



FINAL REPORT

**FAO / USAID / MORU: Regional Laboratory Network Training Of the Trainers (ToT)
Workshop on Biosafety Management**

9-20 December 2013, Bangkok, Thailand

Executive summary

Background

Since 2010, FAO has been conducting a Regional Biosafety Program for national veterinary laboratories in countries of South and Southeast Asia. The activities include biosafety risk assessment, development of biosafety standard operation protocols (SOPs) and trainings, and annual biosafety cabinet certification and servicing. The preliminary assessment under the Regional Biosafety program clearly indicated that there is the lack of biosafety management skills throughout the regional laboratory network. Recognizing the identified needs among the laboratories in the region, FAO, is collaborating with Mahidol-Oxford Tropical Research Unit (MORU) to organize the Regional Laboratory Network Training of the Trainers (ToT) Workshop on Biosafety Management during 9-20 December 2013, in Bangkok, Thailand. The workshop addressed the needs of biosafety management personals in providing general concepts on biosafety management and framework for on-going training and auditing of laboratory facilities. A Training of Trainers module was incorporated into the Biosafety Management course as an integral part of the core subjects. This module covered contents related to training assessment, adult learning development, program design and training techniques. In addition, training and certification of IATA infectious goods shipping will be offered in this workshop.

1.1 Goals of this workshop were:

- To strengthen laboratory capacity on biosafety management skills, occupational health and safety, and facility maintenance with a focus on biosafety.
- Training of Trainers module to raise awareness and provide skills to the participants on systematic processes to carry out staff development activities and training

1.2 Learning Objectives –

- General overviews of concepts of
 - Biosafety practices
 - Biosafety management
 - Biosafety auditing,
 - Critical management practices using the CEN document
- Practical, hands-on training and exercise biosafety related issues
 - Biosafety cabinet testing
 - Formaldehyde fumigations
 - Laboratory maintenance
- General concepts the adult learning concepts and effective training of Trainer (ToT) techniques to deliver subject contents on Biosafety Management (Khun Voravate- AIT)
- Laboratory visit to the Biosafety Level 2/3 Laboratory facilities at MORU
- Training and certification in IATA infectious goods shipping (20 December)

Participants

Thirteen participants (see full details in Appendix 1) from Thailand (3), Bhutan (1), Viet Nam (2), Indonesia (2), Malaysia (1), Korea (1), Philippines (1), Lao PDR (1) and Nepal (1) completed the workshop curriculum. Originally, 17 participants were expected to attend the

workshop however participants from Myanmar and Bangladesh were unable to attend at the last minute. The Cambodian participant returned home on the third day of the workshop due to illness.

Workshop curriculum

The workshop curriculum was developed based on an international standard set of documents (CDC BMBL 5th Edition and the CWA15793) that would allow a simplified approach to the implementation of a biosafety management program in a resource limited situation. While it is not possible to have a one size fits all approach to a workshop style training it was felt by the organisers that this approach would provide the basis for biosafety management skills. It should also be recognised that a number of the participants have never received any previous biosafety training. On the other hand, there were some participants who have attended numerous biosafety trainings and were quite familiar with the concepts that were being presented.

Post-workshop assessments

The workshop was well received by the participants and this was confirmed by the positive comments received in the post-workshop assessment. Participants were happy with the content and organisational matters related to the workshop. A small number of comments related to the balance between theory and practice during the workshop. As it was a management workshop there are unavoidable levels of theory /knowledge transfer required during the training component. However, opportunities were provided for practical sessions such as risk assessments or where there was any technical component such as activities with biological safety cabinets or with auditing skills. Nevertheless, these comments should be considered in future trainings. The training of the trainers component of the training workshop was well received by the participants. None of that the participants had ever received any formal training as a trainer before and so felt that this was something that was new and useful that could be applied when they return to the workplace. The training skills acquired should provide them with the confidence to implement a biosafety program and be able to provide appropriate training to the staff.

Assessment

The overwhelming majority of participants demonstrated increased understanding biosafety concepts at the end of the training. Interestingly, despite some participants never having attended a biosafety training previously, a moderate to high level of understanding was displayed in the majority of the participants at the start of the workshop.

Recommendations

The following recommendations have been made,

Biosafety management training

1. It is recommended that specific training in Risk assessments for biological safety management with the following characteristics,
 - Provided to at least one individual or possibly two so enable the appointment of biosafety officers
 - No more than 15 participants
 - No more than five days duration

- Focus on risk assessments for routine laboratory and surveillance activities
 - Brief training of trainers component be included in the training
 - The training should be similar to that provided during the FAO / USAID / MORU: Regional Laboratory Network Training of the Trainers (ToT) Workshop on Biosafety Management held 9-20 December 2013, Bangkok, Thailand.
 - Held at MORU, Bangkok
2. It is recommended that specific training in Preventative maintenance for safety management with the following characteristics,
 - No more than 15 participants
 - No more than five days duration
 - Participants should have background Basic engineering and have a good command of English
 - Focus on primary containment (biological safety cabinets)
 - Focus on emergency systems (Generators, UPS)
 - Held at MORU, Bangkok
 3. It is recommended that South Asian laboratories being included in all biosafety and Quality assurance training programs in the future
 4. It is recommended that the need for knowledge regarding biosafety policy and biosafety administration be promoted and endorsed by FAO and it's donor partners and should be balanced against the practical implementation of biosafety which is the normal expectation of most biosafety practitioners and staff.
 5. Is recommended that the balance between theory or knowledge transfer when compared with practical sessions always be considered when planning workshops such as those.

Training of Trainers component

1. Each laboratory should have comprehensive staff development plan. The senior management and key laboratory staff need to play important role in preparation of the plan.
2. The laboratories would focus on on-the-job training and coaching. The lab supervisors are the key who serve as trainer. The subject matters have a lot of technicality, participatory methods should be used for training delivery.
3. Participants should have more time to practice important ToT techniques. One more day (6 hours) could be allocated for this.

Regional biosafety coordination

1. Opportunities should be made to review the implementation of biosafety management at a regional level and that individual laboratory level. At the regional level the technical advisory group (TAG) meetings are the most appropriate forum for reporting and information exchange. At an individual laboratory level implementation can be reviewed and examined during visits by the regional biosafety coordinator.
2. There should be an opportunity for information exchange and discussion of methods of best practice biosafety management implementation. Is to be done as part of a technical advisory group meeting you would not need to be done every year.

3. This workshop has presented methodologies to standardise the implementation of biosafety management throughout Southeast Asia and South Asia. It is recommended that FAO RAP formally adopt a regional biosafety standard based on the CEN Workshop Agreement 15793 and the BMBL 5th Edition documentation that can then be promulgated throughout the region.

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Abbreviations

ABSA	American Biological Safety Association
ABSL	Animal Biosafety Level
AIT	Asian Institute of Technology
BSC	Biosafety Cabinet
BSL	Biosafety Level
CWA15793	CEN Workshop Agreement 15793
ECTAD	Emergency Centre for Transboundary Animal Diseases
FAO	Food and Agriculture Organization of the United Nations
HEPA	High Efficiency Particulate (Filter)
IATA	International Air Transport Association
MORU	Mahidol-Oxford Tropical Research Unit
NSF 49	National Sanitary Foundation Standard 49
PPE	Personal Protective Equipment
RAP	Regional Office for Asia and the Pacific
RBP	Registered Biosafety Professional
RG	Risk Group
RPE	Respiratory Protective Equipment
SEA	Southeast Asia
SOP	Standard Operating Procedures
TAG	Technical Advisory Group
ToT	Training of the Trainers

1. Background.

Since 2010, FAO has been conducting a Regional Biosafety Program for national veterinary laboratories in countries of South and Southeast Asia. The activities include biosafety risk assessment, development of biosafety standard operation protocols (SOPs) and trainings, and annual biosafety cabinet certification and servicing. The preliminary assessment under the Regional Biosafety program clearly indicated that there is the lack of biosafety management skills throughout the regional laboratory network. Subsequently, it has been recommended that specific training in biological safety management be provided to the designated biosafety officers in the regional laboratory network so to enable the appointment of biosafety officers and to provide biosafety advice to all staff.

Recognizing the identified needs among the laboratories in the region, FAO, is collaborating with Mahidol-Oxford Tropical Research Unit (MORU) to organize the Regional Laboratory Network Training of the Trainers (ToT) Workshop on Biosafety Management during 9-20 December 2013, in Bangkok, Thailand. The workshop was designed to address the needs of biosafety management personals in providing general concepts on biosafety management and framework for on-going training and auditing of laboratory facilities. The regional biosafety guidelines and resources required for the biosafety management activities were also distributed to the trainees.

The Training of Trainers module was incorporated into the Biosafety Management course as an integral part of the core subjects. This module covered contents related to training assessment, adult learning development, program design and training techniques. It added practical part that the participants practice their presentation techniques. The Training of Trainers module contents and activities were conducted within the duration of 3 days. The aims of Training of Trainers module sessions were to raise awareness of the participants on systematic processes to carry out staff development activities. It sent out the messages that training and development need to be carefully planned and developed. Without proper design, the training programs will not be effective. It also allowed the participants to enhance knowledge on key concepts and principles in designing learning activities for adults. The module addressed training methods that helped the participants transfer knowledge and skills to their colleagues in future.

In addition, training and certification of IATA infectious goods shipping was provided in this workshop.

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Agenda - See Appendix 2.

2. Participants

Thirteen participants (see full details in Appendix 1) from Thailand (3), Bhutan (1), Viet Nam (2), Indonesia (2), Malaysia (1), Korea (1), Philippines (1), Lao PDR (1) and Nepal (1) completed the workshop curriculum. Originally, 17 participants were expected to attend the workshop however participants from Myanmar and Bangladesh were unable to attend at the last minute. The Cambodian participant returned home on the third day of the workshop due to illness.

3. Trainers

(a) **A/Prof Stuart Blacksell**, *BAppSc, MPH, PhD, RBP*

- MORU Biosafety Professional - Main facilitator and trainer



- Worked in Southeast Asia since 1989
- Australian Animal Health Laboratory (AAHL) (BSL4) • (1983-2001)
- Oxford University (MORU) in Thailand (2001-2013)
- Completed two international standard BSL3 labs in Thailand and Laos
- Departmental Biological Safety Officer for MORU reporting to Oxford University
- Registered Biosafety Professional (RBP) with American Biological Safety Association (ABSA)
- International Editor for *Applied Biosafety* Journal
- FAO Biosafety Coordinator for Regional Laboratory Network • (2012-14)
- More than 100 peer-reviewed scientific publications and book chapters

(b) **Soiratchaneekorn Ruanchaiman**, *BSc MSc*

- MORU Biosafety administrator



- MORU Biosafety administrator for 5 years
- Preparation of materials and documentation for biosafety administration

(c) **Marcel Fiocchi** •

Biocontainment engineer / Managing Director, FioTec (Thailand) Co., Ltd.



- Worked in Southeast Asia since 1997
- Built or consulted to major BSL3 and BSL2 projects in Thailand, Singapore, Nepal, Bhutan, Myanmar and Vietnam
- BSL3, BSL3+ Laboratory:
 - General Contractor (all-in-one service - including integration of laboratory and scientific equipment), Design & Planning,
 - Construction supervision with facility commissioning and testing,
 - Electrical and Mechanical Engineering,
- Consulting services for bio-containment related fields,
- Budgeting,
- Process planning, SOP's,
- Bio-safety cabinet (BSC) yearly certifications,
- Facility inspections.

(d) Voravate Chonlasin BSc MSc

Senior Program Specialist (Head of Public Sector Capacity Building) Asian Institute of Technology (AIT) - ToT specialist and trainer



4. Regional Biosafety training resources and materials

The regional biosafety training resources and materials can be found in Annex A and are detailed in table 1 below.

Table 1. Regional biosafety training resources and materials found in Annex A.

Subject	Page number
Workshop reference manual	3
PowerPoint slides	121
Biosafety signs	535
Pre-workshop exam	539
Post-workshop exam	545
Inspection Checklist for BSL-2 Laboratories (BMBL 5th edition; <i>NIH Guidelines</i>)	553
Inspection Checklist for BSL-2 Laboratories (BMBL 5th edition; <i>NIH Guidelines</i>)	557
Staff Induction Checklist form	566
Accident/Incident Report Form	568
Medical Alert card template	569

- *Regional Laboratory Network Training Of the Trainers (ToT) Workshop manual* - This 119-page manual that served as the primary reference document for the participants. This manual has been prepared to provide reference and general guidance for biosafety managers in South East Asia and elsewhere participating in Regional Laboratory Network Training Of the Trainers (ToT) Workshop on Biosafety Management, 9-20 December 2013, Bangkok, Thailand. The manual refers to national and international guidelines such as the *Biosafety in Microbiological and Biomedical Laboratories* (BMBL) published by the U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention National Institutes of Health and the CEN workshop agreement CWA15793 *Laboratory Biorisk Management*. Furthermore, practical advice from many years of experience working at the Mahidol-Oxford Tropical Medicine Research Unit (MORU) has also been provided in this document.
- *PowerPoint Presentations* - PowerPoint presentations covering the knowledge transfer and practical sessions are presented as a 569-page consolidation in Annex K and detailed in Table 2.

Table 2. Description of biosafety training materials and practical sessions

Subject	PowerPoint presentation	Practical session
Biosafety containment principles	X	
Principles of the CWA/CEN	X	

documentation for biosafety management		
Risk Assessments	X	X
Biosafety Documentation	X	
Biosafety Administration	X	
Medical surveillance for biosafety	X	
Personal Protective Equipment	X	X
Decontamination and Disinfection	X	X
Biosafety auditing	X	X
Emergency procedures	X	
Laboratory design and maintenance	X	X
Biosafety cabinet decontamination	X	X
Biosafety cabinet testing and certification	X	X

- *Signs and stickers*
 - Signs in the form of stickers were developed and provided to the course participants detailing the following items,
 - Laboratory rules sign
 - Biosafety door sign
 - Biohazard signs
 - Waste disposal workflow (note this was developed but not provided as stickers to the participants).
- *Pre-training and Post- training knowledge evaluations* - Pre-training and Post- training knowledge evaluations were developed in conjunction with Dr Thuy Ha Bui, the FAO monitoring and evaluation (M&E) expert to determine the pre-course and post-course biosafety knowledge of the participants.
- *Mid-training extended response questions* - In conjunction with Dr Thuy Ha Bui, mid-course extended response questions were developed to determine the biosafety knowledge of the participants in their own laboratory settings. Examples of these questions are presented as the final slides in each Power Point presentation. Answers were provided in written form in a workbook that was collected at the end the training as is currently being used a resource for the course evaluation.
- *Biosafety management forms* - Biosafety management forms including staff induction forms, accident reporting forms, biosafety auditing forms are included in the Regional Laboratory Network Training Of the Trainers (ToT) Workshop manual and were also provided separately to all participants separately on a data thumbdrive at the end of the training course.

5. Training schedule

The training schedule for the Regional Laboratory Network Training Of the Trainers (ToT) Workshop is detailed in Appendix 2. The training schedule was revised to have an emphasis on knowledge transfer in the early components, a focus on the practical aspects of the training in the middle sections followed by a consolidation and practice of the ToT component on days 8 and 9 days performed in conjunction with Khun Voravate Chonlasin from the Asian Institute of Technology. This was followed by IATA Dangerous Goods certification training on the final day performed by World Courier company.

Day 1.

Opening ceremony

Dr. Wantanee Kalpravidh welcomed participants and acknowledged the collaboration between FAO, and Mahidol-Oxford Tropical Medicine Research Unit (MORU) to deliver this workshop under the funding support of USAID and the European Union (EU). She briefly described the IDENTIFY project, one pillar of the USAID funded Emerging Pandemic Threat programme (EPT) which is jointly implemented by FAO, OIE, and WHO, and the EU funded Highly Pathogenic Emerging Diseases programme. The overall aim of these programmes is to enhance early detection and characterization of pathogens at the animal-human interface and limit the impact of such diseases.

Dr Stuart Blacksell welcomed participants and gave a background to MORU and the learning objectives of the workshop.

Group introductions – Each of the participants introduced him/herself and described their role in animal health.

- Introduce yourself to the group.
- Include the following information,
 - Your name and country
 - The institute that you work
 - The type of work that your institute does
 - The type of facilities at your laboratory
 - Your background in biosafety
 - Your biosafety responsibilities
 - *What do you want to get from this workshop?*

The meeting was declared open and a group photo was taken.

Figure 1. Group photo of workshop participants.



Introduction to biosafety concepts and biosafety management concepts and introduction to laboratory biorisk management standard CWA 15793

The first formal sessions of knowledge transfer to the participants was in the area of biosafety concepts that focused on the history of biological safety including the history of laboratory acquired infections, the need for worker protection and the evolution of biosafety and occupational health as a recognise discipline. This was followed by a introduction to the different biosafety levels including primary containment and secondary methodologies using classifications prescribed by the CDC and WHO. Following the morning break the bio risk management standard known as CWA15793 was introduced to the participants as a management tool for implementing a biosafety management program at the laboratory site. It was explained that the document tells you what should be done but not how it should be done.

Risk assessments

The afternoon session focused on one of the base concepts and fundamentals of biosafety administration which is risk assessments. A presentation was given to the participants that explained the differences between the concepts of hazards, risks, opportunities (exposure) and relative risk in terms of the fundamentals of risk assessments. It was explained that the risk assessments form the cornerstone of biological safety practices as the risk assessment mandates what safety practices must be put in place to ensure a safe work environment for the staff and the outside environment. The concept of risk assessment was then transferred to infectious disease work in the laboratory and when collecting samples in a field situation and the introduction of the CDC risk assessment form was presented to the participants.

After the break of the disciplines were broken into three groups and were asked to list at the diseases that they normally worked with in their laboratories, and for three of the diseases to be risk assessed using the CDC risk assessment form and also consider matters such as vaccinations and emergency procedures. The groups considered risk assessments for diseases such as rabies, high pathogenicity avian influenza (HPAI), anthrax, *Brucella* spp., foot and mouth disease. The results of the individual groups risk assessments with then presented back to the participants for consideration and comment.

Day 2 (10 December 2013)

Biosafety management

The second day comprised of presentations that covered the practical aspects of biosafety management. This started with the administration of a biosafety program including the importance of a biosafety policy being adopted by management, the biosafety committee and its composition including roles and responsibilities of this committee. Later sessions covered documentation required to conduct and implement a biosafety program at a laboratory including biosafety manual and its primary requirements, forms relating to accidents and incidents, induction forms. Risk assessments were also covered again in terms of documentation and requirements of conducting such assessments prior to the commencement of any work practices.

Occupational Health& Safety and medical surveillance

Occupational Health& Safety and medical surveillance were also covered in the afternoon session where discussions were held regarding pre-employment medical assessments for underlying diseases, Vaccinations, changes in health status including pregnancy, immunocompromised individuals and diabetes. In a group session, the participants were asked to consider their own current biosafety infrastructure and what they required to ensure that there by a safety structure would meet national and international requirements to provide a safe working environment for their staff, visitors and the environment.

Day 3 (11 December 2013)

Personal protective equipment

The morning session focused on personal protective equipment. At presentation was given that detailed all of the different types of personal protective equipment required for use when working at BSL2 and BSL3. After the theory session a practical session followed the that demonstrated the various types of PPE available including different types of covered footwear that is appropriate for laboratory use, gloves, gowns, eye protection including face shields, respirators including conventional particular respirators, full-face respirators including demonstration of the different types of cartridges, and the use of Powered Air Purifying Respirators (PAPR). Demonstrations in the donning and doffing of PPE in the correct order was also demonstrated as well as demonstrations of various types of particular respirators including those which are more suitable for the Asian face rather than the cup type respirator.

Adult learning principles and presentations

The afternoon session was the introduction to the training of the trainer component of the workshop. Voravate Chonlasin was the facilitator for this component and he introduced the

training needs analysis to the participants as well as giving the students and opportunity to practice their needs analysis in groups. The first lesson was about importance and methods to conduct training need analysis (TNA). The resource person addressed that TNA is essential for selecting training contents that suit best to level of knowledge, skills and current practices of target audience. It also helped trainers to understand objectives of training, and that enabled them to evaluate effectiveness of the program.

Figure 2. Khun Voravate instructing the participants in the methods of training needs analysis.



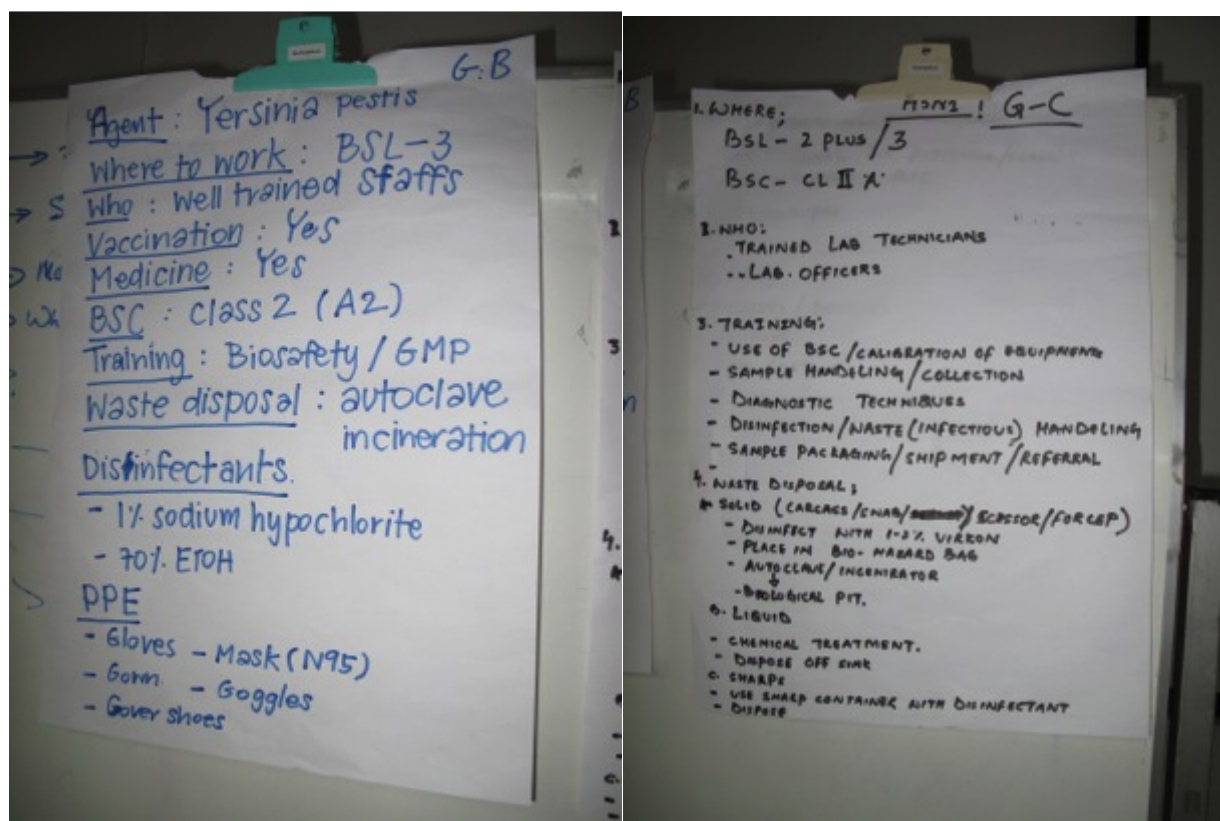
Day 4 (12 December 2013)

Disinfection and sterilization theory

Heading towards the completion of the knowledge transfer section of the training workshop the next session focused on disinfection and sterilisation theory. A presentation was given on the various types of disinfection procedures including chemical disinfection and compatibility of different Chemicals with different types of materials and the effectiveness with different infectious organisms. This was followed a presentation on the use of autoclaves and the use as a sterilisation tool in infectious disease laboratories. An important section been followed on the verification of sterilisation procedures using biological indicators or chemical indicators such as Brownes tubes. During the presentation, waste workflow was introduced and discussed with the participants and the importance of planning for the workflow of waste to prevent the inadvertent exposure of staff and the environment to infectious waste. As a homework item, participants were asked to demonstrate infectious waste workflow in their own laboratories in their workbooks.

After the morning break the participants broke into their previous three groups and were assigned risk assessment tasks for various diseases in a similar manner to what they had done on the first afternoon. The results were developed amongst the groups using the information that had been provided in the knowledge transfer sessions as well as information provided in the workshop manual. Results of the risk assessments with then presented back to the class with opportunities to ask questions regarding the logic behind the risk assessments.

Figure 3. Examples of the risk assessment presentations made to the class.

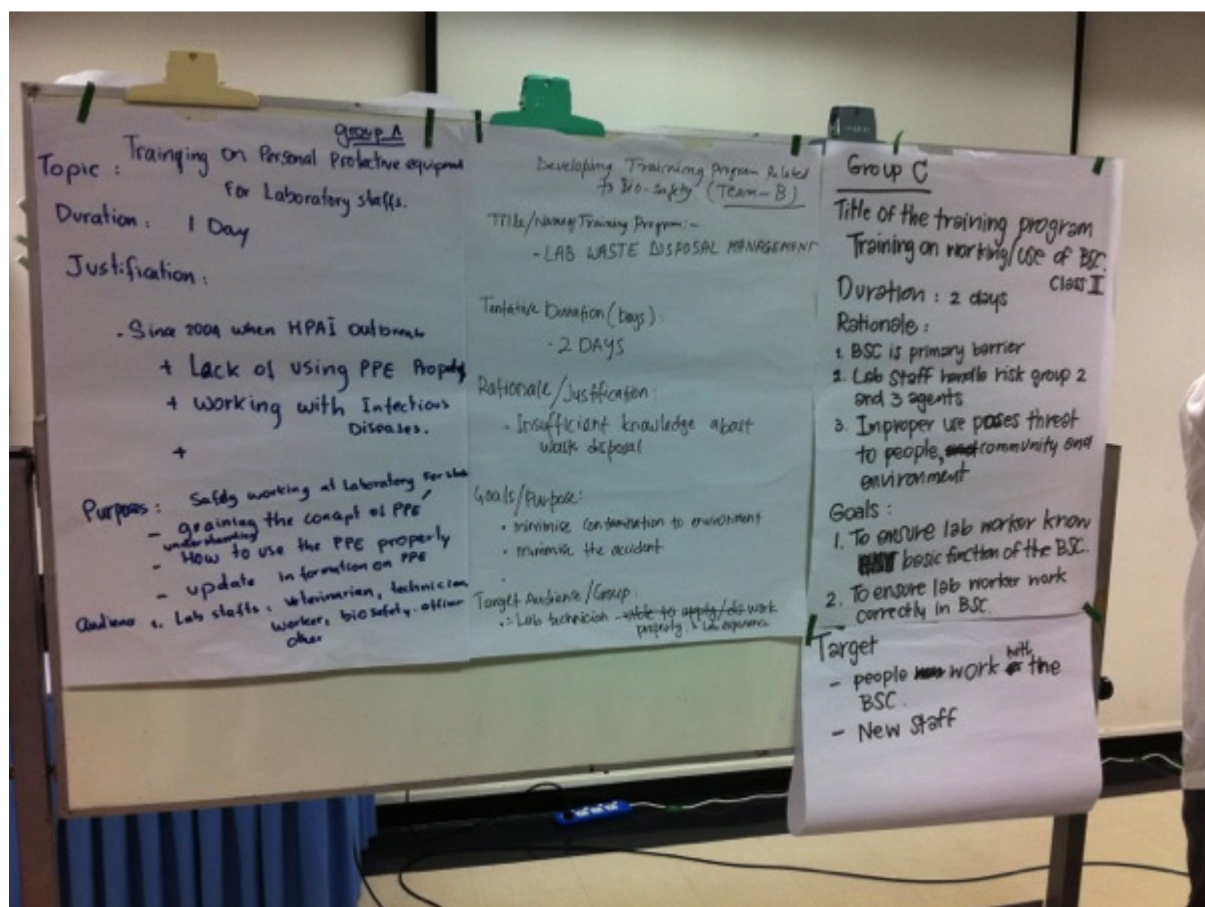


Adult learning principles and presentations

The principles on adult learning approach were delivered during this input session. The participants learned to incorporate the concepts into their ways of delivery of the training sessions. The message was that adults, their laboratory staff in particular, have different learning style and brain's capacity. The trainers should give concerns on this aspect so that they can select the right methods for training. The concepts helped them to identify training techniques their target audience would have key takeaways at the end of the program.

The participants were grouped into 3 teams. Each team selected and prepared training subjects related to Biosafety Management. Group A selected training on personal protective equipment, Group B selected Infectious waste disposal and Group C selected use of biological safety cabinets (Figure 4). Each team member then selected one subtopic to prepare session plan and they practiced delivering training session according to the session plan.

Figure 4. The three topics that were to be presented as part of the ToT component of the training.



Day 5 (13 December 2013)

Biosafety auditing of laboratory situations

The fifth day focused on biosafety auditing of laboratory situations. The day started with a presentation that details the requirements of a complete auditing program including biosafety as well as other general safety aspects. Participants were introduced to the standard CDC BSL2 checklist for biosafety auditing. This was followed by a practical session in the form of audit tour of the MORU BSL2 laboratories with the disciplines asked to act as auditors to find areas of non-compliance.

Emergency procedures and the use of PPE

The afternoon session focused on emergency procedures and the use of PPE. A presentation on emergency procedures was then made to the group of participants that dealt actions following and preventative measures for infectious disease spills, chemical spills, electrical outages, flood and fire. Two videos with them shown demonstrating methods of dealing with and cleaning a infectious disease spill inside a biological safety cabinet and in an open laboratory area. A mock infectious disease spill was simulated and participants were then asked to clean up the spill

using appropriate PPE and the preassembled spill kit. This gave the participants an opportunity to use the PAPR as well as other respirators and necessary PPE. It also gave the participants an opportunity to perform and provide practical advice and criticism on the methods for cleaning an infectious disease spill.

Days 6 (16 December 2013)

Practical aspects of biosafety

The sixth and seventh days focused on the practical aspects of biosafety management. The day started with a presentation from Stuart Blacksell and Marcel Fiocchi on biocontainment laboratory design and the pitfalls involved in the building of a laboratory biocontainment level two and three. In addition, The presentation also detailed the requirements for routine Laboratory preventative maintenance at biocontainment level II and biocontainment level III laboratories. Following the presentation a discussion followed on aspects of Laboratory design and maintenance.

In the following sessions the participants were formed into their three groups and asked to develop a maintenance plan for their laboratories. This included routine preventative maintenance for larger equipment such as generators and more biosafety related equipment such as biological safety cabinets. The findings of the three groups were then presented back to the participants by the leaders of the group.

This was followed by a presentation on gaseous decontamination of the biological safety cabinets and laboratory spaces using formaldehyde, chlorine dioxide, vapourised hydrogen peroxide. The presentations focused on the theory, Practice, costs and validation processes associated with each method of decontamination. Also heavy focus was placed upon the use of appropriate PPE, signage to warn others in the area and monitoring equipment such as formaldehyde monitors to ensure that the safest possible method of decontamination was practised.

In the last session of the sixth day, the participants were formed into two groups and then provided with a tour of the MORU BSL2 and BSL3 laboratories including the plant room area. During the tour, areas requiring preventative maintenance were pointed out and explained to the participants. There was also an opportunity to participate in a respirator fit test that was being conducted for other MORU staff. Marcel Fiocchi and Dr Wathana had the opportunity to be fit tested and found that their normal respirator of use did not provide a sufficient seal to be effective.

Day 7 (17 December 2013)

Theory and practical aspects of biological safety cabinets use and maintenance

On the seventh day of the training workshop, the focus was on biological safety cabinets. There was a presentation by Stuart Blacksell and Marcel Fiocchi on the fundamentals of the operation of a biological safety cabinet including routine maintenance requirements and certification responsibilities. A video presentation from the Esco company was shown to the participants to show the correct method of working inside a biological safety cabinet. Following the presentation, the participants were divided into two groups and the concepts of gaseous fumigation of a biological safety cabinet using formaldehyde was discussed and demonstrated.

This was followed by a demonstration of the practical use of a biological safety cabinet using smoke sticks and particle generated smoke to demonstrate airflows within the biological safety cabinet. It also demonstrated the importance of working in the middle of the work surface rather than too far towards the front. Marcel Fiocchi then performed a biological safety cabinet certification to NSF 49 standards to demonstrate the methodologies and requirements to the participants. Participants have the opportunity to use the certification equipment and to become familiar with the routine aspects of biological safety cabinet certification so that they are prepared to ask appropriate questions when they're biological safety cabinets are in next certified.

Days 8 & 9 (18-19 December 2013)

Adult learning principles and presentations

As mentioned earlier on day 4 of the program, the participants were grouped into 3 teams. Each team selected and prepared training subjects related to Biosafety Management. Each team member then selected one subtopic to prepare session plan and they practiced delivering training session according to the session plan.

Each participant delivered their short training session (15 minutes) in front of resource persons and other participants. They were required to use as many techniques as they can. The training contents were chosen from Biosafety lessons they studied in the course. After each team completed the teaching delivery, the resource persons commented and gave suggestions on the process the participants used. It hoped that this practice helped participants to keep in mind about lesson planning and choosing training techniques that are appropriate to nature of the biosafety contents.

The ToT component complimented very well with the subject matters part. The participants had clear ideas on what to deliver. They now know which subject matters are important for the level of their laboratories.

Day 10 (20 December 2013)

IATA Dangerous Goods certification training

Day 10 was the IATA Dangerous Goods certification training on the final day performed by World Courier company. At the completion of this training, those who passed the examination are certified to pack and complete documentation for the transport of dangerous goods such as infectious materials, biological specimens and dry ice. This training started at 9am was completed with an exam at 5pm.

Closing ceremony

The closing ceremony was conducted by Stuart Blacksell who thanked the participants for their attendance, FAO for facilitating the workshop, the donors and MORU staff. Participants were presented with certificates of completion.

6. Assessments

Assessment is an important component to demonstrate the effectiveness of training and baseline understanding. The following assessment techniques were used during the workshop.

Informal assessments

Informal assessments were performed in the form of homework, practical exercises, risk assessment exercises and auditing exercises.

All students were issued with a workshop workbook which was used to answer questions posed at the end of each knowledge transfer presentation. Students were given time during the formal sessions to answer the questions in their workbooks however most of the time, questions were answered as homework. The questions can be found in the training materials section (Annex A) at the end of every presentation. Generally, questions related to the opinion of the student to their own laboratory situation and therefore strictly, there are no correct or incorrect answers. However, the workbooks are being used by the FAO monitoring and evaluation section for analysis.

In other areas of informal assessment (practical exercises, risk assessment exercises and auditing exercises) assessment was via question and answer as well as presentation to the class. Participants generally performed well and participated willingly however it was noticed that the more experienced “team leaders” were required to do most of the presentations following group exercises (too few doing most of the work) and this needs to be addressed in future trainings.

Formal assessments

Pre-workshop and post-workshop assessment exams were completed by the participants. The exams were designed to test the level of basic biosafety knowledge at the commencement of the workshop using multiple choice and “match the best answer” type questions. The exams were deliberately designed using simple English in the questions to be simple enough for that high-scores could be generated to build confidence. The post-workshop exam was the same as the pre-workshop exam with additional “fill in the gap” and multiple-choice questions based on the workshop manual. Exams can be found in the training materials section (Annex A). Both exams were delivered as “open book” style with participants given a minimum of one evening to complete (post-exam – 2 evenings).

Results of the exams demonstrated that an improvement in the mean score from 86.9% to 92.1% (for the same questions) was gained over the course of the training (see table 3). All students, with the exception of one, demonstrated increased scores ranging with greatest being 16.3% (Bui Huy Hoang) with the average increase being 5.2%.

It should be noted that some participants commented that they did not like formal examinations and preferred informal assessment and this was reflected in the scores of these participants.

Table 3. Results of Pre-workshop and post-workshop assessment exams

Participant	Pre-course assessment (same exam)	Post-course assessment (same exam)	% Change	Final exam	ToT Presentation (voted by peers)
<u>Tshering Dem Tamang</u>	84.5	84.6	0.1	87.7	12
<u>Sri Handayani Irianingsih (Yani)</u>	90.4	97.1	6.7	96.1	13
<u>Ni Luh Dartini</u>	87.5	89.4	1.9	90.3	5
<u>Hyang-mi NAM</u>	90.4	100	9.6	98.1	4
<u>Wathana Theppangna</u>					20
<u>Mhd Syamsul Naim Bin Noorazmi</u>	96.2	98.1	1.9	96.8	10
<u>Salina Manandhar</u>	77.9	86.5	8.6	90.2	3
<u>Cristina Legaspi</u>	92.3	98.1	5.8	97.4	11
<u>Tuangthong Patchimimasiri</u>	87.5	94.2	6.7	92.2	0
<u>Rompheuke Udon</u>	85.6	84.6	-1	87.4	0
<u>Napawan Bunpamong</u>	91.3	97.1	5.8	96.8	4
<u>Bui Huy Hoang</u>	72.2	88.5	16.3	89.6	0
<u>Nguyen Thi Thuy Nga</u>	86.5	87.5	1	90.2	3
Mean	86.9	92.1	5.2	92.7	

ToT presentations

All participants had confidently and effectively delivered the biosafety contents according to theoretical concepts provided in the course. They followed the subjects as well as techniques showed by the expert. The mini session delivery showed that most of the participants had good basic as a trainer or instructor. Their presentation sessions were effective, and they used various techniques to deliver the contents. Although they were given only 15 minutes but most of them could manage the time very well.

From the training program development exercise, it was observed that the participants had inadequate knowledge on training and development management system. They viewed training as a standalone activity. In their perception, training was separated from organizational development. They addressed capacity problems in a short time span. The resource person kept emphasizing training and development should be incorporated together with long term plan of the laboratories. It is necessary laboratories have comprehensive staff development plan.

Participants were asked to score from 3 to 1; the best, second best and third best presentation from outside of their groups and results are presented in table 3.

Training and certification in IATA infectious goods shipping ▪ (20 December)

All participants sat the in IATA infectious goods shipping exam. Results will be issued in due course by World Courier. All the participants passed this exam.

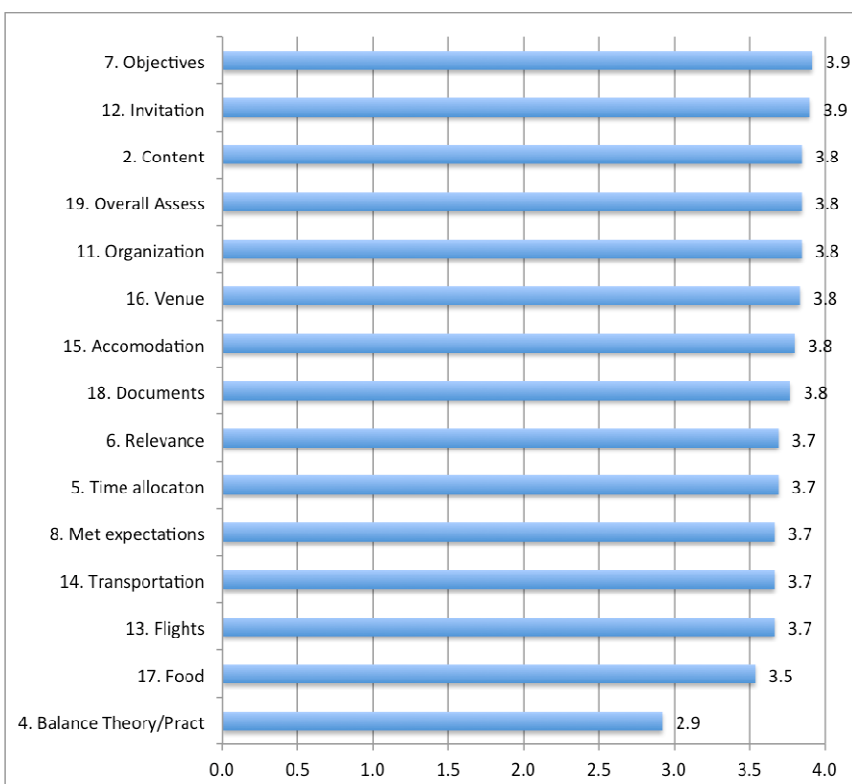
7. Post workshop evaluations

The standard FAO post-workshop evaluation form was completed by all participants. The evaluation is a combination of quantitative scores (0 min – 4 max) and qualitative extended response questions.

Quantitative assessment

The mean results for the scores are presented in figure 5 below. The majority of categories scored means 3.5 or greater. The lowest score was “Balance between theory and practise” with 2.9.

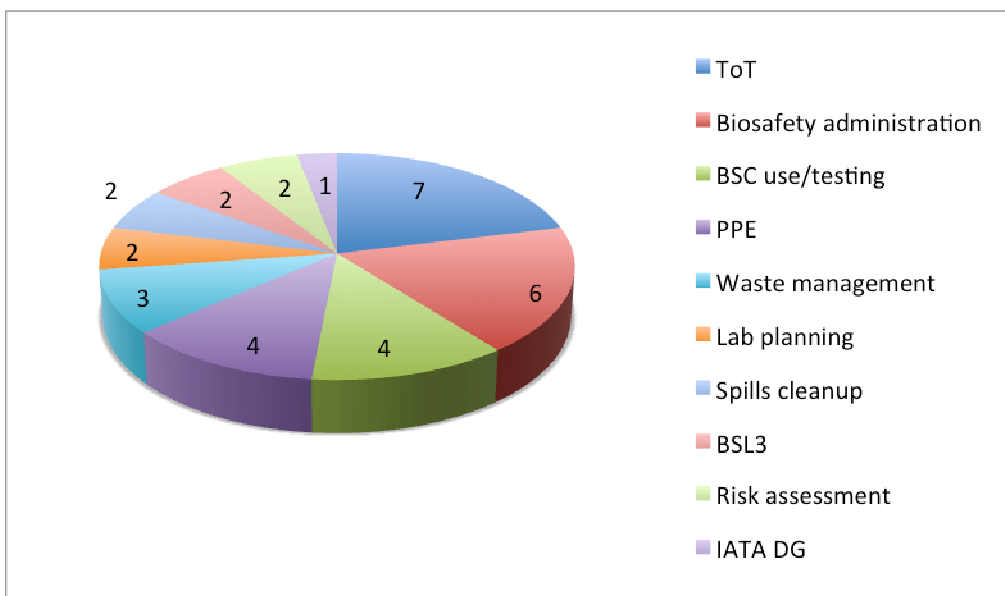
Figure 5. Quantitative assessment of the workshop.



Qualitative assessment

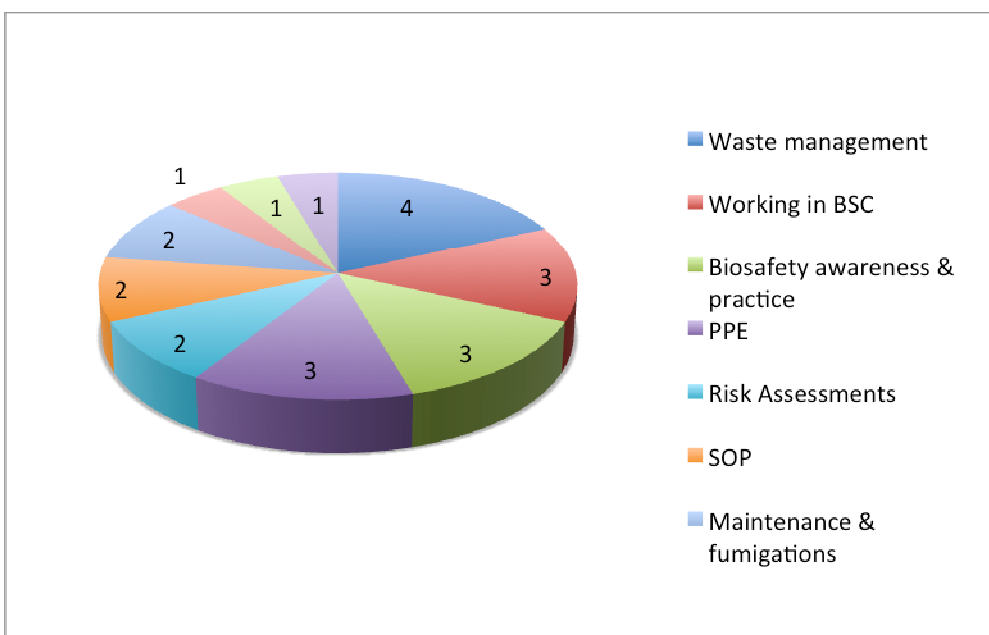
Question 3. related to Practical training knowledge gained from the workshop (see figure 6). ToT, biosafety administration, BSC use/testing and PPE knowledge and use all scored highly.

Figure 6. Practical training comments from the workshop



Question 9. related to additional training needs identified by the participants (see figure 7). Waste management, BSC use, biosafety awareness, and PPE knowledge and use, all of these areas scored highly in the assessment.

Figure 7. Training needs identified by the participants



Question 10 related to regional networks. The answers were very positive Lab networking and BSC certification were important regional activities. Two participants called for an opportunity to review implementation of biosafety management & information exchange at a future meeting. Importantly, one participant requested a single regional biosafety standard which is a sensible suggestions that should be followed up.

Question 19 (see table 4) elicited positive comments on the usefulness of the training and improve skill and confidence. One participant called for less content and more practical sessions.

Question 20 (see table 4) asked what could be done differently in the workshop. Much of the comments evolved were single response with the exception of two asked for more detail in the presentations. This was countered with a request for more practical sessions. Two specific requests for more details in waste management and BSC use were made (note: 1 day of knowledge and practical sessions were devoted to BSCs).

Some of the responses were frankly puzzling and need to be addressed. “No risk assessment knowledge” is completely inaccurate as ¾ days on risk assessment in presentation and two practical sessions as is “No guidelines for biosafety management” as at least 2.5 days of biosafety management in presentations and skills sessions as well as providing the CEN/CWA document in full and the workshop manual – both of which are “how to” documents to set up biosafety management in a laboratory setting.

Table 4. Summary of responses to Questions 19 ad 20.

	Comment	Number
19. General comments	Very useful	7
	Improved biosafety skills	2
	Less content/more practical	1
	Improved confidence	2
20. What could be done different	More practical sessions	1
	More detail in the presentations	2
	No risk assessment knowledge	1
	No guidelines for biosafety management	1
	Evaluation by verbal not written	1
	How to work in BSCII - should be more	1
	Lab waste handling - should be more	1

8. Conclusions

General comments

Biosafety awareness and biosafety management should be a fundamental component of good laboratory management. Well-developed and well implemented biosafety practices protect the staff, visitors, family members, the community at large and the environment from the threat of laboratory acquired infections

The concept behind this workshop was to address gaps and needs that had been brought to the attention of FAO and the donors during the baseline assessments of laboratories during the regional laboratory network by safety program during 2012. The primary needs were identified in the administration of biosafety management program as well as practical matters such as biosafety equipment maintenance, auditing and dealing with infectious laboratory waste.

The workshop curriculum was developed based on an international standard set of documents (CDC BMBL 5th Edition and the CWA15793) that would allow a simplified approach to the implementation of a biosafety management program in a resource limited situation. While it is not possible to have a one size fits all approach to a workshop style training it was felt by the organisers that this approach would provide the basis for biosafety management skills. It should also be recognised that a number of the participants have never received any previous biosafety training. On the other hand, there were some participants who have attended numerous biosafety trainings and were quite familiar with the concepts that were being presented.

Post-workshop assessments

The workshop was well received by the participants and this was confirmed by the positive comments received in the post-workshop assessment. Participants were happy with the content and organisational matters related to the workshop.

A small number of comments related to the balance between theory and practice during the workshop. As it was a management workshop there are unavoidable levels of theory /knowledge transfer required during the training component. However, opportunities were provided for practical sessions such as risk assessments or where there was any technical component such as activities with biological safety cabinets or with auditing skills. Nevertheless, these comments should be considered in future trainings.

Training of the trainer component

The training of the trainers component of the training workshop was well received by the participants. None of that the participants had ever received any formal training as a trainer before and so felt that this was something that was new and useful that could be applied when they return to the workplace. The training skills acquired should provide them with the confidence to implement a biosafety program and be able to provide appropriate training to the staff.

Assessment

The overwhelming majority of participants demonstrated increased understanding biosafety concepts at the end of the training. Interestingly, despite some participants never having

attended a biosafety training previously, a moderate to high level of understanding was displayed in the majority of the participants at the start of the workshop.

9. Recommendations

Biosafety management training

1. It is recommended that specific training in Risk assessments for biological safety management with the following characteristics,
 - a. Provided to at least one individual or possibly two so enable the appointment of biosafety officers
 - b. No more than 15 participants
 - c. No more than five days duration
 - d. Focus on risk assessments for routine laboratory and surveillance activities
 - e. Brief training of trainers component be included in the training
 - f. The training should be similar to that provided during the FAO / USAID / MORU: Regional Laboratory Network Training of the Trainers (ToT) Workshop on Biosafety Management held 9-20 December 2013, Bangkok, Thailand.
 - g. Held at MORU, Bangkok
2. It is recommended that specific training in Preventative maintenance for safety management with the following characteristics,
 - a. No more than 15 participants
 - b. No more than five days duration
 - c. Participants should have background Basic engineering and have a good command of English
 - d. Focus on primary containment (biological safety cabinets)
 - e. Focus on emergency systems (Generators, UPS)
 - f. Held at MORU, Bangkok
3. It is recommended that South Asian laboratories being included in all biosafety and Quality assurance training programs in the future
4. It is recommended that the need for knowledge regarding biosafety policy and biosafety administration be promoted and endorsed by FAO and it's donor partners and and should be balanced against the practical implementation of biosafety which is the normal expectation of most biosafety practitioners and staff.
5. Is recommended that the balance between theory or knowledge transfer when compared with practical sessions always be considered when planning workshops such as those.

Training of Trainers component

6. Each laboratory should have comprehensive staff development plan. The senior management and key laboratory staff need to play important role in preparation of the plan.

7. The laboratories would focus on on-the-job training and coaching. The lab supervisors are the key who serve as trainer. The subject matters have a lot of technicality, participatory methods should be used for training delivery.
8. Participants should have more time to practice important ToT techniques. One more day (6 hours) could be allocated for this.

Regional biosafety coordination

9. Opportunities should be made to review the implementation of biosafety management at a regional level and that individual laboratory level. At the regional level the technical advisory group (TAG) meetings are the most appropriate forum for reporting and information exchange. At an individual laboratory level implementation can be reviewed and examined during visits by the regional biosafety coordinator.
10. There should be an opportunity for information exchange and discussion of methods of best practice biosafety management implementation. Is to be done as part of a technical advisory group meeting you would not need to be done every year.
11. This workshop has presented methodologies to standardise the implementation of biosafety management throughout Southeast Asia and South Asia. It is recommended that FAO RAP formally adopt a regional biosafety standard based on the CEN Workshop Agreement 15793 and the BMBL 5th Edition documentation that can then be promulgated throughout the region.

Appendix 1. List of participants.

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Appendix 2. Workshop agenda.



FAO / USAID / MORU: Regional Laboratory Network Training Of the Trainers (ToT) Workshop on Biosafety Management 9-20 December 2013, Bangkok, Thailand

Item	Details	Trainer
Day 1 - 9 December 2013		
9.00-9.15	Opening ceremony and welcome remarks	FAO & MORU representatives
9.15-10.15	Introduction to biosafety concepts including <ul style="list-style-type: none"> Levels of biosafety risk and containment Primary and secondary containment theory 	Stuart Blacksell
10.15-10.30	Break	
10.30-12.00	Biosafety management concepts and introduction to laboratory biorisk management standard CWA 15793	Stuart Blacksell
12.00-13.00	Lunch	
13.00-14.30	Biosafety risk assessments for new and existing SOPs to determine containment, waste and PPE requirements	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
14.30-14.45	Break	
14.45-17.00	Group exercise – Risk assessment scenarios	
Day 2 - 10 December 2013		
9.00-10.30	Biosafety management administration including <ul style="list-style-type: none"> Biosafety manuals Accident/incident reports Biosafety Management Committee 	Stuart Blacksell, Soiratchachaneekorn Ruanchaiman & Premjit Amornchai
10.30-10.45	Break	
10.45-12.00	Biosafety management administration including <ul style="list-style-type: none"> New staff induction Biosafety training and recording of training Identifying and verifying training needs of new staff Regular training requirements Training of trainers 	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
12.00-13.00	Lunch	
13.00-14.30	Occupational Health risk assessments including <ul style="list-style-type: none"> Vaccinations Baseline serum samples Signs and symptoms Documentation 	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
14.30-14.45	Break	
14.45-17.00	Group exercise – Discussion on existing and available safety resources	
Day 3 - 11 December 2013		
9.00-10.30	Personal Protective Equipment (PPE) specifications and requirements including <ul style="list-style-type: none"> PPE donning and doffing Respirator fit tests 	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
10.30-10.45	Break	
10.45-12.00	Group exercise – PPE practical session	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
12.00-13.00	Lunch	

13.00-14.30	Training Needs Analysis (TNA): Techniques and Tools for KSP Gaps Identification	Voravate Chonlasin
14.30-14.45	Break	
14.45-17.00	Exercise on TNA (1 hr)	Voravate Chonlasin
Day 4 - 12 December 2013		
9.00-10.30	Disinfection and Sterilization theory including <ul style="list-style-type: none"> – <i>Infectious waste workflow</i> – <i>Autoclave verification</i> – <i>Chain of custody (responsibility)</i> 	Stuart Blacksell, Premjit Amornchai & Soiratchachaneekorn Ruanchaiman
10.30-10.45	Break	
10.45-12.00	Group exercise – Standard Operating Procedures writing & Risk assessment practical session	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
12.00-13.00	Lunch	
13.00-14.30	Adult Learning Principles and Its Applications in Instructional Design	Voravate Chonlasin
14.30-14.45	Break	
14.45-17.00	Exercise on Instructional Design using Adult Learning Principles	Voravate Chonlasin
Day 5 - 13 December 2013		
9.00-10.30	Biosafety auditing and inspections using standardized templates	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
10.30-10.45	Break	
10.45-12.00	Group exercise – Biosafety auditing of MORU laboratories	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
12.00-13.00	Lunch	
13.00-15.30	Emergency procedures & Group exercise - Infectious spill cleanup (inside and outside BSC) and Staff evacuation from containment area	Stuart Blacksell & Soiratchachaneekorn Ruanchaiman
15.30-15.45	Break	
15.45-17.00	Group exercise – Emergency procedures and auditing write up time	
Day 6 - 16 December 2013		
9.00-10.30	Laboratory designs and annual maintenance requirements	Stuart Blacksell & Marcel Fiocchi
10.30-10.45	Break	
10.45-12.00	Group exercise – Routine & annual maintenance requirements for national and regional laboratories	Stuart Blacksell & Marcel Fiocchi
12.00-13.00	Lunch	
13.00-14.30	Group exercise – Routine & annual maintenance requirements for national and regional laboratories – Presentations to group	Stuart Blacksell & Marcel Fiocchi
14.30-14.45	Break	
14.45-17.00	Gaseous formaldehyde decontamination – theory and practical	Stuart Blacksell & Marcel Fiocchi
Day 7 - 17 December 2013		
9.00-10.30	Gaseous formaldehyde decontamination – continued	Stuart Blacksell & Marcel Fiocchi
10.30-10.45	Break	
10.45-12.00	Biosafety cabinet (BSC) certification HEPA filter testing	Stuart Blacksell & Marcel Fiocchi
12.00-13.00	Lunch	
13.00-14.30	Biosafety cabinet (BSC) certification– continued	Stuart Blacksell & Marcel Fiocchi
14.30-14.45	Break	
14.45-17.00	BSL3 tour - demonstration of unique features.	Stuart Blacksell & Marcel Fiocchi
Day 8 - 18 December 2013		
9.00-10.30	Effective Training Delivery Techniques	Voravate Chonlasin
10.30-10.45	Break	
10.45-12.00	Exercises on Training Techniques	Voravate Chonlasin
12.00-13.00	Lunch	
13.00-14.30	Preparation of training delivery practice	Voravate Chonlasin
14.30-14.45	Break	

14.45-17.00	Preparation of training delivery practice	Stuart Blacksell & Voravate Chonlasin
Day 9- 19 December 2013		
9.00-10.30	Training Delivery Practices – Selected Subject Matters on Biosafety	Stuart Blacksell & Voravate Chonlasin
10.30-10.45	Break	
10.45-12.00	Training Delivery Practices – Selected Subject Matters on Biosafety	Stuart Blacksell & Voravate Chonlasin
12.00-13.00	Lunch	
13.00-14.30	Training Delivery Practices – Selected Subject Matters on Biosafety	Stuart Blacksell & Voravate Chonlasin
14.30-14.45	Break	
14.45-17.00	Training Delivery Practices – Selected Subject Matters on Biosafety	Stuart Blacksell & Voravate Chonlasin
Day 10 -20 December 2013		
	IATA dangerous goods training certification by World Courier	World Courier Specialist
16.30 – 17.00	Closing ceremony and presentation of certificates	FAO & MORU representatives

LIST OF ANNEXES

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