

**Broad View of
Veterinary/Agricultural
Laboratory Capacity in
Resource-Constrained
Countries**

Suggested Topics

Laboratory capacity in resource-constrained countries:

- n Broad overview of veterinary and ag-lab capacity
- n Successes and challenges in developing laboratory capacity and epidemiological capacity
- n Overall state of clinician and field training in non-US and non-EU countries

Standards: Protect Humans and Environment:

- n **World Health Organization, 2004, *World Health Organization, Biosafety Manual*, Third Edition, World Health Organization, Geneva**
- n **U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; National Institutes of Health, 2007, *Biosafety in Microbiological and Biomedical Laboratories* (BMBL) 5th Edition**
<http://www.cdc.gov/od/ohs/biosfty/bmbl5/bmb15toc.htm>

Biosafety Levels

n WHO and BMBL

BSL-1

BSL-2

BSL-3

BSL-4

n BMBL

BSL-3 AG

Standards: Protect Animals & Environment:

n Reference

- n World Organisation for Animal Health (OIE) 2008. Chapter 1.1.6 Human safety in the veterinary microbiology laboratory, *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*.

http://www.oie.int/eng/normes/mmanual/A_00016.htm, 2005

- n OIE: Containment Groups 1-4

Overview of Laboratory Capacity in Resource-Constrained Countries

Biosafety Level 1

OIE Containment Group 1

- n Minimal biosafety
- n Work with well-characterized agents
- n Laboratory does not need to be isolated
- n Practices to minimize aerosols, biological safety cabinet (BSC) not usually required
- n Laboratory clothing recommended
- n No eating, drinking, smoking
- n No mouth pipetting

Examples:

Histopathology

Chemistry

Serology

Antigen detection tests?

Other ??

Biosafety Level 2

OIE Containment Group 2

Organisms – may be associated with veterinary and human disease

Procedures:

- ∅ Antigen detection procedures
- ∅ Serology
- ∅ Isolation and identification of most bacteria; anthrax-yes, brucella?, glanders-no
- ∅ PCR with appropriate safeguards

Resource-constrained countries can meet most of these biosafety requirements

Biosafety Level 2

OIE Containment Group 2 (cont)

- n BSL 1 plus:
 - n Access to laboratory is limited
 - n Protective lab coats, gowns, uniforms worn in lab but not out of lab
 - n Preferable to have windows that do not open



Biosafety Level 2

OIE Containment Group 2 (cont)

- n Work performed in class II biological safety cabinets (certified?)
- n Eye protection worn, face protection in BSC
- n Wastes not put into drains
- n Method to decontaminate laboratory wastes, _____
autoclave preferably,



Biosafety Level 3

OIE Containment Group 3

Laboratories in some resource-constrained countries can meet some of these BSL-3, CG-3 Standards, few can meet all

Organisms – indigenous or exotic agents which may cause serious or potentially lethal disease.

- n The disease is of severe economic and/or clinical significance.**
- n Prophylactic and/or therapeutic treatments are not readily available or of limited benefit**
- n Examples; isolation and identification of high path avian influenza, rinderpest, Rift Valley Fever**

Biosafety Level 3, OIE Containment Group 3 (cont)

- n BSL 2/Containment Group 2 practices plus the following:
 - n Restricted entry
 - n Decontamination of all waste (autoclave)
 - n All manipulations or infectious materials MUST be conducted in a Class II or III biological safety cabinet (certified?)
 - n Centrifuge buckets opened in biological safety cabinet



Biosafety Level 3

OIE Containment Group 3 (cont)

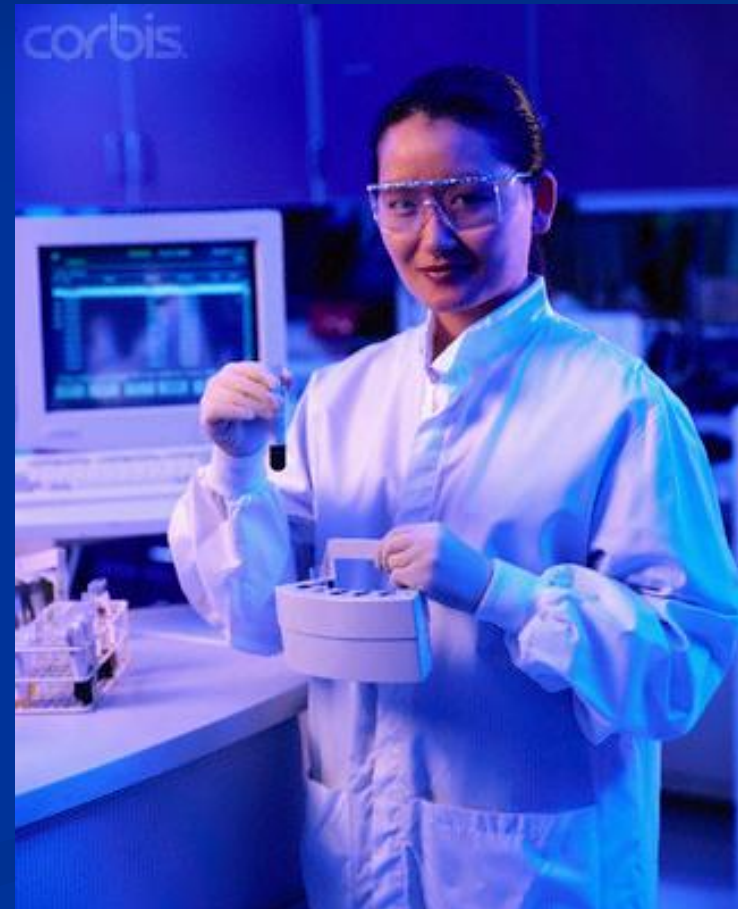
- n Self-closing double door access, doors have locks
- n All windows are closed and sealed
- n Complete clothes change and shower out recommended (Required in most Ag labs)



Biosafety Level 3

OIE Containment Group 3 (cont)

- n Appropriate personal protective equipment is worn
- n Decontamination of laboratory clothing
- n Laboratory is separated from unrestricted traffic flow
- n Floor, wall, and ceiling are sealed, impermeable to liquids, and resistant to disinfectants



Biosafety Level 3

OIE Containment Group 3 (cont)

- n **Capability to decontaminate large equipment**
- n **All windows are closed and sealed**
- n **Incinerator available**

OIE Containment Group 3 (cont) and BSL-3-Plus

Resource-constrained countries often cannot meet the following:

- n Negative airflow – Ducted air ventilation system required, exhaust air must not re-circulate
- n HEPA filtration of exhaust air
- n Gas tight dampers on air system to prevent backflow
- n Decontamination of laboratory effluent

Can a laboratory that has competent trained people and meets the requirements on previous slides, but not these, perform BSL-3/CG-3 and 4 testing?

OIE Containment Group 4

**Containment Group 4 is very similar to BSL-3
*Plus***

- n The disease is of extremely severe economic and/or clinical significance.**
- n No satisfactory prophylactic and/or therapeutic treatments are available**
- n Example: foot and mouth disease**

OIE Containment Group 4

Containment Group 3 plus:

- n Shower out upon exit
- n Supply air to and exhaust air pass through HEPA filters
- n Double door autoclave, dunk tank, fumigation chamber available for decontamination
- n Supplies and materials can only enter through airlock/fumigation chamber or pass clave with interlocks to prevent opening of enter and outer doors

Animal Inoculation

(Example: avian influenza pathotyping)

BSL-3 Ag (As described in BMBL): All the requirements of BSL-3, CG-3, CG-4 should be met plus interior surfaces (walls, floors, and ceilings) and penetrations are sealed to create a functional area capable of passing a pressure decay test, a sealed laboratory
OR

If isolation cages with HEPA inlet and exhaust filters are used, animals can be held in animal biosafety level 3 CG-3 or CG-4 facility.

Should animal inoculation with exotic agents be done in facilities that do not meet this Standard or should inoculation be done in an OIE Reference Laboratory?

Animal Isolation Cage



ONE SET OF TWO MODEL 934-2-WD

Post Mortem Facilities

n Should meet appropriate BSL or Containment Group requirements such as restricted entry, use of biosafety cabinets and shower out

Few resource-constrained countries can meet this standard

An alternative is performing the post mortems in the field wearing PPE and then burying the remains of the animal. Is this satisfactory?



Biosafety Level 4

- n **Organisms – Dangerous or exotic agents which pose a high risk of life-threatening disease to humans**
- n **Example; Ebola Virus**
 - n **Exposure hazard – aerosol-transmitted laboratory infections**

Biosafety Level 4

- n All requirements of Containment Group 4 plus Safety Equipment (primary barriers)
 - n Suit laboratory: All procedures conducted in a biological Safety Cabinet in conjunction with a full-body, air-supplied positive pressure personnel suit *OR*
 - n Cabinet Laboratory: All procedures conducted in a Class III biological Safety Cabinet with appropriate personal protective equipment

Biosafety level 4 facilities have additional requirements that will not be covered here

Successes and challenges in developing laboratory and epidemiological capacity

Successes

- n An enthusiastic, conscientious workforce that is anxious to meet biosafety requirements
- n Many have received excellent training
- n Many laboratories have purchased or been supplied with some of the equipment and supplies needed.

Challenges

- n Limitations, in some countries:
 - ∅ Disease surveillance infrastructure, small number of samples submitted
 - ∅ Small field force
 - ∅ Number of vehicles
 - ∅ Disease is not always reported
 - ∅ Accessibility to animals limited
 - ∅ Laboratory resources:
 - ∅ Facilities, i.e. only BSL-1, CG-1
 - ∅ Reagents, i.e. test kits
 - ∅ Equipment, i.e. biosafety cabinets
 - ∅ Training
 - ∅ Electric generator

Training

- n Excellent avian influenza training has been provided to many laboratory and some field people
- n Training included clinical signs, diagnostic tests, optimal response, disease reporting, and disease control techniques
- n Personnel, especially field people, from some countries did not receive this training
- n Limited availability of training for diseases other than AI

Conclusions:

Resource-Constrained Countries

- n BSL-2, CG-2 procedures are the primary diagnostic methods used in most countries, very few BSL-3, CG-3 or CG-4 laboratories. These BSL-2/CG-2 procedures generally can provide an accurate diagnosis**
- n Some laboratories have incorporated some of the BSL-3/CG-3 biosafety procedures in order to provide additional diagnostic testing capability, i.e., virus isolation**
- n OIE Reference Laboratories support these laboratories by providing other procedures, such as animal inoculation**
- n Limited resources and poor infrastructure have restricted the disease surveillance and laboratory response in some countries**