

Decontamination

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PROFESSIONALISM

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Welcome to the Introductory Training about Decontamination

Outline

- Decontamination
 - Definitions
 - Categories
 - Prep Work
 - Methods
 - Physical
 - Chemical
 - Gases
 - Questions?



Decontamination Definitions

“A procedure or process that renders an area safe for occupancy or material or equipment safe to handle or use.”

Decontamination Definitions

- Antisepsis:
 - Is the disinfection of living tissues; achieved through the use of antiseptics.
 - The objective is to prevent sepsis, either by destroying potentially infectious organisms or by inhibiting their growth and multiplication.
 - No sporicidal activity is implied

Decontamination Definitions

- Sanitization:

- Reduces a microbial population to levels considered safe by public health standards
- Objects usually cleaned as well as partially disinfected

*e.g. sanitizers are used to clean restaurant utensils and these do not have to be sterilized before use

Decontamination Definitions

- Disinfection:
 - killing, inhibition or removal of microorganisms that may cause disease or compromise the integrity of equipment
 - Usually accomplished with chemical agents
 - Does not necessarily sterilize objects (some spores & microorganisms remain)

Decontamination Definitions

- Sterilization:
 - Use of a physical or chemical procedure to destroy *all* microbial life, including algae, bacteria, fungi, protozoa, viruses, dormant endospores, prions and poorly characterized agents such as viroids.
 - Sterilization requires verification of the process before sterility is assumed.

Decontamination Categories

- Categories of decontamination in the microbiology lab:
 - Surface decontamination
 - Waste decontamination
 - Space decontamination

Decontamination Categories

- *Surface decontamination: Why*
 - Daily clean-up of work area
 - Decontamination of any spills
- **Common Methods**
 - Liquid disinfectants most commonly used

Decontamination Categories

- Waste decontamination:
 - Why
 - To protect workers who handle lab waste away from the lab
 - To protect the environment
 - Common Methods
 - Autoclaving
 - Liquid disinfectants



Decontamination Categories

- Space decontamination: Where: Biological Safety Cabinets (BSC)
 - Large areas with inaccessible surfaces
 - BSL3 labs
- Common Methods
 - Requires use of fumigants such as formaldehyde
 - Vaporous hydrogen peroxide (VHP)
 - Chlorine dioxide

Decontamination Prep Work

- Written procedures are required to ensure best management practices.
 - Establish procedures based on current needs, equipment and disinfectants.
 - Research laboratories all use some form of disinfecting.
- Often cleaning procedures are not in place.
 - When unwritten, cleaning procedures are passed on verbally or guessed at based on experience with other cleaning chemicals and potentially mistaken assumptions.
 - Write, review, update and refer to SOP's (Standard Operating Procedures) regularly.
- Find helpful templates here: [Fact Sheets and Templates](#)

Decontamination Prep Work

- Risk Assessment:
 - Risk assessment needs to include what products and tools should be used, when to use them and how to use them.
 - Consider the following information when writing a disinfection procedure.
 - Product Label and efficacy data
 - Organism(s)
 - Resistance profile
 - Contact time required for efficacy
 - Training requirements to use chosen method safely

Examples of Relative Resistance of Microorganisms

	Microbe	Examples
More Resistant		
	Bacterial Spores	<i>Bacillus subtilis</i>
	Mycobacteria	Mycobacterium tuberculosis
	Hydrophilic Viruses (non lipid, non enveloped)	Rhinovirus
	Fungi	Candida
	Vegetative bacteria	Streptococcus pneumonia
	Lipophilic Viruses (lipid containing enveloped)	Herpes Simplex
Least Resistant		

Decontamination Methods

- Decontamination can be achieved by:
 - Physical methods (heat, filtration, radiation)
 - Chemical disinfectants
 - Gases

Decontamination Methods

- Read the Label:
 - Review the labels of your current disinfectants.
 - Do these solutions match the profile of the microbes you need to kill?
 - The labels of concentrated disinfectants state the proper level of dilution for maximum effectiveness.

Decontamination Methods

- Selection of decontamination method:
 - type of organism/number
 - Amount of organic material present
 - Its risk group or containment level classification
 - The reason for the decontamination
 - Degree of microbial killing required

Decontamination Methods

- Selection of decontamination method (cont'd):
 - The nature of item/surface to be treated
 - Type & concentration of disinfectant
 - Time/temperature of exposure
 - Safety

Decontamination Methods

- Physical agents:
 - Heat
 - Filtration
 - Radiation (UV & gamma)

Decontamination Methods

- Heat:
 - Moist – steam (autoclaves, renderer)
 - Dry – convection oven
 - Incineration

Decontamination Methods

- Heat: Steam sterilization (autoclaves) (cont'd)—
 - Ensure proper functioning of autoclave
 - Load test to be carried out to determine standard load times/temps.
 - Vessels should be loosely capped or plugged
- Verification
 - Biological indicators
 - Thermocouples
 - Chemical integrators

Example of an autoclave



This really should not happen, but it does!



Autoclave “Do’s

- Do test autoclaves monthly
- Do use autoclave bags
- Do loosely close the bag
- **All autoclave users must be trained before they use an autoclave!!!**



Autoclave “Don’ts

- Do not tightly close the autoclave bag
- Do not use foil caps on bottles use vented caps or loosely capped bottles
- Do not overfill the bag (less than 3/4 full)
- **Do not use an autoclave without training**

Autoclaving Resources

- [Biological Waste Disposal Table](#)
- [Autoclaves](#)
- [Biohazardous and Infectious Waste](#)
- And LOTS more on the [Biosafety and Occupational Health website!](#)

Decontamination Methods

- Heat: Steam sterilization (renderer/ biowaste cooker) –
 - used for solid waste or liquid effluent
 - secondary waste treatment method for BSL3 and ABSL3



Decontamination Methods

- *Heat*: Dry heat sterilization (oven) –
 - Used for glassware*, metal instruments etc.
 - Denaturation of proteins: 160 - 170°C/2-4h

*Do not use plastic coated racks, plastic test tubes, Nalgene ware etc.

Decontamination Methods

- *Filtration:*
 - Used for heat-sensitive material, e.g. pharmaceuticals, culture media, antibiotics, HEPES buffer, etc.
 - Synthetic membrane filters – 0.2 μ m diameter pores
 - HEPA filters remove 99.99% of 0.3 μ m particles from the air

Decontamination Methods

- Radiation:
 - UV lamps– do not penetrate glass, dirt, films, water & other substances very effectively; effectiveness drops off quickly as number of lamp hours increases
 - Gamma radiation used for cold sterilization of antibiotics, sutures, pathogens coming out of containment labs, etc.

Decontamination Methods

- Chemical: Used for:
 - Decontamination of surfaces & equipment that cannot be autoclaved
 - Clean-up of infectious spills, rooms & animal cubicles

Decontamination Methods

- Factors influencing the effectiveness of chemical disinfection:
 - Number of microorganisms present
 - Type of population of microorganisms
 - Concentration & nature of disinfectant
 - Length of treatment
 - Environmental factors

Decontamination Methods

- Microorganisms differ in their resistance to chemical disinfection:
 - **High Resistance:** spore forming organisms
 - **Moderate Resistance:** protozoan cysts, Hepatitis B, poliovirus, *M. tuberculosis*, *S. aureus*, *Pseudomonas*
 - **Least Resistance:** most bacteria, yeasts

Decontamination Methods

- Chemical disinfectants should be:
 - Effective against a wide variety of infectious agents at high dilution & in presence of organic matter
 - Toxic for the infectious agent but not toxic to people
 - Non-corrosive for common materials

Decontamination Methods

- *Chemical disinfectants should be (cont'd):*
 - Stable upon storage
 - Odorless or ideally with a pleasant odor
 - Soluble in water & fats for penetration into pathogens
 - Inexpensive

Decontamination Methods

- Types of chemical disinfectants:
 - Phenolics
 - Alcohols
 - Halogens
 - Quaternary ammonium compounds
 - Aldehydes
 - Gases

Decontamination Methods

- Phenolics:
 - First widely used disinfectant – used today
 - Active against tuberculosis; effective in presence of organic material
 - Remains active on surfaces long after application
 - Disagreeable odor & can cause skin irritation & allergies
 - e.g. Lysol

Decontamination Methods

- Alcohols:
 - Kill bacteria, fungi & some lipid- containing viruses but not spores
 - Ethanol & isopropanol (70% concentration)

Decontamination Methods

- Halogens:
 - **Iodine** can be used as a skin disinfectant & in lab (e.g. Wescodyne, Betadine)
 - **Bromine** used instead of chlorine in hot tubs
 - **Chlorine** (sodium hypochlorite) kills live bacteria & fungi, moderately effective against spores
 - Inactivated by organic material
- *Use 1/9 (v/v) dilution of household bleach (100 ml household bleach/900 ml water)

Decontamination Methods

- Quaternary Ammonium Compounds:
 - Actual detergents, not soaps
 - Cationic detergents kill most bacteria but not *M. tuberculosis* or spores
 - Stable, non-toxic but inactivated by hard water

Decontamination Methods

- Aldehydes:
 - Active against spores; used as a chemical sterilant
 - Formaldehyde widely used to sterilize lab spaces & BSCs
 - 2% glutaraldehyde (e.g. Cidex); much less irritating than formaldehyde
 - Used to disinfect hospital & lab equipment

Decontamination Methods

- Types of chemical disinfectants:

Biocide	Concn (mg/liter)	
	Sporistatic	Sporicidal
Benzalkonium chloride	5	— ^b
Chlorhexidine	1	—
Ethanol	700	—
Sodium hypochlorite	1	100
Phenol	500	—
Hydrogen peroxide	500	50,000
Peracetic acid	10	100
Glutaraldehyde	50	10,000
Formaldehyde	500	20,000

Decontamination Methods

- Gases:
 - Ethylene oxide kills both living bacteria & spores
 - Penetrates packing material
 - Vaporous hydrogen peroxide (VHP) used to decontaminate BSCs & sealed containment labs
 - Chlorine dioxide gas

Decontamination Methods

- Write your Standard Operating Procedure (SOP)
 - Once the work of selecting a method and procedure is done, write it up, train staff on it and keep it up to date

Decontamination Emergency

- **Small spill:**
 - Put on gloves
 - Cover the spill with paper towels
 - Soak the towels with 1:9 (v/v) household bleach solution
 - Wait 30 min.
 - Clean up towels and discard.
 - 2nd Treatment with 1:9 (v/v) bleach
 - Remove gloves, wash hands.
- **Large Spill:**
 - Call Biosafety and Occupational Health (BOHD) 612-626-5008.
 - Request assistance.

Resources for Choosing a Disinfectant

- [Decontamination and Disinfection](#)
- [Biological Waste Disposal Table](#)
- [Decontamination Template](#)
- [Equipment Decontamination](#)
- [The Antimicrobial Spectrum of Disinfectants](#)
- [Characteristics of Selected Disinfectants](#)

Decontamination Management Best Practices

Management of microbial contaminants:

- Use best practices to protect patients, employees and the environment.
 - Because disinfectants are designed to kill cellular organisms, they are toxic and it is important to follow the instructions on the label.
 - Most chemicals used as disinfectants are corrosive, irritants and potentially carcinogenic.
 - Use only the amount of disinfectant necessary to effectively decontaminate.

Decontamination

- Be Safe
- Use good microbiological practices and good hygiene!
- Disinfectants DO NOT replace good microbiological practices or good hygiene!



More Resources

The [Biosafety & Occupational Health](#) website provides information on:

- [Autoclaves](#)
- [Decontamination and Disinfection](#)
- [Biological Spills](#)
- [Biohazardous and Infectious Waste](#)
- [Fact Sheets and Templates](#)
- [University Health and Safety \(UHS\)](#)

Thank you!

Questions:

Contact Biosafety 621-626-5008

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