Non-hazardous reagents can be drain disposed. These include:
  - Reagents without pictograms
  - Reagents with the exclamation mark as their **only\*** pictogram
  - Reagents that are **not** obviously malodorous, dyed, viscous, or soapy
  - Bottles with less than 1 in of residue or less than 3% by weight remaining (**except those with the skull and crossbones pictogram**)

\*Verify against the Safety Data Sheet (SDS)

## 2) Send the Hazardous Reagents to EHS

- Reagents with ethanol added are flammable and will be taken by EHS
- Reagents with the other pictograms will also be taken by EHS

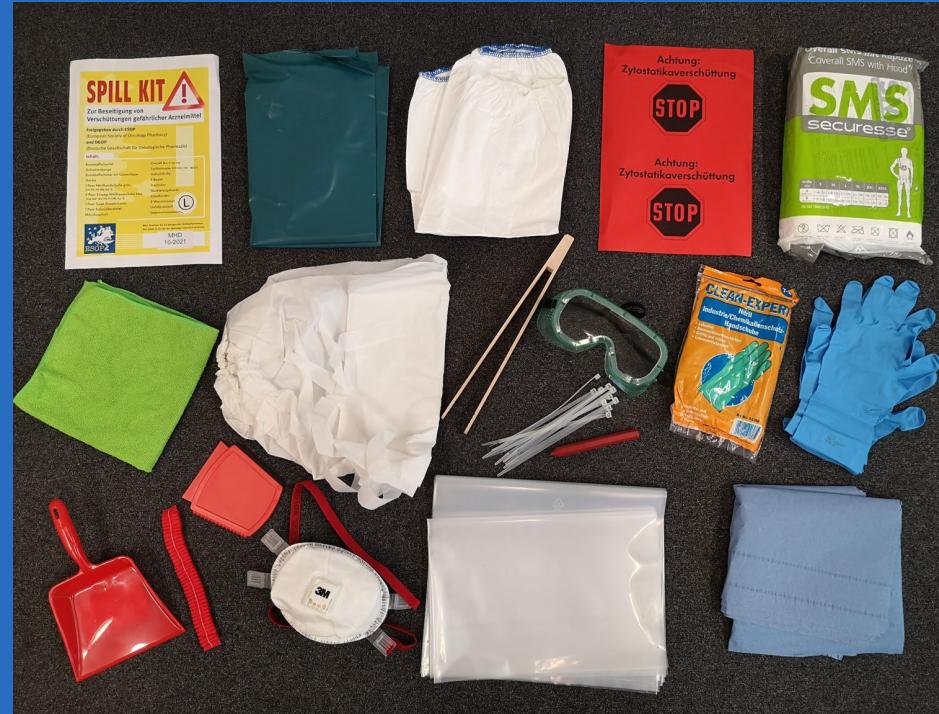


## 3) Recycle the Packaging

- Cardboard boxes and rinsed, capped plastic bottles go into the regular blue bins designated for city recycling.
- Pipette tips, tubes, and other lab plastics go into the lab plastic recycling bin.
- Soft plastics, such as plastic wrapping, bags, etc., go into the soft plastics recycling bin.

## Part 4

# Emergency Response Procedures

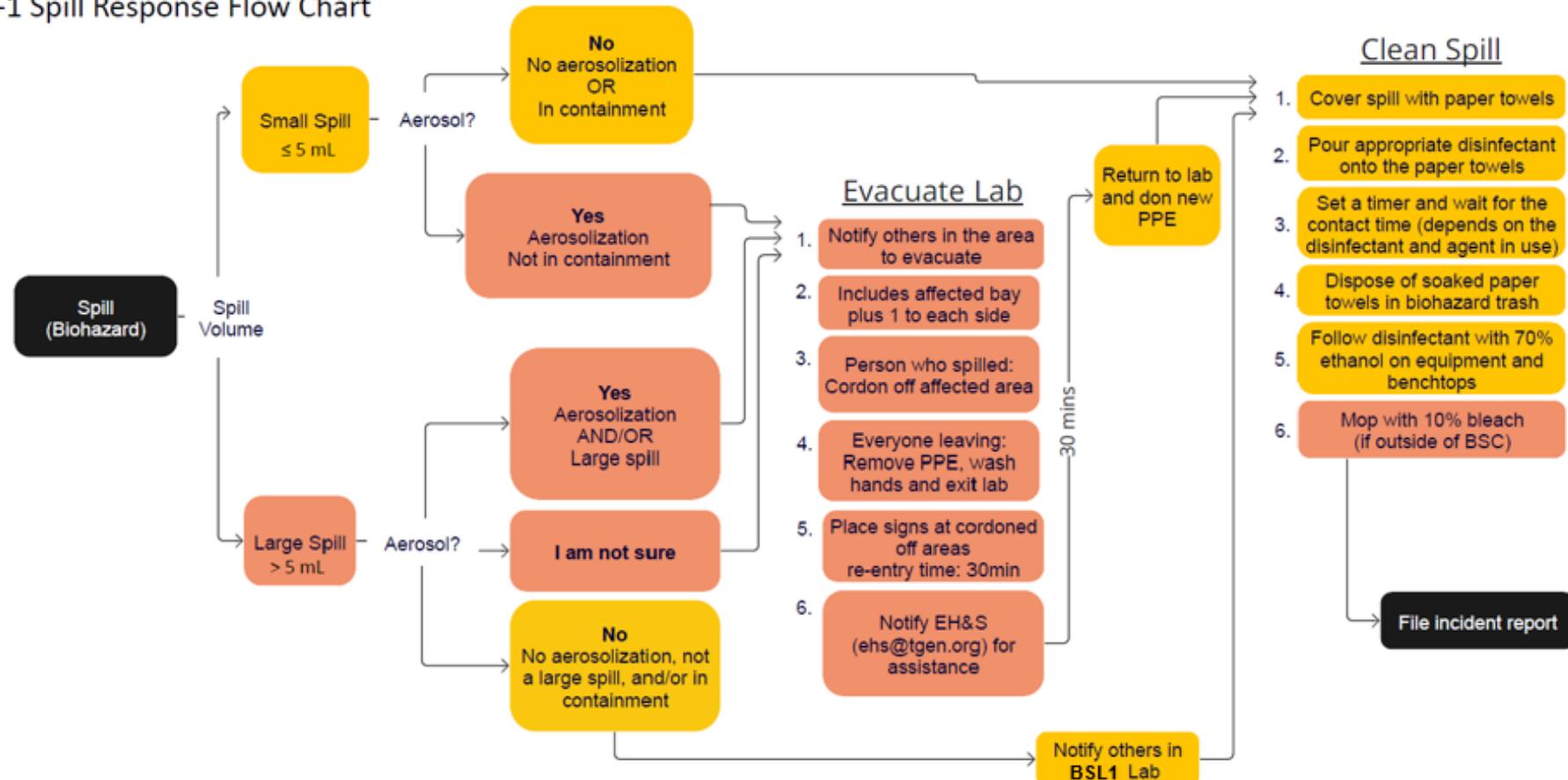


# Environmental Spill

- Alert those around you, **contact your supervisor or biosafety for assistance.**
- Wear a lab coat, safety glasses, and gloves during clean-up.
- Place dry paper towel on spill (to absorb liquids); then layer a second set of disinfectant soaked paper towels over the spill.
- Recommended disinfectant is a 10% (vol/vol) solution of household bleach (containing a minimum of 5.25% sodium hypochlorite).
- Bleach breaks down quickly in water and therefore must be prepared fresh daily.
- Allow 20-30 minutes contact time to ensure germicidal action of bleach.
- Discard contaminated disposable materials using appropriate biohazardous waste disposal procedures (e.g., autoclave or biological waste container).
- Disinfect reusable items.
- See the Spill Response Flowcharts for HQ (BSL-2 and BSL-1/Open Lab) and TGen North on TGen Hub → Policies and Procedures page (see the resources slide at the end) and on the EHS page → Emergency Response.

# Spills in BSL-1 Laboratories

BSL-1 Spill Response Flow Chart



## Biosafety Level 1:

BSL-1: Open lab areas (limited work with biohazards). Low risk materials such as urine, saliva, low aerosol risk. Conduct primary inactivation steps in the BSL-2/TC rooms; exemptions must be approved by EH&S. Move materials between spaces in secondary containment.

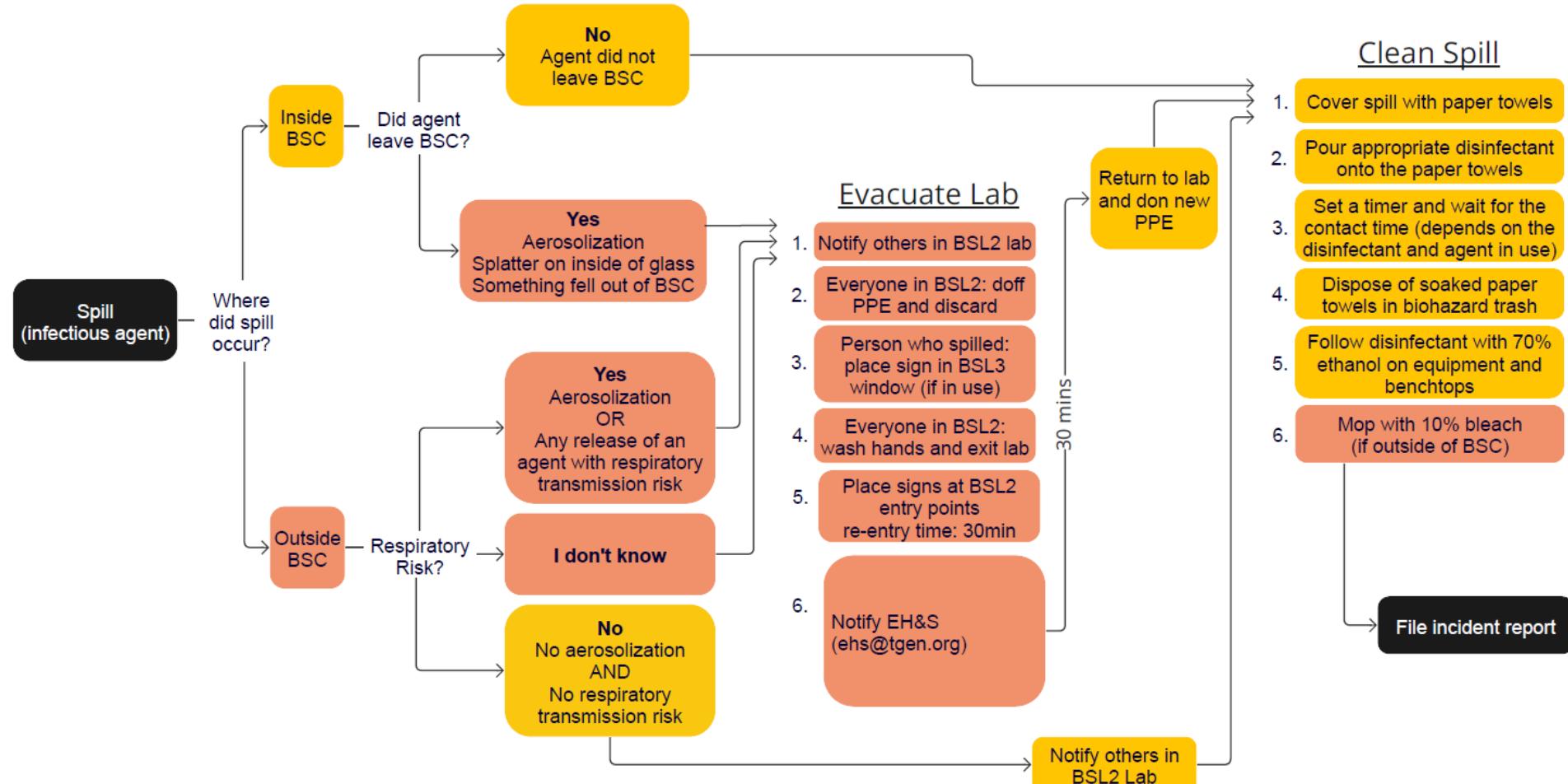
## Aerosolization:

An event involving material dropping to the floor, high mechanical force release or forceful expulsion of liquid

## Containment:

An enclosure, box, or location that contains the work in a manner that minimizes release. Can be a Class I type BSC, a dead-air box or related.

# Spills in TGen HQ BSL-2 Laboratories



## Aerosolization:

An event involving material dropping to the floor, high mechanical force release or forceful expulsion of liquid

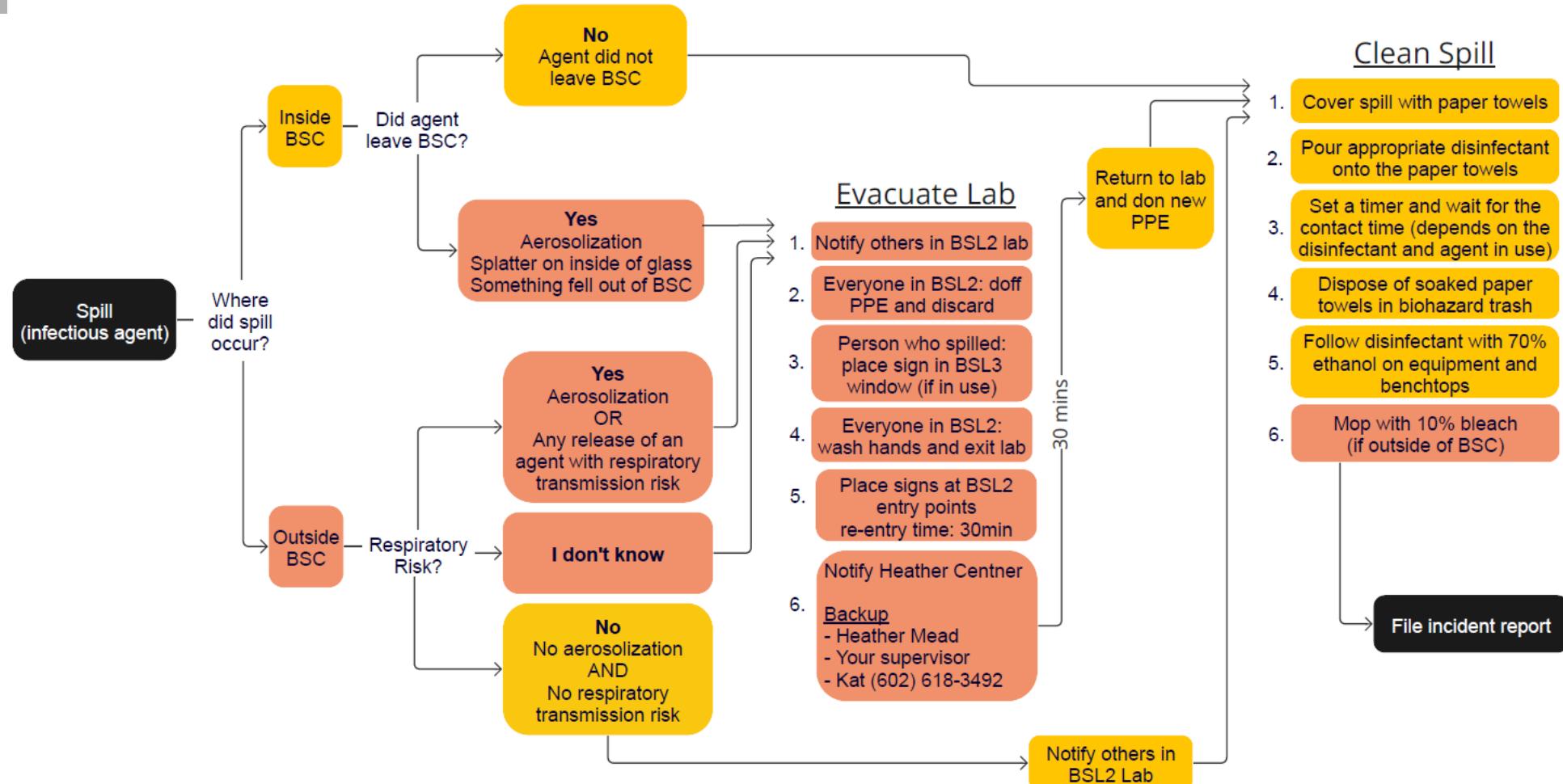
## Common respiratory transmission risks:

- Clinical samples from nasal, oral, or lung body sites
- COVID, Flu, RSV
- Wastewater

## Biosafety Level 2:

Samples handled are moderate risk to healthy adults. Most work is conducted in a certified BSC with exceptions for non-aerosol generating activities. PPE required includes lab coat and gloves; safety glasses for work outside a BSC.

# Spills in TGen-North BSL-2 Laboratories



## Aerosolization:

An event involving material dropping to the floor, high mechanical force release or forceful expulsion of liquid

## Common respiratory transmission risks:

- Clinical samples from nasal, oral, or lung body sites
- COVID, Flu, RSV
- Wastewater

# Possible Bloodborne Pathogen Exposure

## Thoroughly Cleanse the Area of Exposure:

- ✓ Wash needle-sticks and cuts with soap and water (**15 minutes**).
- ✓ Flush splashes to the nose, mouth or skin with copious amounts of water (**at least 15 minutes**).
- ✓ Irrigate eyes using the eyewash station or use saline (**at least 15 minutes**).

- ☎ Immediately report all occupational exposures with blood or OPIM to your supervisor and EHS.
- ☎ Contact HR at ext. 8403/8803 and EHS at 8849.
- ☎ File an incident report within 24 hours.

**BLOODBORNE PATHOGENS**

UNIVERSAL PRECAUTIONS FOR THOSE EXPOSED TO BLOOD OR OTHER POTENTIALLY INFECTIOUS MATERIALS IN THEIR OCCUPATION

**PROTECT YOURSELF**  
ALL BLOOD AND BODILY FLUID MUST BE TREATED AS IF THEY WERE INFECTED WITH:

- HUMAN IMMUNODEFICIENCY VIRUS (HIV) WHICH FREQUENTLY LEADS TO AIDS.
- HEPATITIS B VIRUS (HBV).
- OTHER BLOODBORNE PATHOGENS (MICROORGANISMS FOUND IN HUMAN BLOOD WHICH CAN CAUSE DISEASE).

**KNOW THE RULES**  
BE FAMILIAR WITH YOUR ORGANIZATION'S EXPOSURE CONTROL PLAN.  
**MADE SURE YOU KNOW:**

- VACCINATION REQUIREMENTS
- PROCEDURES
- PRACTICES
- PROPER REPORTING REQUIREMENTS FOR INCIDENTS OF EXPOSURE.

**KNOW YOUR COLORS**

- RED BAGS OR CONTAINERS DON'T NEED TO BE LABELED - THEIR COLOR INDICATES THEY MAY CONTAIN BIOHAZARDS.
- FLUORESCENT ORANGE-RED LABELS AND SIGNS WITH CONTRASTING LETTERING OR SYMBOLS ARE APPROPRIATE

**WEAR THE RIGHT EQUIPMENT**

- LAB COATS, APRONS, GOWNS
- SHOE COVERS
- FACE MASKS
- SPLASH GOGGLES
- GLOVES
- FACE SHIELDS

**READ ALL LABELS AND SIGNS**

**PROPER PROCEDURE CAN REDUCE YOUR RISK OF INFECTION TO ZERO**

**WASH HANDS**  
AND FOLLOW SAFE HYGIENE AND WORK PRACTICES.

**DISPOSE** OF NEEDLES IN APPROPRIATE CONTAINERS.  
**NEVER** RECAP, BEND, OR BREAK NEEDLES.

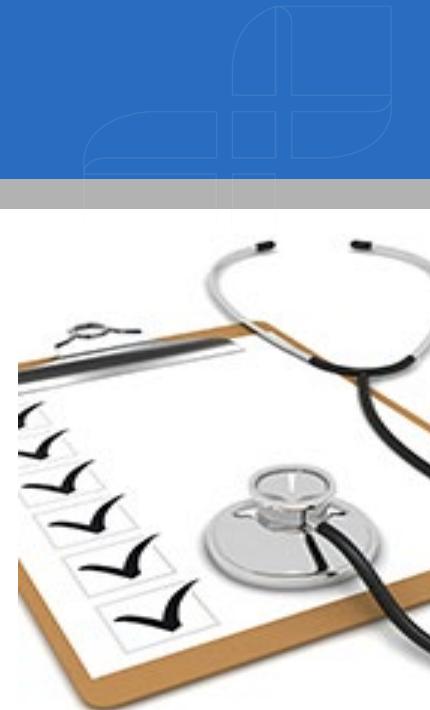
**FOLLOW** PROPER DISPOSAL PROCEDURES.  
CONTAMINATED LAUNDRY AND PERSONAL PROTECTIVE EQUIPMENT SHOULD BE DISPOSED OF IN PROPERLY DESIGNATED AREAS.

**KEEP IT CLEAN**  
CLEAN WORKSITE AND DECONTAMINATE EQUIPMENT. FOLLOW ALL SAFE HANDLING PROCEDURES.

**DON'T FORGET**  
ALL BODY FLUIDS SHOULD BE HANDLED AS IF POTENTIALLY INFECTIOUS.

# Post-Exposure Evaluation

- A confidential medical evaluation is provided at no cost to the affected employee.
- The hepatitis B vaccine may be given to anyone who requests it even if they declined previously.
  - Banner Occupational Health for HQ.
  - Concentra for TGen North.
- Other treatment options are discussed with the medical staff.
- Don't ignore symptoms that may be related to your work/exposure.
- File an Incident Report within 24 hours.
- TGen Incident Report is on TGen Hub → EHS Page (see next slide)



# TGen Headquarters – Banner Occupational Health Clinic



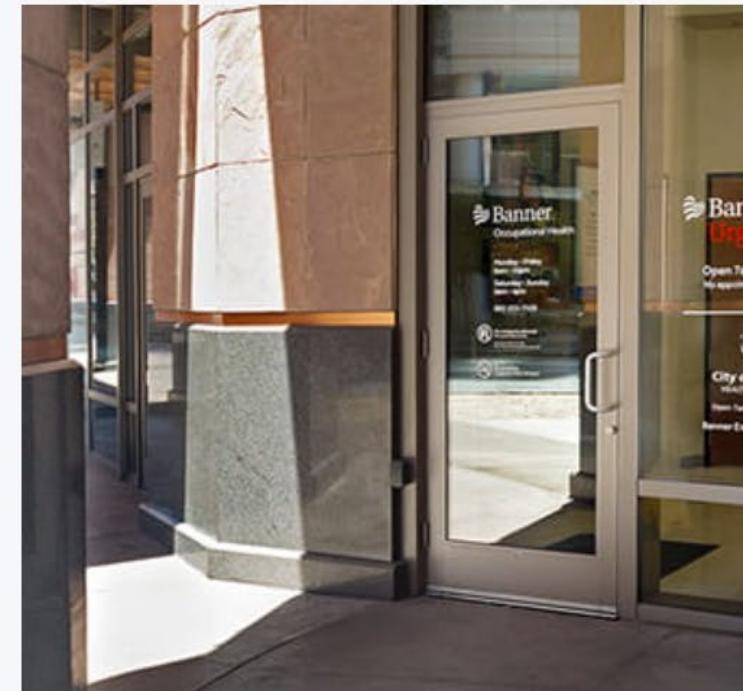
## Banner Occupational Health Clinic

1 North Central Ave.  
Phoenix, AZ 85004  
[\(602\) 839-4456](tel:(602)839-4456)

**Hours Today** • 8:00 a.m. to 4:00 p.m.

### Location hours

Monday.....6:00 a.m. to 10:00 p.m.  
Tuesday.....6:00 a.m. to 10:00 p.m.  
Wednesday.....6:00 a.m. to 10:00 p.m.  
Thursday.....6:00 a.m. to 10:00 p.m.  
Friday.....6:00 a.m. to 10:00 p.m.  
Saturday.....8:00 a.m. to 4:00 p.m.  
Sunday.....8:00 a.m. to 4:00 p.m.



# TGen North – Concentra

**Concentra®**

EMPLOYERS PATIENTS CAREERS HUB LOGIN LOCATIONS PAY BILL FORMS

Workplace Injuries Physical Therapy Physicals Work Health Screenings Vaccinations Urgent Care [Pay Bill](#) [Contact Us](#)

Concentra is expanding! New medical centers coming this fall in Norfolk, Virginia; Fort Myers, Florida; and Groveport, Ohio. [DISMISS](#)



[Back to Search](#)

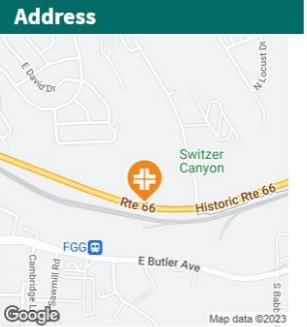
**Flagstaff - Urgent Care** ● OPEN UNTIL 5:00 PM

[Services](#) [Specialists](#)

**About the Clinic**

The Flagstaff center features the company's signature design and upscale interior elements to create a warm and relaxing atmosphere. The center has numerous patient exam rooms, a spacious physical therapy area, and a patient-focused design to make a more positive health care experience. This center is close to local businesses, with convenient access to major roadways.

**Address**



Map data ©2023 Google

**Flagstaff**  
1110 E. Route 66 Suite 100  
Flagstaff, AZ 86001  
[Get Directions](#)

**Hours**

**Medical Center**

Monday  
8:00 am - 5:00 pm

Tuesday  
8:00 am - 5:00 pm

Wednesday  
8:00 am - 5:00 pm

For non-urgent needs, make an appointment and get an authorization form from EHS!

# Incident Reports

- Work-related incidents are tracked and investigated to help prevent future incidents and to maintain safe and healthy workplaces.
- Incident reports are for fact finding, not fault finding and input from the affected employee is an essential feature.
- A TGen Incident Report should be **filed within 24 hours of an incident** and sent to EHS.
  - EHS will share with HR if medical attention is received. Records will be maintained in the employees confidential file.

# Incident Report on TGen Hub

**tgenhub** Environmental Health & Safety

Biological Agent Reference Sheets   Recycle bin   Edit

+ New ▾   Page details   Analytics

## About Environmental Health & Safety

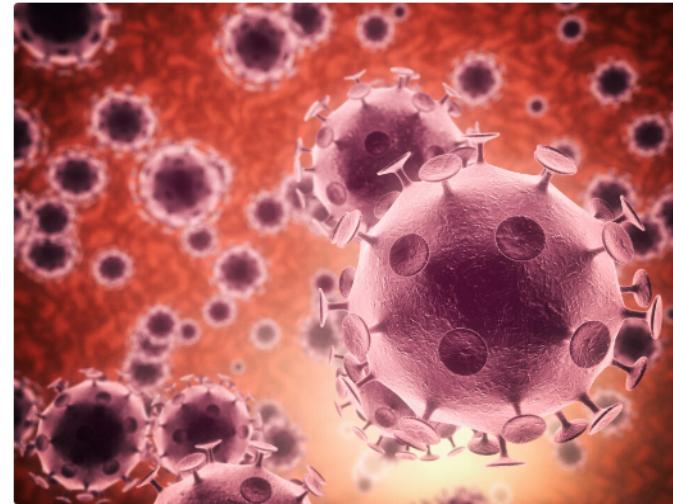
TGen is committed to integrating a sound Environmental Health and Safety (EH&S) program into its research operations. The goal of the EH&S program is to protect employees from job related injuries and illnesses; to recognize and mitigate hazards (biological, chemical, physical and other) in the workplace; and provide employees with training, information and resources to support a safe and healthy work environment.

TGen senior management and supervision support employee's rights for a safe workplace and employees have ongoing responsibility to educate themselves regarding safe laboratory practices, as well as to adhere to all policies and procedures defined by TGen management.

This website is intended to support the objectives outlined above. It provides policies and procedures for employee safety across all departments as well as targeted information for the safe and compliant conduct of laboratory research. This page and related pages are designed to serve as an information resource for all employees. Additional compliance sites are listed below.

If you have any questions regarding lab safety and compliance, or if you have any concerns you would like addressed, please contact Kathleen Kennedy or Tisa Tehranchi by email at [EHS@tgen.org](mailto:EHS@tgen.org).

**Report An Incident**   Go To Policies & Procedures   Safety Data Sheets   Ask EHS a Question



### TGen Environmental Health and Safety Team



Kathleen Kennedy  
Manager Sr, Environmental Health and...  
[LinkedIn Profile](#)



Tisa Tehranchi  
Environmental Health and Safety Speci...  
[LinkedIn Profile](#)

# Chemical Incompatibilities

- Verify the compatibilities of chemicals you will work with and mix (commingle), including wastes.
- Mixing incompatibles can have hazardous results:
  - Excessive heat: exothermic (e.g., water + lithium chloride\*).
  - Generation of gas: pressurization (e.g., liquid nitrogen moving to room temperature, polymerization reactions).
  - Generation of toxic gas: mixing bleach with buffers containing guanidine, also results in pressurization.
  - Production of explosive compounds: sodium azide in contact with metal (e.g., do not pour down drains).



\* Titration is often required when preparing solutions, to minimize reactions.

# Preventing Mistakes

- Check the labels to avoid accidental mixing.
- Clearly label all containers containing chemicals or waste.
- Review protocols for hazardous reactions.
- Emphasize the hazards of accidental mixing:
  - Lab-specific training, notices, lab protocols / SOPs

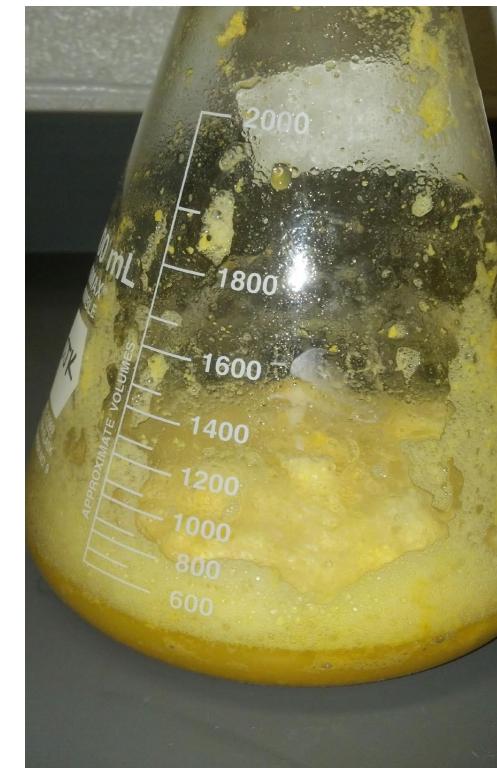


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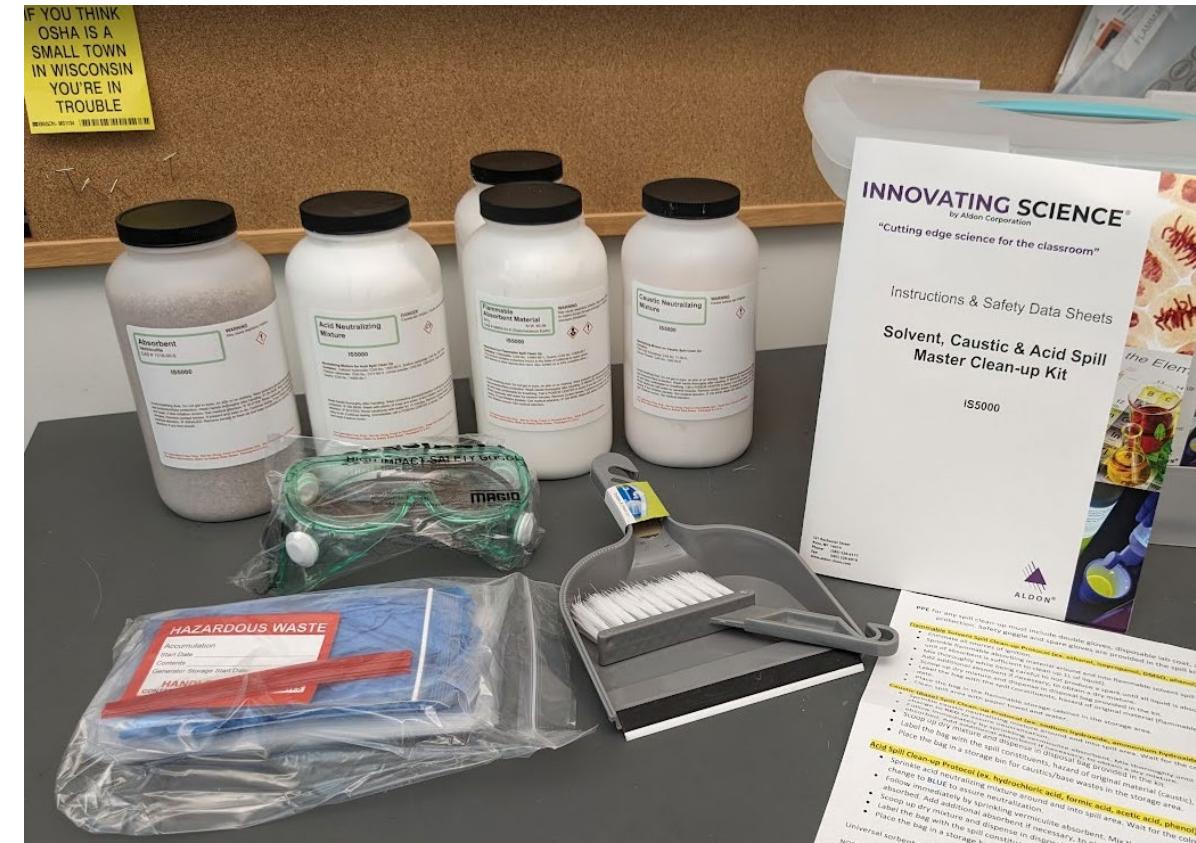
**CAUTION: DO NOT add bleach or acidic solutions directly to the sample-preparation waste.**

Buffer AL and Buffer AW1 contain guanidine hydrochloride, which can form highly reactive compounds when combined with bleach. If liquid containing this buffer is spilt,



# Emergency Response— Spill Kits and Clean Up

- Alert others in the area of spill.
  - Vacate the area if the spill is noxious or hazards are uncertain.
  - Contact EHS.
- Locate the spill kit
  - Fume hood alcoves at HQ
  - Other signed areas in labs
- Review Incident Response Sheet.
- Wear appropriate PPE.
- Follow instructions for spill type.
- Complete an incident report (<24 hr.)



This is an example of spill kits at TGen (there are others). Spill kits have all the materials needed to clean up the majority of spills in our laboratories. Contact EHS for assistance!

# Emergency Response – Spill Kits and Clean Up

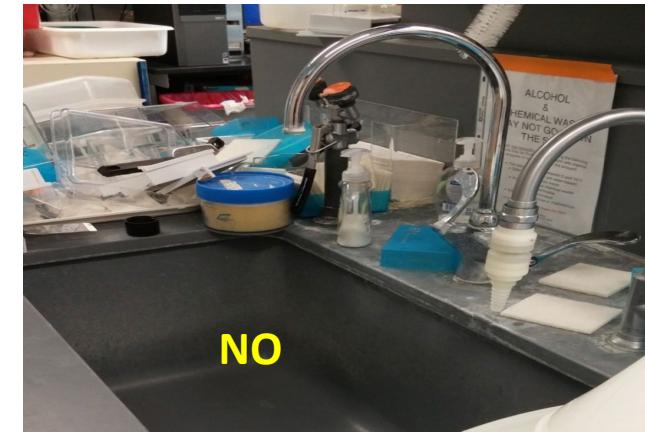
## Do Not:

- Clean up a spill if uncertain how to proceed safely, contact EHS.
- Clean up a spill with bare hands.
- Toss spill clean up debris in regular trash.
- Use a mop and bucket for initial clean-up.
  - May use after spill is removed and bagged.
- Sweep up powders (aerosolizes powder).
- Attempt to clean up strong acids\*, contact EHS.
  - Strong acids include sulfuric, nitric and hydrochloric acids.
  - May clean up if spill is small ( $\leq 50$  mL).



# Emergency Response – Chemical Exposure

- Rinse any exposed area thoroughly with copious amounts of water, **15 minutes**, including mouth, nose and skin.
- Flush splashes to the eyes with an emergency eye wash station, **15 minutes**.
  - Do not attempt to remove contact lenses first. Allow lenses to flush out during eye wash.
- Seek medical attention if needed (Banner Occupational Health or Concentra).
- File an incident report with EHS (<24 hr.).
- Keep areas around emergency eye wash clean and clear of clutter.



# Do Not Block Emergency Equipment

- Sprinklers – An 18” clearance from the ceiling should be maintained at all times.
- Fire Extinguishers – Should never be blocked with boxes, barrels or other objects.
- Eye wash stations – keep the sink clear around this area to maintain accessibility.
- Showers – never store, stack or place anything in the emergency shower area.

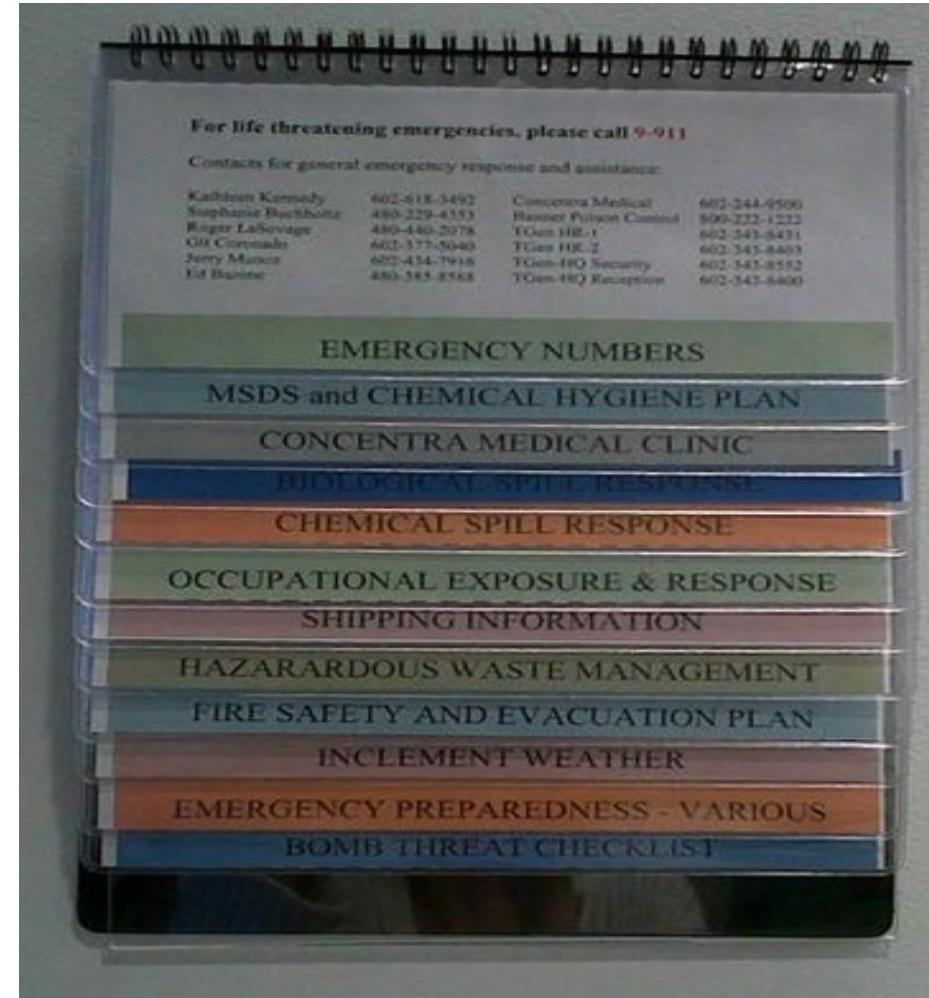


# Emergency Preparedness



## Safety Flip Charts

- Located in the labs along the main walkway
- Also found in break-areas or common office spaces
- Contains useful info on:
  - Emergency numbers
  - Exposure response
  - Evacuation Procedures
    - Fire safety
    - Inclement weather
    - Other



# Fire Safety/Evacuation



Time to safely evacuate the building. Please proceed to the nearest fire exit.

Exits are located at the NW and SE corners of each floor (TGen North, one floor). Exit and move toward the east side of the parking garage just north of our building and wait for further instruction.

- Do not use elevators
- Do not use main stairs at HQ

# Other Safety Considerations – Dry Ice



## Dry ice Hazards:

- **Explosion hazard:** Dry ice releases a large volume of carbon dioxide gas as it sublimates. If packaged in a container that does not allow for release of the gas, it may explode, causing personal injury or property damage
- **Suffocation hazard:** A large volume of carbon dioxide gas emitted in a confined space may create an oxygen deficient atmosphere.
- **Contact hazard:** Dry ice is a cryogenic material that causes severe frostbite upon contact with skin



## Dry Ice Precautions

- Do not store dry ice in airtight containers.
- Always use dry ice in a well-ventilated area.
- If the area isn't well ventilated, you must monitor for CO<sub>2</sub> and O<sub>2</sub>.
- Do not transport dry ice in the passenger area (trunk only or leave windows open, dry ice secure and labeled).
- Protect skin and eye from contact, use cryogenic gloves when handling dry ice.
- Do not dump dry ice in the sink. Contact facilities for assistance.

# Other Safety Considerations – Liquid Nitrogen

- Liquid Nitrogen Hazards

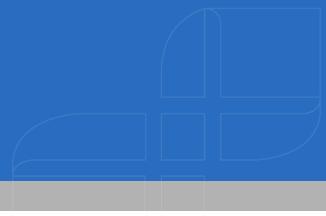
- Extreme cold
  - Frostbite
  - Tissue damage
- Simple asphyxiant
  - Odorless
  - Oxygen deficiency
- Expansion
  - Expands to 700X its volume in air
  - Rapidly displaces oxygen
  - Can pressurize containers, explosion hazard



- Hazard Mitigation Measures

- Never tamper with cylinders
- Keep doors to filling rooms open
- Wear required PPE
- Use the minimum amount needed
- Remove samples from freezers carefully, slowly
- Keep LN in use secure, in approved containers and labeled
- Complete the LN Safety training in Paylocity (required at HQ).

# Housekeeping Reminders



- No alcohol or hazardous chemical waste can go down the sink
- Liquid non-hazardous chemical wastes with the following criteria may be flushed down the sink with copious amounts of water (~20-30 times the amount):
  - Dissolves in water or are water-based
  - Are not a toxic waste
  - Are not a hazardous chemical waste
  - Are not flammable, corrosive, reactive
  - Are not dyed or very soapy
  - Are not malodorous or viscous

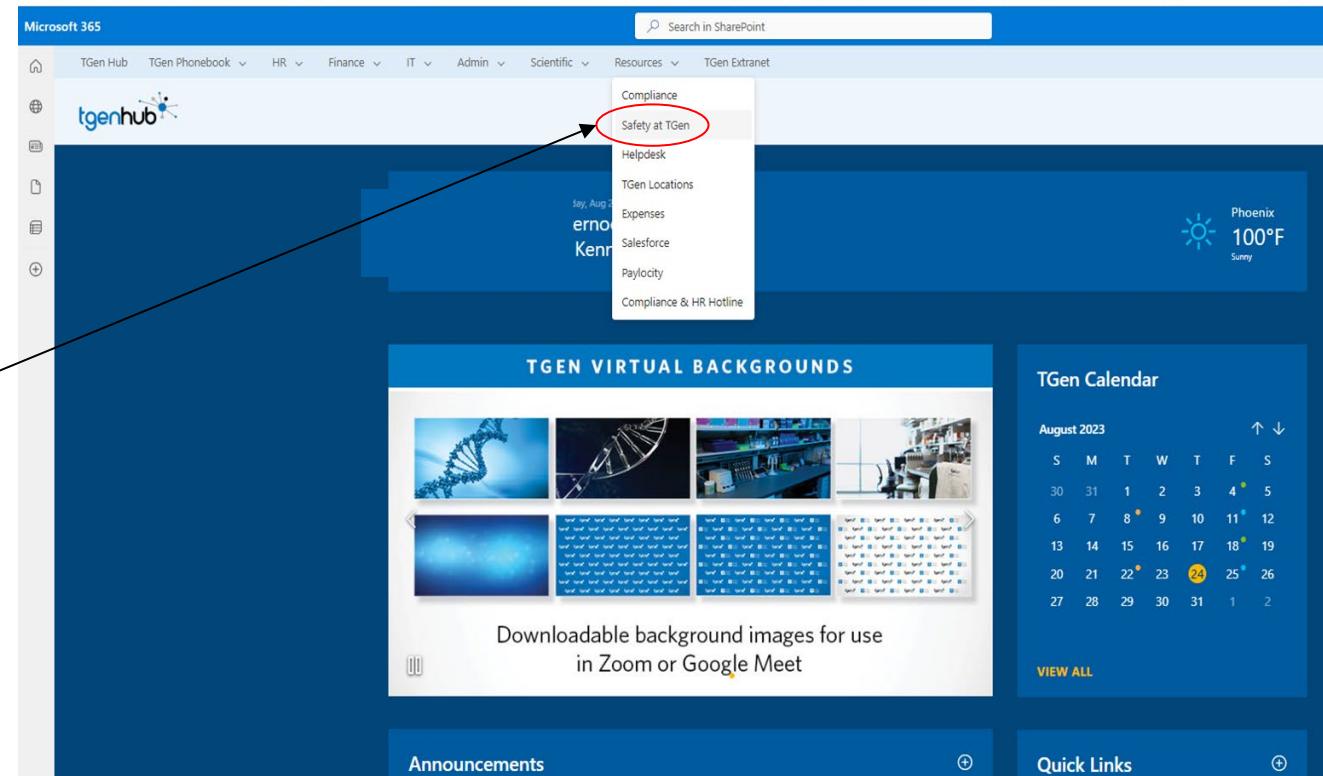


# Summary / Highlights

- Bloodborne pathogens are infectious organisms found in blood and other potentially infectious materials that can cause disease in humans.
- There are numerous hazardous chemicals in the lab. It is incumbent on all employees who work with hazardous chemicals and reagents to understand and control the hazards.
- Hazard mitigation measures include principles and practices to reduce the risk of exposure to hazards in the lab. Controls include engineering, work practice, and administrative controls; PPE, proper biowaste management and emergency response procedures.
- OSHA/GHS hazard pictograms and safety data sheets are essential tools for understanding hazards associate with various chemicals.
- Hazardous waste generated in the laboratory must be handled properly.
- Additional training in Biosafety, Biosafety Cabinet Essentials and more is available in Paylocity.
- Contact EHS for input/questions, anytime!

# Resources

- Environmental Health and Safety
  - [TGen Hub Phonebook](#)
  - [ehs@tgen.org](mailto:ehs@tgen.org)
- Resources on TGen Hub (SharePoint):
  - [Policies and Procedures](#)
  - [EHS SharePoint Page](#)
  - [IBC page](#)
- [NIH/CDC BMBL, 6th edition](#)
- [29 CFR 1910.1030: Bloodborne pathogens](#)
- [Green-Z solidifier for bio-waste](#)
- [Facilities for sharps container, red bags, bleach, paper towels](#)



# EHS Policies and Procedures to Know

- TGen Laboratory Housekeeping (EHS-002-POL)
- Bloodborne Pathogen Exposure Control Plan (EHS-003-POL)
- Chemical Hygiene Plan (EHS-005-POL)
- Laboratory and Biohazardous Waste (EHS-006-POL)
- Ethidium Bromide and Alternate Stains (EHS-007-POL)
- Automated External Defibrillator Policy (EHS-012-POL)
- Hazardous Waste Management (EHS-102-SOP)
- Fire Safety and Emergency Evacuation (EHS-106-SOP)
- Safe Handling of Hazardous Drugs and Carcinogens (EHS-111-SOP)
- Oxygen Detection System and Alarm Response (EHS-119-SOP)
- Reproductive Health in the Laboratory (EHS-124-SOP)

[TGen Policies and Procedures Repository](#)

Filter by EHS or IBC to see all related Policies, SOPs and Guidance Documents



**SAFE SCIENCE IS GOOD SCIENCE  
THANK YOU!**