



Sustainable & Locally Practical Solutions for Laboratories in Resource Limited Countries

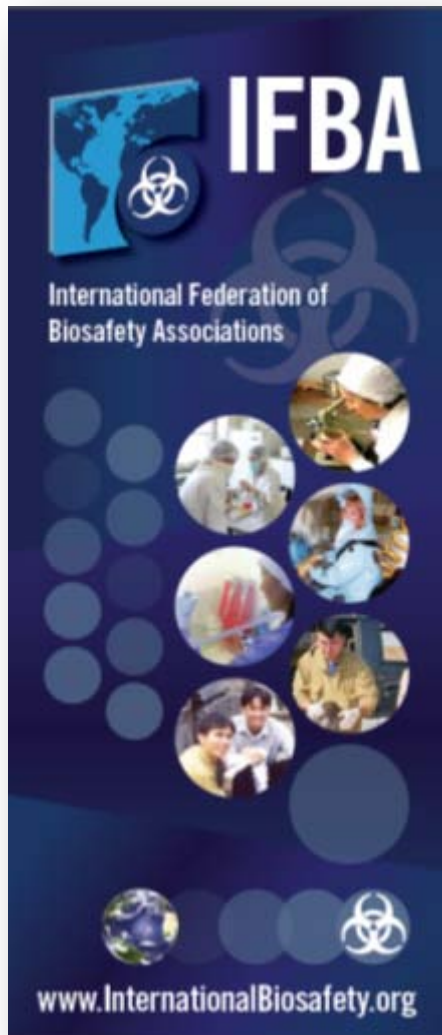
M. Ellis

Executive Director

International Federation of Biosafety Associations



International Federation of Biosafety Associations



- International non-profit NGO established in 2001
- Member national & regional biosafety associations
- Observer organizations (govt's, academia, multilateral organizations, NGOs)
- *"Safe, Secure & Responsible Work with Biological Materials"*



International Federation of Biosafety Associations

- Over 60 National/Regional biosafety association members & observers worldwide



- Collaborate with WHO, OIE, ASLM, CDC Global AIDS, Chatham House, CEN/ISO and many others as related to safe and secure laboratory facilities



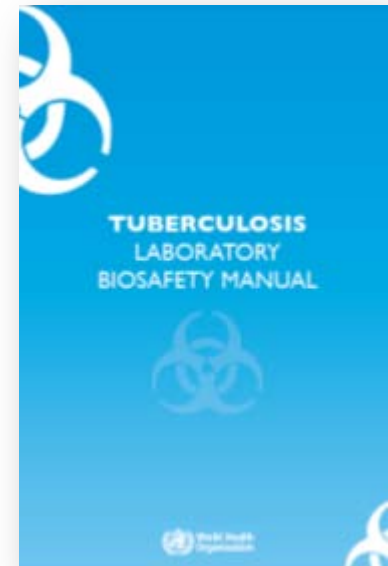
International Federation of Biosafety Associations

- Member of Stop TB Partnership's Global Laboratory Initiative
- Key GLI priority 2014 – “risk-based & sustainable engineering solutions for TB laboratories”



Stop TB Partnership

Global Laboratory Initiative



Laboratory biosafety, involving a task force to achieve consensus on appropriate biosafety standards for TB laboratories in resource-constrained settings, develop appropriate biosafety manuals, and design a comprehensive training plan and training materials.

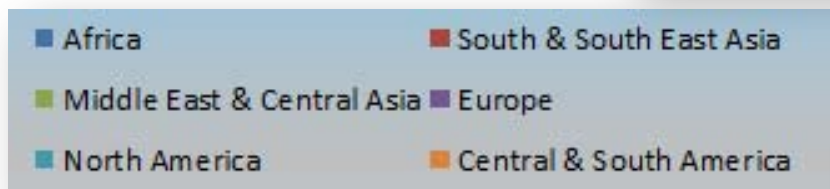
Biocontainment Engineering Working Group

- scientists, biosafety professionals, architects, engineers, facility maintenance staff, equipment manufacturers from around the world
 - Malaysia, Indonesia, India, Uganda, South Africa, Tanzania, Kyrgyz Republic, Switzerland, UK, Canada, US,
- familiar with working in, maintaining, designing, building, certifying BSL2/3/4 laboratories for both human & animal health
- understand local, practical issues in building and maintaining cost-effective facilities that are sustainable in resource limited countries over the longer term



Biocontainment Engineering Working Group

- BEWG met in 2012 in South Africa
- Gathered data on local challenges using real-time audience participation “Data on the Spot”
- Developed priority projects and needs for resource limited countries



BEWG Industry Partnerships

- Developed partnerships with private industry to achieve innovative & sustainable solutions for laboratory design



Modular laboratories for TB and BSL-2/3 Applications

Germfree, Nuair and IBA are working together to develop sustainable laboratory solutions to meet the most demanding global requirements. Germfree modular TB and BSL-2/3 labs are provided with primary and secondary containment equipment engineered to be energy efficient, durable and most important, locally certified and maintained.

Visit us at www.GERMFREE.com to learn more.



PROJECT SHEET

Project Name: Infectious Disease Diagnostic Laboratory, Natural ventilation/sustainable Systems

Initiative Sponsor: BEWG, Biosafety Engineering Working Group under the auspices of the IFBA-International Federation of Biosafety Associations

Location: Africa (or warm climate geography)

Value \$: 4-5 Million CND\$ (estimate)

Size of Project: Approximately 150 m²

Preliminary Design Work Underway: 2013

Firm Leading the Assignment: Merrick Canada

Contact Reference: Paul Langevin/Kuair Munoz

Phone Number: (1-613-410-8950)



Merrick & Company, under direction and support of the BEWG and IFBA, has developed a preliminary design for consideration that uses natural supply ventilation and hybrid mechanical exhaust ventilation to provide air conditioning and directional airflow in support of an infectious disease diagnostic laboratory. The principles of thermal buoyancy and wind are maximized to provide a sustainable solution. Additionally solar and wind power provide electrical support for primary and/or back-up energy linked to local utility companies and emergency generators if necessary. Air quality is controlled by a combination of convective entrainment baffles and filtration. A central up-draft, two stage fan is also provided to simplify the directional airflow. The architecture of the laboratory has three separate diagnostic zones with a specimen receiving, a small pathogen storage zone and inoculation rooms supporting each lab zone.



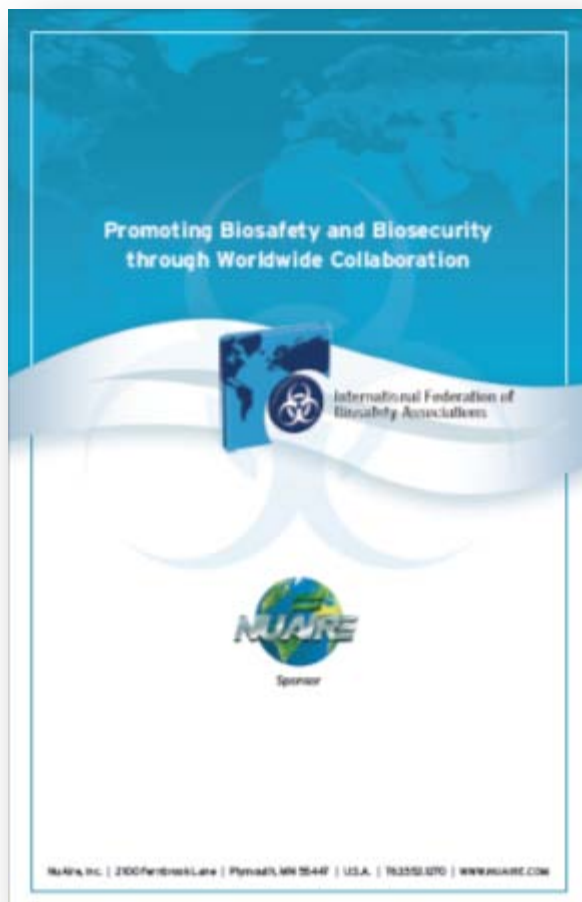
The shape of the facility uses millennium-old concepts that has been used for natural ventilated structures and has enhanced the controllability to include a re-mechanical fan to be added when thermal loads require or natural effects need augmentation. A water capture and storage system is also contemplated to include pre-treatment for internal use and integration with a utility supply. The design basis that has been applied considers various forms of sustainable opportunities; further considerations include light harvesting, re-circulation for the clean exhaust air, electrical tank-based heat and pre-mix return air.

Activities executed provided can be characterized as:

- Use of conventional and molecular PCR techniques to conduct preliminary and confirmatory diagnosis of BSL-2 or BSL-3 infectious agents.
- Reporting results to a central national laboratory.
- Providing regional diagnostic support for a countries disease response network.
- Sample accessioning and processing throughout the 3 zones.
- Biological Safety Cabinet placement for air pattern wind protections.
- Pathogen storage for regional considerations.

BEWG Industry Partnerships

- Developed partnership with Nuaire to achieve locally practical and sustainable solutions for BSCs



The IFBA and Nuaire are working together to find simple, safe and workable solutions to improve global laboratory biosafety by educating laboratory technicians, scientists and maintenance personnel about Biological Safety Cabinets as a primary means of containment for working safely with infectious organisms.



30% of Class II biological safety cabinets tested were poorly designed, installed incorrectly, not certified, or being operated incorrectly

Problem:
Risk assessment in human and animal health diagnostic laboratories is a fundamental process to identify potential hazards and specify practices and procedure that will minimize or eliminate exposure to those hazards. The use of biological safety cabinets (BSCs) presents one avenue for mitigating hazards associated with infectious biologicals and aerosols. Unfortunately, and far too often, personnel are not adequately trained in the proper selection, installation, use and ongoing maintenance of BSCs. Results of a recent survey conducted by the Asia-Pacific Biosafety Association highlighted that many BSCs were below an acceptable level of functionality (e.g. 30% of Class II biological safety cabinets tested were poorly designed, installed incorrectly, not certified, or being operated incorrectly).

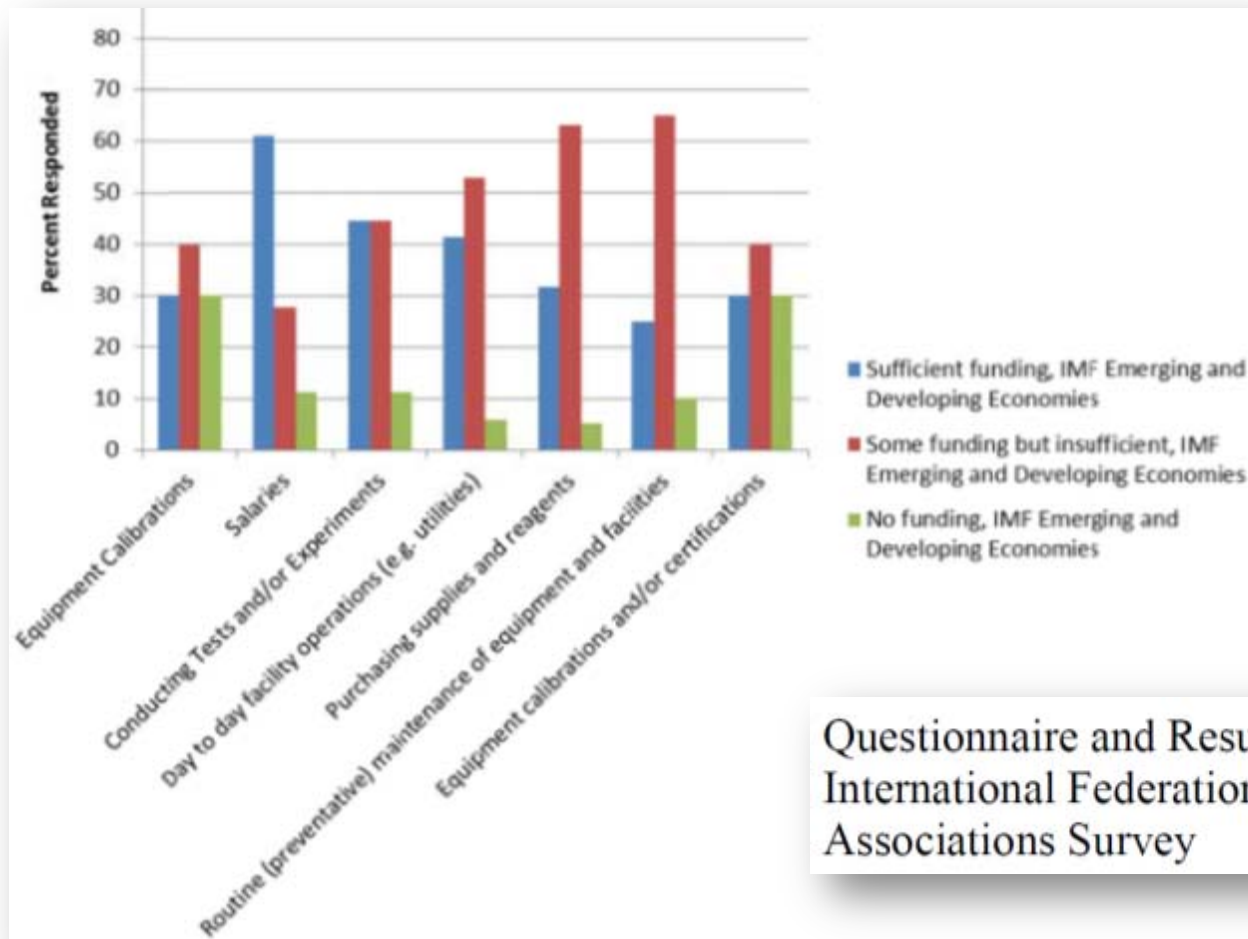
Challenges in Resource Limited Countries

- Cost pressures to build and maintain facilities
- Local unavailability of highly technical equipment
- Unreliable utilities
- Unfamiliarity of constructing and operating a highly complex laboratories



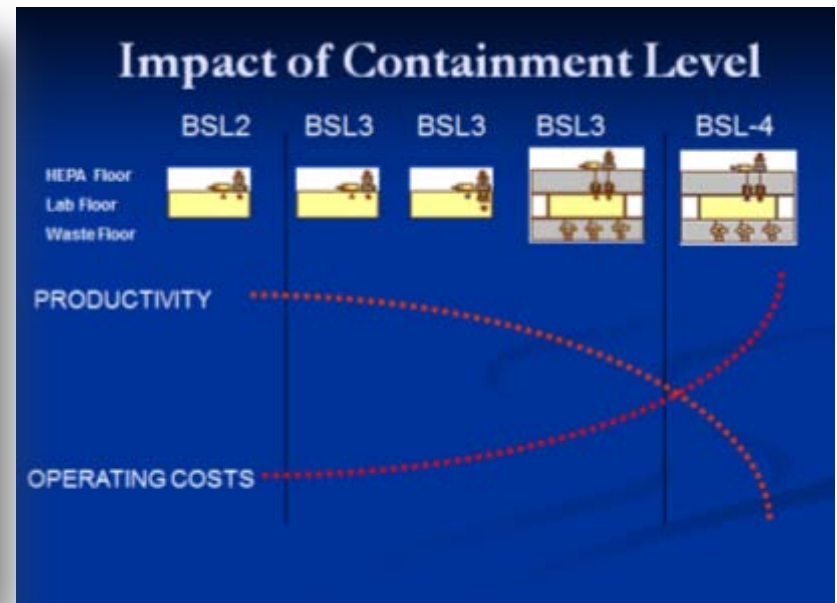
Cost Pressures in Resource Limited Countries

- Does your institution have funding for?

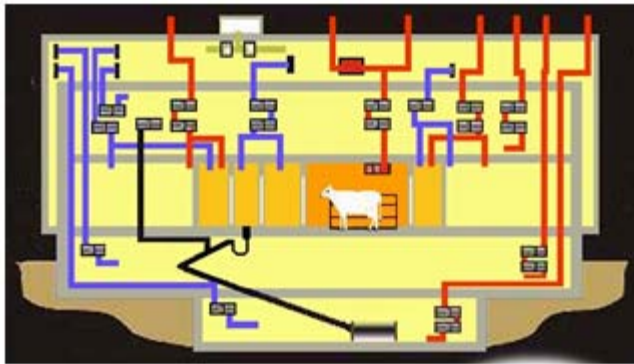


Cost Pressures in Resource Limited Countries

- Many resource limited countries need to routinely handle highly infectious diseases (TB, avian flu, anthrax, foot & mouth)
- Do not want to “overdesign” laboratory facility
 - Laboratory space (especially BSL3) is very expensive to build, operate and maintain
 - Working at BSL3 is less efficient (protective clothing, entry/exit procedures, medical surveillance)



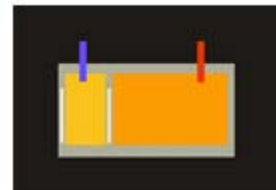
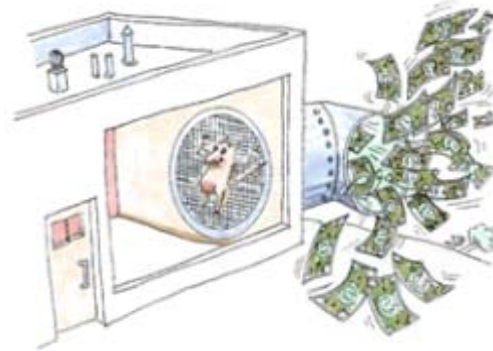
Cost Pressures in Resource Limited Countries



Don't build this.....



Big money....

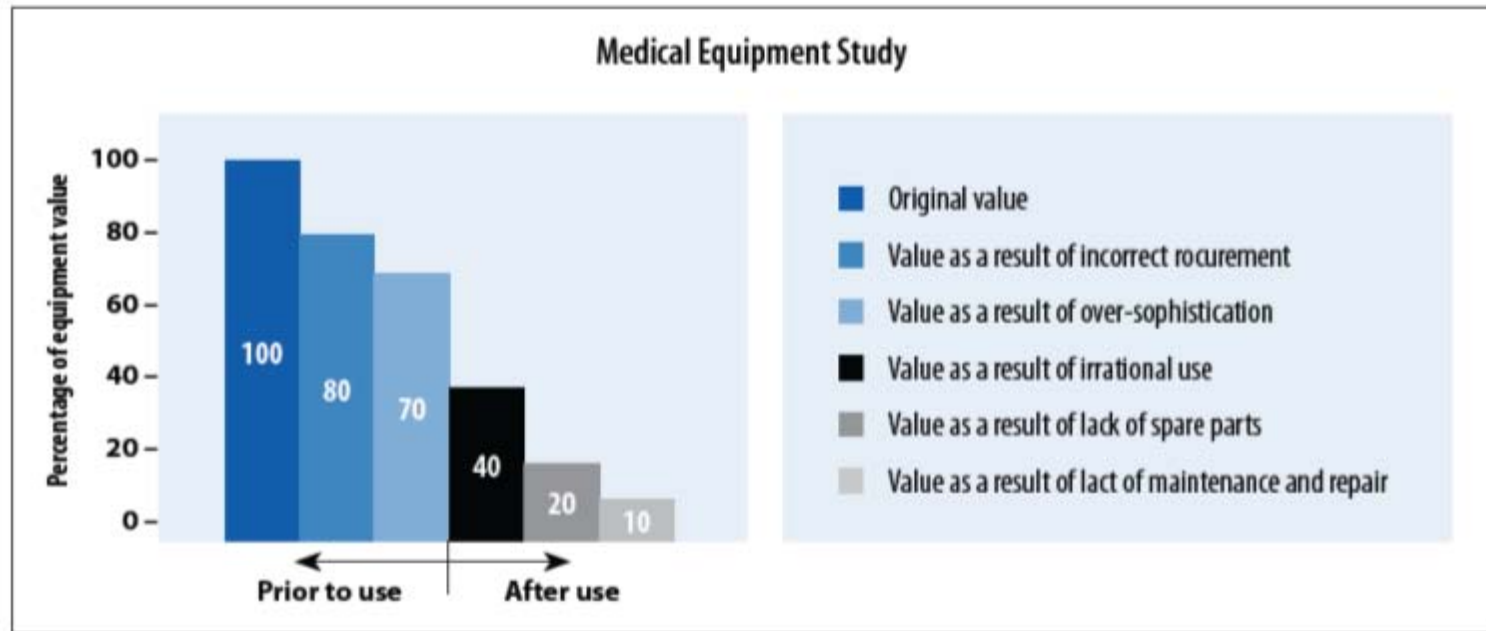


Pocket change....

When all you need is this

Cost Pressures in Resource Limited Countries

- Use limited resources towards a “rational” approach that is risk-based, cost-effective, practical and sustainable
- Identify the most effective technologies within country “context” – use of inappropriate technologies wastes resources and drains funds from more effective interventions



Source: Swiss Center for International Health, Basel, 2005

Risk-Based Approaches to Biocontainment

Does not prescribe specific BSL2 vs BSL3 requirements

- Scalable approach based on local risk assessment
- Balance between operational practices & engineering solutions
- Identify local solutions that are practical and can be cost-effectively sustained over the long term



BIO SAFETY ASSOCIATION FOR CENTRAL ASIA & THE CAUCASUS

3rd Annual Conference
Of The Biosafety Association
For Central Asia & The Caucasus

September 27-30, 2011
Holiday Inn
Tbilisi, Georgia

**"BIO SAFETY AND BIOSECURITY IN THE REGION:
WHAT WORKS AND WHAT DOESN'T"**

In program:

- Risk assessment
- Legal and regulatory issues
- Sustainability
- Training and education

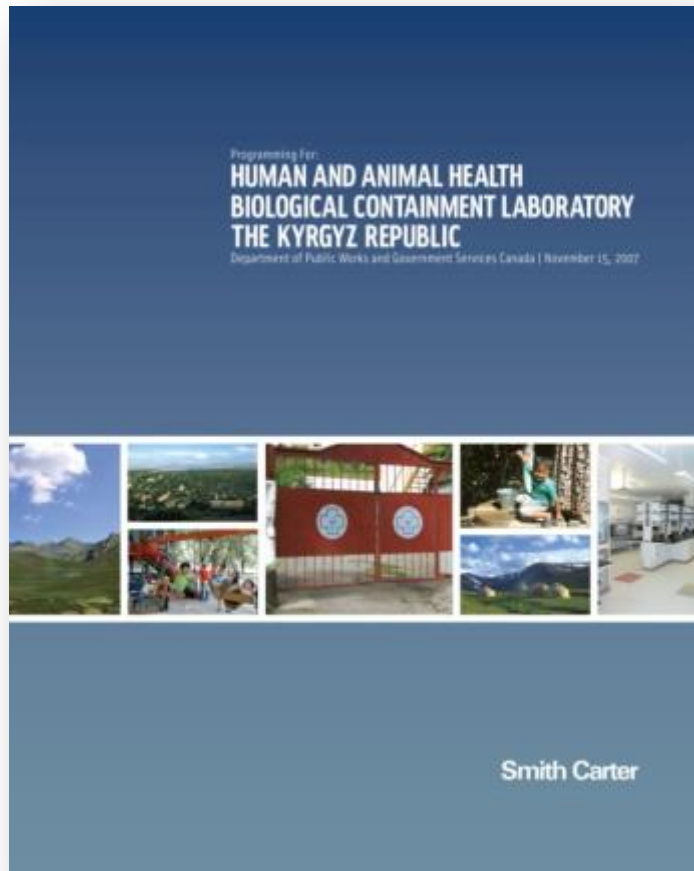
Pre-conference Workshops:

- Basic biosafety & biosecurity
- Training methodology and skills for adults training for biosafety trainers
- Proposal writing
- Occupational health & safety

FOR DETAILS AND REGISTRATION PLEASE VISIT WWW.BIAC.AC.ORG

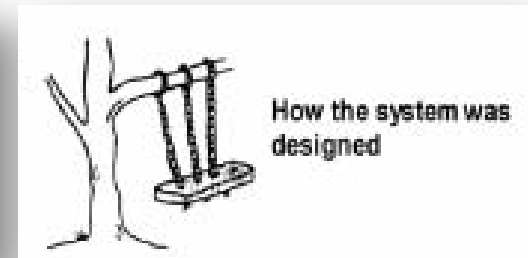
Risk-Based Approaches to Biocontainment

- Lessons learned on risk-based approach for new laboratory in Kyrgyz Republic
- Design completed but lab not built (*local political issues*)



Risk-Based Approaches to Biocontainment


- Experienced team to conduct risk assessment and recommend approach to laboratory design & construction
 - Architects, engineers, scientists, biosafety, O&M, security
- Uncertainty leads to overdesign \$\$\$\$\$



Risk-Based Approaches to Biocontainment

Team needs to be familiar with latest diagnostic technologies and approaches for setting up laboratory networks (e.g. Xpert MTB/RIF)

- Recommend appropriate biocontainment equipment & facilities


 **World Health Organization**

TUBERCULOSIS DIAGNOSTICS Xpert MTB/RIF Test

WHO RECOMMENDATIONS

The rapid TB test – known as Xpert MTB/RIF- is a fully-automated diagnostic molecular test. It has the potential to revolutionize and transform TB care and control. The test:

- simultaneously detects TB and rifampicin drug resistance
- provides accurate results in less than two hours so that patients can be offered proper treatment on the same day
- has minimal bio-safety requirements and training needs, and can be housed in non-conventional laboratories



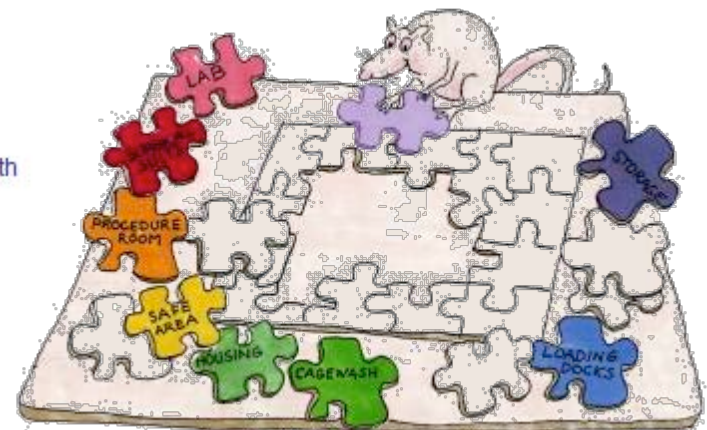
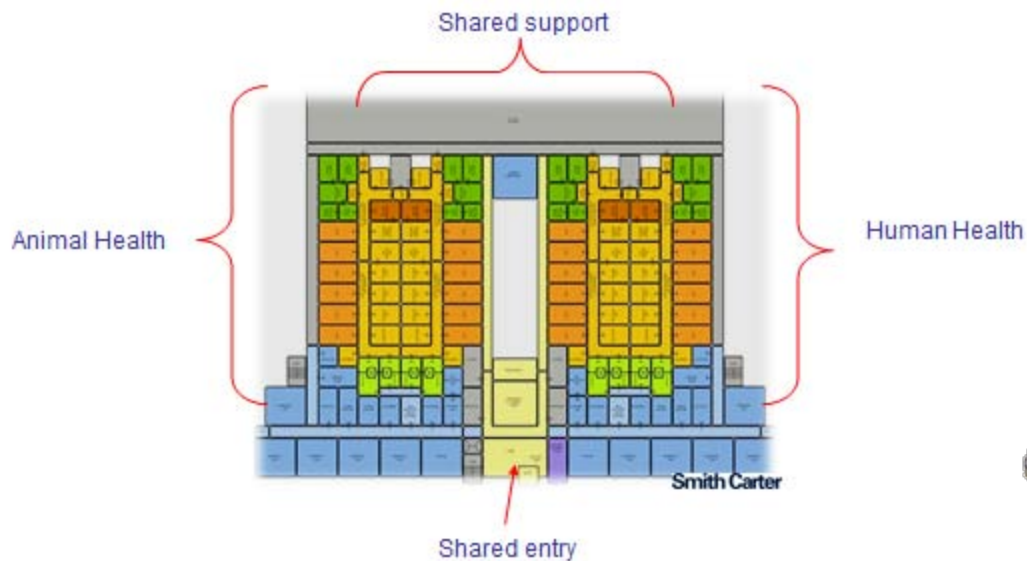
Risk-Based Approaches to Biocontainment

- Plan facility in accordance with capabilities of local facility operators and maintenance trades to construct and sustain facility over the long term
- Incorporate local equipment and import only what cannot be sourced locally



Risk-Based Approaches to Biocontainment

- Conserve human and financial resources by sharing laboratory between programs (different diseases, human & animal health, academia)
- Adjacency of spaces & efficiency of flow



Risk-Based Approaches to Biocontainment

- Balance between operational procedures and high-tech engineering solutions
 - Use HEPA bonnet cages or flexible film isolators instead of ventilated cage racks for small animals



Old open cages



Jar with tuna can lid



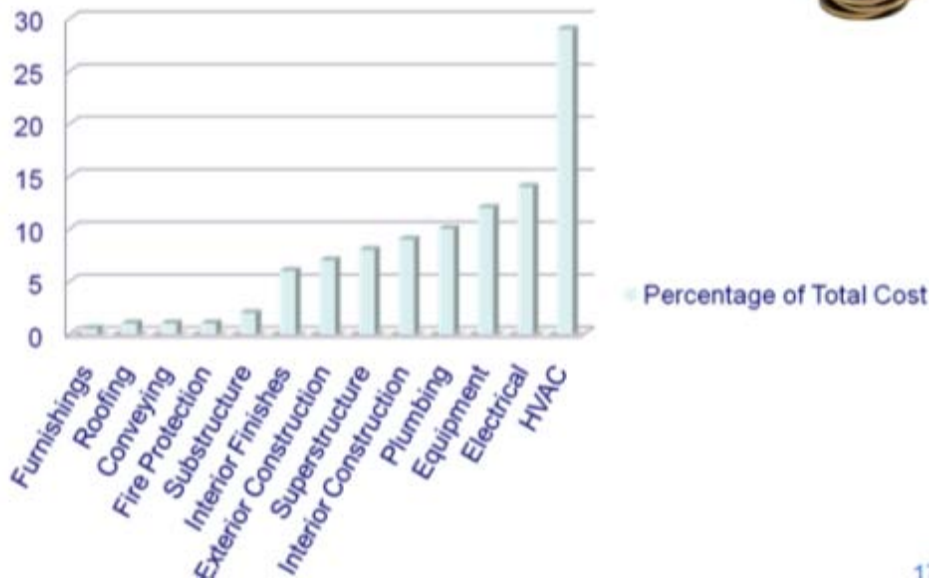
frequent cage changes due to poor microenvironment
(but labour is inexpensive)



have many cage parts and filters to maintain; need to balance with room

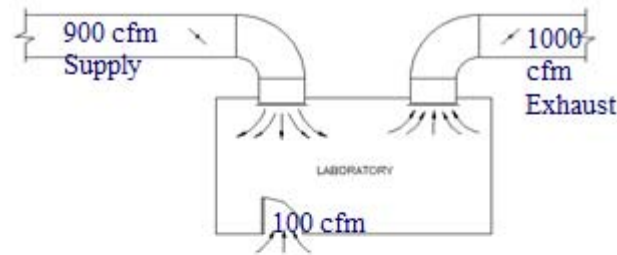
Risk Based Approaches to Biocontainment

- Where to save \$\$\$\$

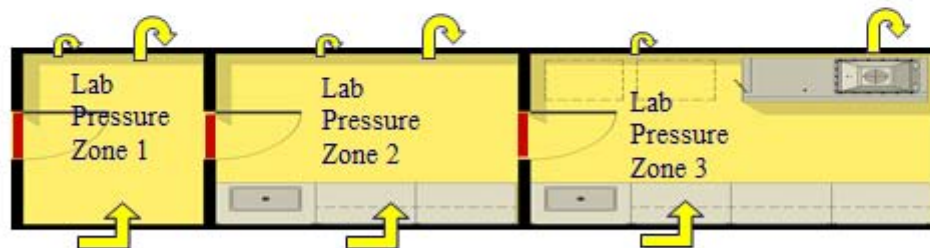


Risk-Based Approaches to Biocontainment

- Simple HVAC solutions



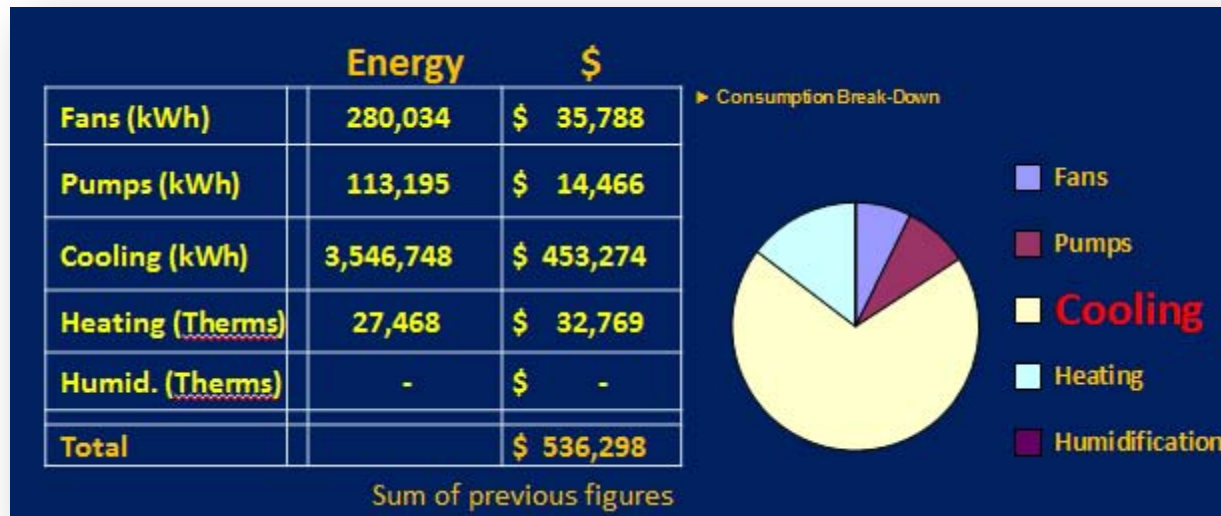
Simple solution – Volumetric Offset
“Leaky” Level 3



Complex solution – Differential Pressurization
“Air tight” Level 3

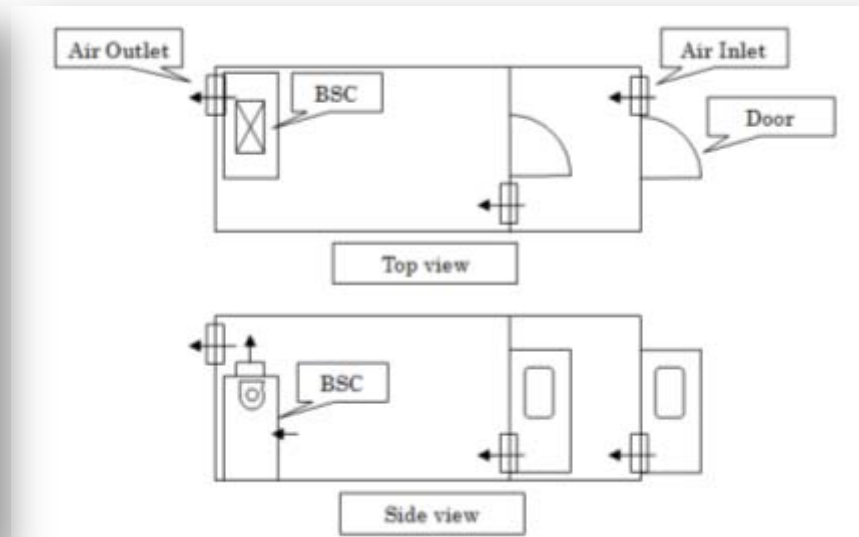
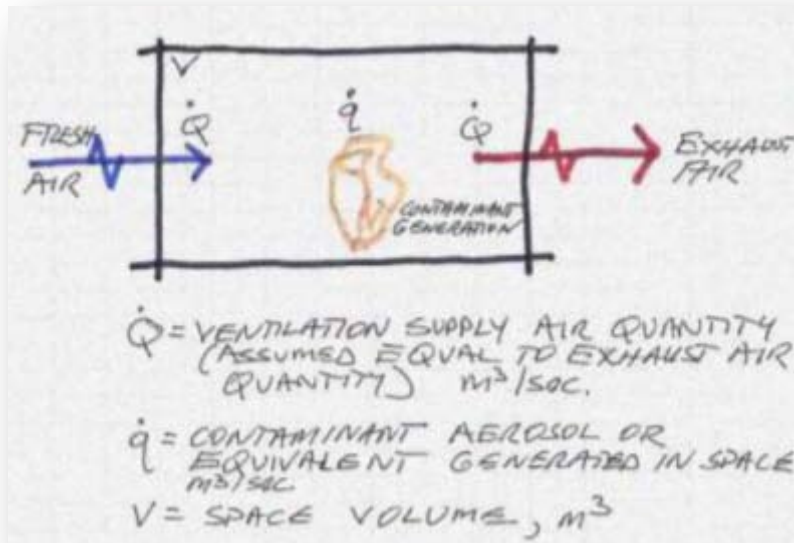
Where Else to Save \$\$\$\$

- Energy costs (e.g. cooling single pass air)
 - Consider recirculation, natural ventilation options



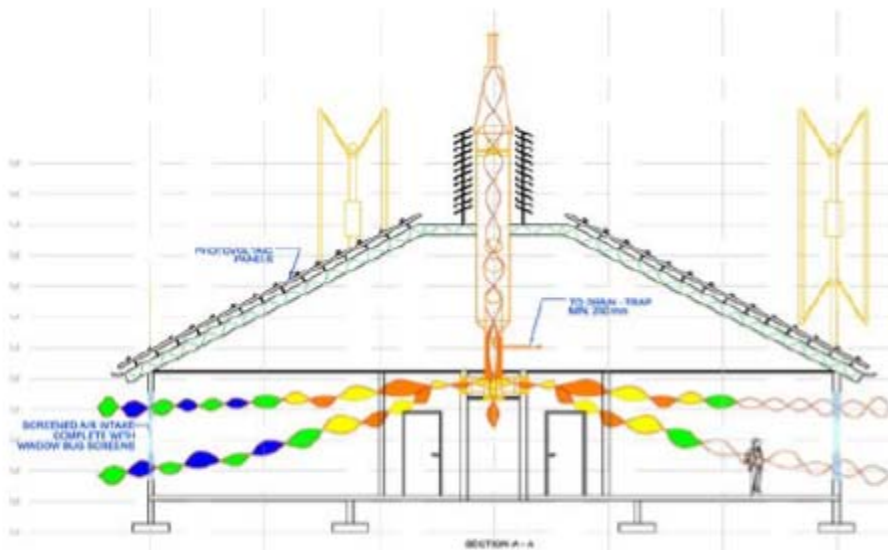
Natural Ventilation

- BEWG developing position papers and models for approaches to natural ventilation for laboratories
- Test run the model in developing country



Natural Ventilation

- Developing prototype designs



Practical Sustainable Approaches TB Labs

- Natural ventilation may be applicable for low level TB labs

Session N.00142

Biosafety for TB Laboratories: Involving Local Professional Associations in Practical Sustainable Approaches



Type Symposium

Track TB Bacteriology and Immunology

Topic TB laboratories: quality management and TB laboratories' network

Description Many TB laboratories lack adequate biosafety practices and infrastructure. The International Federation of Biosafety Association's global network of local NGOs is implementing practical and cost-effective biosafety and TB laboratory design solutions including natural ventilation. IFBA's local members understand local challenges in operating safe TB laboratories and are well placed to implement simple yet effective and sustainable biosafety solutions. The IFBA, a member of 'Stop TB Partnership', is also advocating for national authorities to work with biosafety associations.

Target audience Government TB policy makers, TB laboratories, architects/engineers who design and build TB laboratories, and other stakeholders with an interest in strengthening TB biosafety programs and laboratories.

Objectives

1. To demonstrate how local NGO partnerships can identify practical and sustainable TB biosafety approaches.
2. To present simple, practical risk-based solutions to TB biosafety practices, equipment and infrastructure.
3. To show how local NGOs are providing a valuable contribution to national TB control strategies.
4. To present a cost-effective modular approach to TB laboratories in a low resource setting.
5. To present natural ventilation approaches for TB laboratories.

Keyword(s) TB laboratories; biosafety; biocontainment; natural ventilation laboratories; nongovernmental professional associations

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Chair(s) Tabi Abiola [Nigeria] - tabiabiola@yahoo.com, Maureen Ellis [Canada] - m.ellis@internationalbiosafety.org

Presentations

00:00 - 00:00 The Role of Non-Governmental Biosafety Professional Associations in Implementing Practical Approaches to TB Biosafety
Maureen Ellis [Canada] - m.ellis@internationalbiosafety.org

00:00 - 00:00 The African Biological Safety Association and Nigeria's National TB Program
Tabi Abiola [Nigeria] - tabiabiola@yahoo.com

00:00 - 00:00 A Locally Driven Modular Approach to TB Laboratory in Haiti
John Ha [Haiti] - ha@hfr.cdc.gov

00:00 - 00:00 Locally Practical and Sustainable Approaches to TB Laboratory Biosafety in Asia-Pacific
Tin Chua [Singapore] - tinchua@hfr.org.sg

00:00 - 00:00 Natural Ventilation Approaches for TB Laboratories
Paul Jensen [USA] - pj44@hfr.gov, Alison Jones [UK] - ajon@hfrdesignglobal.com



WHO Publication/Guidelines

Natural Ventilation for Infection Control in Health-Care Settings

Edited by:
James Atkinson, Yves Chartier,
Carmen Lúcia Pessoa-Silva,
Paul Jensen, Yuguo Li
and Wing-Hong Seto

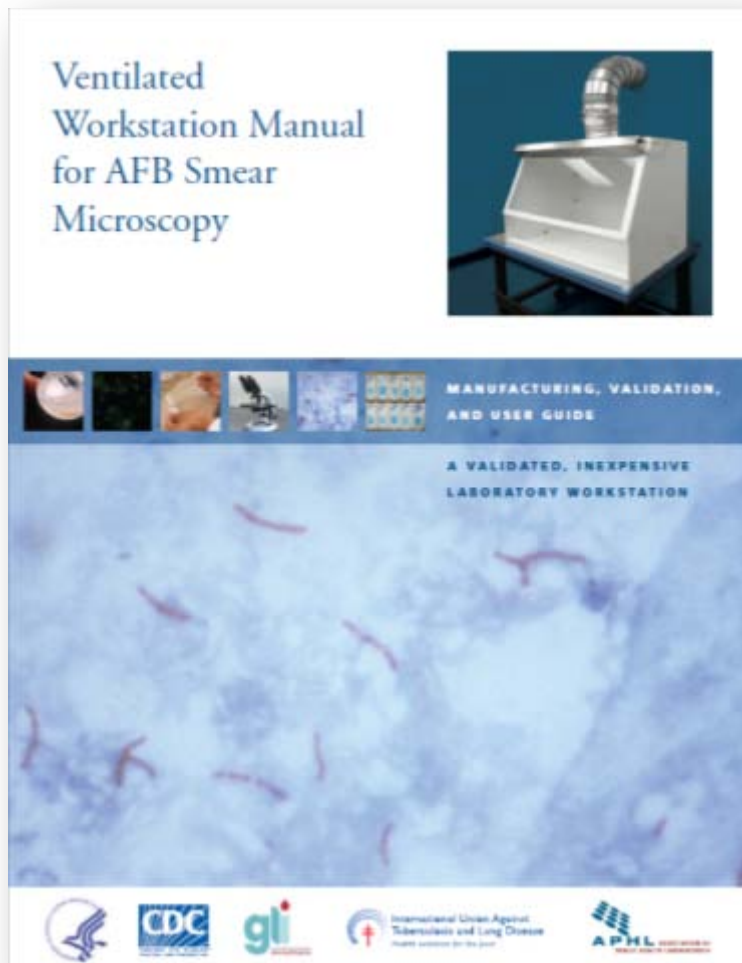
Practical Sustainable Approaches TB Labs

- BEWG also exploring modular approaches for TB labs
Hopital Universitaire Justinien, Cap Haitien, Haiti



Practical Sustainable Approaches TB Labs

- Ventilated workstation



Biological Safety Cabinets

- Many laboratories around the world do not have access to expertise & equipment to certify biological safety cabinets



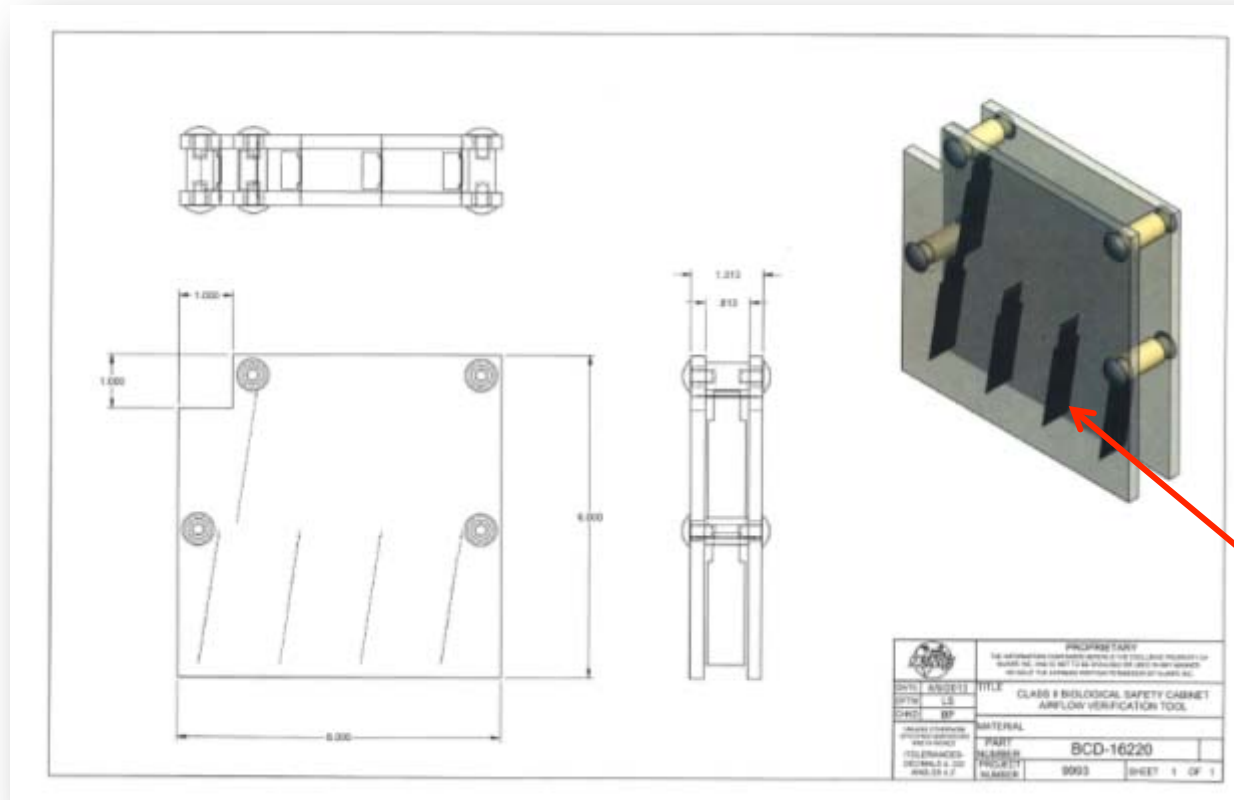
Biological Safety Cabinets

- Some programs to train certifiers and provide equipment
 - Canada's Global Partnership Program (Central Asia)
 - ACLEM (African Centre for Laboratory Equipment Maintenance)



Biological Safety Cabinets

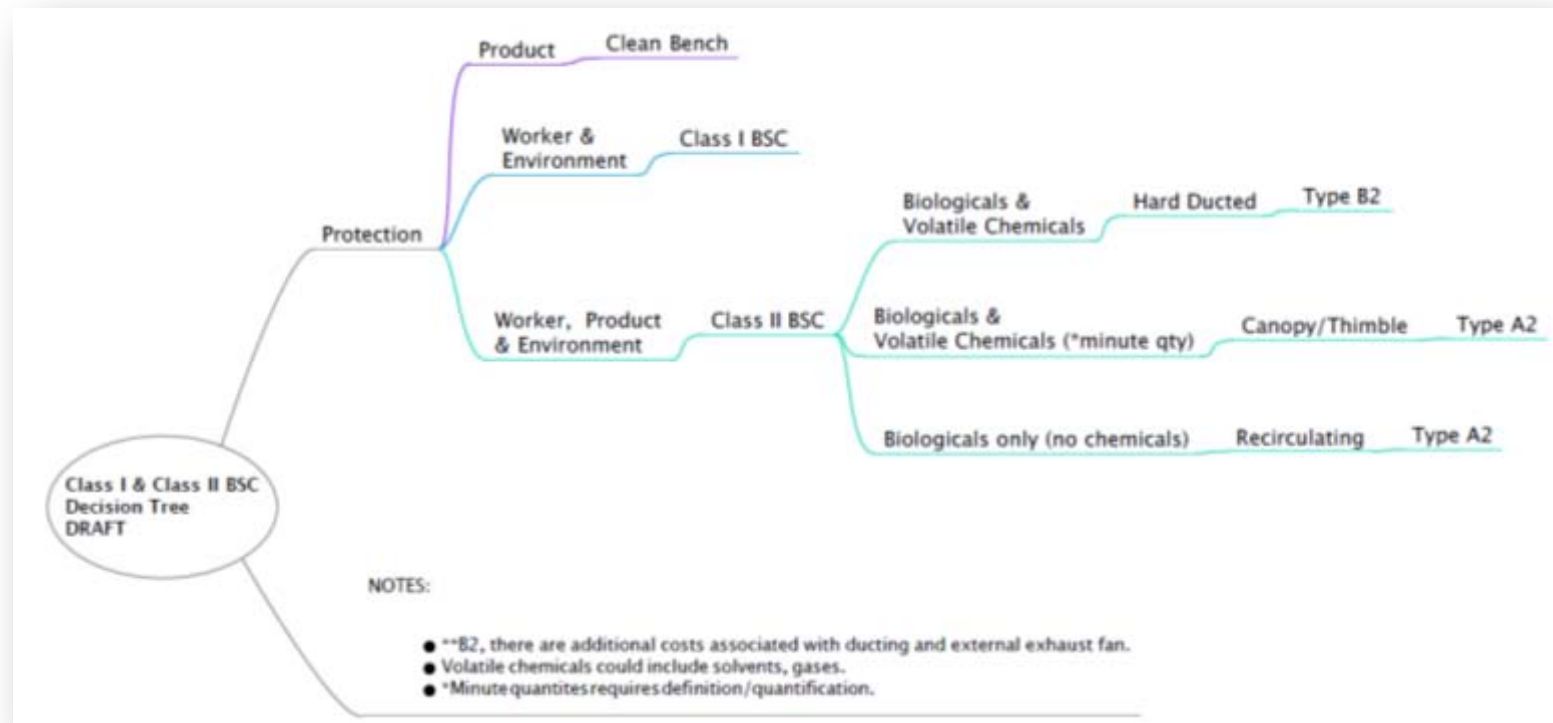
- Developing new user friendly functional user test to verify correct operation of critical elements of BSC safe operation



Vaness measure airflow across cabinet opening

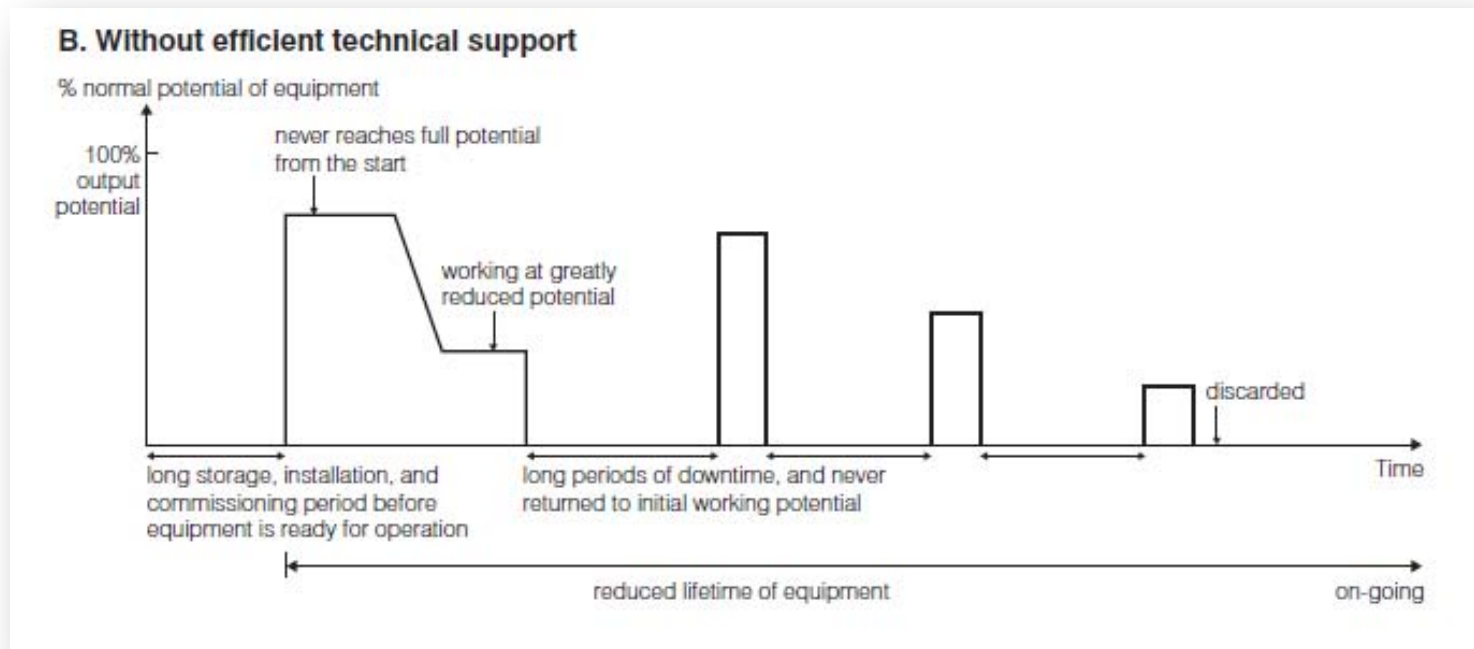
Biological Safety Cabinets

- Simple decision trees & guidance for selection of BSCs that can be locally maintained
 - Type A2 recirculating, limit ducted Type B2, robust BSC with fewer automations



Sustainability of Laboratory Investments

- Carefully manage biosafety equipment, facilities & technology
 - Selected properly; used correctly and to maximum capacity; lasts as long as possible
- Cannot underestimate recurrent costs, infrastructure needs, knowledge of application, & maintenance (technical and managerial issue)



Sustainability of Laboratory Investments

IFBA Biocontainment and Engineering Survey

8. How does your institution maintain, calibrate, and certify the equipment? (check all that apply)

- ☐ Institution's own engineers/technicians
- ☐ Specialists available within the country
- ☐ Specialists available outside of the country
- ☐ But available regional
- ☐ Must look globally to fix
- ☐ Other (please specify)
- ☐ Our laboratory does not
- ☐ I don't know

Comments

IFBA Biocontainment and Engineering Survey

15. Does your institution have access to reliable utility sources? (check all that apply)

	No Access	Less than 50% Access	50-75% Access	75-95% Access	95-100% Access	Not Applicable
Electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Gas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fuel (backup)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

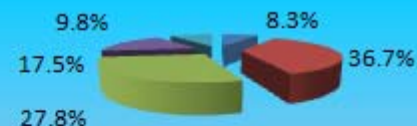
Please Identify Specific Concerns:



Sandia
National
Laboratories

9.) Laboratory equipment is not maintained because:
(pick top 3 choices) (priority ranking)

	Responses	
Don't know how to maintain equipment	28	8.28%
No funds for spare parts	124	36.69%
No maintenance personnel on staff	94	27.81%
Don't know how equipment should properly function.	59	17.46%
Lack of supporting utilities (e.g. clean water, power).	33	9.76%
Totals	338	100%



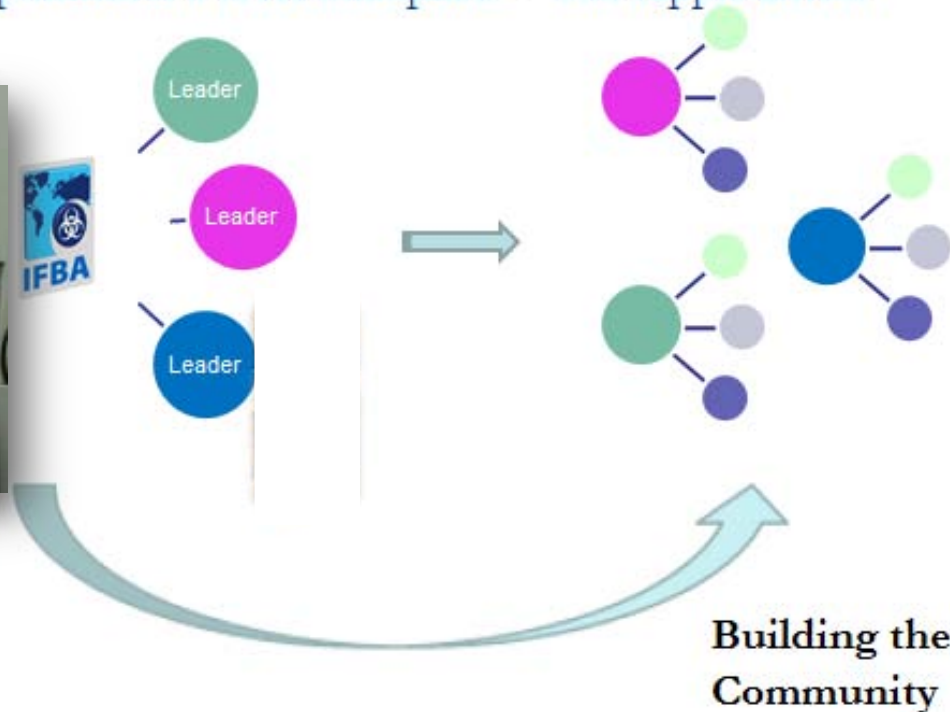
- Don't know how to maintain equipment
- No funds for spare parts
- No maintenance personnel on staff
- Don't know how equipment should properly function.
- Lack of supporting utilities (e.g. clean water, power).

Mentoring Biocontainment Engineers

- Mentor those new to the field of biocontainment laboratory operations & maintenance
- Provide leadership and nurture champions
- Perpetual optimism is a force multiplier – “The Ripple Effect”



**Champions
inspiring
leaders**



**Building the
Community**

IFBA Biosafety Heroes

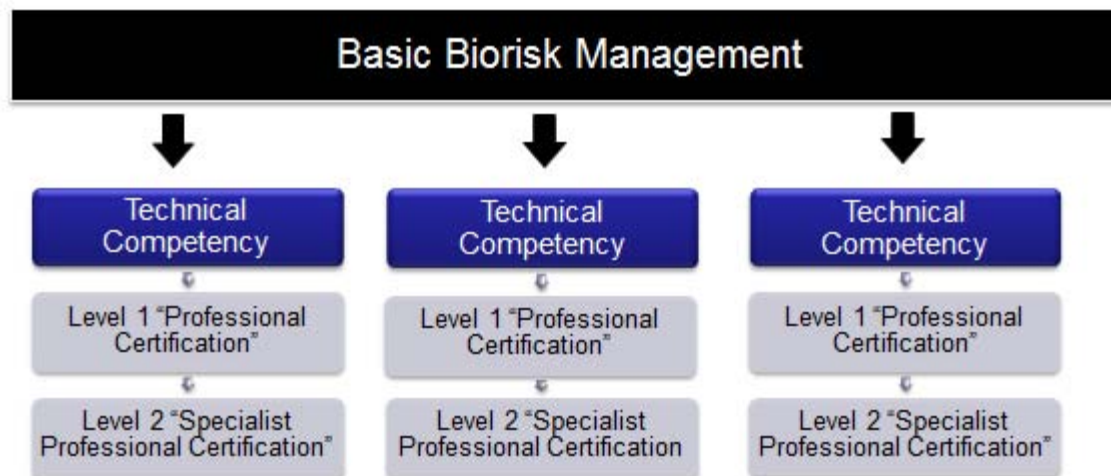
Mentoring Biocontainment Engineers

- IFBA Sustainable Biocontainment Engineering Award
- Identify and celebrate individuals who have developed innovative approaches with little resources
- Cash award and travel support to conference/training event
- The award will be given to individuals or teams that create effective biocontainment engineering solutions that improve worker safety, environmental safety, or security. In addition, solutions must fulfill one or more of the following criteria:
 - Be relatively low cost, and/or reduce maintenance costs;
 - Be practical and sustainable;
 - Can be constructed of locally available materials, and maintained using locally available expertise;
 - Have minimal environmental impact;
- Engineering areas where solutions relevant to this award could be developed include, but are not restricted to:
 - Waste disposal (biological, chemical, carcass, etc)
 - Primary containment- work space / air flow cabinets
 - Decontamination
 - Air flow / filtration
 - HVAC (Heating Ventilating Air Conditioning)
 - Supply chain / maintenance improvements
 - Containment facilities, temporary or permanent
 - Personal Protective Equipment
 - Biosecurity



IFBA Certification of Professionals

- IFBA creating new certification program for biosafety, biosecurity and biocontainment professionals
- Offer certifications in different technical disciplines with graduated levels within each competency
- Foster continual learning and professional development throughout an individuals career



INTERNATIONAL
STANDARD

ISO/IEC
17024

Second edition
2012-07-01

Conformity assessment — General
requirements for bodies operating
certification of persons

*Évaluation de la conformité — Exigences générales pour les
organismes de certification procédant à la certification de personnes*

IFBA Certification of Professionals

- Pilot testing in 2014:
 - Basic Biorisk Management (*prerequisite for all other certifications*)
 - Biological Waste Management
- Further priority certifications to be developed in coming years:
 - **Biological Laboratory Design & Maintenance**
 - Biosafety & Biosecurity Program Management
 - Laboratory Biosecurity
 - Animal Biosafety
 - Biological Safety Cabinets

Subject matter experts and stakeholder community involved in identifying competency requirements for each technical discipline



SUSTAINABLE LABS CANADA
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