

Strategies of Disinfection and Decontamination

Comprehensive Risk Mitigation and Waste Management in Clinical
Laboratories

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THE HIERARCHY OF CONTROL

- In a clinical laboratory, risk mitigation follows a strict order of priority:
- **Engineering Controls:** Safety equipment (Biosafety cabinets, proper ventilation).
- **Administrative Controls:** Management, training, and standard operating procedures (SOPs).
- **Work Practices:** Hand hygiene and safe handling techniques.
- **PPE (Last Resort):** Personal Protective Equipment (Gloves, Coats, Eye protection)



DISINFECTION AND DECONTAMINATION

Mechanical

Cleaning (soap and water)

Filtration

Physical

Heat

- Autoclave (steam + pressure)
- Steam
- Dry Heat
- Boiling

Radiation

Chemical

Liquid

- Alcohols
- Aldehydes
- Phenols
- Chlorines/Iodines
- Peroxides/oxidizers
- Acids/alkalis
- Quaternary ammonia ('quats')

Chemical cont.

Gases & Vapor-Phase

- Hydrogen peroxide
- Chlorine dioxide
- Formaldehyde



CHEMICAL DISINFECTION GUIDE

- Selection depends on the "Hierarchy of Resistance" (Prions/Spores = High; Enveloped Viruses = Low).

- **A. Alcohols (Ethanol / Isopropanol)**

Best Concentration: 70% in water.

- **Targets:** Enveloped viruses (e.g., COVID-19, HIV) and vegetative bacteria.
- **Critical Weakness:** No activity against Bacterial Spores. Evaporates too quickly for long contact times.

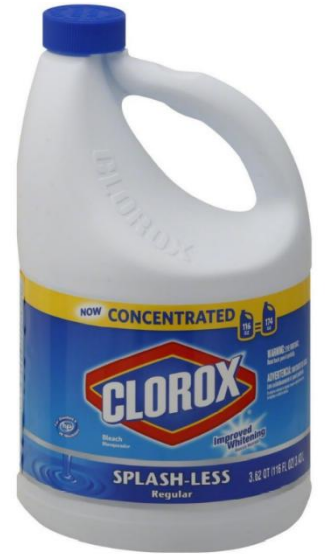
- **B. Chlorines (Bleach / NaOCl)**

Standard Dilution: 1:10 (5,000 ppm).

Target: Wide spectrum, including mycobacteria and fungal spores.

Maintenance: Must be prepared fresh every 24 hours.

Warning: Highly corrosive to metals



- **C. Peroxides (Peracetic Acid H2O2)**

- Key Advantage: Leaves no residue (breaks down into H2O and O2)

- Target: Highly effective against spores and high soil loads.



PHYSICAL Decontamination

What method to use?

- Autoclave
- Incineration
- Deep burial
- Destruction and shredding
- Radiation





SECTION 3: WASTE DISPOSAL PROTOCOLS

Method

Application

Mandatory Requirements

- | Method | Application | Mandatory Requirements |
|----------------|----------------------------|--|
| ■ Autoclave | Reusable tools / Bio-waste | Steam + Pressure (121°C). |
| ■ Incineration | Organic/Combustible waste | Stack height > 30m; No plastics/mercury. |
| ■ Deep Burial | Carcasses / Remote areas | 2m deep pit; 6m above groundwater. |
| ■ Rendering | Animal carcasses | 131°C for 30 minutes. |

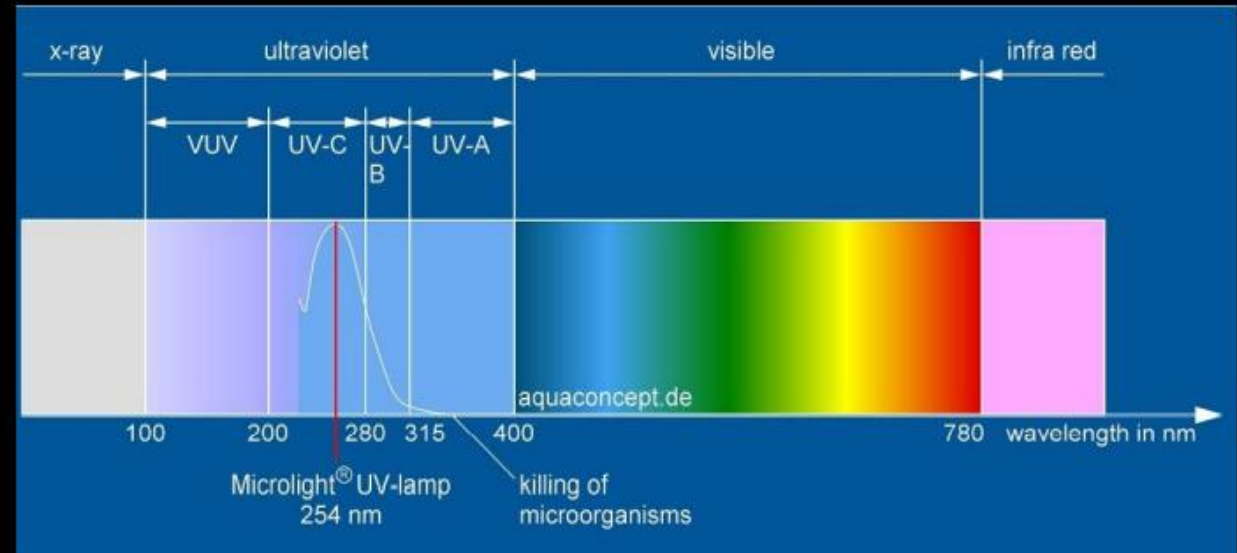


ULTRAVIOLET (UV)

Radiation

Things to consider if/when using UV:

- Minimum flux = 40 microwatts/cm² at 254 nm
- UV has limited penetrating power
- Intensity decreases with distance from the lamp
- Lamp should be cleaned and its output should be measured periodically



RADIATION

Disinfection and decontamination

Three types of radiation that are commonly used:

- Ultraviolet (UV) – non-ionizing
- Microwave – non-ionizing
- Gamma irradiation – ionizing

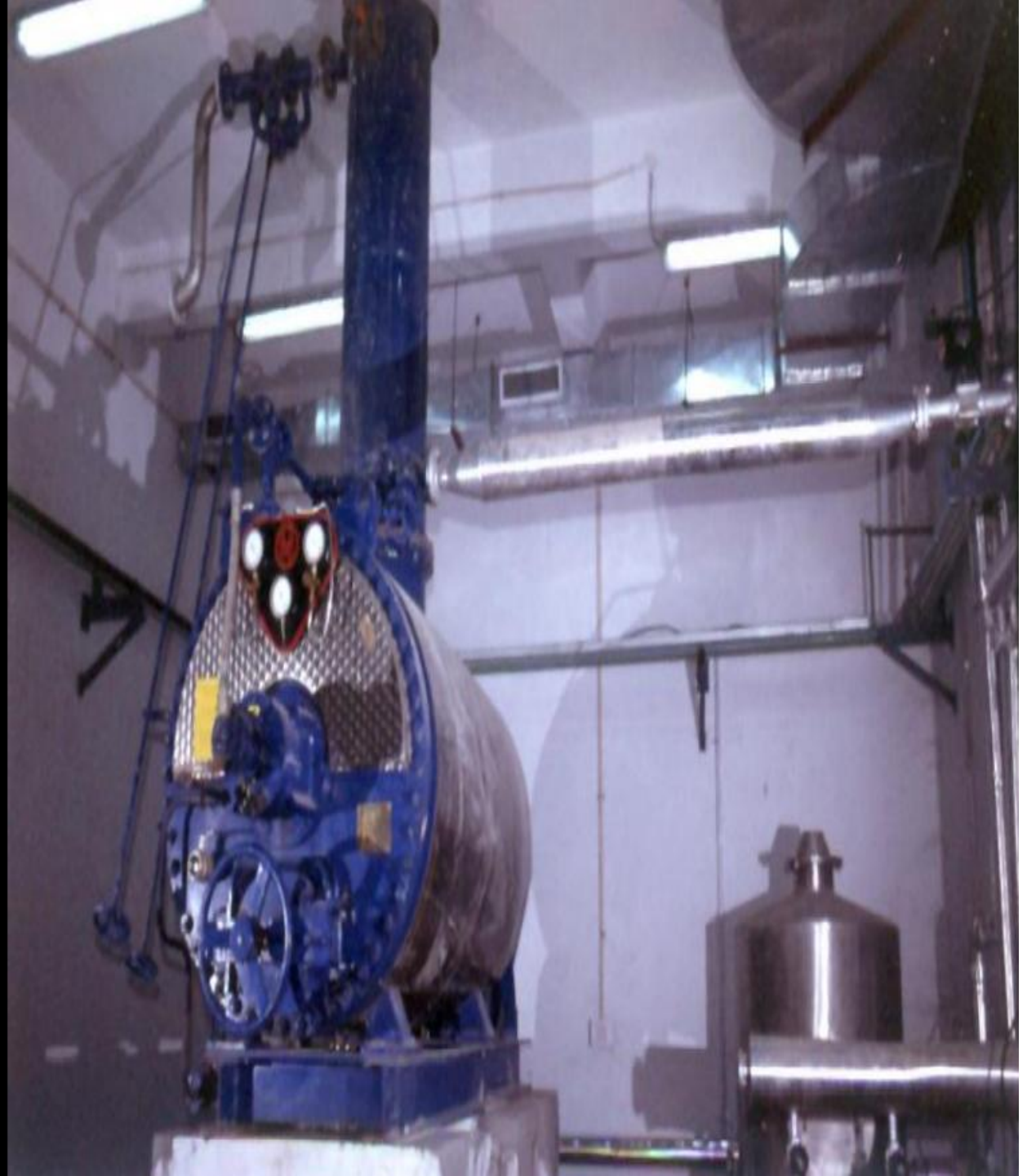


RENDERING

Heat

Rendering

- Used for disposal of animal carcasses
- Operating temperature: 131C
- Time required for holding: 30 minutes
- The end product comes in the form of slurry which can be used as manure or animal feed or can be disposed off by incineration





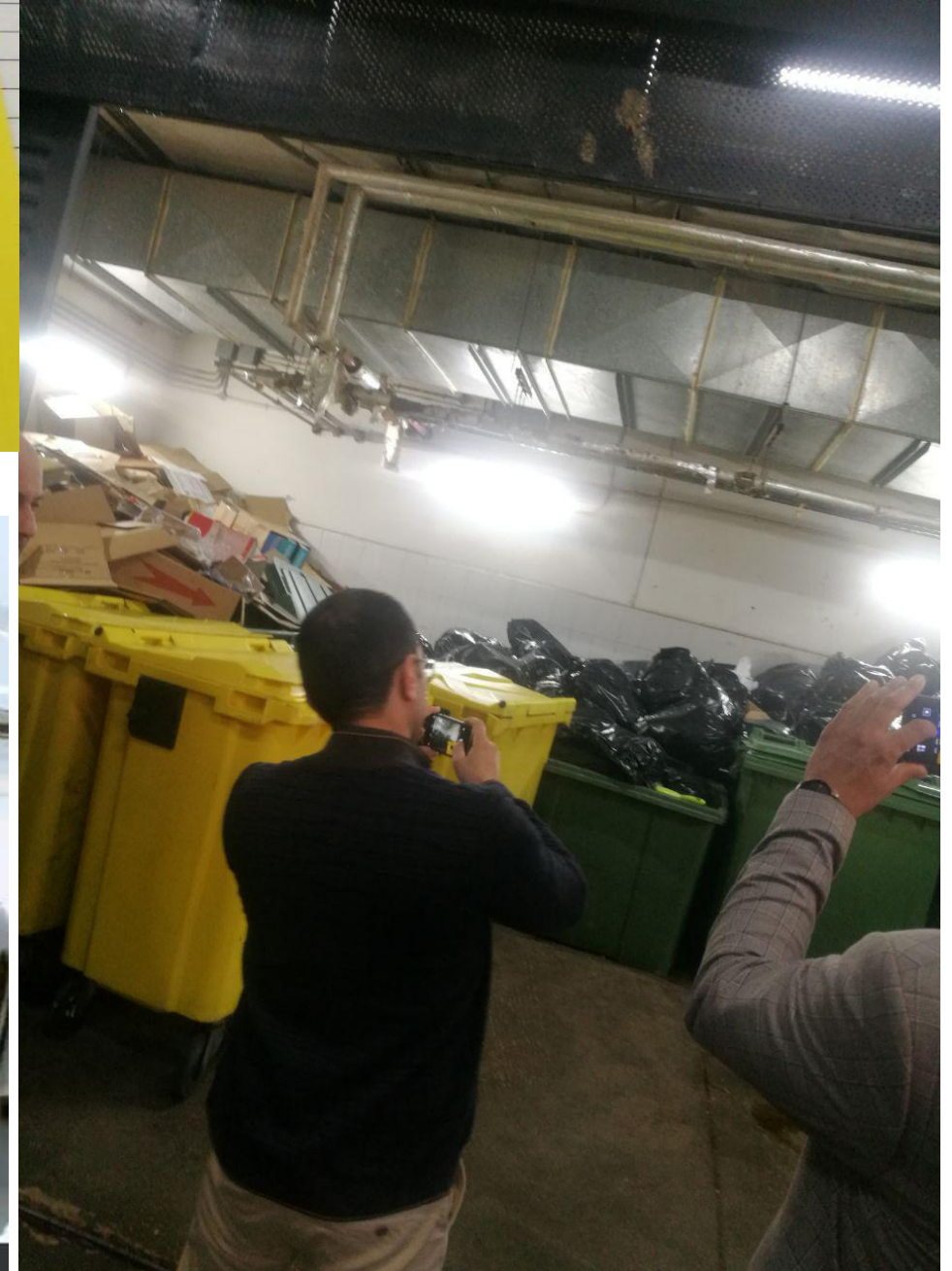


بطاقة نفايات خطرة

كلية / مركز / وحدة / دائرة / قسم :

نوع النفايات :

الوزن : كغم التاريخ / / ٢٠
اسم الشخص المسؤول : توقيعه





SECTION 4: DOCUMENTATION & LOGS

- Every waste container must have a tag before disposal.
- Hazardous Waste Tag Template
- Type: Biological Chemical Sharps
- Physical State: Liquid Solid
- Weight: _____ kg
- Responsible Person: _____
- Date: ____ / ____ / 202__

Ⓢ SECTION 5: EMERGENCY SPILL CHECKLIST (CLEAN)

- **C**onfirm: Identify the chemical and its hazard.
- **L**eave: Evacuate if toxic vapors are present.
- **E**valuate: Is a Spill Kit required?
- **A**bsorb: Use neutralizers or sand to contain the spill.
- **N**otify: Report the incident to the Safety Officer