WHO Laboratory Biosafety Manual

- Having served for global biosafety community
  - Hereinafter, “WHO Manual”
  - “For more than 20-30 years, since it was first published in 1983, the Laboratory Biosafety Manual has provided practical guidance on biosafety techniques for use in laboratories at all levels.” – WHO web site

- The 3rd edition translated into >10 UN official and other languages
  - WHO still receives queries for new languages
  - Published in 2004: 10 years have passed in this fast-evolving field → Time for revision

Things evolve

WHO Manual (1\textsuperscript{st} edition, 1983)

- Risk Group: I, II, III and IV
- "Laboratory Classification": Basic, Containment and Maximum Containment
  - "BSL" yet to be defined
- PDCA cycle $\rightarrow$ review

Technology

- Common diagnostic methods
- e.g. virus isolation $\rightarrow$ PCR
  - PCR first demonstrated in 1983
- WHO Extended Biosafety Advisory Group (BAG), 2010

- Regulatory and oversight mechanisms
  - “Many countries remain without…”

- Laboratory design and operating parameters
  - “Often confusing”
  - “a lack of evidence to underpin many commonly used controls”

- Universality of “solutions” questioned
  - “Developing countries in particular often struggle to implement”
  - “effective supplier networks, maintenance provision and other basic measures” often unavailable
WHO Extended Biosafety Advisory Group (BAG)
Meeting, Geneva, 24-25 November 2014

- Stakeholder meeting
- Review the 5-year plan
  → Redefine organizational roles and functions of WHO
- Recommendations
  - Revision to the WHO Biosafety Manual is both a necessary and a priority
  - General agreement that a user needs survey would be beneficial to determine how the Manual can best suit their needs
Discussion highlights:

- Fundamental or progressive changes to manual
- Prescriptive or performance-based requirements
- Standard or guideline
- Practical handbook or authoritative reference
- Need for basic biosafety principles/criteria
- Acknowledgement that WHO documents are considered the 'bible for users'
- Need to promote local and green solutions with focus on energy conversation - move away from unsustainable outcomes
- Acknowledgement that a graduated approach to compliance (whether by tier, step, etc.) can be beneficial
- Useful to consider “appropriate technology” that provides equivalent safety with a limited cost
Our audience varies...
What is “DR”? (Translated from Hindi)

कोठा न. ९१
- DR (डी ए एर) विरामी
जाँच गरें 'ठाँ'
International Health Regulations – IHR (2005)

Legally binding for all 196 States Parties, international law

Requires countries to develop minimum core national and international surveillance and reporting capacities

Core capacity 8: Laboratory
- Policy and coordination
- Diagnostic capacity
- Laboratory biosafety and biosecurity
- Laboratory based surveillance
Revision objectives

- Comprehensive revision
- Critical appraisal of biosafety practices (i.e. pathogen RG and BSL)
  - to be discussed below
- Risk-based
- Core/minimum requirements + suggestions for additional safety/security
  - provision of decision making instrument/flowchart
- Evidence-based
  - knowledge gap
    - what sort of evidence/experiments/research needed?
- Feasible and sustainable
WHO Laboratory Biosafety Manual
Reviewing/redefining key concepts

- **Microorganism Risk Group**
  - Risk Groups 1 to 4

- **Biosafety level**
  - Simple equation: helpful?
    - e.g. Ebola = RG4 = BSL4??

→ **Risk-based** approach
→ **Evidence-based** biosafety
→ **Clear needs to define core requirements**
  - realistic; better feasibility and sustainability

Risk Group 1: No or low individual and community risk
Risk Group 2: Moderate individual risk, low community risk
Risk Group 3: High individual risk, low community risk
Risk Group 4: High individual and community risk

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**Table 2: Relation of risk groups to biosafety levels, practices and equipment**

<table>
<thead>
<tr>
<th>RISK GROUP</th>
<th>BIOSAFETY LEVEL</th>
<th>LABORATORY TYPE</th>
<th>LABORATORY PRACTICES</th>
<th>SAFETY EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic – Biosafety Level 1</td>
<td>Basic teaching, research</td>
<td>GMT</td>
<td>None; open bench work</td>
</tr>
<tr>
<td>2</td>
<td>Basic – Biosafety Level 2</td>
<td>Primary health services; diagnostic services, research</td>
<td>GMT plus protective clothing, biohazard sign</td>
<td>Open bench plus BSC for potential aerosols</td>
</tr>
<tr>
<td>3</td>
<td>Containment – Biosafety Level 3</td>
<td>Special diagnostic services, research</td>
<td>As Level 2 plus special clothing, controlled access, directional airflow</td>
<td>BSC and/or other primary devices for all activities</td>
</tr>
<tr>
<td>4</td>
<td>Maximum containment – Biosafety Level 4</td>
<td>Dangerous pathogen units</td>
<td>As Level 3 plus airflow entry, shower exit, special waste disposal</td>
<td>Class III BSC, or positive pressure suits in conjunction with Class II BSCs, double-ended autoclave (through the wall), filtered air</td>
</tr>
</tbody>
</table>

BSC, biological safety cabinet; GMT, good microbiological techniques (see Part IV of this manual)
Review for the revision...1

- **Scope**
  - Audience
  - Biological materials, new technology

- **Biosafety and biosecurity**

- **Approach**
  - Setting out “core requirements”

- **Focused areas**
  - Good microbiological practices (GMP)
  - Risk assessment
Review for the revision...2

- Pathogen risk group (RG)
  - e.g. 1918 influenza: RG2 in some countries?
    - e.g. EU DIRECTIVE 2000/54/EC

- Biosafety level (BSL)
  - Physical containment (PC) level
  - Operational practices
  - BSL3+? BSL2**??

- Clear dissociation of RG and BSL

- Engineering and operational/administrative controls
  - Hierarchy of controls
  - Human factors (Human failure), e.g. validation
Areas missing/consideration

- Commissioning/Decommissioning
- Regulatory oversight mechanism
  - Reference to roles and functions of regulatory framework
  - to share best practices
- Field/emergency operations
  - Practically feasible operational guide
    - e.g. Ebola outbreak
- Common causes of accidents
- Risk communication
High containment facility

- Definition
- “Certification”
  - WHO standard?
- BSL3 assessment tool
- Mashrooming of BSL3s
  - Costing tool and checklist for planning
  - Recurring costs tend to be forgotten
- Construction, commissioning, operational/specific training
Derivatives/Supplementary publication

- Training tools
- “Monograph” – subject-specific booklet, such as:
  - BS in pathology lab
  - Research and production facilities
  - Animal facilities
  - Designing the labs
  - Waste management/waste segregation
    - clear guidance and solutions
  - Emergency procedures
- Field/outbreak operations
- Equipment and PPE - selection criteria
- Disinfection, inactivation
- Validation
- Regulatory oversight mechanism
- Accident/incident investigation, reporting, analysis
- Risk communication
- …
WHO Manual revision: Summary

- Comprehensive revision
  - Work plan drafted
    - a three-year project
    - consultation to various stakeholders planned
  - Manual (main text) + monographs

- Core requirements
  - Risk-based
    - clear decoupling of RG and BSL $\rightarrow$ decision-making instrument
    - Evidence-based
  - Aiming at practical feasibility and sustainability
  - User-oriented $\Rightarrow$ suggestions much appreciated
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