

Sample collection and shipping

Transport, biosafety and disinfection

medsurge+

therapeutics • technics • life

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Learning objectives

At the end of the presentation, participants should understand:

- Principles of biosafety
- How to transport dangerous pathogens
- Biosafety levels in a laboratory
- General disinfection principles

Laboratory Biosafety

WHO describes this is as:

- containment principles
- technologies
- practices
- implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release

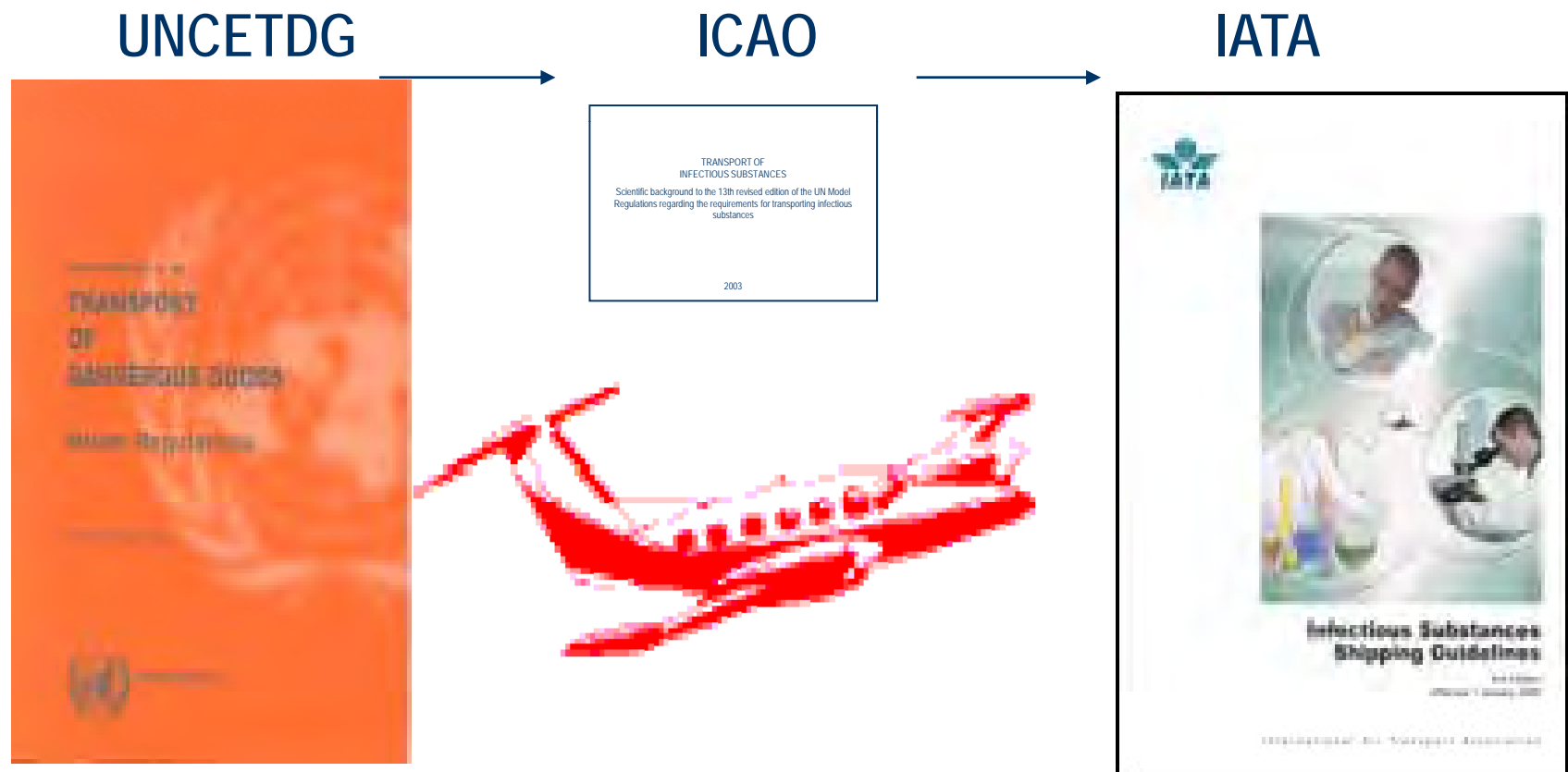
Principles of biosafety

To protect:

- the patient
- yourself
- the environment

Air transport of infectious substances

International Air Transportation Association (IATA) Infectious Substances Shipping Guidelines



Transport regulations (1)

- Transport of infectious substances is subject to strict national and international regulations:
 - proper use of packaging materials
 - proper labelling, notification
- Compliance:
 - reduces likelihood of damaging packages
 - minimizes exposure
 - improves carrier's efficiency and confidence in package delivery

Transport regulations (2)

- Subject to regular amendments
 - shippers refer to latest issuances of national and international regulations for regulations
- International regulations not intended to supersede local or national requirements
 - where national requirements do not exist, international regulations should be followed

How to select a laboratory

- Depends on specimen and analyses required
 - assess lab's capacity before sending
 - Some analyses (e.g. Ebola) performed in few places
 - identify recipient before sending
- Depends on transportation options, timing
- Depends on what capacity available
 - national reference laboratory, hospital laboratory
 - WHO Collaborating Centre laboratory, polio network laboratory
 - Pasteur Institute network laboratory, CDC/Namru/others

What to include on a request form

- Specimen collection date, time
- Epidemiological or demographic identification
 - to link laboratory and epidemiological data
 - patient's name (or identifier/outbreak code), age, sex
- Suspected clinical diagnosis, main clinical signs
- Context
 - suspected outbreak, confirmed outbreak, verified outbreak, end of outbreak or routine surveillance
- Sender name(s) and contact information

Triple packaging

- Main goals
 - protects the environment, the carrier
 - protects the sample
 - arrival in good condition for analysis
- If triple packaging not available
 - prepare according to international dangerous goods transportation rules (see IATA guidelines)

The basic triple packaging system

- Three layers of protection are needed:
 - primary receptacle
 - secondary packaging
 - outer packaging
- IATA shipping guidelines provide details about definitions, packaging requirements, markings and labels, accompanying documentation, notification protocols and refrigerants

The basic triple packaging system: primary receptacle

- Leak-proof specimen container
- Packaged with sufficient absorbent material to absorb the entire content of the primary receptacle in case of breakage

The basic triple packaging system: secondary receptacle

- Leak-proof secondary container
- Encloses and protects the primary receptacle(s)
 - several cushioned primary receptacles may be placed in one secondary packaging
 - sufficient additional absorbent material to absorb all fluid in case of breakage

The basic triple packaging system: outer packaging

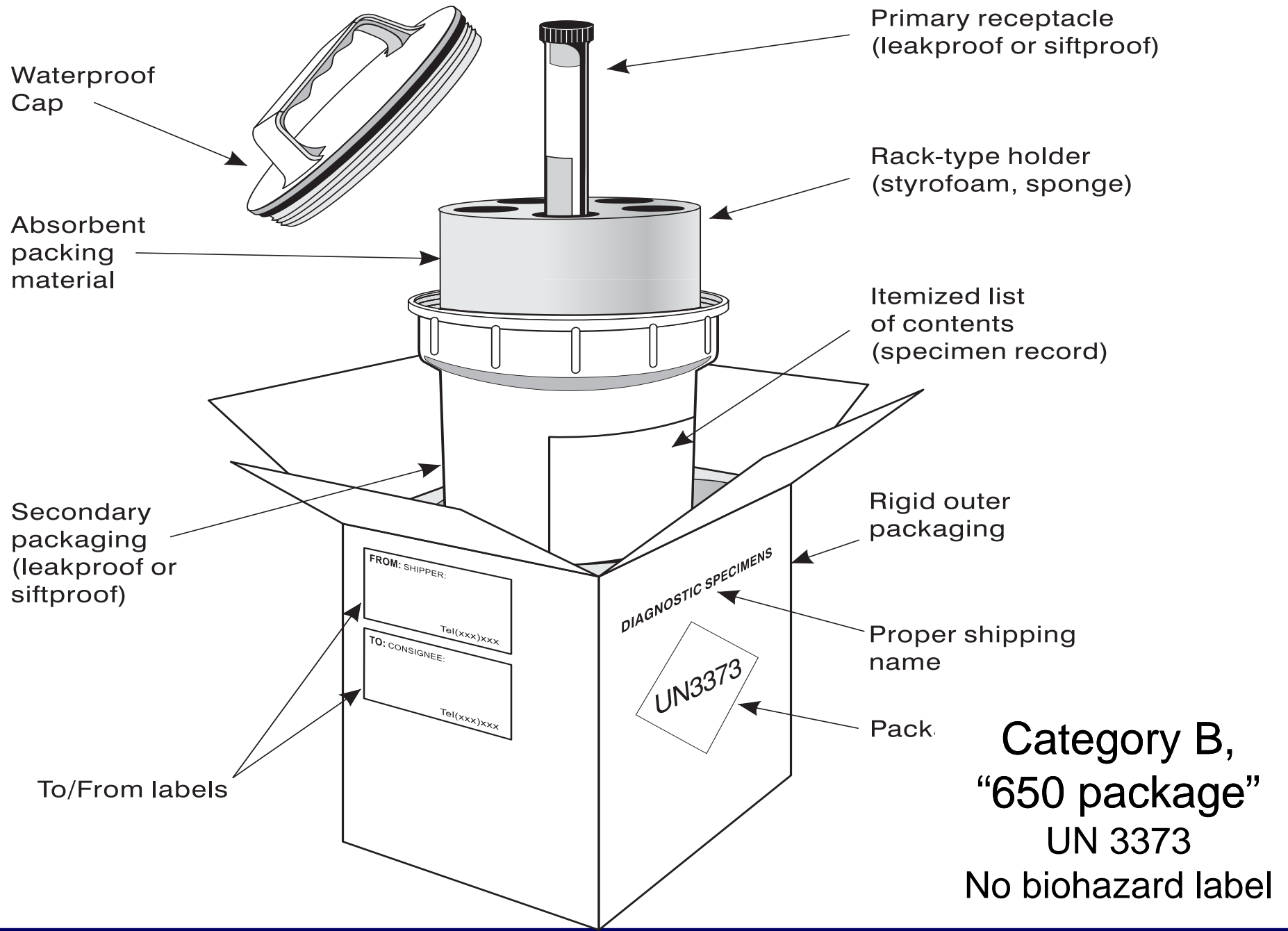
- Secondary packaging(s) are placed in outer shipping packaging with suitable cushioning material
- Outer packaging protects contents from outside influences, physical damage, while in transit
- Smallest overall external dimension 10 x10 cm

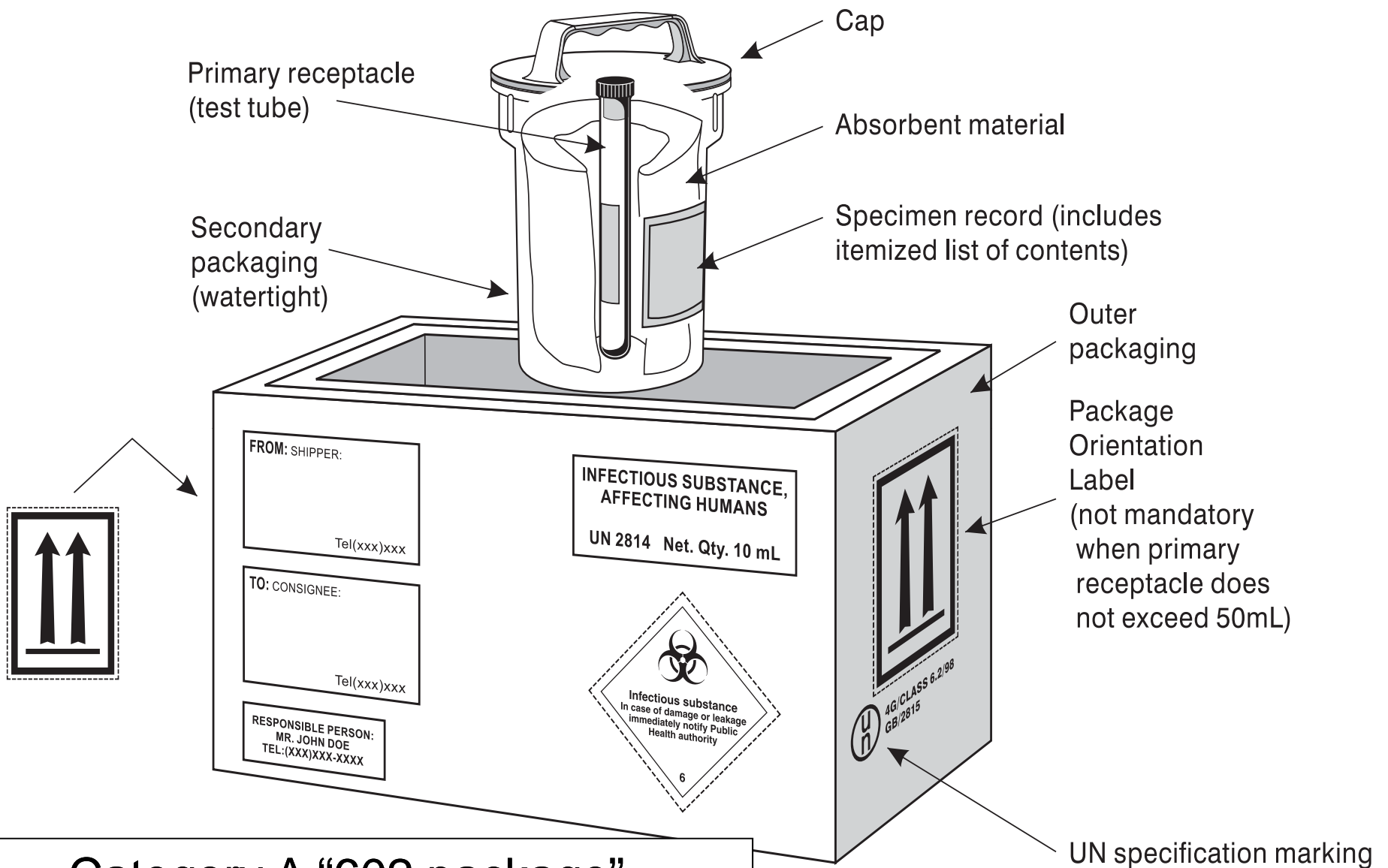
Infectious substances included in the category A

- Highly pathogenic micro-organisms
- Indicative list available
 - Haemorrhagic fever agents
 - Variola virus
 - Other pathogens dangerous only in culture
(of concern to laboratory staff only)

Key principles: dangerous goods

- Infectious substances, Category B
 - IATA Packing Instruction 650, “Diagnostic specimens” (UN 3373)
 - Use UN 3373 label
 - Do not use biohazard label
- Infectious substances, Category A
 - IATA Packing Instruction 602, “Infectious substances” (UN 2814 or UN 2900)
 - Use biohazard label

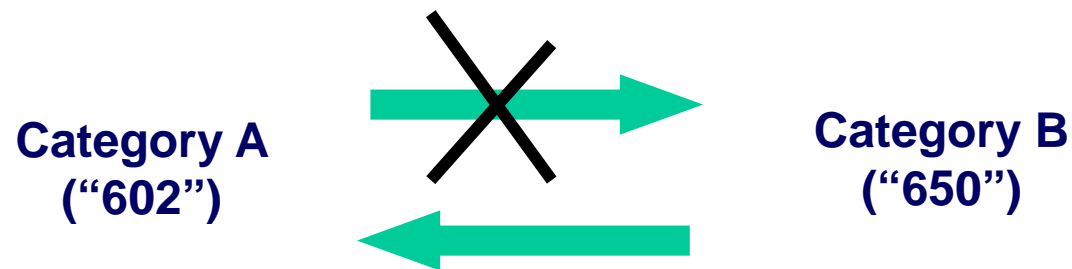




Category A “602 package”
 Labels: UN 2814 UN 2900 Biohazard

Triple packages

- Category B infectious substances may be shipped in "602" packages, as long as the correct marking and labelling is provided on the outer package
- Category A infectious substances cannot be shipped in "650" packages



Biosafety containment levels

- Biosafety levels
 - Level 1 & 2: basic laboratories
 - Level 3: containment laboratories
 - Level 4 : high containment laboratories
- Each level associated with appropriate
 - Equipment, practices, work procedures
- Diagnostic and health-care laboratories must be biosafety level 2 or above

Risk group classification

Risk Group	Individual risk	Community risk
1	no, low	no, low
2	moderate	low
3	high	low
4	high	high

Risk Group 1

- Unlikely to cause animal or human disease
- Non pathogenic agent

Risk Group 2

- Pathogenic for humans
- Unlikely a serious hazard
- Treatment and preventive measures available
- Limited risk of spread of infection



CDC, Yersinia pestis laboratory

Risk Group 3

Pathogenic, cause serious disease

Effective treatment and preventive measures usually available

Little person-to-person spread



Laboratory in Lyon France

Risk Group 4

Lethal, pathogenic agent

Readily transmittable

- direct, indirect

Effective treatment and preventive measures not usually available



National Institute for Infectious Diseases, Rome, Italy

Risk groups, biosafety levels, practices and equipment

BSL	Laboratory type	Laboratory practices	Safety equipment
1	Basic teaching, research	Good microbiological techniques	None Open bench work
2	Primary health services; diagnostic services, research	Good microbiological techniques, protective clothing, biohazard sign	Open bench PLUS biological safety cabinet for potential aerosols
3	Special diagnostic services, research	As BSL 2 PLUS special clothing, controlled access, directional airflow	Biological safety cabinet and/or other primary devices for all activities
4	Dangerous pathogen units	As BSL 3 PLUS airlock entry, shower exit, special waste	Class III biological safety cabinet, positive pressure suits, double ended autoclave (through the wall), filtered air

Disinfection

Disinfection requirements depend on the experimental work and nature of the agents being handled

Contact time and concentration for disinfectants are specific for each material and manufacturer

Efficacy is a function of surface, contact time, product, dilution

Using detergents

- Use licensed detergents/disinfectants
- Follow manufacturers' recommendations
- Wear adequate personal protective equipment
- Perform hand hygiene
- Avoid difficult to clean surfaces/ materials (carpet, wood)
- Apply disinfectant to a large area - wiping, soaking
- Avoid aerosolizing specimens while handling

Disinfection with household bleach

Work areas

- disinfect with 0.5% bleach after every procedure

Contaminated supplies

- soak with 0.5 % household bleach for 30 minutes
- wash in soapy water
- sterilize as necessary



Photo: WHO

Activity spectrum of select detergents and disinfectants

	BG+	BG-	Myco B	Spores	Yeast	Virus	Prions
Alcohol 70°	++	++	++	0	+	+	0
Aldehydes	+++	+++	++	+	+++	++	0
Ammonium IV	+++	+	0	0	+	+	0
Anilides	+	0	NP	NP	0	NP	0
Chlorhexidine	+++	++	0	0	+	+	0
Cl compounds	+++	+++	++	++	++	++	+ (a)
Iodine (+ der.)	+++	+++	++	++	++	++	0
Hg compounds	++	++	0	0	+	0 ou +	0
Phenols :	Variable activity depending on components ^(b)						
Hexachlorophene	+++	+	0	0	+	0	0

(a) Bleach (6%) during 60 min at 20° C ; (b) discussion on efficacy of phenol on prions

Personal Protection: Gloves

- Whenever possible, suitable gloves should be worn when handling biohazardous materials
 - not a substitute for regular and proper hand hygiene

Personal Protection: Hand hygiene



Alcohol based hand rubs are gold standard in health care settings (if hands not visibly soiled)

Must complement with hand washing with normal soap

Photos: WHO

Category A

Bacillus anthracis (cultures only)

Coccidioides immitis (cultures only)

Brucella abortus (cultures only)

Coxiella burnetii (cultures only)

Brucella melitensis (cultures only)

Crimean-Congo hemorrhagic fever virus

Brucella suis (cultures only)

Dengue virus (cultures only)

Burkholderia mallei [Pseudomonas mallei – Glanders](cultures only)

Eastern equine encephalitis virus (cultures on

Escherichia coli, verotoxigenic (cultures only)

Burkholderia pseudomallei [Pseudomonas pseudomallei] (cultures only)

Ebola virus

Chlamydia psittaci [avian strains] (cultures only)

Flexal virus

Francisella tularensis (cultures only)

Clostridium botulinum (cultures only)

Category A (cont'd)

Guanarito virus

Hantaan virus

Hantaviruses causing haemorrhagic fever with renal syndrome

Hendra virus

Hepatitis B virus (cultures only)

Herpes B virus (cultures only)

Human immunodeficiency virus (cultures only)

Highly pathogenic avian influenza virus (cultures only)

Japanese Encephalitis virus (cultures only)

Junin virus

Kyasanur Forest disease virus

Lassa virus

Machupo virus

Marburg virus

Monkeypox virus

Mycobacterium tuberculosis (cultures only)

Nipah virus

Francisella tularensis (cultures only)

Category A (cont'd)

Omsk hemorrhagic fever virus

Poliovirus (cultures only)

Rabies virus (cultures only)

Rickettsia prowasekii (cultures only)

Rickettsia rickettsii (cultures only)

Rift Valley fever virus (cultures only)

Russian spring-summer encephalitis virus (cultures only)

Sabia virus

Shigella dysenteriae type 1 (cultures only)

Tick-borne encephalitis virus (cultures only)

Variola virus

Venezuelan equine encephalitis virus (cultures only)

West Nile virus (cultures only)

Yellow fever virus (cultures only)

Yersinia pestis (cultures only)

Category A (cont'd)

- African swine fever virus (cultures only)
- Avian paramyxovirus Type 1 [Velogenic Newcastle disease virus] (cultures only)
- Classical swine fever virus (cultures only)
- Foot and mouth disease virus (cultures only)
- Lumpy skin disease virus (cultures only)
- Mycoplasma mycoides [Contagious bovine pleuropneumonia] (cultures only)
- Peste des petits ruminants virus (cultures only)
- Rinderpest virus (cultures only)
- Sheep-pox virus (cultures only)
- Goatpox virus (cultures only)
- Swine vesicular disease virus (cultures only)
- Vesicular stomatitis virus (cultures only)

Sample collection and shipping

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