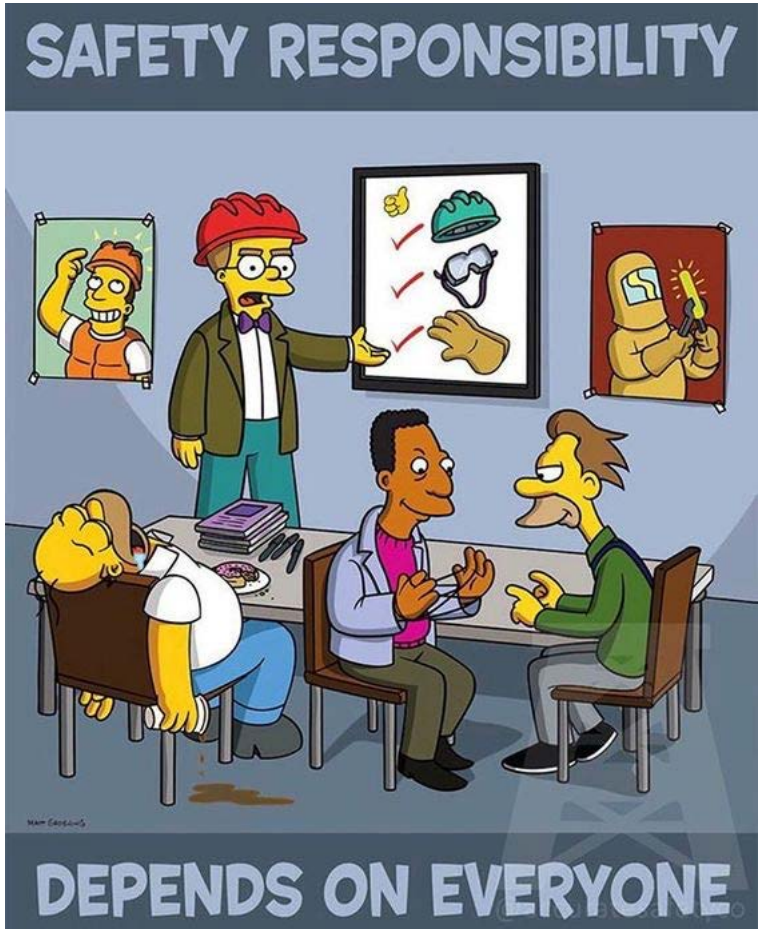
Biosafety and Biosecurity

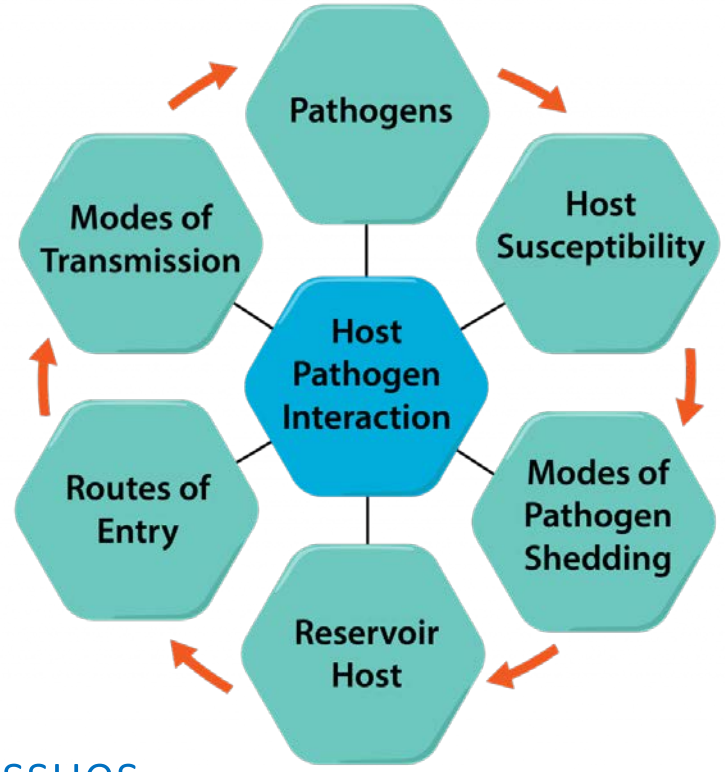
What is biosafety?

1. Identify the possible hazards of the pathogen
2. Quantify the risks of the procedures
3. Implement control measures to protect human health and environment.



Pathogens and Pathogenicity

- **What are pathogens?**
  - Infectious organism
  - capability of causing disease



- **What is pathogenicity?**
  - Case fatality rates
  - Ability of the organism to invade the tissues of the host

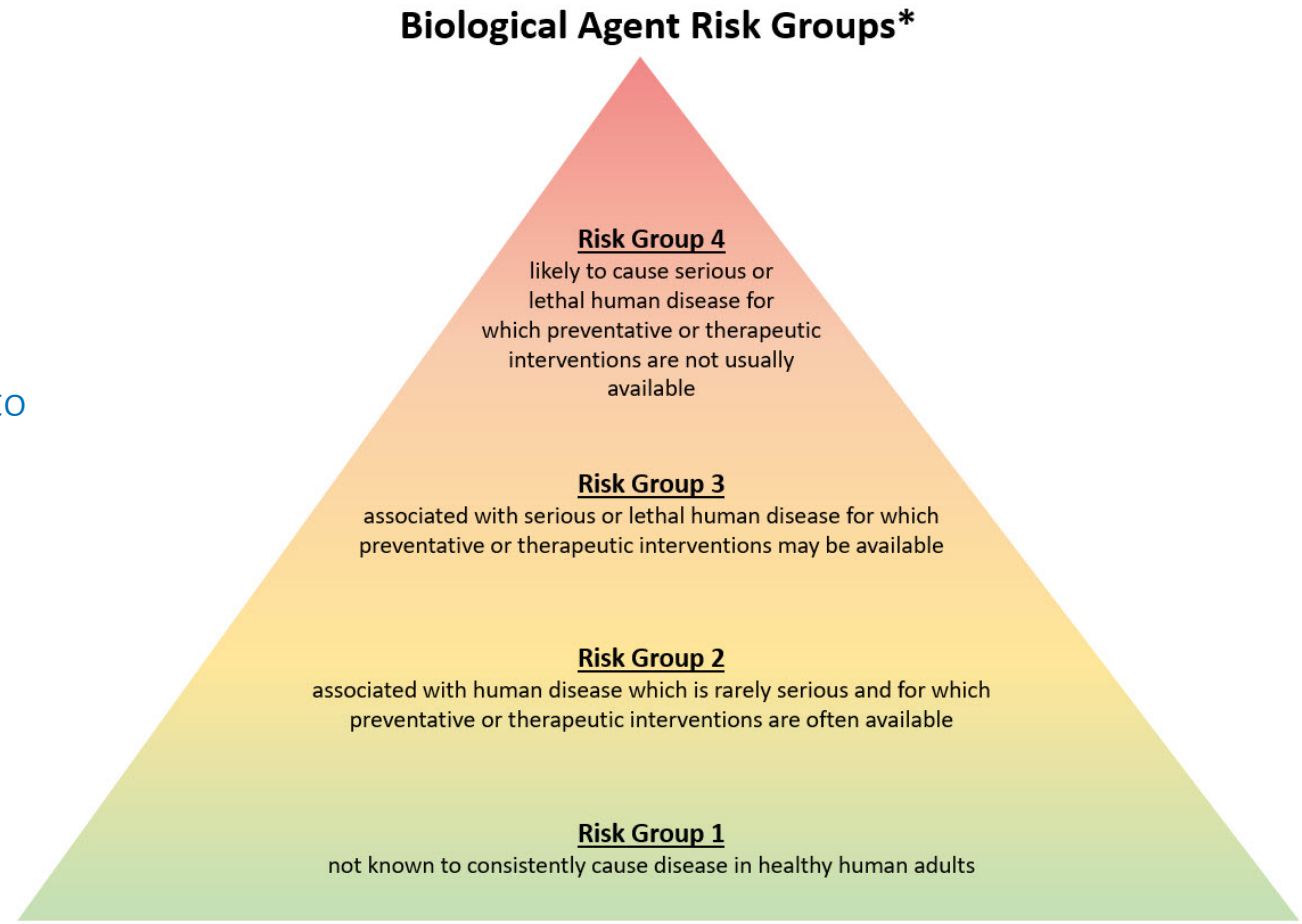
Pathogen Risk Groups – how dangerous is it?

- **Risk group 1**
  - Unlikely to cause human disease

- **Risk group 2**
  - Human disease and might be a hazard to workers;
  - Unlikely to spread to the community;
  - Effective prophylaxis or treatment available

- **Risk group 3**
  - Severe human disease and present a serious hazard to workers;
  - Risk of spreading to the community,
  - Usually effective prophylaxis or treatment available

- **Risk group 4**
  - Severe human disease and is a serious hazard to workers;
  - High risk of spreading to the community;
  - No effective prophylaxis or treatment available



The Risk-based concept: RG and BSL

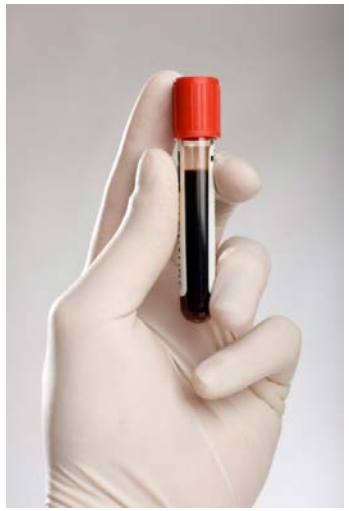
The big misunderstanding

Risk groups ≠ **Biosafety level**

Main objective of the LBM revision

Decoupling Risk groups and Biosafety levels

The Risk-based approach to biosafety



+

Pathogen (Hazard) → **Risk** ← **Process**

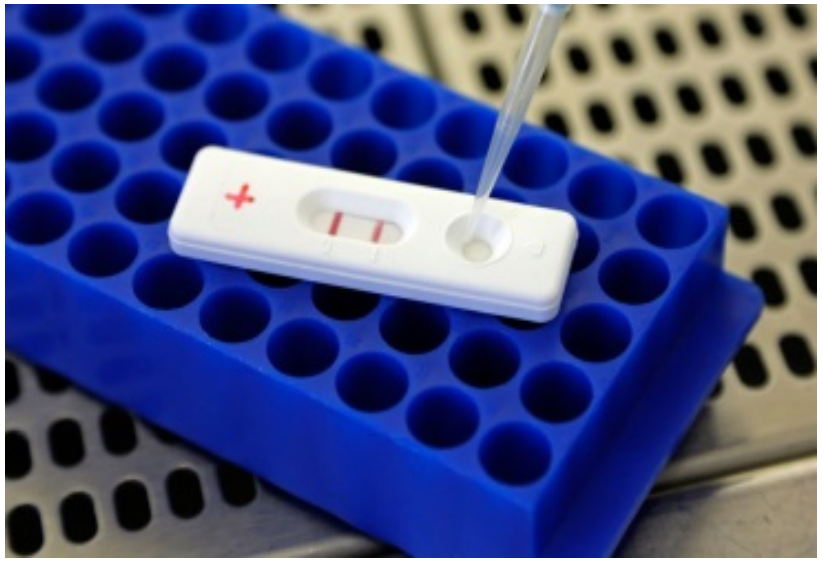
[Likelihood + severity of harm]

MORU Tropical Health Network

Laboratory Biosafety Manual Revision

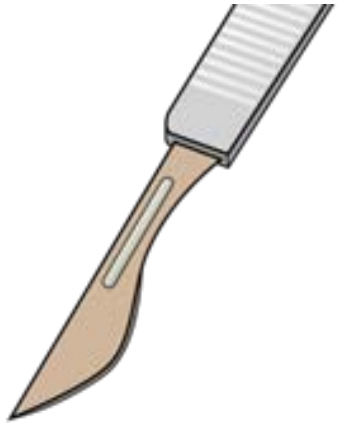
Procedures with low likelihood of exposure

- Use of agar plates (e.g. streaking, spreading)
- Serial dilution
- Preparing/staining slides
- Nucleic acid extraction
- Inactivation
- Use of autoanalysers
- ELISA
- PCR
- Rapid diagnostic tests



Procedures with high likelihood of exposure

- Producing and using large volumes and high titres
- Procedures that might have the potential to generate aerosols
  - sonication,
  - deliberate generation of aerosols
- Infecting animals
- Using sharps
- Necropsy where infection is suspected
- Increasing virulence of organism



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Laboratory Biosafety Manual Revision

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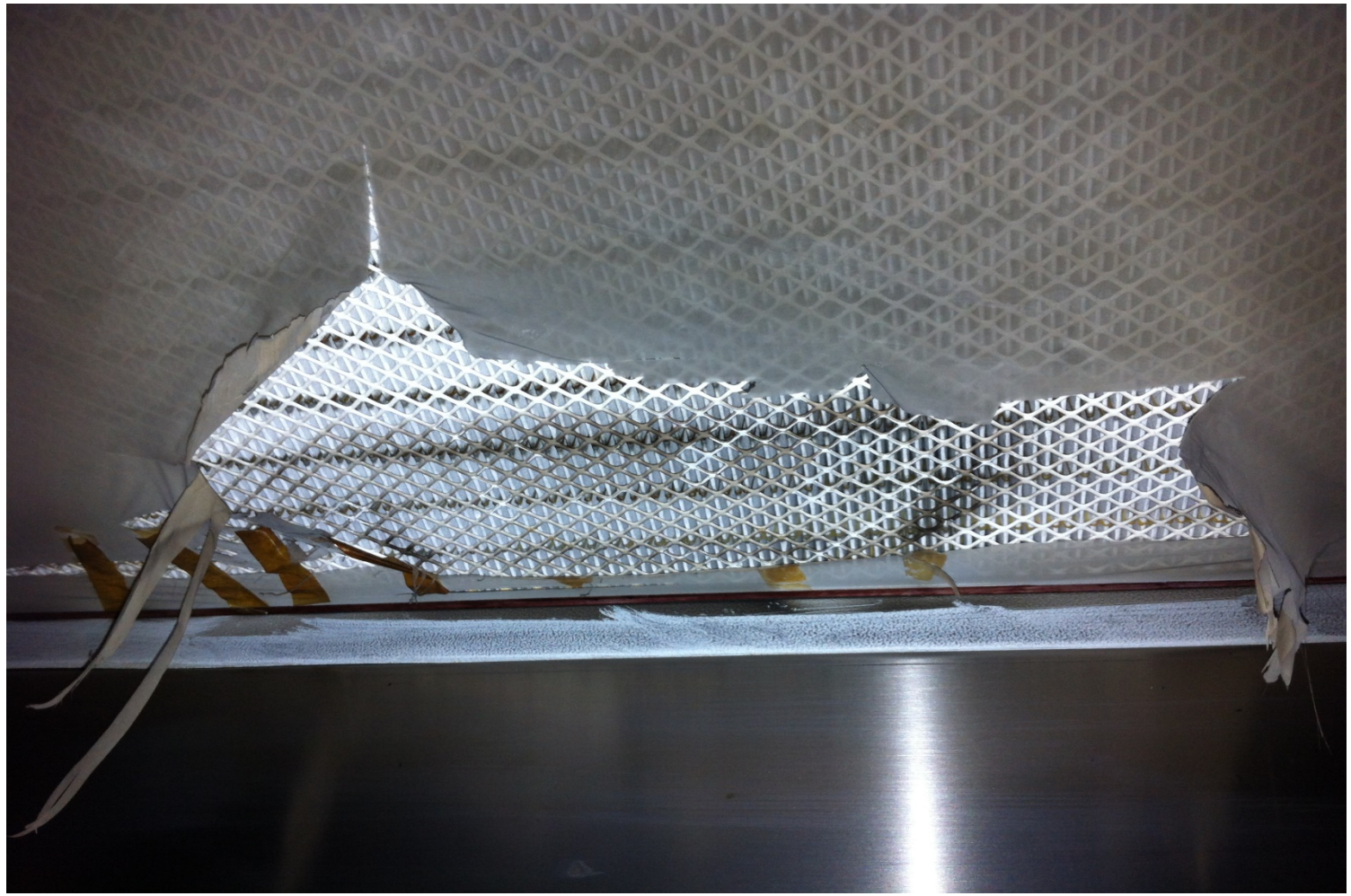

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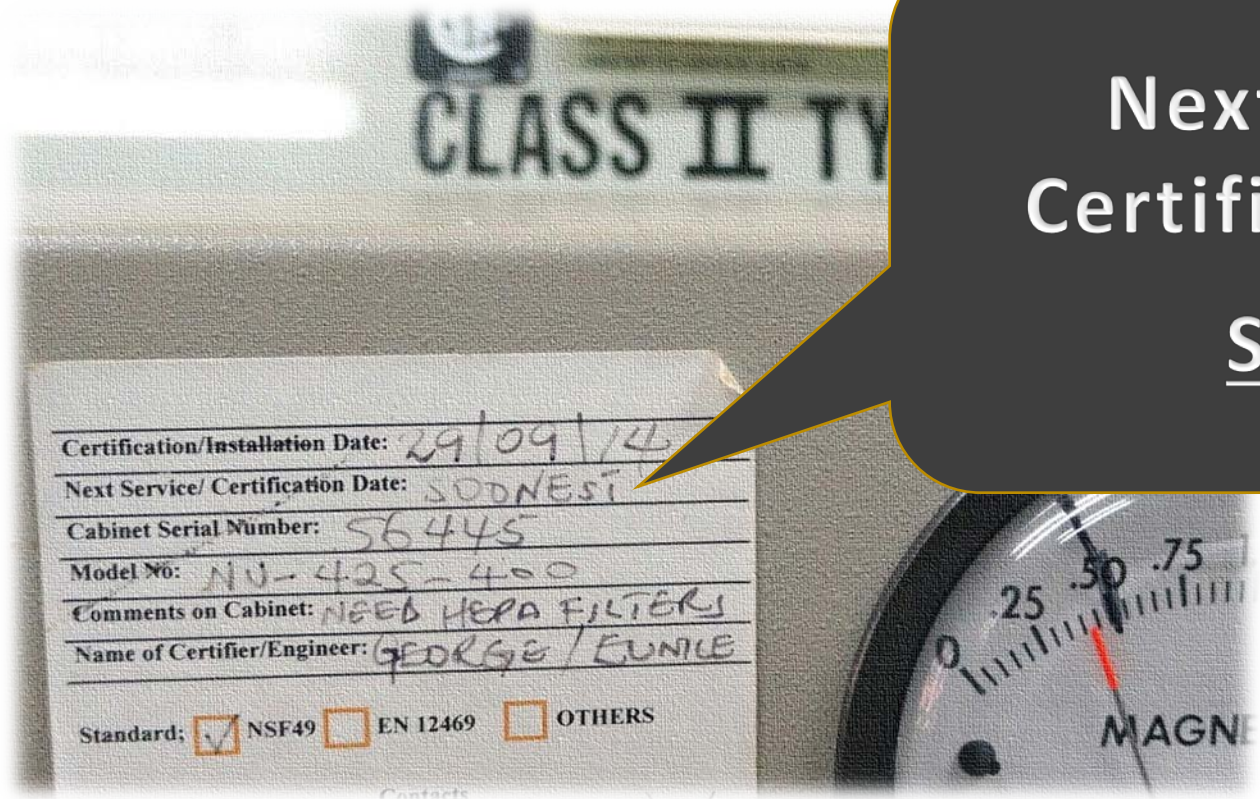

Next Service / Certification date:

Soonest

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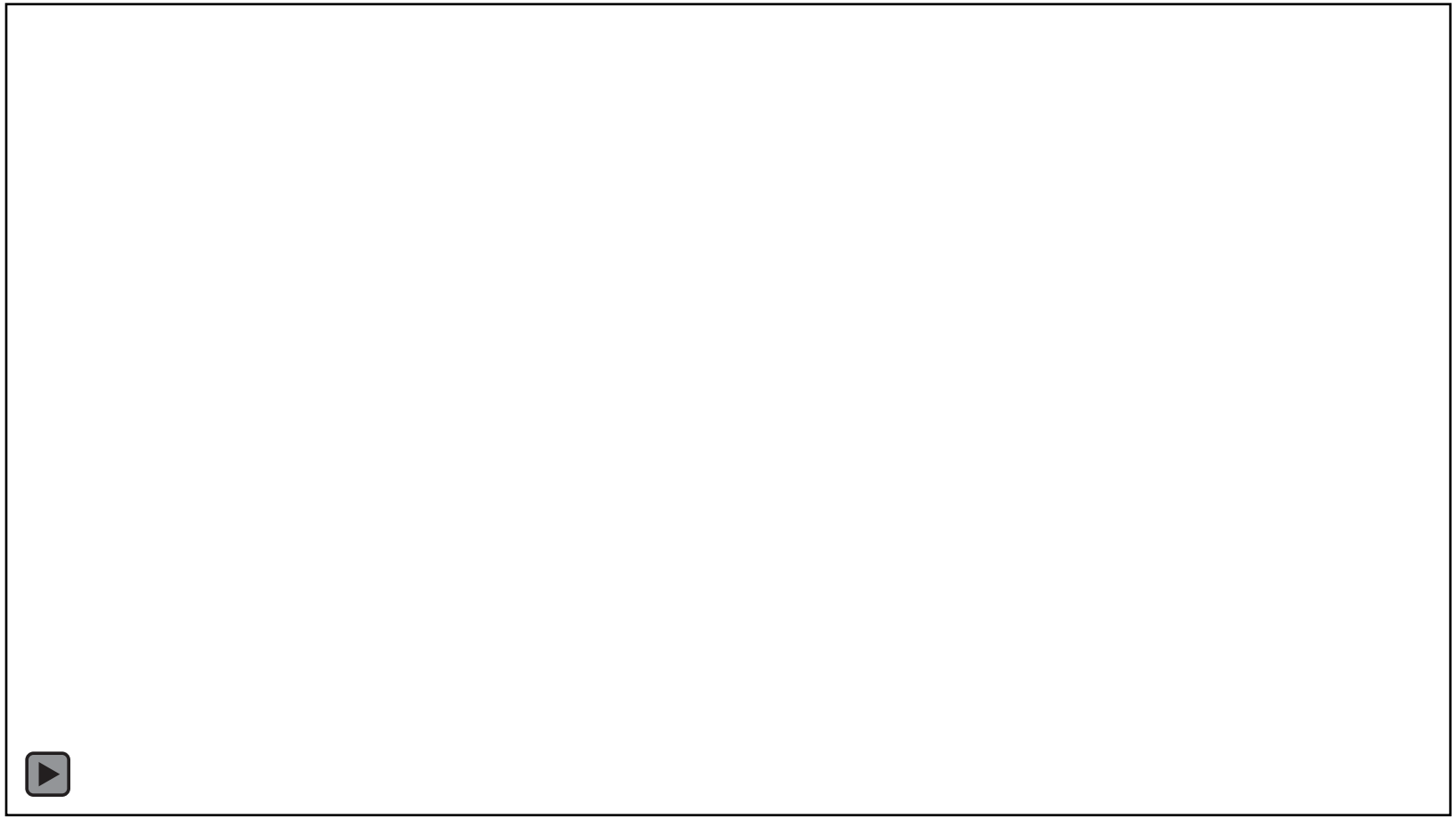
Lab Wars (1).mp4

Surface decontamination



Disinfection

World Health Organization unicef

Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19

Interim guidance

29 July 2020

Cleaning agents and disinfectants

Many disinfectants are active against enveloped viruses, such as SARS-CoV-2, including commonly-used hospital disinfectants. Currently, WHO recommends using:

• 70% ethyl alcohol to disinfect small surface areas and equipment between uses, such as reusable dedicated equipment (for example, thermometers, Goggles etc);

• sodium hypochlorite at 0.1% (1000 ppm) for disinfecting surfaces and 0.5% (5000 ppm) for disinfection of blood or bodily fluids spills in health-care facilities.

Notes: Ensure the following is included on the disinfectant

1. Date of preparation
2. Date of expiry
3. Name who prepared

https://www.nea.gov.sg/our-services/public-cleanliness/environmental-cleaning-guidelines/guidelines-for-environmental-cleaning-and-disinfection

https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125

Disinfection (Contd)

World Health Organization

unicef

Water, sanitation, hygiene, and waste management for SARS-CoV-2, the virus that causes COVID-19

Interim guidance

29 July 2020

Cleaning agents and disinfectants

i. Infectious waste produced during patient care, including those with confirmed COVID-19 infection (e.g. sharps, bandages, pathological waste) and should be collected safely in clearly marked lined containers and sharp boxes.
ii. This waste should be treated, preferably on-site, and then safely disposed.
iii. Preferred treatment options are high temperature, dual chamber incineration or autoclaving.
iv. If waste is moved off-site, it is critical to understand where and how it will be treated and disposed.

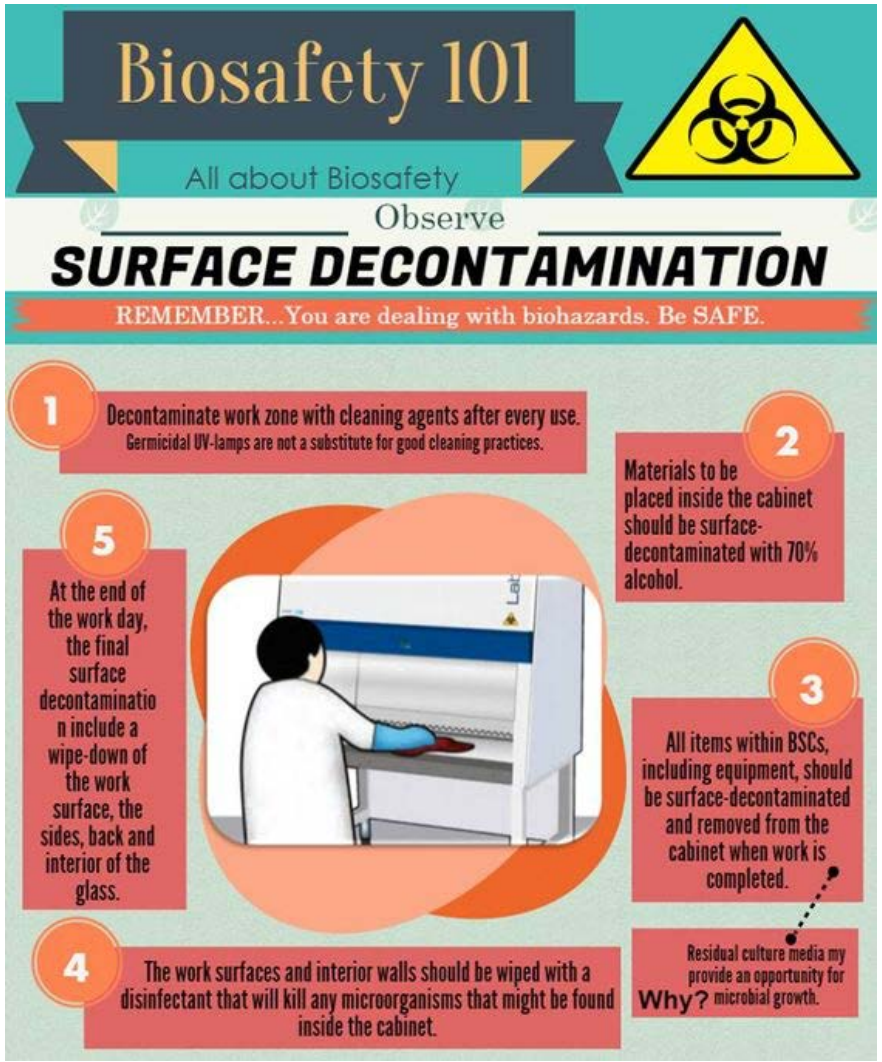
Notes: Ensure the following is included on the disinfectant

1. Date of preparation
2. Date of expiry
3. Name who prepared

https://www.nea.gov.sg/our-services/public-cleanliness/environmental-cleaning-guidelines/guidelines-for-environmental-cleaning-and-disinfection

https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125

Biosafety Basics - Disinfectants



Disinfectant Property Table

Type	Properties	Limitations
Activated Hydrogen Peroxide	• Broad effectiveness • Non-corrosive • Lower contact time • No scent or residue • Non-toxic and non-staining • Longer shelf life	• Generally not active against bacterial spores • Combined products including acid to inactivate bacterial spores require special PPE
Alcohols	• Inexpensive • No residue • No odor	• Varied activity • Sufficient contact time can be challenging • Flammable • NOT appropriate for use with human material
Aldehydes	• Non-corrosive • Broad effectiveness • Bacterial sporicidal at extended contact time	• Limited shelf-life once diluted • May require special PPE
Chlorine (bleach)	• Broad effectiveness • Effective against bacterial spores at higher contact time • Cheap • Little residue • Readily available	• Corrosive • May be inactivated by organic matter • Longer contact time • Limited shelf life once diluted unless ready-to-use product with stabilizers
Iodophors	• Broad effectiveness • Long shelf life	• Inactivated by organic matter • Poor residual activity • Concentration must be 1-3% for efficacy • May stain surfaces
Quaternary ammonium compounds (quats)	• Non-corrosive • Slight residue • Some scent • Lower contact time • Longer shelf life	• Varied activity • Not active against bacterial spores • Can be inactivated by organic matter
Phenolics	• Non-corrosive • Not easily inactivated by organic matter	• May require PPE due to toxicity • Unpleasant smell • Residue

Biosafety Basics -

Disinfectants

Table 12.2

Microbial Resistance and Approaches to Treatment

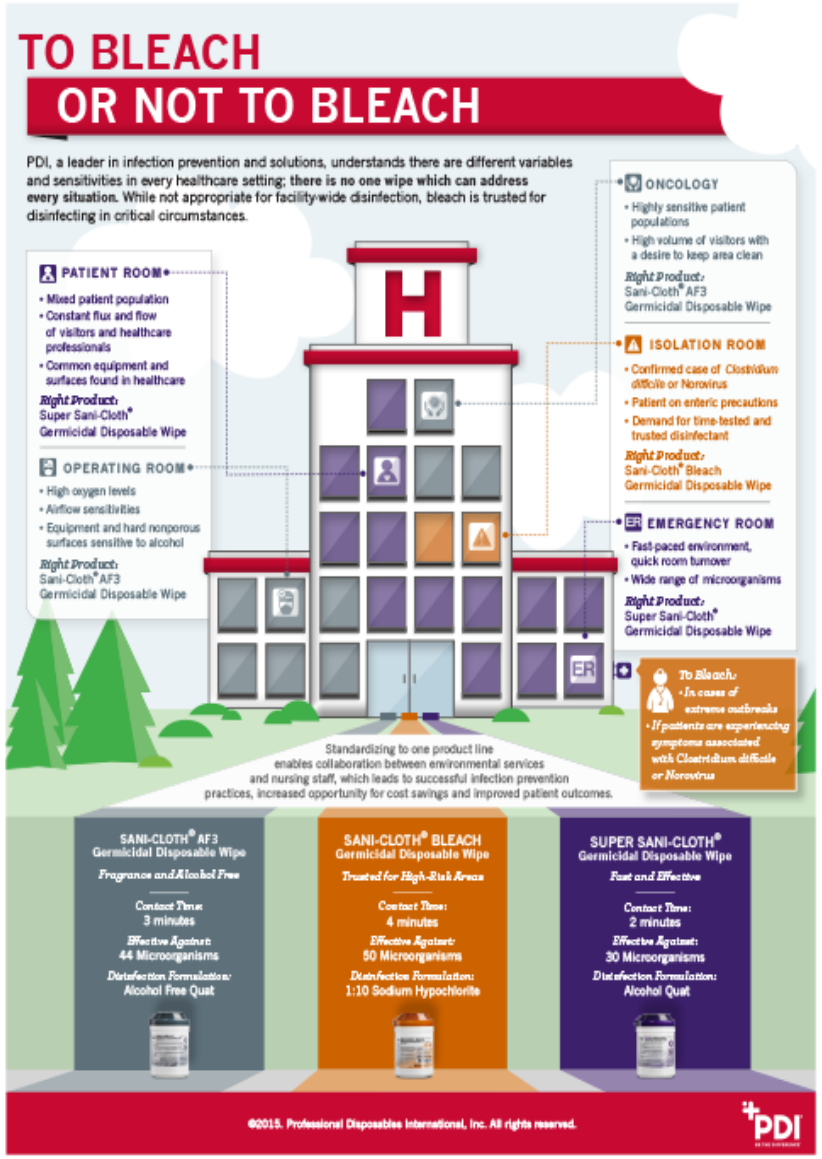
	Microbial Group Examples	Susceptibility to Chemical Germicides	Treatment Required	Recommended Germicides
Least Resistant	Mycoplasma: *Ureaplasma, Mycoplasma*	Highly susceptible	Low or intermediate disinfection	Alcohols, aldehydes, biguanides, halogens, ozone, peroxide, phenols, QACs
	Gram-negative bacteria: *Pseudomonas, Escherichia*	Susceptible	Intermediate disinfection	Alcohols, aldehydes, biguanides, halogens, ozone, peroxide, some phenols, some QACs
	Gram-positive bacteria: MRSA, MSSA, streptococci, enterococci, *Legionella*			
	Enveloped viruses: HIV, HBV, HSV Adenovirus, rotavirus, influenza			
	Vegetative fungi: *Aspergillus, Candida*	Susceptible	Intermediate disinfection	Alcohols, aldehydes, biguanides, halogens, ozone, peroxide, some phenols, some QACs
	Fungal spores: *Aspergillus, Penicillium*	Susceptible to resistant	High-level disinfection	Some alcohols, aldehydes, biguanides, halogens, peroxide, some phenols
	Nonenveloped viruses: Parvovirus, HPV, Norovirus	Resistant to highly resistant	High-level disinfection	Aldehydes, halogens, ozone, peroxides
	Mycobacteria: MTB, *M. chelonae*			Aldehydes, halogens, some peroxides, some phenols
	Bacterial spores: *Bacillus, Clostridium*	Highly resistant	High-level disinfection; sterilization	Aldehydes, high-concentration halogens, peroxides (prolonged exposure time)
Most resistant	Prions: Scrapie, JCD	Extremely resistant	Special sterilization techniques	High-concentration sodium hypochlorite and/or heated sodium hydroxide

QACs, quaternary ammonium compounds; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*; HBV, hepatitis B virus; HSV, herpes simplex virus; HPV, human papillomavirus; MTB, mycobacteria tuberculosis; JCD, Jakob-Creutzfeld disease.

Adapted from McDonnell G, Burke P. Disinfection: is it time to reconsider Spaulding? *J Hosp Infect* 2011;78:163–170; McDonnell GE. *Antisepsis, disinfection and sterilization. Types, action and resistance*. Washington, DC: ASM Press, 2007; Fanning S. Altered tolerance to biocides: links to antibiotic resistance? Paper presented at: International Association of Food Protection (IAFP), European Symposium on Food Safety; 2011; The Netherlands. http://www.foodprotection.org/events/european-symposia/11Ede/Fanning.pdf. Accessed November 15, 2012; Rutala W, Weber D. Guideline for disinfection and sterilization of prion contaminated medical instruments. SHEA guidelines. *Infect Control Hosp Epidemiol* 2010;31:107–117.

Disinfectants – Compatibility -

Bleach



Clorox Healthcare® Disinfectant Materials Compatibility

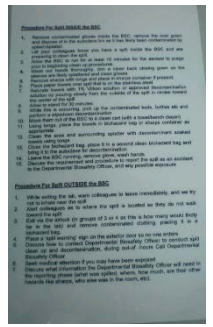
Johnston FOOD SERVICE & CLEANING SOLUTIONS

	Surface	Examples	 Clorox Healthcare® Bleach Germicidal Wipes	 Clorox Healthcare® Fuzion™ Cleaner Disinfectant	 Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	 Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant Wipes	 Clorox Healthcare® Multi-Surface Quat Alcohol Cleaner Disinfectant Wipes
Polymers	Acrylics (PMMA)	Phone displays, incubators, X-ray protective shields, isolettes	★★★	★★★	★★★	★★★	★★★
	ABS	Keyboards, pumps, medical devices for blood access, enclosures for electrical and electronic assemblies	★★★	★★★	★★★	★★★	★★★
	High-Density Polyethylene (HDPE)	Packaging, trays, bottles, and other industrial plastic products	★★★	★★★	★★★	★★★	★★★
	Marlite®	Wall panels	★★★	★★	★★	★	★★
	Polypropylene (PP)	Hard molded plastic used for bottles, trays, device exteriors	★★★	★★★	★★★	★★★	★★★
	Polyurethane (PU)	Upholstery, lights, tubing, mattress covers	★	★	★	★	★
	Polyvinylchloride (PVC)	Furniture, mattress covers, tubing, floors	★★★	★★★	★★★	★★★	★★★
	Tritan™ Copolyester	Clear polymer device components	★★★	★★★	★★★	★★★	★★★
	Vinyl	Floors, furniture	★★★	★★★	★★★	★	★★★
Glass	Etched Glass	Wall panels, bathroom/shower enclosures	★★★	★★★	★★★	★★★	★★★
	Glass	X-ray shields, glass partitions	★★★	★★★	★★★	★★★	★★★
	Sapphire Glass	Device screens, protective covers	★★★	★★★	★★★	★★★	★★★

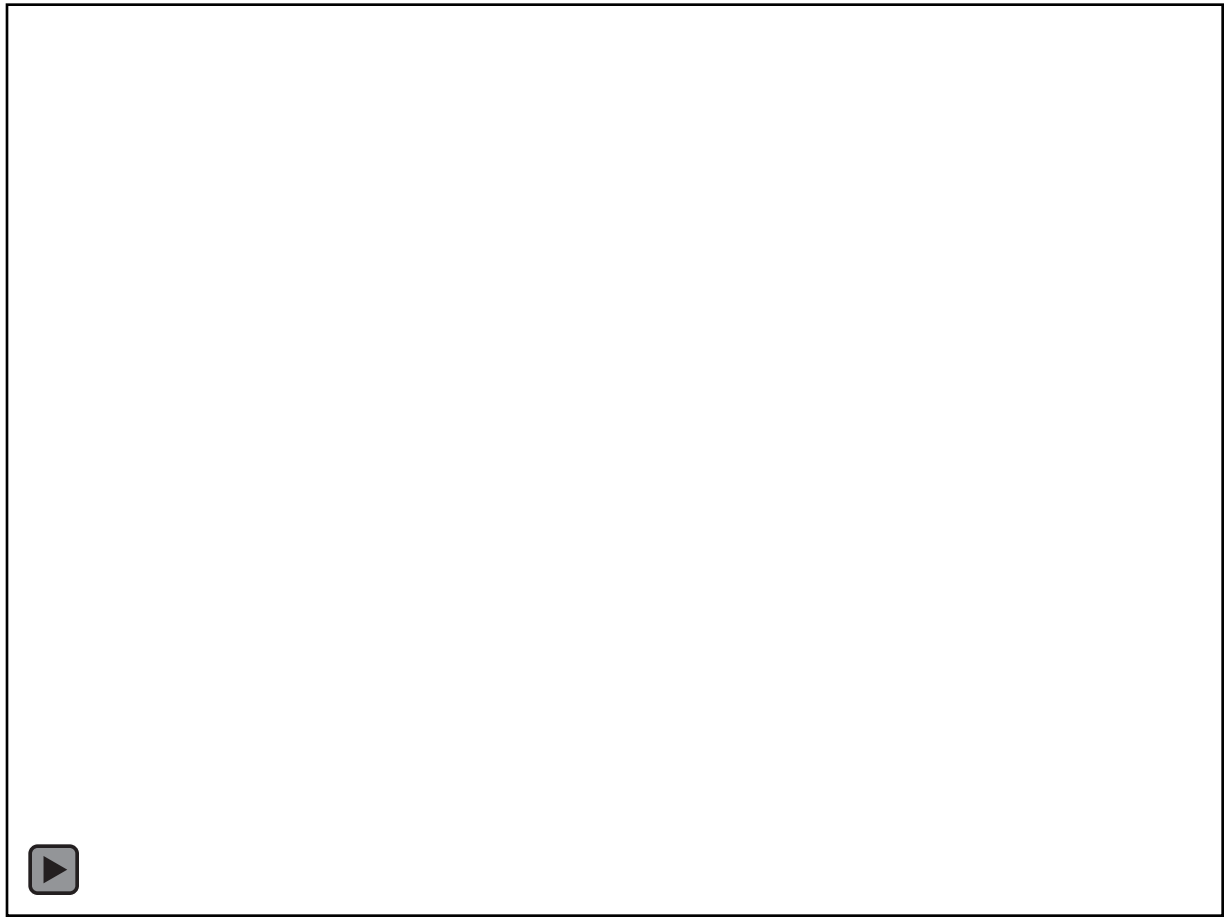
Updated June 2017

Emergency preparedness

- Preparing for emergencies is part of good laboratory management plan
  - Infectious spills
  - Chemical spills
  - Fire



Spills cleanup



Fire safety equipment

- Check fire extinguishers and fire alarms regularly

- Practice the use of fire extinguishing equipment

Chemical spill kit

- Commercial or home-made
- Should contain the following
  - Pads or tissue to absorb chemical
  - Vermiculite
  - Dams
  - Brush and Pan
  - Chemical resistant bags

First Aid Kit

Sharps


DO NOT PUT LOOSE SHARPS IN THE TRASH
7 BILLION
SHARPS ARE DISCARDED IN THE TRASH EVERY YEAR.
Up to 850,000 people are injured every year by sharps that are not discarded properly.
Used sharps can cut people, infect them and spread disease.
WARNING
Needle stick injury can expose you to infectious diseases such as Hepatitis and HIV.
TO AVOID INJURY...
Do not force sharps into container
Do not put fingers inside container
Do not remove needle
Do not bend or break needle
Do not recap needle
Kwikpoint
FDA
BE SMART WITH SHARPS
USE A SHARPS CONTAINER
These are sharps
Syringes
Needle connectors
Lancets
Needles
Auto injectors
Infusion sets
KEEP YOUR COMMUNITY SAFE
DO NOT throw loose sharps in trash
DO NOT put sharps in recycling
DO NOT flush sharps down toilet
KEEP OUT of reach of children
GET A SHARPS CONTAINER
FREE sharps containers may be available from your doctor, hospital, health insurance or medication supplier.
You can also buy a sharps container from your pharmacist or online.
Portable travel containers
Sharps container with vertical drop slot
Sharps container with horizontal drop slot
In some areas it is illegal to dispose of sharps in the trash.
Please follow your community guidelines.
Report problems associated with sharps and sharps disposal containers to the FDA (800-FDA-1088).
FDA
For information about rules and laws in your community, contact the Coalition for Safe Community Needle Disposal at 800.643.1643.
For more information on sharps visit fda.gov/safesharpsdisposal.

Sharps


Use a Sharps Container
1 Visually check sharps container for hazards before handling. Read all labels.
MAKE SURE container is not overfilled or damaged.
CHECK that container is large enough to fit your sharp.
FULL
BIOHAZARD
2 Put sharp in container immediately after use.
Keep your hands behind the sharp tip.
Discard a Sharps Container
Stop using sharps container when 2/3 full or filled to FULL line.
1 Close sharps container as instructed on label.
Different containers have different closures.
2 Bring sharps container to a sharps disposal program.
Find a program through your local waste or public health department, your doctor, veterinarian, hospital or pharmacist.
TYPES OF SHARPS DISPOSAL PROGRAMS:
Mail-back program
Drop box or supervised collection site
Special waste pick-up service
At-home needle destruction device
Syringe exchange program (SEP)
Hazardous waste collection site
For information about rules and laws in your community, contact the Coalition for Safe Community Needle Disposal at 800.643.1643. For more information on sharps visit fda.gov/safesharpsdisposal or safeneedledisposal.org
If You Cannot Get a Sharps Container...
FDA RECOMMENDS ALWAYS USING FDA-CLEARED CONTAINERS
If you do not have a sharps container, use an empty household container with these features:
Stays upright
Tight-fitting lid that cannot be punctured
Made of heavy-duty plastic
Does not leak
DO NOT USE
These containers can break or puncture easily.
Milk container
Soda can
Glass container
Water bottle
Dispose of a household sharps container when it is 2/3 full:
1 Close lid and tape shut. Label container.
Sharps Biohazard
2 Bring container to a sharps disposal program.
If you cannot find a disposal program, put container in center of full trash bag and discard in regular trash.*
DO NOT put sharps containers in RECYCLING!
*In some areas it is illegal to dispose of sharps in the trash. Please follow your community guidelines.

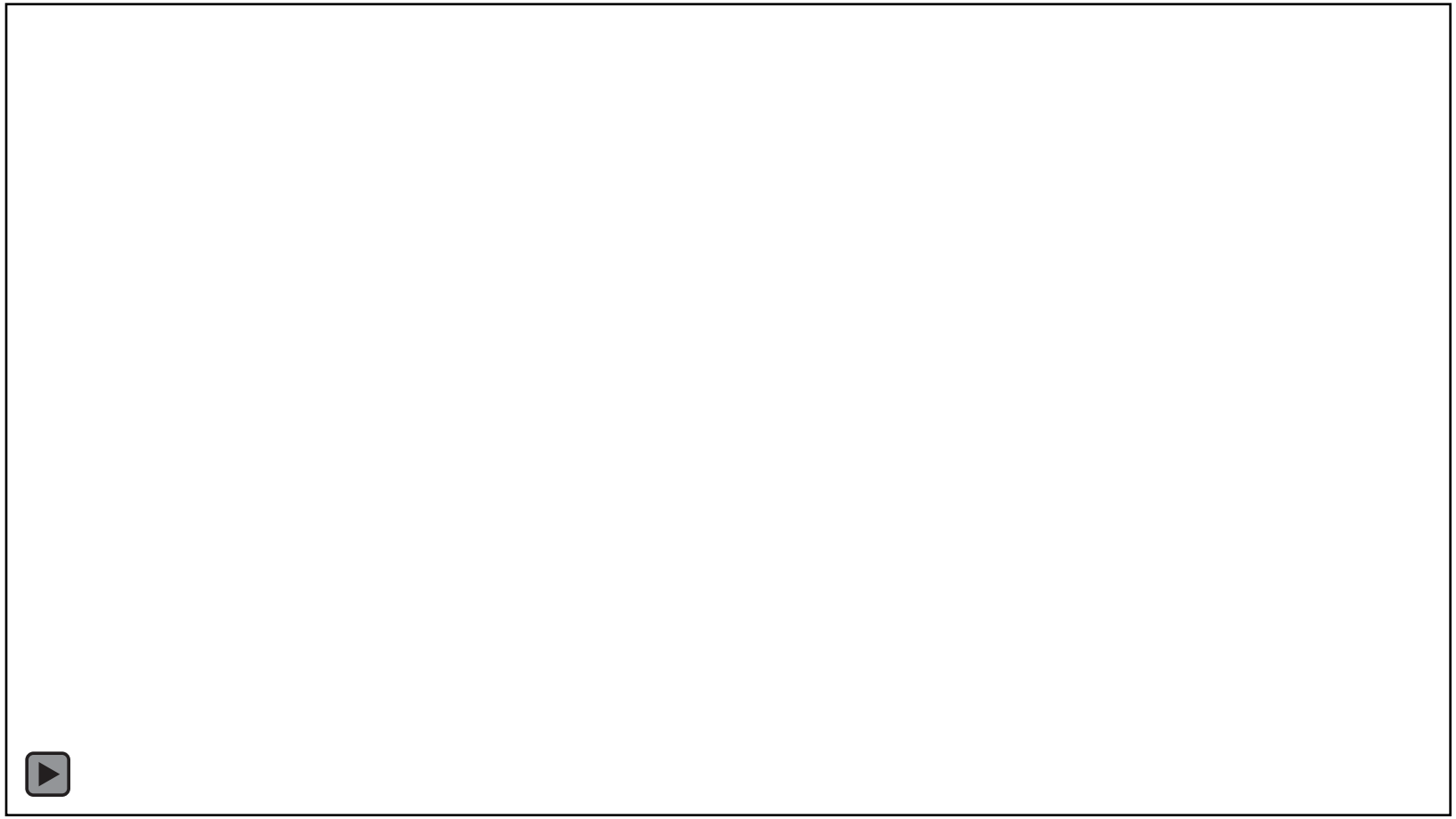
Biosafety Basics - Gaseous Decontamination

- Inherently risky procedure
- Only performed if risk assessment indicates
- Formaldehyde vs VHP
  - Formalin (38%) is widely available in pharmacies and cheap (500 ml=60 Baht)
  - VHP infrastructure is expensive
- Problems
  - Lack of training leads to accidents
  - Lack of PPE and Formaldehyde monitoring
  - Low usage of Biological Indicators

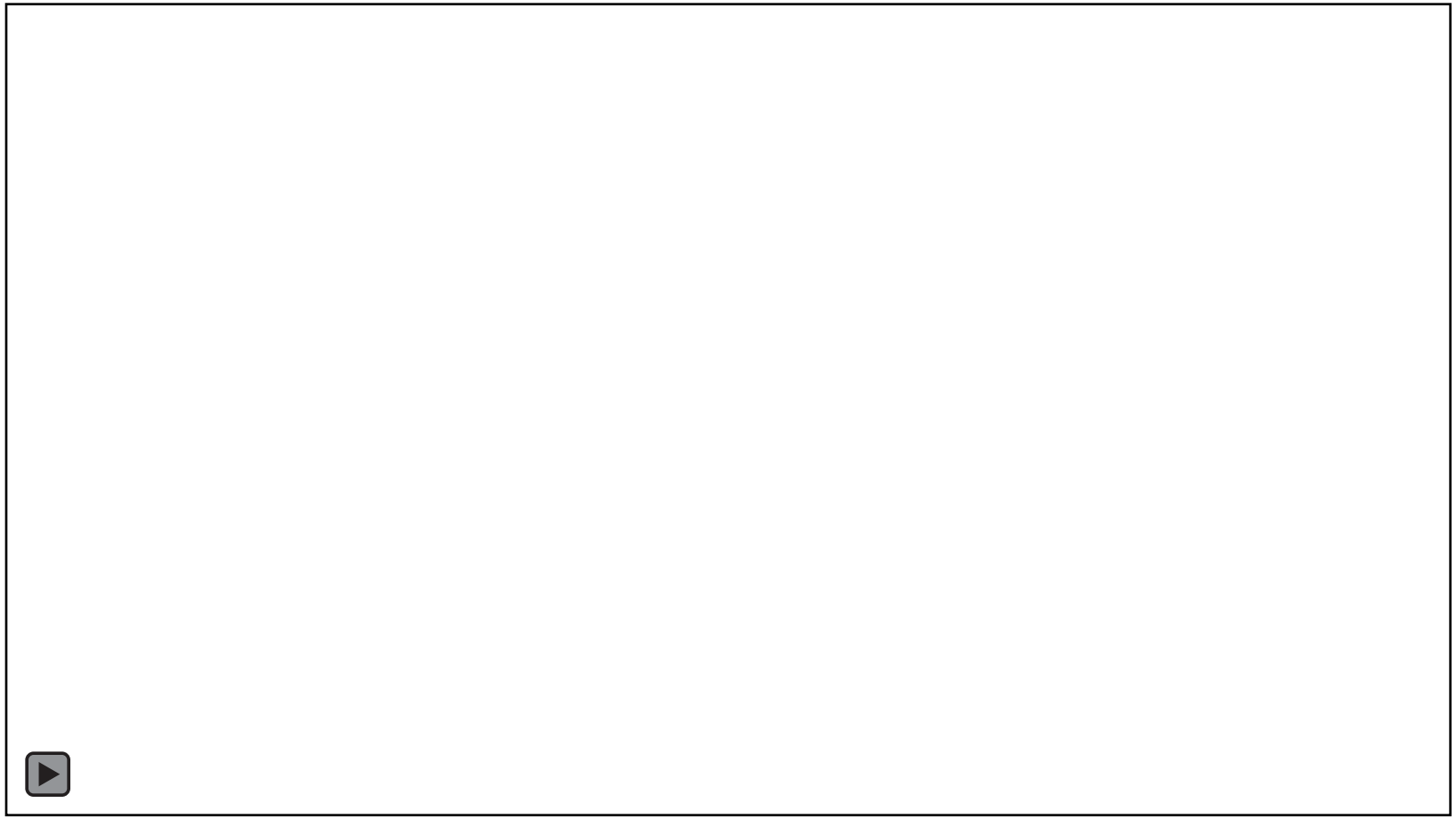
Don’t take it home!

Handwashing!

Transport



Workflow



THANK YOU