



## Bio Basics Fact Sheet: Biohazards and Toxin Decontamination & Spill Clean-up

### Background:

Decontamination is any process that reduces biohazardous material (infectious agents, rDNA material, human material, biological toxins, etc) to an acceptable level, one that is below the level necessary to cause disease. Acceptable levels will depend on the biohazardous material in question and the type of work being done.

This Fact Sheet deals with liquid chemicals used for routine decontamination and spill cleanup. In order to select the proper decontamination procedure one must consider many factors including; the biohazard's concentration and resistance to disinfectants, chemical compatibility with other materials present, surface being decontaminated, and hazards to humans and the environment associated with the disinfectant. Ineffective decontamination can provide a false sense of security and spread disease.

Acceptable levels of decontamination, along with methods used to decontaminate, should be determined **before** work is begun and should be included in the lab's Standard Operating Procedures (SOPs).

**Note: All rDNA containing waste, including Biosafety Level 1 material, must be decontaminated prior to disposal or disposed of as biohazard waste before being released from the laboratory.**

See attached [Decontamination and Spill Clean-up template](#). It can be used in writing lab specific SOPs. This template must be customized for each lab.

### Definitions:

- Sanitizing** - reduces the number of microbes to a safe level.
- Antiseptics** - destroy microorganisms on living tissue.
- Disinfectants** - destroy microorganisms on inanimate objects.
- Sterilization** - kills all microbes.

### Microbial Resistance to Chemical Disinfectants:

| More Resistant  | Microorganism                   | Examples                                    |
|---|---------------------------------|---|
|  | Prions                          | BSE, vCJD, Scrapie                          |
|   | Bacterial Spores                | Bacillus, Geobacillus, Clostridium sp.      |
|   | Protozoan Oocytes               | Cryptosporidium                             |
|   | Helminth Eggs                   | Ascaris, Enterobius                         |
|   | Mycobacteria                    | M. tuberculosis                             |
|   | Small non-enveloped viruses     | Poliovirus, Parvoviruses, Papillomaviruses  |
|   | Protozoan Cysts                 | Giardia, Acanthamoeba                       |
|   | Fungal Spores                   | Aspergillus, Penicillium                    |
|   | Gram-negative Bacteria          | E. coli, Salmonella spp.                    |
|   | Vegetative Fungi & Algae        | Candida, Chlamydomonas                      |
|   | Vegetative Helminths & Protozoa | Ascaris, Cryptosporidium, Giardia           |
|   | Large Non-enveloped Viruses     | Adenoviruses, Rotaviruses                   |
|   | Gram-positive Bacteria          | Staphylococcus, Streptococcus, Enterococcus |
|   | Less Resistant                  | Enveloped viruses                           |

## Common Types of Disinfectants:

The following two tables provide general information only. Phenolics and quats are available in many formulations with different properties. Follow the manufacturer's recommendations for use.

| Type   | Tips for Use  | Advantages   | Disadvantages  |
|--|---|--|--|
| Chlorine Compounds   | <ul style="list-style-type: none"> <li>-Dilute household bleach 1:9(v/v) solution of household bleach (10% bleach solution), make fresh monthly</li> <li>-Store diluted solutions in sealed container that is protected from light.</li> <li>-For spill cleanup, and to wipe down work surfaces</li> <li>-FINAL concentration of 10% bleach used for liquid infectious waste</li> <li>-Fisher Scientific supplies <i>Fisherbrand*</i> Bleach Solution Dispenser. It is a unique, two-bottle design and fixed-ratio trigger sprayer automatically mixes concentrated bleach with tap water. Cat. No. 23-640-127</li> </ul> | <ul style="list-style-type: none"> <li>-Relatively nontoxic</li> <li>-Low cost</li> <li>-Effective with detergents</li> <li>-Fast acting</li> <li>-Broad spectrum effectiveness</li> </ul> | <ul style="list-style-type: none"> <li>-Inactivated by organic material such as blood,</li> <li>-Do not use at less than 1:9 (v/v) dilution</li> <li>-Strong oxidizer; corrosive</li> <li>-Irritates mucus membranes, eyes, skin</li> <li>-No residual activity on surfaces</li> <li>-Can damage clothing</li> <li>-Incompatible with quats</li> <li>-Produces toxic chlorine gas if mixed with acids or ammonia compounds</li> <li>-Can't be used to disinfect radioactive iodine.</li> </ul> |
| Alcohols   | <ul style="list-style-type: none"> <li>-Dilute to 70% in water, (loses effectiveness at concentrations above 90%)</li> <li>-Use to clean instruments and wipe down interior of Biological Safety Cabinets</li> <li>-Use as topical antiseptic on intact skin</li> </ul>   | <ul style="list-style-type: none"> <li>-Non-corrosive</li> <li>-Effective with detergent</li> </ul>  | <ul style="list-style-type: none"> <li>-Can have reduced effectiveness in organic material, does not penetrate organic material</li> <li>-Flammable</li> <li>-No residual activity and limited effective exposure time due to high rate of evaporation</li> </ul>  |
| Phenolics  | <ul style="list-style-type: none"> <li>-Dilute according to manufacturer's instructions</li> <li>-Commonly used to clean walls, floors, etc</li> <li>-Useful in areas where organic matter cannot always be removed, such as animal areas</li> </ul>  | <ul style="list-style-type: none"> <li>-Good effectiveness in organic material</li> <li>-Effective with detergent</li> <li>-Has some residual effectiveness</li> </ul>                     | <ul style="list-style-type: none"> <li>-Toxicity varies with specific compound, can be absorbed through skin</li> <li>-Some formulations may have unpleasant odor</li> <li>-Corrosive</li> <li>-Skin irritant</li> <li>-Not effective against spores</li> </ul>  |
| QUATS<br>Quaternary Ammonium Compounds (cationic detergents) | <ul style="list-style-type: none"> <li>-Dilute according to manufacturer's instructions</li> <li>-Surfaces must be rinsed free of anionic soap or detergents before use</li> <li>-Commonly used to clean walls, floors, etc</li> </ul>  | <ul style="list-style-type: none"> <li>-Strong surface activity</li> <li>-Low toxicity</li> <li>-Non-corrosive</li> <li>-Effective over wide pH range</li> </ul>                           | <ul style="list-style-type: none"> <li>-Easily inactivated by organic materials, anionic detergents, and salts of metals in water (hard water)</li> <li>-Skin irritant</li> </ul>  |

## Disinfectant Selection:

|                             | Chlorine Compounds   | Alcohols      | Phenolics     | Quats                                   |
|-----------------------------|--|---------------|---------------|---|
| <b>Bacteria</b>             | Very good  | Good          | Good          | Good for gram positive                  |
| <b>Envelope Viruses</b>     | Very good  | Good          | Good          | Good                                    |
| <b>Non-envelope Viruses</b> | Very good  | Fair**        | Fair**        | Not effective                           |
| <b>Fungi</b>                | Good   | Fair          | Good          | Fair                                    |
| <b>Bacterial Spores</b>     | Good with high concentration                                   | Not effective | Not effective | Not effective                           |
| <b>Protozoal Parasites*</b> | Moderate with high concentration and long contact time (hours) | Not Effective | Not Effective | Fair (some quats at high concentration) |

\* hydrogen peroxide most effective

\*\* check disinfectant susceptibility for individual virus

## Decontamination Procedures:

For any spills of agents that are transmitted by inhalation, such as *Mycobacterium tuberculosis*, evacuate the lab immediately, close the door, do not allow any one to enter the lab, remove any contaminated clothing, wash exposed skin with soap and water, called the Biosafety Officer for assistance (612-626-6002). Report all spills to P.I. or lab supervisor.

### Toxin Decontamination

- Use 2N NaOH or other decontaminant proven to be effective against a specific toxin
- Follow below clean-up procedures

### Materials to keep on hand for spill cleanup

- Written spill procedure including emergency phone numbers
- Disinfectant suitable for biological materials and surfaces being used
- Paper towels, gloves, shoe covers, and safety goggles
- Forceps to pick up sharps, including broken glass
- Sharps container for broken glass, etc
- Squeegee (or other appropriate device) and dustpan to clean up shards of broken glass in contaminated liquid, should be autoclavable or otherwise capable of being decontaminated
- Biohazard bags (red bags for pick-up or autoclave clear bags for 60 minutes at 121°C)

### Small and moderate spills outside the biological safety cabinet

- Remove any contaminated clothing and put in autoclavable bag. Be aware that autoclaving may damage fabric.
- Notify other workers in the area of the spill and control traffic through area.
- Wear shoe covers and safety goggles if spill is on floor, may have splashed beyond immediate area of spill.
- Put on gloves and cover spill area with paper towels.
- Pour disinfectant over towels from edges of spill to center, be carefully not to splatter.
- Decontaminate all objects in spill area.
- Allow 30 minutes of contact time.
- Pick up any sharps, including broken glass, with forceps and place in sharps container.
- Use squeegee (or other appropriate device) and dustpan to recover any shards of broken glass in contaminated liquid. Decontaminate squeegee and dust pan.
- Wipe area with disinfectant and clean paper towels and put in biohazard bag.
- Mop if spill is on floor.

- Remove gloves and foot covers before leaving area of the spill, put in biohazard bag.
- Wash hands.

### **Large spills (greater than 100ml) within or without of the biological safety cabinet**

- Evacuate room, close doors, prevent others from entering, and wait 30 minutes for aerosols to settle.
- Follow above procedures for small and moderate spills.

### **For small spills in a biological safety cabinet**

- Leave the biosafety cabinet (BSC) running.
- Wipe down all interior BSC surfaces with appropriate disinfectant.
- Wipe down all supplies and equipment in BSC.

### **For moderate spills in a biological safety cabinet follow general spill procedures plus**

- Leave the BSC running.
- Wipe down all interior surfaces.
- Determine if spill has gone beyond the work surface such as on the grilles or in side seams. If yes, disassemble as much of BSC as possible for decontamination.
- If the BSC has a catch basin below the work surface that may be involved in the spill, flood the basin with disinfectant. Do not use alcohol as a large quantity of alcohol presents a flammable hazard. Clean basin after 30 minutes.
- Autoclave or wipe down all items in BSC with disinfectant.
- Let BSC run for at least 10 minutes after cleanup.

### **For major spills in a biological safety cabinet**

- Contact the Biological Safety Officer in DEHS (612-626-6002) to determine if professional decontamination is indicated.

## **Accidental Exposure Response:**

If spill results in a hazard exposure (i.e. face and/or eye splash, cut or puncture with sharps, contact with non-intact skin):

- Encourage needle sticks and cuts to bleed, gently wash with soap and water for 5 minutes; flush splashes to the nose, mouth, or skin with water; and flush eyes at the nearest eyewash station with clean water for 15 minutes.
- For all injuries and biological exposures, call 911 or seek medical attention.
  - For urgent care employees may go to [HealthPartners](#) Occupational and Environmental Medicine (M/F day time or Urgent Care after hours), or [UMMC-Fairview Hospital](#) (24 hrs). You may seek medical attention at the closest available medical facility or your own healthcare provider.
  - Follow-up must be done by HealthPartners Occupational and Environmental Medicine.
- Report the incident to your supervisor as soon as possible, fill out the appropriate documentation.
  - [Employee First Report of Injury](#)
  - [Supervisor Incident Investigation Report](#)
- Send [Incident Report Form](#) to the IBC if exposure has occurred during work on an IBC protocol. Any accident involving recombinant DNA must be reported to the IBC office within 24 hours to meet institutional requirements prescribed by the [NIH Guidelines for Research Involving Recombinant DNA Molecules](#).
- Report all biohazard exposures to the Office of Occupational Health and Safety (612-626-5008) or [uohs@umn.edu](mailto:uohs@umn.edu).

**Note:** It is important to fill out all of the appropriate documents to be eligible to collect workers compensation should any complications from the hazardous exposure arise in the future.

## Reference:

*Disinfection, Sterilization, and Preservation* edited by Seymour S. Block, Lippincott Williams & Wilkins, Philadelphia, 2001

For EPA registered antimicrobial products effective against certain blood borne/body fluid pathogens, Mycobacteria spp (tubercle bacteria), human HIV-1 virus, Hepatitis B or Hepatitis C virus as well as products classified as sterilizers and products used for medical wastes see <http://www.epa.gov/oppad001/chemregindex.htm>.

APIC (Association for Professionals in Infection Control and Epidemiology) "Guidelines for Selection and Use of Disinfectants" reprint from American Journal of Infection Control see [http://www.premierinc.com/quality-safety/tools-services/safety/topics/guidelines/downloads/16\\_gddisinfAJIC-96.pdf](http://www.premierinc.com/quality-safety/tools-services/safety/topics/guidelines/downloads/16_gddisinfAJIC-96.pdf)

For information on "FDA-Cleared Sterilants and High Level Disinfectants with General Claims for Processing Reusable Medical and Dental Devices" published in November 2009 see <http://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/ReprocessingofSingle-UseDevices/UCM133514>

*Biological Safety Principles and Practices* edited by Diane Fleming & Debra Hunt, ASM Press, Washington DC, 2000.

CDC/NIH *Biosafety in Microbiological and Biomedical Laboratories, 5<sup>th</sup> edition*  
<http://www.cdc.gov/biosafety/publications/bmbI5/index.htm>

NIH *Guidelines for Research Involving Recombinant DNA Molecules*,  
[http://oba.od.nih.gov/rdna/nih\\_guidelines\\_oba.html](http://oba.od.nih.gov/rdna/nih_guidelines_oba.html)