

# 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.





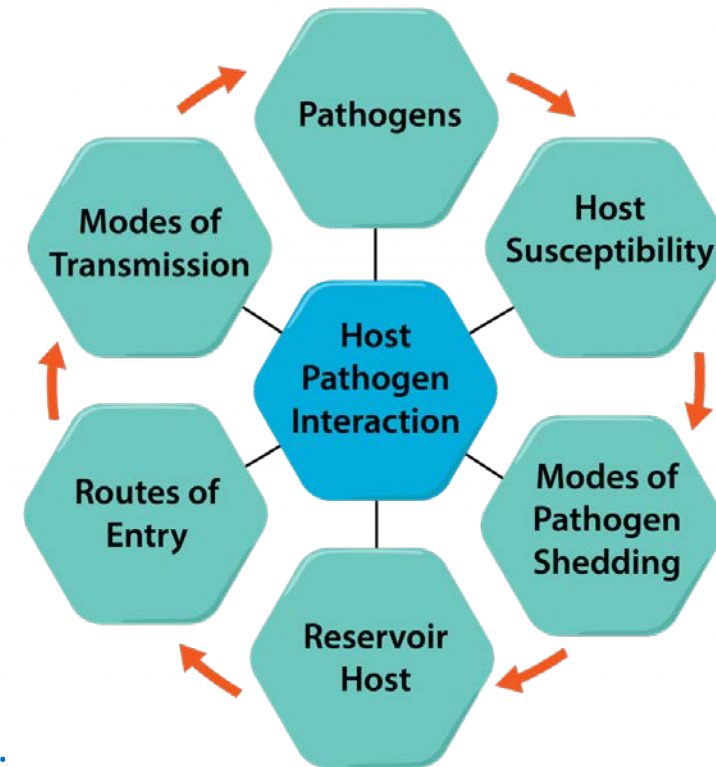
# Pathogens and Pathogenicity

- 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**

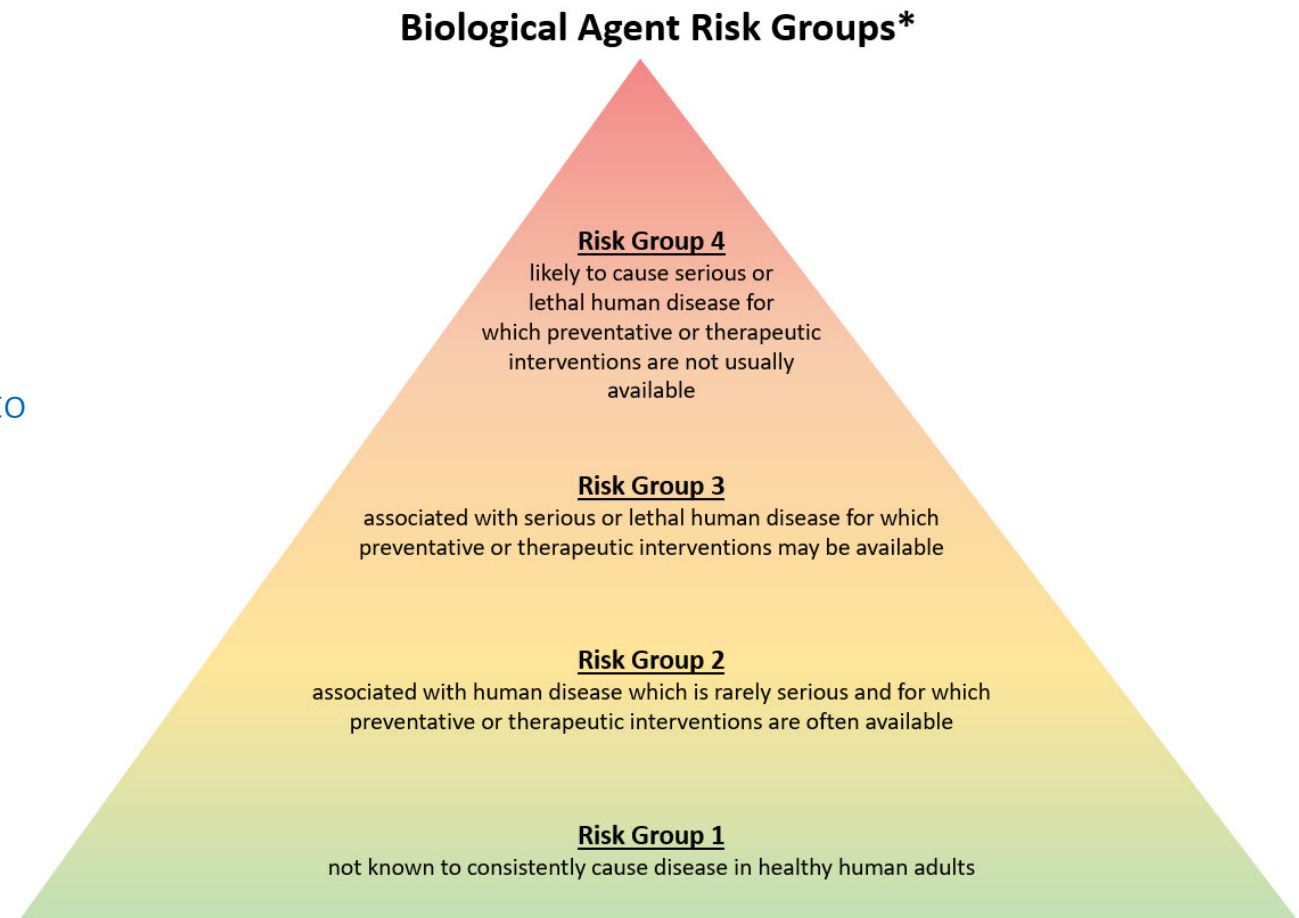
- Human disease and might be a hazard to workers;
- Unlikely to spread to the community;
- Effective prophylaxis or treatment available

- **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



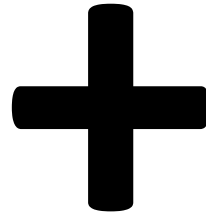
Biosafety level

Main objective of the LBM revision

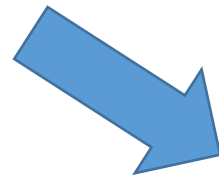
## Decoupling Risk groups and Biosafety levels



# The Risk-based approach to biosafety



**Pathogen  
(Hazard)**



**Risk**

**Process**

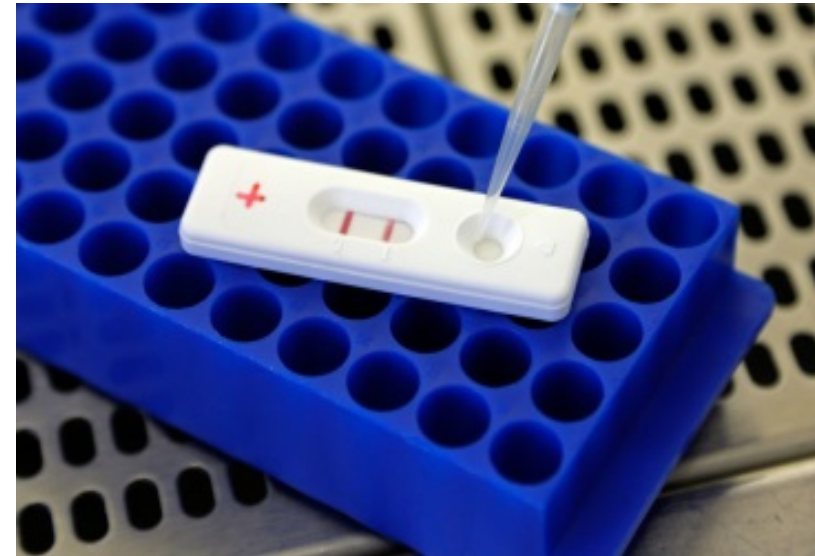


[Likelihood + severity of harm]



# 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











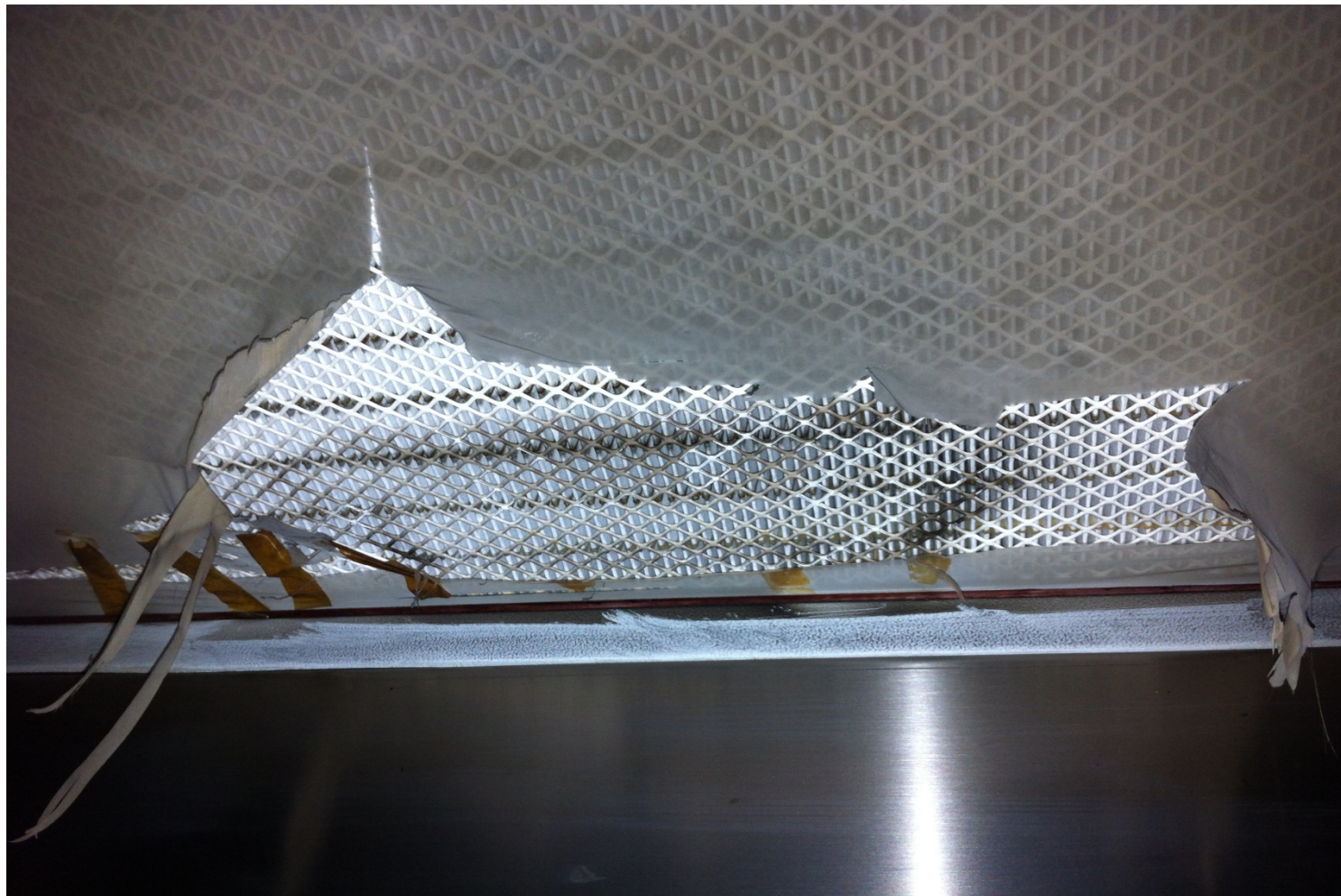
















CLASS II TYPE

Certification/Installation Date:	29/09/14
Next Service/ Certification Date:	SOONEST
Cabinet Serial Number:	56445
Model No:	NV-425-400
Comments on Cabinet:	NEED HEPA FILTERS
Name of Certifier/Engineer:	GEORGE/EUNICE
Standard:	<input checked="" type="checkbox"/> NSF49 <input type="checkbox"/> EN 12469 <input type="checkbox"/> OTHERS

Contacts

MAGNE

Next Service /  
Certification date:  
Soonest



# Lab Wars (1).mp4





# Surface decontamination





# Disinfection

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.

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

Notes: Ensure the following is included on the disinfectant

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



# Disinfection (Contd)

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



# Biosafety Basics - Disinfectants

## Biosafety 101

All about Biosafety

Observe

### SURFACE DECONTAMINATION

REMEMBER...You are dealing with biohazards. Be SAFE.

**1** Decontaminate work zone with cleaning agents after every use. Germicidal UV-lamps are not a substitute for good cleaning practices.

**2** Materials to be placed inside the cabinet should be surface-decontaminated with 70% alcohol.

**5** At the end of the work day, the final surface decontamination include a wipe-down of the work surface, the sides, back and interior of the glass.

**3** All items within BSCs, including equipment, should be surface-decontaminated and removed from the cabinet when work is completed.

**4** The work surfaces and interior walls should be wiped with a disinfectant that will kill any microorganisms that might be found inside the cabinet.

Residual culture media may provide an opportunity for microbial growth.  
**Why?**

Disinfectant Property Table		
Type	Properties	Limitations
Activated Hydrogen Peroxide	<ul style="list-style-type: none"> <li>Broad effectiveness</li> <li>Non-corrosive</li> <li>Lower contact time</li> <li>No scent or residue</li> <li>Non-toxic and non-staining</li> <li>Longer shelf life</li> </ul>	<ul style="list-style-type: none"> <li>Generally not active against bacterial spores</li> <li>Combined products including acid to inactivate bacterial spores require special PPE</li> </ul>
Alcohols	<ul style="list-style-type: none"> <li>Inexpensive</li> <li>No residue</li> <li>No odor</li> </ul>	<ul style="list-style-type: none"> <li>Varied activity</li> <li>Sufficient contact time can be challenging</li> <li>Flammable</li> <li><b>NOT</b> appropriate for use with human material</li> </ul>
Aldehydes	<ul style="list-style-type: none"> <li>Non-corrosive</li> <li>Broad effectiveness</li> <li>Bacterial sporicidal at extended contact time</li> </ul>	<ul style="list-style-type: none"> <li>Limited shelf-life once diluted</li> <li>May require special PPE</li> </ul>
Chlorine (bleach)	<ul style="list-style-type: none"> <li>Broad effectiveness</li> <li>Effective against bacterial spores at higher contact time</li> <li>Cheap</li> <li>Little residue</li> <li>Readily available</li> </ul>	<ul style="list-style-type: none"> <li>Corrosive</li> <li>May be inactivated by organic matter</li> <li>Longer contact time</li> <li>Limited shelf life once diluted unless ready-to-use product with stabilizers</li> </ul>
Iodophors	<ul style="list-style-type: none"> <li>Broad effectiveness</li> <li>Long shelf life</li> </ul>	<ul style="list-style-type: none"> <li>Inactivated by organic matter</li> <li>Poor residual activity</li> <li>Concentration must be 1-3% for efficacy</li> <li>May stain surfaces</li> </ul>
Quaternary ammonium compounds (quats)	<ul style="list-style-type: none"> <li>Non-corrosive</li> <li>Slight residue</li> <li>Some scent</li> <li>Lower contact time</li> <li>Longer shelf life</li> </ul>	<ul style="list-style-type: none"> <li>Varied activity</li> <li>Not active against bacterial spores</li> <li>Can be inactivated by organic matter</li> </ul>
Phenolics	<ul style="list-style-type: none"> <li>Non-corrosive</li> <li>Not easily inactivated by organic matter</li> </ul>	<ul style="list-style-type: none"> <li>May require PPE due to toxicity</li> <li>Unpleasant smell</li> <li>Residue</li> </ul>



# Biosafety Basics - Disinfectants

## SURFACE DISINFECTION: What's hiding in the fine print?

### QUATS



EFFICACY	
FAST	NO 10 MINUTE DISINFECTION TIMES
NO	Can bind to fabrics and not impact the surface
SAFETY	
NO	May cause serious eye damage, eye irritation
NO	May cause an allergic skin reaction
NO	Wash hands thoroughly after use
SUSTAINABILITY	
NO	NOT CERTIFIED EPA Design for the Environment
NO	Chemicals persist in the environment

### BLEACH



EFFICACY	
FAST	NO 10 MINUTE DISINFECTION TIMES
LIMITED	shelf life (when diluted)
NO	May pit surfaces that absorb acids and oxides to further germs
SAFETY	
NO	May cause substantial but temporary eye damage
NO	Avoid prolonged breathing of vapors
NO	Wash hands thoroughly after use
SUSTAINABILITY	
NO	NOT CERTIFIED EPA Design for the Environment
NO	Chemicals persist in the environment

## FORMULATION MATTERS

### Patented Ethyl Alcohol Technology

EFFICACY	
FAST	30 SECOND DISINFECTION TIMES
NO	fabric binding issues
NO	shelf life limits
SAFETY	
NO	precautionary statements
NO	hand washing required after use
NO	rinse required on food contact surfaces
SUSTAINABILITY	
CERTIFIED	EPA Design for the Environment
DOES NOT	persist in the environment



Source:

1. Rutala WB, et al. *Infect Control* 2013;34(5):536-541. PMID:23414000. Published online 2013. DOI:10.1016/j.jinf.2013.05.001.

2. [http://www.epa.gov/p2/p2tools/clean/chem\\_search/p2p/084368-00001-20130301.pdf](http://www.epa.gov/p2/p2tools/clean/chem_search/p2p/084368-00001-20130301.pdf)

VISIT [WWW.PURELLSURFACE.COM](http://WWW.PURELLSURFACE.COM)

**Table 12.2**

## Microbial Resistance and Approaches to Treatment

	Microbial Group Examples	Susceptibility to Chemical Germicides	Treatment Required	Recommended Germicides
<div style="display: flex; align-items: center;"> <div style="width: 10px; height: 100px; background: black; margin-right: 5px;"></div> <div style="writing-mode: vertical-rl; transform: rotate(180deg); font-size: 24px; font-weight: bold;">↓</div> </div>	Mycoplasma: <i>Ureaplasma</i> , <i>Mycoplasma</i>	Highly susceptible	Low or intermediate disinfection	Alcohols, aldehydes, biguanides, halogens, ozone, peroxide, phenols, QACs
	Gram-negative bacteria: <i>Pseudomonas</i> , <i>Escherichia</i>	Susceptible	Intermediate disinfection	Alcohols, aldehydes, biguanides, halogens, ozone, peroxide, some phenols, some QACs
	Gram-positive bacteria: MRSA, MSSA, streptococci, enterococci, <i>Legionella</i>			
	Enveloped viruses: HIV, HBV, HSV, Adenovirus, rotavirus, influenza			
	Vegetative fungi: <i>Aspergillus</i> , <i>Candida</i>	Susceptible	Intermediate disinfection	Alcohols, aldehydes, biguanides, halogens, ozone, peroxide, some phenols, some QACs
	Fungal spores: <i>Aspergillus</i> , <i>Penicillium</i>	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, <i>M. chelonae</i>			Aldehydes, halogens, some peroxides, some phenols
	Bacterial spores: <i>Bacillus</i> , <i>Clostridium</i>	Highly resistant	High-level disinfection; sterilization	Aldehydes, high-concentration halogens, peroxides (prolonged exposure time)
	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-Creutzfeldt 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/11EdeFanning.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

## TO BLEACH OR NOT TO BLEACH

PDI, a leader in infection prevention and solutions, understands there are different variables and sensitivities in every healthcare setting; there is no one wipe which can address every situation. While not appropriate for facility-wide disinfection, bleach is trusted for disinfecting in critical circumstances.

### PATIENT ROOM

- Mixed patient population
- Constant flux and flow of visitors and healthcare professionals
- Common equipment and surfaces found in healthcare

**Right Product:**  
Super Sani-Cloth® Germicidal Disposable Wipe

### ONCOLOGY

- Highly sensitive patient populations
- High volume of visitors with a desire to keep area clean

**Right Product:**  
Sani-Cloth® AF3 Germicidal Disposable Wipe

### ISOLATION ROOM

- Confirmed case of Clostridium difficile or Norovirus
- Patient on enteric precautions
- Demand for time-tested and trusted disinfectant

**Right Product:**  
Sani-Cloth® Bleach Germicidal Disposable Wipe

### OPERATING ROOM

- High oxygen levels
- Airflow sensitivities
- Equipment and hard nonporous surfaces sensitive to alcohol

**Right Product:**  
Sani-Cloth® AF3 Germicidal Disposable Wipe

### EMERGENCY ROOM

- Fast-paced environment, quick room turnover
- Wide range of microorganisms

**Right Product:**  
Super Sani-Cloth® Germicidal Disposable Wipe

**To Bleach:**

- In cases of extreme outbreaks
- If patients are experiencing symptoms associated with Clostridium difficile or Norovirus

Standardizing to one product line enables collaboration between environmental services and nursing staff, which leads to successful infection prevention practices, increased opportunity for cost savings and improved patient outcomes.

**SANI-CLOTH® AF3**  
Germicidal Disposable Wipe  
*Fragrance and Alcohol Free*

Contact Time:  
3 minutes

Effective Against:  
44 Microorganisms

Disinfection Formulation:  
Alcohol Free Quat

**SANI-CLOTH® BLEACH**  
Germicidal Disposable Wipe  
*Trusted for High-Risk Areas*

Contact Time:  
4 minutes

Effective Against:  
80 Microorganisms

Disinfection Formulation:  
1:10 Sodium Hypochlorite

**SUPER SANI-CLOTH®**  
Germicidal Disposable Wipe  
*Fast and Effective*

Contact Time:  
2 minutes

Effective Against:  
80 Microorganisms

Disinfection Formulation:  
Alcohol Quat

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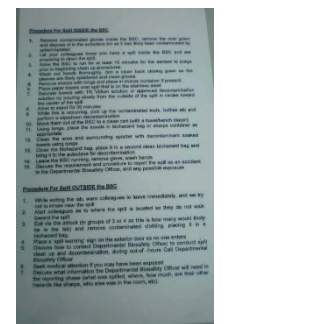


	Surface	Examples	Clorox Healthcare® Bleach Germicidal Wipes	Clorox Healthcare® Fuzion™ Cleaner Disinfectant	Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	Clorox Healthcare® Hydrogen Peroxide Cleaner Disinfectant Wipes	Clorox Healthcare® Multi-Surface Quat Alcohol Cleaner Disinfectant Wipes
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	★★★★	★★★★	★★★★	★★★★	★★★★
Glass	Vinyl	Floors, furniture	★★★★	★★★★	★★★★	★	★★★★
	Etched Glass	Wall panels, bathroom/shower enclosures	★★★★	★★★★	★★★★	★★★★	★★★★
	Glass	X-ray shields, glass partitions	★★★★	★★★★	★★★★	★★★★	★★★★
	Sapphire Glass	Device screens, protective covers	★★★★	★★★★	★★★★	★★★★	★★★★



# 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**



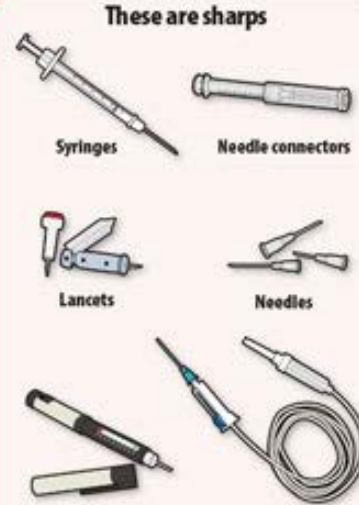
**7 BILLION**  
SHARPS ARE DISCARDED IN THE TRASH EVERY YEAR.

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.

Source: www.safeneedlepoint.org and www.cdc.gov

**USE A SHARPS CONTAINER**

These are sharps



Syringes      Needle connectors  
Lancets      Needles  
Auto injectors      Infusion sets

**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

**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



Kwikpoint®   
FDA

**BE SMART WITH SHARPS**



Kwikpoint assumes no liability for any action(s) a user may or may not take as a result of using this product.  
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**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](http://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.



- 2 Put sharp in container immediately after use.



## 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/sharpsdisposal](http://fda.gov/sharpsdisposal) or [safeneedledisposal.org](http://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

Made of heavy-duty plastic



### DO NOT USE

These containers can break or puncture easily.



Dispose of a household sharps container when it is 2/3 full:

- 1 Close lid and tape shut. Label container.



- 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.\*



\*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!



## DO NOT BRING THEM HOME WITH YOU!

Sometimes we forget that the microorganisms we work with can make us sick. Follow these lab practices and stay healthy.

- 

**WASH YOUR HANDS.**

  - ✓ BEFORE you start working
  - ✓ AFTER working
  - ✓ BEFORE you leave the lab
- 

**AVOID CONTAMINATION.**

  - ✓ LEAVE personal items outside the lab.
  - ✓ DO NOT eat and drink inside the lab.
- 

**NEVER UNDERESTIMATE A MICROBE.**

  - ✓ SAFELY store your samples and cultures.
  - ✓ DISINFECT your work area before and after use.

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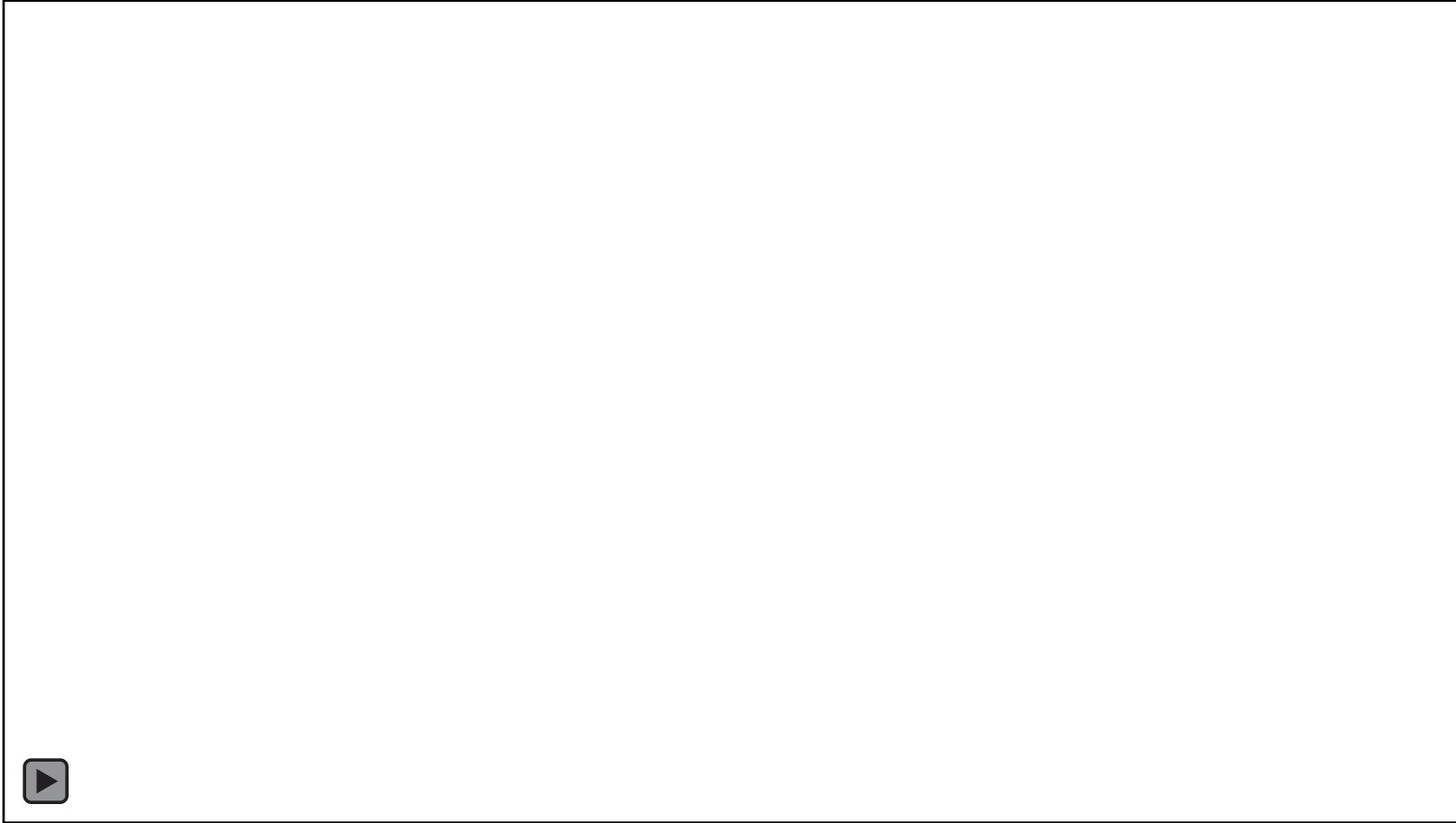


# Transport





# Workflow





THANK YOU