Bio-medical waste management and safe handling of dangerous materials

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Wastes generated in lab

- Biomedical wastes
- Hazardous waste
Name some biomedical wastes from your laboratory

- Blood in tubes
- Culture Media
- Waste tissue/ gauze
- Pipette tips
- Slides
- Broken glass
- Syringes with needles
Why should we segregate waste?
MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 24th August, 2011

Why should we follow the rules?

- Prevent infection
- Reduce pollution
- Reduce injuries
Bio-medical waste

• Any waste, which is generated during the diagnosis, treatment, including operation, or immunization of human beings or animals or in research activities including production of biological, etc. is termed as biomedical waste
Biomedical waste categories

Classified into 10 categories

1. **Human parts**- tissues, organs, placenta, amputated parts
2. Animal waste
3. **Microbiological** and biotechnological waste – culture plates, culture media, vaccines etc
4. **Waste sharps**- scalpel, blades, needles and broken glasses etc
5. Discarded medicines, and cytotoxic drugs
Biomedical waste categories

6. Soiled contaminated waste: infected bandages, gauze pieces, **cotton swabs**, dressings linen etc.
7. Solid waste: disposable items-tubes, plastic **syringes**, catheters, urobags, etc
8. Liquid waste-dirty waters
9. Incineration ash-ash generated in the incineration plant
10. **Chemical waste**-chemical used in laboratory diagnosis, disinfectants, antiseptics, etc
<table>
<thead>
<tr>
<th>Category</th>
<th>Type</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human parts-tissues, organs, placenta, amputated parts</td>
<td>Incineration</td>
</tr>
<tr>
<td>2</td>
<td>Animal waste</td>
<td>Incineration / deep burial</td>
</tr>
<tr>
<td>3</td>
<td>Microbiological and other laboratory waste: wastes from clinical samples pathology, biochemistry, hematology, blood bank, culture plates, stock cultures</td>
<td>Disinfection at source by chemical treatment or by autoclaving/ microwaving followed by mutilation/shredding, final disposal in secure landfill</td>
</tr>
<tr>
<td>4</td>
<td>Waste sharps- scalpel, blades, needles and broken glasses etc</td>
<td>Disinfection at source by chemical treatment or by autoclaving/ microwaving followed by mutilation/shredding, final disposal in secure landfill</td>
</tr>
<tr>
<td>5</td>
<td>Discarded medicines</td>
<td>Incineration, disposal in secure landfills</td>
</tr>
</tbody>
</table>
## BMW categories for laboratories

<table>
<thead>
<tr>
<th>Category</th>
<th>Type</th>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Soiled contaminated waste-cotton swab</td>
<td>Incineration</td>
</tr>
<tr>
<td>7</td>
<td>Infectious Solid waste - syringes</td>
<td>Disinfection at source by chemical treatment or by autoclaving/ microwaving followed by mutilation/shredding, final disposal by authorised recyclers</td>
</tr>
<tr>
<td>8</td>
<td>Liquid waste</td>
<td>Chemical treatment, discharge in drain</td>
</tr>
<tr>
<td>9</td>
<td>Incineration ash</td>
<td>Disposal in municipal landfill</td>
</tr>
<tr>
<td>10</td>
<td>Chemical waste-chemical used in laboratory diagnosis, disinfectants, antiseptics, etc</td>
<td>Chemical treatment, discharge in drain</td>
</tr>
</tbody>
</table>
## Segregation of BMW

<table>
<thead>
<tr>
<th>Colour coding</th>
<th>Type of container</th>
<th>Waste category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Non-chlorinated plastic bags</td>
<td>1, 2, 5, 6</td>
<td>Infected non plastic- tissues, cotton</td>
</tr>
<tr>
<td>Red</td>
<td>Non-chlorinated plastic bags</td>
<td>3, 7</td>
<td>Infected plastics – vacutainers, culture plates</td>
</tr>
<tr>
<td>Blue</td>
<td>Non-chlorinated plastic bags</td>
<td>10</td>
<td>chemical waste</td>
</tr>
<tr>
<td>Black</td>
<td>Non-chlorinated plastic bags</td>
<td>Municipal waste</td>
<td></td>
</tr>
<tr>
<td>Container</td>
<td>Puncture proof container</td>
<td>4</td>
<td>sharps</td>
</tr>
</tbody>
</table>
# MANIPAL HEALTH SYSTEMS

## PLASTIC COLOR COVERS FOR HOSPITAL WASTE SEGREGATION

<table>
<thead>
<tr>
<th>YELLOW COLOR</th>
<th>RED COLOR</th>
<th>WHITE COLOR</th>
<th>BLACK COLOR</th>
<th>PUNCTURE PROOF CAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOILED/INFECTIVE WASTE</td>
<td>INFECTED PLASTICS/ RUBBER</td>
<td>NON INFECTIVE PLASTICS/ RUBBER</td>
<td>GENERAL WASTE (NON INFECTIVE)</td>
<td>SHARPS</td>
</tr>
<tr>
<td>SOILED COTTON DRESSINGS CONTAMINATED WITH BLOOD &amp; BODY FLUIDS</td>
<td>SYRINGES TUBINGS CATHETERS LV.SETS GLOVES</td>
<td>LV.SET COVER GLOVE COVER</td>
<td>WASTE PAPER NEWS PAPER FACE MASKS CAPS</td>
<td>NEEDLES SCALPELS BLADES</td>
</tr>
<tr>
<td>HUMAN PARTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Follow the color of the covers irrespective of Bucket/Drum color.
How is BMW identified?

- International biological hazard symbol on the container

- The phrase “Biomedical Waste”, “Infectious Waste” or “Biohazardous” must be on the container

- Bagged waste must be in **non chlorinated plastic bags**.
Segregation of BMW

• Segregated at **point of origin** into its proper container
  – “Point of origin” is the lab, patient/exam/procedure room or other area where the BMW is generated

• Choices for proper BMW container:
  – Biowaste bag
  – Labeled fiberboard box lined with a biowaste bag
  – Sharps container – puncture resistant container specifically designed for sharps
Segregation: Do not mix BMW with radioactive or chemical waste!

- Chemically or radiologically contaminated gloves, tubes, etc. do not go into a biomedical waste box. They go into their appropriate waste container.

- Remember – the biomedical waste box is not a universal disposal container!
Segregate medical sharps into sharps containers

- Never Re-Cap Needles or Scalpels
  - Don’t bend, break, or detach from syringe

- Discard directly into a leak-proof, puncture resistant container

- Replace container when ¾ full

- Never attempt to re-open a closed sharps container
Sharps

- Container should be **located where the sharps are used:** phlebotomy, procedure areas, etc.

- Only sharps should go into sharps containers (needles, broken slides, broken glass)
  - **Soft items quickly overfill containers and may cause sharps to stick out of the top of the box.**
Needles, Broken Glass, and Sharps

- do not recap needles
- always use puncture-resistant, leakproof, sharps containers
- always use specific waste disposal containers
- never directly handle broken glass
Do you see anything wrong?
Do NOT reuse disposable injection equipment
Options for items that can cut or puncture the biowaste bag or box?

• Examples: broken glass, Pasteur pipets, serological pipets, pipet tips, glass slides/cover slips
• Dispose of in a way that they can’t do harm
  – Sharps box
  – Bench top biohazard bag or empty media bottle for pipet tips
  – Sturdy box placed in biohazard bag
  – Plastic sleeve (to bundle pipets together) placed in biohazard bag
  – Align serological pipets in one direction
## Packaging and Disposing of Biological Waste

Handling biological waste must be done with Standard/Universal Precautions.

<table>
<thead>
<tr>
<th><strong>DO NOT</strong></th>
<th><strong>Fold opposite flaps and tape bottom in “H” pattern with clear tape.</strong></th>
<th><strong>Fold flaps to the outside of the box.</strong></th>
<th><strong>Line the box with a red biowaste bag.</strong></th>
<th><strong>Cover infectious or potentially infectious waste with nonporous cover.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DO NOT</strong></td>
<td><strong>put sharps in.</strong> They puncture and cause injury.</td>
<td><strong>DO NOT use feet or hands to compress contents.</strong> If needed, use a sharps box on top of contents.</td>
<td><strong>Sharps boxes must be labeled with site address label.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>To seal, twist and tape.</strong></td>
<td></td>
<td><strong>Twist, double over and tape again.</strong></td>
<td><strong>Sealed bag with label.</strong></td>
<td><strong>“H” tape box and label with name, location, phone, and date.</strong></td>
</tr>
</tbody>
</table>

*Indicates additional steps or requirements.
BMW Storage

- BMW must be stored in an area away from general traffic & accessible only to authorized personnel. Storage area must be:
  - Labeled with biohazard sticker
  - Secure (locked/non-accessible)
  - Easily cleanable & tidy

- Packages must be labeled as biomedical waste with the biohazard symbol, name, location, phone & date

- Then transport it to outdoor containers removed for disposal by a designated waste disposal agency
Handling BMW

• Wear appropriate PPE (gloves, clothing cover, safety glasses) when handling non-inactivated waste

• Use Universal Precautions – assume all BMW is infectious

• Transport waste in leak-proof containers

• Know how to handle spills
Who Picks Up/Transports BMW?

- Transportation of BMW is provided by the following registered BMW transporter:
  - RAMKY
  - MARIDI
Treatment of BMW

• BMW shall be treated by heat, incineration, or other equivalent method
  – Autoclave which sterilizes the waste or
  – Incineration which destroys the waste

  – All infected plastic wastes are autoclaved
  – Nonplastics are incinerated
Practical tips

• Sharps: autoclave / treat with sodium hypochlorite before sending
• Infected plastics: vacutainers, media plates etc – autoclave, put residue in red bag
• Cotton swabs, gauze: yellow bag – send directly
Autoclaving

- **Requirements:**
  - Biological indicator testing
  - Log book
  - Regular maintenance
  - 250°F/121°C, 15-20 lb pressure

- Large loads/resistant pathogens need more time 60 minutes

- Transport waste to autoclave in closed bag and leak-proof container
Bleach Inactivation

• Acceptable for liquid material if done correctly
  – Add **full strength household bleach** to final concentration of 10% (5000 ppm available chlorine).
  – Mix. Contact time should be at least 30 minutes.
  – Pour down drain to sanitary sewer.
BMW Spills & Surface Disinfection

- Proper spill handling:
  - Notify people in the area
  - Don appropriate PPE
  - Place absorbent material on spill
  - Apply appropriate disinfectant – allow sufficient contact time (30 min)
  - Pick up material (watch for glass – use tongs or dust pan); dispose of material into biomedical waste
  - Reapply disinfectant and wipe
Do you have a bio-spill kit?

- Container of undiluted household bleach / sodium hypochlorite
- Several pairs of gloves
- Safety glasses
- Absorbent material
- Biohazardous waste (autoclave) bags
- Dust pan & scoop or tongs for broken glass

Place in a labeled bag or bucket and keep in areas where biohazards are used.
Safe handling of hazardous chemicals
Laboratory Accident
Why All the Fuss?

- Exposure to Hazardous Chemicals Can Result in acute or chronic health effects

  - **Acute** – occurring within hours or days of exposure
  - **Chronic** – occur after exposure over many years
Name some hazardous / dangerous materials in laboratory

- Ammonia
- Chloroform
- Diamino benzidine
- Hydrochloric acid
- Sulphuric acid
- Nitric acid
- Picric acid
- Acetic acid (glacial)
- Hydrogen peroxide
- Phosphoric acid
- Phenol
- Methanol
- Ethidium bromide
- Formalin
Chemical hazards

Physical hazards
Flammable, combustible, compressed gases, explosives, organic peroxides, oxidizers, pyrophorics, water reactives

Health hazards
Carcinogens, corrosives, toxic agents, reproductive toxins, irritants, sensitizers, target organs agents

Hazard factors include chemical form, route of entry, amount, frequency
Hazard control measures for chemicals

Operational controls - SOPs

* Generic
  - Ordering, storage & distribution of chemicals
  - Safe use of chemicals
  - Emergency response for spills or unintentional releases
Hazard control measures for chemicals

Engineering controls

* Chemical substitution

* Ventilation
  - Good general ventilation
  - Well ventilated chemical store room
  - Lab hoods (fume hood)

* Isolation
Hazard control measures for chemicals

Other controls

* Lab maintenance and inspection
* Protective equipment
* Safety equipment
  - Lab hoods and sinks
  - Eyewash fountains and drench showers
  - Fire extinguisher
  - Fire alarm & telephone
General Safety Equipment

- shower
- eye washer
- fire safety
- waste disposal
- PPE
Safe Practice: Maintain a Chemical Inventory!

Conduct a **yearly inventory** of chemicals and update the file of material safety data sheets (MSDS) to prevent the accumulation of orphaned chemicals.

Some of these chemicals become unstable, react with the container, slowly degrade or evaporate.
Material Safety Data Sheets (MSDS)

- An MSDS Must Be on File & Available for Each Chemical in the Lab.
- An MSDS lists:
  - Product Identity
  - Hazardous Ingredients
  - Physical Data
  - Fire & Explosion Hazard Data
  - Reactivity Data
  - Health Hazard Data
  - Precautions for Safe Handling & Use
  - Control Measures
Conduct a full chemical inventory. Update yearly. Properly dispose of unused chemicals.

Gather Material Safety Data Sheets and retain.

Ensure that chemical labels remain intact, and proper relabeling is conducted if chemical is transferred.
WARNING
EXPOSURE TO THIS MATERIAL CAN CAUSE DAMAGE TO THE FOLLOWING ORGANS AND/OR PARTS OF THE BODY:
- Bladder
- Blood
- Brain
- Cardiovascular System
- Central Nervous System
- Eyes
- Gallbladder
- Heart
- Intestines
- Kidney
- Liver
- Lung
- Lymphatics
- Pancreas
- Prostate
- Respiratory System
- Skin
- Spleen
- Stomach
- Uterus
- Nerves

FOR FURTHER INFORMATION AND INSTRUCTIONS REFER TO CORRESPONDING MSDS

DANGER
DO NOT REMOVE THIS TAG
TO DO SO WITHOUT AUTHORITY WILL MEAN IMMEDIATE DISCHARGE
IT IS HERE FOR A PURPOSE

SEE OTHER SIDE

CAUTION
TOXIC/HAZARDOUS CHEMICALS ARE USED IN THIS WORKPLACE
SAFETY DATA SHEETS ARE AVAILABLE IN THE SUPERVISORS OFFICE

SEE OTHER SIDE
Safety Showers and Eyewashes

Must Be Available in All Lab Areas That Use or Store Chemicals Which Are Corrosive or an Irritant to the Eyes or Skin
Storage of chemicals

**Acids:**
- Stored in separate acid resistant plastic trays
- On shelves at two or three feet and never above eye level.
- Make sure that the picric acid is kept wet and in a bottle with a plastic lid
Storage of chemicals

**Bases:** Ammonium, Sodium, Potassium Hydroxides should be stored at two or three feet and never above eye level.

**Flammables:**

such as solvents, oils and combustible liquids should be stored in a flammable storage cabinet.

Don’t store paper, cardboard or other combustible packaging materials inside the cabinet.
Storage of chemicals

**Oxidizers:**

- Are highly reactive and should be stored separately from other chemicals.
- Oxidizers such as Hydrogen peroxide, permanganates, chlorates including bleach need to be stored together and away from flammables.
- Nitrates and metal salts that are not oxidizers should be stored in this area but on a different shelf from those listed above or in a separate area.
Storage of chemicals

- **Sodium:**
  Water reactive metals, such as Sodium and Lithium, should be stored in a separate cabinet because of their reactivity.

- **Dry Chemicals:** can be stored together.
Chemical Hazards

Biosafety Level 1 and 2 laboratories

Separate cabinets for storage:
- spill containment cabinet
- hazardous waste storage
- flammable liquids storage
<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>KEEP OUT OF CONTACT WITH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid</td>
<td>Chromic acid, nitric acid, perchloric acid, peroxides, permanganates and other oxidizers</td>
</tr>
<tr>
<td>Acetone</td>
<td>Concentrated nitric and sulfuric acid mixtures, and strong bases</td>
</tr>
<tr>
<td>Alkali metals</td>
<td>Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens</td>
</tr>
<tr>
<td>Ammonia, anhydrous</td>
<td>Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials</td>
</tr>
<tr>
<td>Flammable liquids</td>
<td>Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens</td>
</tr>
<tr>
<td>Hydrogen peroxide</td>
<td>Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids</td>
</tr>
<tr>
<td>Iodine</td>
<td>Acetylene, ammonia (aqueous or anhydrous), hydrogen</td>
</tr>
<tr>
<td>Nitrates</td>
<td>Sulfuric acid</td>
</tr>
<tr>
<td>Nitric acid (concentrated)</td>
<td>Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals</td>
</tr>
<tr>
<td>Peroxides, organic</td>
<td>Acids (organic or mineral), avoid friction, store cold</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, etc.)</td>
</tr>
</tbody>
</table>
The “Don’ts” of Chemical Storage!

- Avoid storing any chemical above eye level
- Don’t store incompatible chemicals together
- Don’t store chemicals near sources of heat or sunlight
- Don’t store chemicals in the hoods or acids on metal shelves
- Avoid storing anything on the floor, especially glass bottles
Ideal Storage Area Set-Up

- **Acids**
  - Room Should Have:
    - Eye Wash
    - Safety Shower
    - Emergency Phone
    - Fire Extinguisher

- **Bases**

- **Dry Chemicals**

- **Spill Materials**

- **NA, LI**

- **Oxidizers**

- **Metal Salts**

- **Nitrates**

- **Flammables Cabinet**
Spill kit for chemical spills

- Include spill control pillows, pads, etc.; scoops, brooms, pails & bags; absorbent – such as diatomaceous earth; neutralizers – for acids & alkalis and mercury spill control kits.
Chemical spill kit

- Polypropylene or high-density polyethylene bucket with top
- Personal protective equipment (PPE) – (safety eyewear, gloves, etc.)
- Tools – (chemical resistant, nonsparking (plastic) dustpan or scoop and brush, etc.)
- Inert absorbents – (vermiculite, sand, clay, absorbent socks or pillows, etc.)
- Neutralizing and treatment materials – (type and quantity are dependent on the laboratory’s chemicals)
- Chemical resistant bags
- Hazardous waste tags
Chemical spill

- Wear PPE
- Contain the spill with the cotton rolls
- Spread sand / absorbent / neutraliser (e.g. sodium bicarbonate for acid spill)
- Scoop up into a plastic container
Chemical Spills

- anything beyond a \textbf{minor} spill and requiring help from outside of the laboratory group constitutes a \textbf{major} spill
Large or especially hazardous spills

- Quickly assess whether there are any injured persons and attend to any person who may have been contaminated.
- Follow the notification, evacuation and emergency medical treatment procedures.
- Evacuate the immediate area until the hazardous release has been controlled.
Laboratory Fire Safety
Learn how to operate a portable fire extinguisher
Standard Safety Practices

DO-
EVERYONE is responsible for quality and safety