ASIA-PACIFIC BIOSAFETY ASSOCIATION

Volume 3 No.1
Jan 2010

ASIA-PACIFIC BIOSAFETY ASSOCIATION BIOSAFETY MANAGEMENT COURSE

2-10 November 2009,
conducted at Temasek Life Sciences, Singapore

Course participants gowned in various types of PPE

This year A-PBA changed the format of its already popular Biosafety Management course taught from November 2-10, 2009. Courses were provided in modules so attendees had a greater ability to pick and choose among the options of Biosafety Principles and Practices (2 days), Biosafety Management (3 days), Singapore Biosafety Coordinator (5 days with a component on Singapore's Biological Agents & Toxins Act (BATA), and two specialty modules on Engineering for Biosafety Personnel, and Molecular Biology 101 & Function of IBC.

Approximately 127 people attended the modules, with 89 people taking the Biosafety Management examination and 45 sitting for the BATA examination component. The demographics of course participants were diverse both in occupation and countries of origin. The importance of understanding and practicing biosafety is realized by individuals across many professions such as biosafety officers, laboratory and facility managers, scientists and technicians, architects, engineers and others. It was heartening to see a robust representation of attendees from the Asia-Pacific region and further areas to include: Singapore, Malaysia, Indonesia, Bangladesh, Brunei, Hong Kong, Kenya, Philippines, Thailand and Vietnam. Internationally and locally based instructors brought a wealth of expertise and shared many different experiences from Singapore, Canada, Thailand, United States and Bangladesh.

Donning PPE and a PAPR using the buddy system

Taken together, what many of us witnessed is the continued growth of biosafety in the region and that these courses serve as a first and important step in 'growing' biosafety as a profession. The next step is for attendees to not forget the valuable networking opportunities they have had with their peers and forge long- term professional relationships with them and their local biosafety associations to help solve biosafety problems.

Cleaning up a spill

By Barbara Johnson

IN THIS ISSUE:

ASIA-PACIFIC BIOSAFETY ASSOCIATION

Autoclave Validation for Microbiological and Biomedical Laboratories (MBL)

By Dr Felix Gmuender, MSc, RBP. Basler & Hofmann Singapore Pte Ltd

Summary

Autoclave validation in microbiological and biomedical laboratories (MBL) is a requirement – but actual guidelines or rules how to validate and monitor the steam decontamination process are not available. The focus of this article is on the decontamination of liquid and solid biohazardous waste in terms of safe disposal into the municipal waste stream (local regulations may prevail).

The sterilisation of culture media and equipment in terms of meeting certain quality criteria (ISO 17025, Calibration and Testing Laboratories) is not discussed, because this does not fall under biosafety regulations and guidelines. However, the validation of these processes can be achieved by applying the same basic principles as presented in this article.

Definitions

Validation is a confirmation through the provision of objective evidence that requirements for decontamination have been fulfilled (adapted from CWA 15793:2008 - Laboratory biorisk management standard).

Process monitoring is used to check a decontamination process for adequacy of decontamination (adapted from US FDA, 21 C.F.R. § 880.2800).

Decontamination means a procedure that eliminates or reduces biological agents and toxins to a safe level with respect to the transmission of infection or other adverse effects (CWA 15793).

Sterilisation is a process used to render a product free from viable microorganisms (ANSI/AAMI ST46:2002, Steam sterilisation and sterility assurance in health care facilities).

Introduction

Steam sterilisers or autoclaves are used by many industries and laboratories to reduce or eliminate threats by microorganisms to the health and safety of staff, the community, patients, or consumers. In most applications, autoclave sterilisation is used to reach a quality goal. A few examples are given below:

- The food industry uses autoclaves to sterilise canned food and food ingredients;
- The pharmaceuticals industry steam-sterilises e.g. packaging materials for drugs consisting of glass vials and containers;
- Hospitals and clinics sterilise items like garments, equipment for surgery, implants, and medical waste;
- MBL sterilise culture media, all kind of lab-glassware, and must decontaminate biohazardous waste.

In most industries, when practical, steam sterilisation in autoclaves is considered the method of choice to ensure sterility or decontamination.

Autoclaves are used for very different processes in terms of type of application and – more importantly – in terms of the quality goal. The consequences of a failed sterilisation or decontamination process also vary a lot. Thus, each industry has developed its own standards how to validate and monitor whether the sterilisation or decontamination process is reaching the goal. Thus, the methods for validation and process monitoring differ somewhat between different industries and applications. In addition, in some industries, it is important that the autoclave and steam are very clean; the goods must not get contaminated with impurities found in steam or coming from autoclave steam pipes and the chamber. For waste decontamination in MBL one can learn from other industries, but one should not sheepishly adopt their standards (e.g. a standard like ANSI/AAMI ST46:2002, Steam sterilisation and sterility assurance in health care facilities).

Unfortunately, there is no accepted standard or guidance document on validation available for the safe disposal of biohazardous waste. Until about ten years ago, there was no demand for a method how to validate a waste decontamination process. What was and is available was borrowed from other industries. And this is not always adequate. For instance, in many industries, the goods to be sterilised already have a low level of biological contamination. In stark contrast, waste from microbiological and biomedical laboratories almost always has very high loads with biological agents per weight and volume. Because the decontamination process is dynamic, these differences can matter.

Sterility Assurance Levels (SAL)

In many industries where sterility must be assured, the so-called SAL is brought into play. Because the inactivation of biological agents follows an exponential function, an SAL of 10^{-6} is often applied to reach a sufficient probability that all agents have been sterilised. The SAL of 10^{-6} means that the probability of a single agent to survive is less than one in one million. When the sterilisation process is associated with significant risks in terms of

contaminated implants, surgical instruments etc., a SAL of 10^{-6} is always applied (http://en.wikipedia.org/wiki/Sterility_assurance_level).

However, in MBL, where the initial bacteria and viral count per load in wastes can be very high, the SAL concept comes to its limits. A millilitre of culture media can have more than 10^9 bacteria! All the same, the safe disposal of biohazardous waste is not a problem, because most of the agents are viruses and vegetative bacteria that have very short D-values at 121°C (D-value: see for instance http://en.wikipedia.org/wiki/D-value, or consult a textbook). For biohazardous waste, decontamination is required, sterilisation is not (see definitions). It is a misconception that for a successful autoclave process with saturated steam, a temperature of 121°C is required. What counts for the thermal resistance of biological agents are parameters such as the D-value, the Z-value, and the F-value (for details see: Wikipedia or a textbook on sterilisation). In practice, a validated and monitored autoclave process ensures the safe disposal of biohazardous waste.

The validation procedure and process monitoring presented in this article ensure an adequate level of safety. For the validation, a biological indicator organism that is most thermally resistant is used (*Geobacillus stearothermophilus*).

Types of loads in MBL

In microbiological and biomedical laboratories, most autoclave loads fall under one of the following four categories:

1) Garments made of cotton or a heat-resistant plastic fabric (dry goods).

2) Liquid culture media with bacteria, cell-lines with and without viruses, body fluids.

3) Laboratory waste such as solid media (agar petri dishes, agar slants etc.) in bags (tied).

4) Disposables, sharps, and other material (dry goods; in boxes or bags).

5) Culture media and equipment that must be sterile after autoclaving (not discussed in this article).

The autoclave process requires saturated steam conditions for a reliable and reproducible decontamination. If liquid waste in bottles or vials is autoclaved, saturated steam conditions are always met. In contrast, bags or boxes with densely packed garments and other dry material can be problematic, in particular in displacement or gravity-assisted autoclaves (http://en.wikipedia.org/wiki/Autoclave), where the lighter-than-air steam has to force out the air through the autoclave's discharge at the bottom. For instance, in bags in an upright position, even if the tie is loose or the bag is open, air can get trapped in the bag's bottom. A cup of water (about 0.25 L) must be added to a bag of a volume of 30 L to reach moist conditions. Water can be safely added to waste bags in a BSL-2 laboratory. For waste generated in a higher-risk environment such as BSL2+ or BSL-3, adding the water can be associated with aerosol formation. One option is to add the water to the bag first, before waste is placed. Another option is to place the waste in a bag that melts in the autoclave. This (tied) bag is then placed in an open, regular autoclave bag that doesn't melt. This way the waste remains sealed until steam melts the inner bag. The water is added to the outer bag. In vacuum cycle autoclaves, adding water is not necessary at all. The bag can be put in an upright position into the autoclave, but the tie should still allow air and steam to flow in and out of the bag. The vacuum cycles will remove air to down to one to five percent; which is sufficient for waste decontamination.

Bowie-Dick-Test

In hospitals and other settings, where the vacuum-assisted autoclave process has to fulfil strict quality and sterility requirements, the Bowie-Dick-Test is used to ensure that no residual air is left in the autoclave chamber or containers. In BML, this test is not necessary. The validation method presented here are sufficient to ensure that the decontamination requirements are fulfilled.

Validation procedure

The autoclave validation consists of a chamber validation performed by the manufacturer's technician or engineer after delivery, installation and commissioning, and the subsequent load validation, to be done by the end user. The chamber validation confirms the correct basic function of the autoclave, before the autoclave is handed over to the end user.

Chamber Validation

The chamber validation serves to ensure that the choices of programmes work reliably and reproducibly as described in the autoclave specifications. The manufacturer's engineer or technician would use a set of calibrated and certified thermocouples to ensure that the time-temperature profile is reached throughout the chamber, and to recalibrate the autoclave's thermocouples if necessary. The chamber validation has to be repeated after each service, or at least once per year.

Load validation

The load validation serves to determine and validate the programmes and load types the end user is going to use to decontaminate waste. The end user must be able to carry out this load-validation themselves. It is part of the job to set up and adopt the biorisk management system, more specifically, the SOPs for waste treatment and autoclave operation. Normally, there will be two to four types of loads that require a validation. As a minimum, a dry and a liquid load must be validated.

But for large and complex BML, in particular animal biosafety facilities, there can be many more types of loads (bags with cages and bedding, bags or even drums with faeces, waste from necropsy, etc.). In this case, the validation and process monitoring can become time-consuming and costly.

The load validation for decontamination is done with biological indicator (BI) strips (for dry loads only) or indicator ampoules (for liquid or dry loads). Chemical indicators cannot be used for validation purposes. The load validation for decontamination is repeated at least once per year.

Chemical indicators (such as indicator tapes or tablets) are used to distinguish between processed and unprocessed items (external indicators). Caveat: Chemical indicators cannot be used to establish whether adequate decontamination criteria were met. However, chemical indicators can help to quickly recognise serious malfunction of an autoclave (adapted from ANSI/AAMI ST46:2002). If chemical indicators are not responsive, the process has failed.

A biological indicator is a sterilisation or decontamination process-monitoring device consisting of a standardized, viable population of microorganisms (usually bacterial spores). Biological indicators are intended to demonstrate whether the conditions were adequate to achieve decontamination (adapted from ANSI/AAMI ST46:2002). For correct application, follow the manufacturers instructions. So-called Rapid Readout Biological Indicators allow monitoring the efficiency of the decontamination process within one hour. This is useful in situations where every load must be cleared before final disposal, or when a result is needed very urgently.

Thermocouples or temperature loggers are helpful to determine whether the set temperature is reached deep inside bags, boxes, containers, or drums. If the BI test fails, the temperature logging can help to narrow down the reason for the failure. In most cases, a failed BI-test is due to excess heat insulation inside large bags or containers, and/or failure to displace air in gravity-assisted autoclaves. For decontamination purposes, temperature logging (if done correctly) can be an adequate and sufficient means to monitor a process.

If the procurement of thermocouples and loggers is too expensive, an internal thermocouple that comes with the autoclave (included in some models to prevent superheating of liquid goods), will be most helpful. If these devices are not available, a validation with biological indicators alone is adequate. A successful BI validation is a sufficient criterion.

The load validation is done with so-called standard loads, which are characterised by the maximum number, size, and weight of goods to be autoclaved in a single process. The standard load describes the maximum possible load for a specific process for which safe decontamination must be ensured. In other words, one should assume a realistic "worst-case scenario". For routine operation, one can have less or smaller loads of the same type, but not bigger or more compressed ones. In particular, if garments and other compressible goods are autoclaved in bags or boxes, the number of items and degree of compression is relevant. For instance, the number of scrubs per bag has to be limited. For liquid goods, the volume, wall-material and thickness, and shape of containers are relevant. For carcasses, numbers, size (weight), and arrangements (piled or side-by-side) in bags or boxes must be noted. Taking pictures of the standard loads is helpful to specify the standard load in an SOP, and for training.

The load validation is done as follows:

1) Figure out the type of loads you will have for routine decontamination (bags, containers, bottles, etc.).

2) Describe the load in terms of maximum numbers of items, composition, largest size of bag or container, how many of them are placed on the autoclave tray, and where exactly (geometry of the load). For bags, it has to be described how much ties need to be loosened. Take pictures and notes.

3) The load validation is done with BI strips or ampoules and, if available, with thermocouples or temperature loggers (sensors). One or more BI strips and sensor must be placed at the centre *and/or* towards the bottom of bags and containers (but not exactly at the bottom). For some goods, one has to experiment a bit and to figure out the adequate location of BI and sensors for the validation purpose. For instance, for the validation of small animal decontamination, the ampoules and sensors must be inserted into the centre of the animal(s). Caveat: The validation of carcass decontamination with wet heat requires extra care and experience. If long hoses or tubes have to be decontaminated, they have to be cut in two in the middle. The strip and sensor are inserted some distance away from the cut, and the two hose or tube ends reattached and sealed for the process.

4) A load and process is considered as validated for decontamination after three successful runs (all BI show negative growth, temperature profile meets requirements). For each run, one BI strip or ampoule must serve as a control (positive growth control).

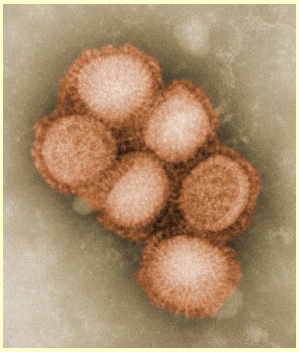
Process monitoring

The autoclave is now ready for routine operation. Every single process must be monitored by means of the autoclave's internal thermocouples and temperature print-*(continued on Pg 5)*

outs, and chemical indicators as a minimum.

Biological indicators must be used at least once per month to verify the adequacy of the decontamination. For higher risk laboratories such as BSL-2+ or BSL-3 or if for some reason the loads show a lot of variation, BI-monitoring may be required more frequently or even in every load. Should the monitoring fail, the reason has to be investigated and the problem solved before routine operations can resume.

All records must be properly maintained as specified in your risk management system.



Updated advisory for labs handling pandemic H1N1
30 November 2009

The updated and revised guidance document is now available on the web:

"Laboratory biorisk management for laboratories handling human specimens suspected or confirmed to contain influenza A (H1N1) causing the current international epidemics" (30 November 2009)

WHO recommends that "all diagnostic laboratory work and PCR analysis on pandemic (H1N1) 2009 clinical specimens taken from patients who are suspected or confirmed cases of the pandemic virus infection should be conducted adopting practices and procedures described for basic laboratory – Biosafety Level 2 (BSL2), as detailed in the WHO *Laboratory biosafety manual*, 3rd edition".

The advisory stresses that "final responsibility for the identification and implementation of appropriate containment measures for viral isolation lies with individual countries and facilities. Accordingly, needs may vary from country to country based on the variables mentioned (in the document), and decisions should be taken in light of currently available knowledge and context."

The document is divided into three parts:
1. Summary of current knowledge of pandemic influenza A (H1N1) 2009 virus.
2. Biorisk management checklist for laboratory managers and staff.
3. Recommendations addressing minimal/essential working conditions associated with specific manipulations in laboratory settings.

The full updated advisory can be found at:
http://www.who.int/csr/resources/publications/swineflu/LaboratoryHumanspecimensinfluenza/en/index.html

[Copyright-free image of influenza virus above was obtained from Public Domain Clip Art at http://publicdomainclip-art.blogspot.com/2009/04/swine-influenza-swine-flu-type-h1n1.html]

TECHNICAL PAPER REVIEW

STANDARD SAFETY PRACTICES FOR SORTING UNFIXED CELLS

Reviewed by Lin Yueh Nuo, Agri-food & Veterinary Authority of Singapore

Biological specimens subjected to cell sorting can harbour a variety of known and unknown infectious agents, particularly when unfixed or inadequately fixed samples are handled. Samples containing genetically-engineered cells that carry genomic sequences of infectious agents or sequences which could produce oncogenic or toxic effects also pose a risk. In addition, samples may also contain toxic and/or carcinogenic dyes. The creation of droplets and aerosols during sorting of such samples therefore poses a potential health risk not only to the operator, but to the environment should aerosols escape from the instrument into the room.

Due to these risks, the International Society of Analytical Cytology (ISAC) developed safety guidelines for the sorting and analysis of unfixed cells in 1994. However, the many changes that have occurred since then in the field of cytometry, in safety practices and in regulatory requirements have necessitated that existing standards be reviewed and updated. The updated standard for sorting of unfixed cells was published in 2007 (**Schmid, I *et al.* International Society for Analytical Cytology Biosafety Standard for Sorting of Unfixed Cells. Cytometry Part A 71A:414-437, 2007, Wiley-Liss Inc.)** and reviewed in an earlier issue of the A-PBA Newsletter (Vol.2 No.1).

Here we follow up with a review of a related 20-page paper by the same authors on standard safety practices for sorting unfixed cells (**Schimd I, *et al.: Current Protocols in Cytometry, 2007, Unit 3.6.1-3.6.20, John Wiley & Sons, Inc.)***.This paper describes standard practices for handling and sorting potentially biohazardous specimens, as well as methods for assessing risks to operators and laboratory personnel.

Firstly, the appropriate biosafety level (BSL) for work with live, unfixed cells, including genetically-modified cells, must be determined for the agent in particular, taking into account national regulatory requirements and international standards. The authors stress that "droplet-based sorting procedures are considered BSL-3 practices" and recommend "that all potentially infectious samples be sorted at a minimum on a sorter which has been tested for aerosol containment located in a BSL-2 facility". High-speed sorting, especially with free-standing sorters with high operating pressures, should be performed in a BSL-3 facility. If samples are fixed, it is important to carry out the fixation process carefully, and to validate the complete inactivation of the infectious material. Samples which are thought to be inactivated, but are in fact not, will pose a serious health hazard to laboratory personnel.

Apart from making operator-specific recommendations with regards to immunisation, personal protective equipment, specimen handling and operator training, the paper also describes several instrument-specific areas that should be given due consideration. These are:

1. **Proper operation of the cell sorter**. This includes operating the instrument according to manufacturer's instructions, carrying out rigorous preventive maintenance and routine leak checks, verifying proper operation and stability of sort streams, and thorough decontamination with an appropriate and suitable decontaminating agent. Here the authors provide a useful list of disinfectants and indicate their effectiveness against the various types of infectious agents.
2. **Nozzle tip.** A clogged nozzle is one of the major reasons for increased aerosol production on cell sorters. Filtering samples with filters of a suitable pore size and choosing the correct nozzle size help reduce clogging due to cell clumps. The authors also recommend ways to deal with clogged nozzles in this section.
3. **Aerosol control measures.** Checks for air leaks should be performed before sorting, to ensure the seal around collection chambers designed to contain aerosols are tight. Several newer models of cell sorters with improved aerosol containment features are mentioned, such as those incorporating a removable containment hood vented by a HEPA filter/fan unit that covers the sort area and sample introduction port. One other commercially-available model of a high-speed sorter comes with a Class I biosafety cabinet attachment.
4. **Use of stream view cameras** to prevent the operator from coming close to the area of the instrument that poses the greatest potential hazard.

Finally, the authors emphasise that the effectiveness of aerosol containment must be verified by rigorous testing both under regular sorting conditions and in instrument failure mode, before sorting any potentially infectious samples. A record of such verification results should be maintained. Two methods for assessing aerosol containment are briefly described, that is, the use of aerosolised bacteriophage and that of "Glo Germ" (Moab, UT), a highly fluorescent resin particle.

Overall, this is a useful article highlighting the areas of risk and outlining the practices to minimise such risks. The full paper can be found at http://fhs.mcmaster.ca/safetyoffice/docments/StdSafetyPracticesSortingUnfixedCellsUnit3.6.pdf.

ASIA-PACIFIC BIOSAFETY ASSOCIATION

ASIA-PACIFIC BIOSAFETY ASSOCIATION (A-PBA)

5th Biosafety Conference
25 May - 28 May 2010
Seoul, Korea

Advancing Biosafety Technology and National Legislation in the Asia-Pacific

Please mark these dates in your calendar!
More information will be available on the website (http://www.a-pba.org) *very soon.*

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- A-PBA newsletter
- Access to membership directory
- Participation in A-PBA's mentoring program
- Subsidized registration rates for Conferences and Workshops
- Members only access to exclusive training tools and other contents on the A-PBA website

Every member makes a difference…

ASIA-PACIFIC BIOSAFETY ASSOCIATION

A-PBA Membership Application

Member-Get-A-Member Campaign

New Member Application:

Types of Membership

Annual Subscriptions

- ◯ Full Membership: SGD 30.00
- ◯ Corporate Membership (allows up to 3 employees): SGD 300.00

Life Subscriptions

- ◯ Full Membership: SGD 300.00

Title:	Select An Option		
Full Name:		NRIC / Passport No:	
Nationality:		Date of Birth:	(E.g. 31/12/1987
Address:		Postal / Zip Code:	
Country:	Select An Option		
Company:		Designation:	
Email:		Confirm Email:	
Office Tel:		Office Fax:	
Mobile:			

Payment mode:

- ◯ Online Payment
- ◯ Payment via Bank draft / Cheque / Casher's Order

Referring Member:

Member's Name: (please confirm)

First Name:

Last Name:

Email: (please confirm)

19th Meeting of the International Federation of Biosafety Associations (IFBA)

The IFBA conducted its 19th meeting in Miami on the 18th of October, 2009. Three new member organizations (Azerbaijan Biological Safety Association, Philippine Biosafety and Biosecurity Association and the Biosafety and Biosecurity Network of Thailand) and three observer organisations (Biosafety Association of Central Asia and the Caucasus, Korean Biological Safety Association and the Biological Safety Association of Pakistan) were welcomed to the growing IFBA family. A-PBA was represented by President of A-PBA Dr Chua Teck Mean (middle row, 6th from left) and A-PBA Secretary Ms Chook Mee Lan (seated, 1st from left). More information can be found in www.internationalbiosafety.org.

INTERNATIONAL CALENDER OF EVENTS

2010 European Biosafety Event 22-23 April 2010
Ljubljana, Slovenia www.ebsaweb.eu

20th Meeting of the International Federation of Biosafety Associations (IFBA)
(Held in conjunction with the 13th Annual Conference of the European Biosafety Association – EBSA)
Friday, April 23, 2010
Ljubljana, Slovenia www.internationalbiosafety.org

The 2010 International Conference on Biocontainment Facilities

Date: 25 - 26 March 2010
Venue: St. Petersburg, Florida, USA www.TradelineInc.com/BIO2010

The 2010 International Conference on Research Facilities

Date: 17 - 18 May 2010
Venue: Toronto, Canada www.TradelineInc.com/Research2010

9th International High Containment Workshop
May 16th - 21st, 2010
Canadian Science Centre for Human and Animal Health
Winnipeg, Manitoba, Canada. www.biosafety.ca

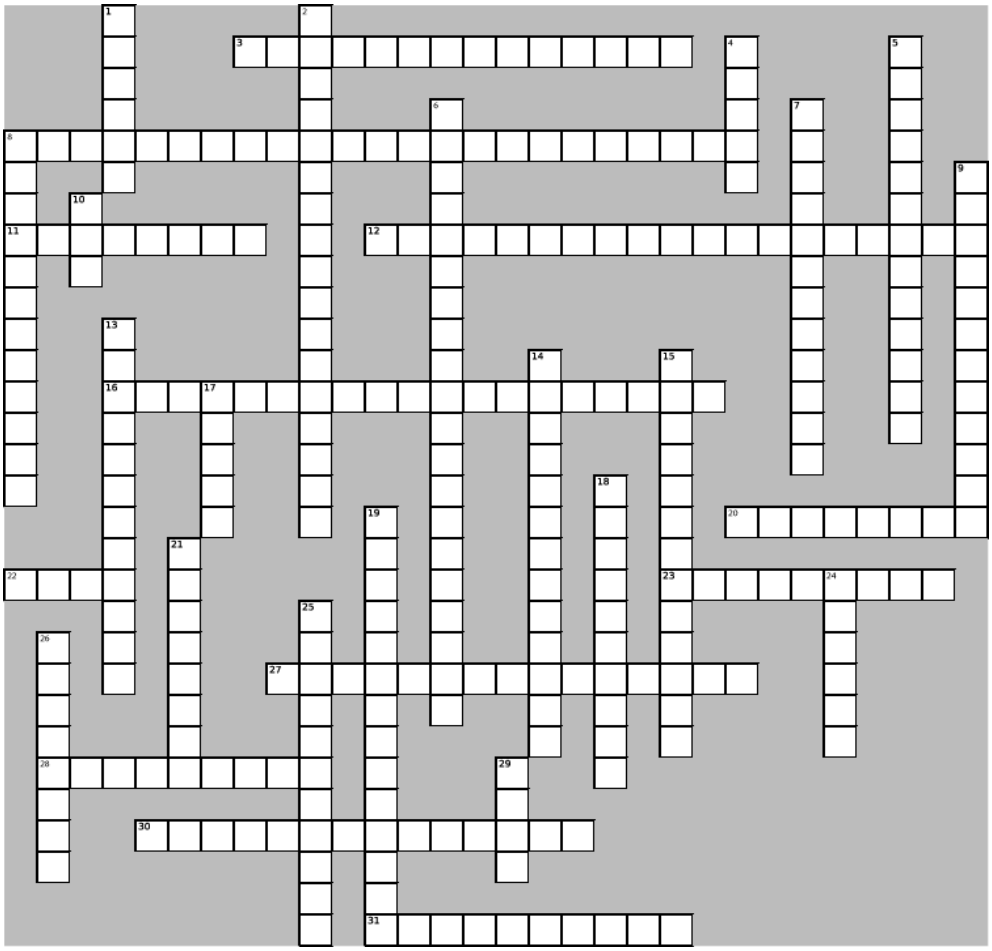
Biosafety Management Systems in Laboratories
May 11th - 14th, 2010
Canadian Science Centre for Human and Animal Health
Winnipeg, Manitoba, Canada. www.biosafety.ca

ASIA-PACIFIC BIOSAFETY ASSOCIATION

A-PBA's Biosafety Crossword #2

Maureen Ellis

Enjoyed the last crossword? Here's another one to figure out! Plus, how well do you know your Association?



Across

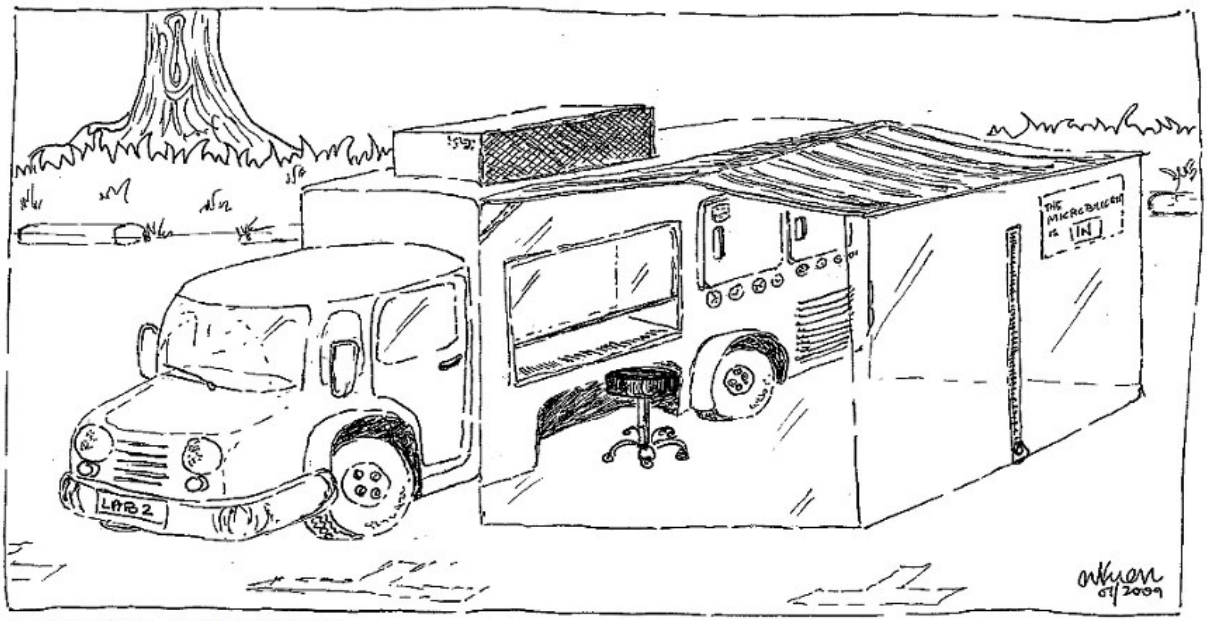
3 This activity is prohibited in the laboratory
8 Every laboratory should have one of these
11 Vinyl flooring and benchtops in a BSL3 facility should be this
12 These are used to verify that autoclaving has been successful
16 HEPA filters on the supply HVAC provide this
20 This product can be corrosive to the biosafety cabinet
22 The international regulatory authority for shipping infectious mate als by air
23 All pathogens in the laboratory must be included in this
27 This should be done every year for a BSL3 facility
28 A type of handwashing sink
30 *Brucella* has a low one
31 To be worn when working with infected animals

Down

1 An emergency kit should be readily available in the lab to deal with these
2 Two of these are needed on a HEPA filter housing
4 When the air handling system fails, this should ring
5 A dangerous form of aerosol that can travel far distances
6 Important component of a biosecurity program for laboratory staff
7 A type of respiratory protection that protects the patient, not the wearer
8 These should not be used in biosafety cabinets as they may damage the HEPA filter
9 This substance can be used to decontaminate a laboratory
10 The month in which the next A-PBA conference will be held
13 This infectious agent is responsible for many laboratory-acquired infections
14 All biosafety cabinets must undergo this before being used
15 The process to ensure a laboratory is constructed in accordance with the design
17 The next A-PBA annual biosafety conference will be held in this country
18 A-PBA's web site address
19 BSL3 control systems should be provided with this as a backup
21 These must be turned off before using the biosafety cabinet
24 This person is A-PBA's current President
25 Every one of these should be carefully investigated to prevent further occurrences
26 This piece of equipment must not be used for work with microorganisms
29 This material should not be used for laboratory casework in a BSL3 lab

Answers will be posted at www.a-pba.org

A Lighter side of Science



LAB ON WHEELS

Can't ship that biological sample? Call 1800-LAB-HELP and we'll be there faster than you can say *Bacillus anthracis*