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Engineering Controls and Laboratory Equipment

Design Document

Sandia National Laboratories
International
BIOLOGICAL THREAT REDUCTION

BEP

CBEP
Cooperative Biological Engagement Program

Part I: Lesson Overview

Lesson Description

Overview

Engineering Controls and Laboratory Equipment is intended for participants who are already familiar with biorisk management concepts, hierarchy of controls, and biorisk mitigation strategies. It is designed to offer a cursory review of key engineering controls and equipment typically found in a biomedical research laboratory and to provide learners with the basics of their operation, functions, key features and maintenance needs.

Scope

This lesson covers general use, operation, functions, features, etc. for the following equipment and engineering controls. Specific information about a particular model or brand is not covered:
HEPA filters
BSCs
Fume Hoods
Clean Benches
Centrifuges
Transport containers
Vacuum line protection
Engineered safer sharps

Learning Level
based on Bloom's taxonomy

- ✓ knowledge
- ✓ comprehension
- ✓ application
- synthesis
- evaluation

Length of Course

4 hours

Lesson Objectives

At the end of this lesson, learners will be able to:

Organizational Objectives

- To introduce the concepts of engineering controls and laboratory equipment as they apply to biorisk mitigation
- To design effective and proper SOPs for laboratory equipment and engineering controls

Instructional Objectives

- Define, give examples, and demonstrate key features, functions, and proper operation and maintenance of laboratory engineering controls (equipment, etc.), per lab-specific SOPs.
- Describe engineering controls used in the laboratory to contain hazardous materials;
- describe proper functioning of laboratory engineering controls
- adhere to work practices when using the engineering control
- Know how a HEPA filter works

Personal Objectives

Know

- Participants should know the difference between primary and secondary containment. How a BSC works. Appreciate the function of a HEPA filter.

Feel

- Protected when properly using appropriate lab equipment and engineering controls

Do

- Set up and work in BSC to avoid contamination.
- Describe how a HEPA filter works

Key Messages

1. Containment facilities and equipment establish and maintain primary and secondary barriers. Primary barriers contain the agent at the source. Secondary barriers protect personnel or environment in case of a release from primary containment
2. Biosafety Cabinets provide outstanding primary containment when used properly.
3. Engineering controls must be maintained properly
4. There are a variety of equipment and design features that provide containment in a laboratory. Understanding their function is key to proper use.

Evaluation Strategy

Level 1 (satisfaction):	Students will complete a satisfaction survey about their experience with the lesson
Level 2 (learning):	Students will complete a "learning contract" for the next steps needed to begin biorisk management implementation
Level 3 (behavior):	Desired behavior is for students to participate in additional learning opportunities on BRM – this behavior will be evaluated three to six months post-training and may encompass additional training lessons
Level 4 (organizational change):	A repeat of the training needs assessment will be performed at least annually – this annual assessment can be compared to the baseline assessment to determine improvements in biorisk management performance

Learner Description (for lesson design purposes)

Number of learners: 10 to 25; small groups of 5 people each

Biorisk Management Role:

Policy Makers
Top Management
✓ Biorisk Management Advisors/Advocates

✓ Scientific/Lab Management
✓ Workforce

Audience Assumptions:

(assumed range is indicated by shaded cells)

		Novice		Practi-tioner		Expert
Education	Scientific	1	2	3	4	5
	BRM*	1	2	3	4	5
Expertise	Scientific	1	2	3	4	5
	BRM	1	2	3	4	5
Competence	Scientific	1	2	3	4	5
	BRM	1	2	3	4	5
BRM = "biorisk management". See definitions for terms in Resources section						

Language of instruction; translation or interpretation anticipated:

English (for design purposes)

Prerequisites

Orientation to BRM and *Risk Mitigation Strategies*

Pre- or post-work required for completion

None

Certificates or documents of completion:

Certificates of completion will be provided

Preparation for future coursework

This lesson overlaps many of the concepts found in the Facility course. Therefore, if taught together, some of the redundancies should be eliminated.

Anticipated next steps

Learners will participate in either the management & leadership, advice & advocacy, or skills & competency biorisk management tracks, as defined by the local training needs assessment and other SME recommendations.

Instructional Environment

Number of Trainers/Staff required:	TBD depending on number of learners – optimal ratio is 1 trainer per no more than 12 learners
Trainer Qualifications:	Trainers must have completed BRM Curriculum Orientation, which includes this lesson, and be enrolled in the BRM training network.

Learning Environment

Media:	Instructor-led
Exercises & Activities	
Experience (Activists)	Students will be asked to consider their experiences with their work in regard to how laboratory equipment and engineering controls work.
Reflection (Reflectors)	Students will be asked to reflect on those experiences to help develop a model for properly using and maintaining lab equipment and engineering controls in their facility
Models (Theorists)	Students will be introduced, through their own experiences and reflections, to management system models (Plan – Do – Check – Act) and to the biorisk management AMP (Assessment, Mitigation, Performance) model
Practice (Pragmatists)	Students will be given the opportunity to develop examples of the PDCA and AMP models, as well as describe next steps for applying these models in their facility.

On-Site Specifics

Location	TBD
Room organization	Clusters of tables to facilitate small group (no more than 5 learners per group
Dress code and/or important cultural considerations	TBD

Instructional Materials

Equipment & Supplies	Large flip charts Markers (enough for up to 5 groups plus instructor(s)) 6 x 8 inch multicolor Post-it notes (no lines) Student binders (1" or less) and tabs Pens Laptop computer with PowerPoint files loaded Projector Easels (x ~6)

	Name tags/lanyards or placards Certificates Notepads PowerPoint files Facilitator notes Student handouts/notes pages Course evaluation forms Reference materials (WHO LBM and Biorisk Management Guidance, SNL) Lab Biosecurity handbook, CWA 15793:2008 and CWA guidance)
Student Handouts	Student notes Glossary CWA 15793

Resources

Dependencies	WHO Biorisk Management course
Authorities	
References	CWA 15793 CEN WS 55, 53 WHO Laboratory Biosafety Manual Glossary of terms (in development)

Terms used in this document

- Knowledge – remembering the material in the same form as it was taught
- Comprehension – student's ability to understand the material by (for example) explain or summarizing key messages
- Application – ability to use the material in a new or given situation
- Synthesis – ability to put together learning material in a new whole entirety. For example, using the material to create a new program or plan.
- Evaluation – ability to judge the value of the material presented as a peer (to be able to critically advise or judge others on their application and synthesis of this learning material)

- Novice – a person who is new to the circumstances, work, etc. in which s/he is placed; beginner
- Practitioner – a person engaged in the practice of a profession; a person who practices something specified
- Expert – a person who has special skill or knowledge in some particular field; specialist; authority; trained by practice
- Education – the act of acquiring particular knowledge or skills, as for a profession
- Expertise – the process of personally observing, encountering or undergoing something; knowledge or practical wisdom gained from

what one has observed, encountered, or undergone

- Competence – Possession of a suitable or sufficient skill, knowledge, experience, etc. for some specified purpose; properly qualified

Part II: Course Outline/Schedule							
Day	**Segment time (min)**	**Time**	**Topic**	**Instructional Method**	**Slide#**	**KM #**	**T/F**
1	20	00:00	Welcome & Introductions	Lecture, student introductions, course objectives discussion	1-5		T,F
	20	00:20	Biorisk Management	Lecture	6-9		T
	30	00:40	Containment	Small group activity, plenary discussion, lecture	10-14	1	T,F
	10	01:10	BREAK				
	40	01:20	Engineering Controls: Biosafety Cabinets	Small group activity, plenary discussion, lecture	15-30	2-4	T,F
	10	02:00	BREAK				
	40	02:10	Other Engineering Controls	Plenary discussion, group activity , lecture	31-43	2-4	T,F
	10	02:50	BREAK				
	20	03:00	Laboratory Equipment	Lecture, small group activity	44-49	3,4	T,F
	20	03:20	Examples of Poor Engineering Controls	Plenary discussion	50-53	3,4	F
	20	03:40	Review	Lecture, plenary discussion	54-57		T,F
		04:00	End of Course				
KM = key messages ; T/F = teaching versus facilitation (instructor-based versus learner-based)							