MODULE 2:

LABORATORY BIOSAFETY INSTRUCTIONS

1. Scope of the Training Module This module aims to teach healthcare professionals working in microbiology laboratories how to correctly and effectively apply biosafety instructions in daily laboratory practice, including during disasters and extraordinary conditions. The main topics covered in the module are: • Personal Protective Equipment (PPE): Selection according to risk level, donning and doffing sequence • Spill/Splash Management: Step-by-step intervention algorithm for chemical and biological incidents • Decontamination: Agent selection, contact time, and applications specific to disaster conditions • Waste Management: Category-color coding, temporary storage and disposal under extraordinary conditions • Notification and Recording: Legal responsibilities, notification chain, and incident record form

1a. Purpose of the Training Module The purpose of this training module is to enable microbiology laboratory personnel to systematically recognize biosafety risks and develop the necessary knowledge, skills, and attitudes to control these risks. The module particularly addresses why standard procedures become even more critical in disaster and extraordinary conditions, how to make correct decisions in environments with limited resources and damaged infrastructure, and how individual intervention connects to the institutional notification chain. In this way, participants are expected not only to gain knowledge but also to become professionals who can act effectively in real-life incident scenarios.

1b. Objectives of the Training Module Participants who complete this module are expected to achieve the following objectives:

1. Determine the risk level, select appropriate PPE, and correctly don and doff it.
2. Apply the standard intervention algorithm (STOP–DON PPE–ISOLATE–NOTIFY–DECONTAMINATE–RECORD) in chemical and biological spill/splash incidents.
3. Select the appropriate decontamination agent, comply with contact time, and perform mechanical cleaning before chemical disinfection.
4. Correctly identify waste categories, comply with color coding, and apply the 48-hour temporary storage rule under disaster conditions.
5. Perform incident notification within legal timeframes and completely fill out the incident record form.

2. Learning Outcomes of the Training Module

2.1. Knowledge Outcomes • Distinguish between biosafety and biosecurity concepts; explain why simultaneous management of both is critical in disaster conditions. • Define the BSL classification system and the PPE standards required for each level. • Explain the risks formed in chemical and biological spill scenarios (exposure types, transmission routes, toxic threshold values). • Know the mechanisms of action, spectra of activity, and limitations of decontamination agents under disaster conditions. • Explain category definitions within the scope of the Regulation on Control of Medical Wastes and the 48-hour temporary storage rule. • Define SGK occupational accident notification (Law No.

5510, Art. 13), notification obligations under the Environmental Law, and AFAD notification processes.

2.2. Skill Outcomes • Use the PPE selection table according to risk level and apply the donning/doffing sequence without error. • Apply the six-step spill management algorithm step by step through real scenarios. • Select the decontamination agent, concentration, and contact time according to the pathogen-surface combination. • Correctly determine waste category and color code; in mixed pathogen waste, apply the highest risk category as priority. • Completely fill in the mandatory fields of the incident record form and operate the notification chain in the correct order. • Keep handwritten incident notes when communication is interrupted and follow the physical notification route.

2.3. Attitude Outcomes • Adopt compliance with biosafety procedures not as an individual preference but as a professional and legal obligation. • Accept that usual routines may be disrupted in disaster and extraordinary conditions and internalize being prepared for such situations as an institutional value. • Adopt record-keeping and reporting habits as the foundation of institutional learning and patient safety. • Be willing to inform colleagues and take on the role of in-house trainer.

3. Methods and Techniques of the Training Module Problem-Based Learning (PBL) and Case-Based Learning (CBL) methodologies are used together in this module. Participants develop solution strategies through realistic disaster scenarios; they construct knowledge in the context of application rather than passive reception. This approach supports permanent skill acquisition by basing learning on individual experience.

Main Methods and Techniques Used:

Problem and Case-Based Learning (PBL/CBL) Within the framework of PBL/CBL, which is the main learning method of the module, two realistic scenarios are studied. Each scenario confronts participants with real extraordinary conditions such as limited resources, communication difficulties, and time pressure. Working in small groups (4–5 people), they discuss questions, develop solution proposals, and share their discussions with the class.

Case 1 — Post-Earthquake Chemical Spill Accident (Selin's Case) 20 minutes after a 7.6-magnitude earthquake, laboratory technician Selin working in a BSL-2 laboratory notices broken formaldehyde (10% formalin) bottles under the overturned chemical storage rack. The ventilation system is not working, communication is cut, and appropriate PPE is not available. Participants discuss the following questions: What should Selin do — evacuate or intervene? Is the available PPE sufficient for formaldehyde? How does the notification chain work when communication is cut?

Case 2 — Earthquake: Biological Waste and PPE Crisis (Mehmet's Case) 45 minutes after the earthquake, the waste storage room door of the BSL-2 laboratory remained unlocked and the rack overturned. Cleaning staff Mehmet notices biological waste bags containing suspected HIV, HBV, and TB patient samples spilled on the floor. It is 03:15 — only two people are on night duty, and liquid is leaking through a crack to the basement floor. Participants work on three questions: What should Mehmet's first three steps be? How is the PPE standard determined in a mixed pathogen spill? How should an institutional emergency waste management plan be created to maintain minimum service while protecting biosafety in the first 72 hours after an earthquake?

Presentation and Visual Materials An interactive presentation is used for the transmission of the theoretical framework. Slide materials are supported by visual models such as the PPE selection table, donning/doffing sequence, spill algorithm, decontamination agent comparison table, waste category color coding, and notification chain flow diagram. The theory presentation is limited to 15 minutes of the total 90-minute session; the main learning is left to case studies.

Team-Based Learning (TBL) For the third question of Case 2, participant groups create a draft “Emergency Waste Management Plan” for their own institutions. The plan should include headings such as scope and conditions, responsible persons and command chain, minimum PPE stock list, disposal flow chart, and notification chain. Groups share their prepared plans with the class and peer evaluation is conducted.

Assessment Tools A Kahoot-based pre-knowledge test is administered at the beginning of the module. At the end of the module, a closing test is conducted with the same questions to measure the difference in outcomes. Additionally, an exit survey collects in writing the most important information gained from the module, a topic that is still not understood, and one change participants can immediately implement in their institutions.

4. Content – Scope

4.1. Personal Protective Equipment (PPE): Risk-Based Selection and Correct Use Personal protective equipment is the last line of defense against biological and chemical risks in the laboratory. However, it should not be forgotten that PPE alone is not sufficient and constitutes the last step in the hierarchy of controls (engineering → administrative → procedural → PPE).

Three determining factors in PPE selection are: the procedure being performed, the agent being worked with, and splash/aerosol risk. The combination of these three factors determines the required PPE level. Four risk levels are defined:

Risk Level	Example Procedure	Required PPE
Low	Routine blood draw, biopsy processing	Gloves + gown
Medium	BSL-2 culture work, centrifugation	Gloves + gown + goggles + surgical mask
High	TB/HIV material handling, BSL-3	Double gloves + coverall + FFP2/N95 + face shield
Disaster / Unknown Risk	Post-earthquake/sel mixed pathogen	High level + chemical/biological kit

Donning and Doffing Sequence The PPE removal sequence is as critical as the donning sequence. Breaking the sequence leads to contact of cleaned hands or face with contaminated surfaces. The standard sequence is: • **Donning:** Hand hygiene → Gown → Mask/FFP2 → Goggles/face shield → Gloves (gown cuffs covered by gloves) • **Doffing:** Gloves (most contaminated component, turned inside out) → Goggles/face shield (holding from the back) → Gown (rolled inward) → Hand hygiene → Mask (holding from ties or elastic parts, without touching the front surface)

In disaster conditions, PPE stock may become insufficient. In such cases, priority should be given to high-risk areas and the use of alternative PPE should be documented in the institutional Standard Operating Procedure (SOP).

4.2. Spill/Splash Management: Step-by-Step Algorithm In a biological or chemical spill/splash incident, the instinctive reaction is "clean it immediately"; however, this is the most dangerous decision. The standard intervention algorithm consists of six steps:

1. **STOP:** Do not approach the area. Warn the surroundings, close doors. Assess structural safety (in disaster conditions, definitely question ceiling and rack collapse risk).
2. **DON PPE:** Fully don PPE appropriate to the risk level. If appropriate PPE is not available, do not intervene — evacuate and call for help from a safe location.
3. **ISOLATE:** Determine the clean/dirty boundary. Empty the corridor if necessary. Place "DO NOT ENTER" warning.
4. **NOTIFY:** Activate the chain: Unit supervisor → Occupational Health → Infection Control → Management. If communication is cut, keep handwritten records and physically deliver to the first reachable supervisor.
5. **DECONTAMINATE:** Select the correct agent, taking into account surface and agent compatibility. Comply with waiting time. Perform mechanical cleaning (removal of organic matter) before chemical disinfection.
6. **RECORD:** Fill out the incident form: time, location, agent, exposed person(s), PPE status, actions taken. Institutional learning cannot occur without records.

4.3. Decontamination: Agent Selection Guide Three critical rules always take priority in decontamination: (1) Mechanically remove organic matter first, then apply chemical disinfectant — reverse order reduces effectiveness by 60–80%. (2) Comply with contact time — "wipe and go" is not sufficient; the surface must remain wet for the full duration. (3) The cloth, mop, and absorbent materials used become biological waste themselves; dispose of them in a separate red bag.

Agent	Spectrum of Activity	Contact Time	Disaster Condition Note
Na Hypochlorite ≥1000 ppm	Broad spectrum, sporicidal, HIV/TB/HBV	10–30 min (30 min for TB)	Corrosive on metal surfaces; rinse. Prepare fresh — degrades in 24 hours.
Glutaraldehyde 2%	Instrument sterilization, including fungi	10–20 min	Strong irritant; do not use if ventilation is unavailable.
70% Ethanol	Vegetative bacteria, enveloped viruses	3–5 min	Insufficient alone for TB (Mycobacterium tuberculosis). Fully wet the surface.
Autoclave 121°C	All microorganisms	15–30 min	Cannot be used during power outages — specify alternatives in disaster plan.

4.4. Waste Management in Disaster Conditions Within the scope of the Regulation on Control of Medical Wastes (Official Gazette No. 25883, 22 July 2005), four waste categories and color coding are defined:

Category	**Container/Color**	**Basic Rule**
Infectious	Red bag (double layer)	Biohazard label + date + unit. Max 48 hours storage before autoclaving.
Sharps	Yellow puncture-proof container	Broken glass CANNOT BE COLLECTED BY HAND — forceps/tongs mandatory. Replace when full.
Chemical	Purple-labeled leak-proof container	Use agent-specific container. Mixing with other categories is FORBIDDEN.
Domestic	Black/transparent bag	Never mixed with others. If contamination is suspected, treat as infectious.

Category Determination in Mixed Pathogen Situations In wastes falling into multiple categories, management is carried out according to the highest risk category. For example, broken tubes containing suspected HIV, HBV, and TB samples have both sharps and infectious properties. In this case, since biological transmission risk takes precedence over physical cut risk, the infectious category (red bag) has priority. In practice, a red bag + puncture-proof container combination is used.

Additional Protocol for Disaster/Extraordinary Conditions When the normal disposal route is disrupted, three additional rules come into effect: • **Temporary storage:** If normal disposal cannot be performed due to infrastructure damage, wastes can be stored for a maximum of 48 hours in a locked, biohazard-labeled, and adequately ventilated temporary area. If it is foreseen that 48 hours will be exceeded, the Provincial Health Directorate should be called to request an alternative licensed carrier. • **Alternative disposal route:** If the normal carrier cannot be reached, a pre-determined backup licensed carrier is activated. Every delivery must be recorded with a written document containing date, time, and signature. • **Route safety and secondary containment:** Infectious waste should not be transported on damaged roads. When transportation is mandatory, the waste bag must be placed in a leak-proof, lidded, rigid outer container (secondary containment). Even if the bag tears, liquid will not leak and contamination will not spread.

4.5. Notification and Recording: The Backbone of Incident Management After any biological or chemical accident in the laboratory — needlestick, spill, aerosol exposure, waste leakage — a structured notification and recording process must be implemented. Without records, neither individual follow-up nor institutional precautions can be developed.

Notification Chain The following sequence must be followed immediately after the incident occurs: • Unit supervisor → Occupational Health / OSGB → Infection Control → Management (primary chain) • SGK occupational accident notification: within 3 working days (Law No. 5510, Art. 13); administrative fines apply for late notification. • Chemical spill: Notification to the Provincial Environmental Directorate is mandatory (Law No. 2872 on Environment). • Biological/chemical accident in disaster conditions: Notification to AFAD and the Provincial Health Directorate is required. • If communication is cut: Keep a handwritten, time-stamped incident note → physically deliver to the first reachable supervisor → enter into the digital system once communication is restored. Paper forms remain legally valid if the digital system is down.

Mandatory Fields of the Incident Record Form The incident record form must fully include the following fields: date and time, location (department and room), agent/sample type, exposed person(s), PPE status (was it worn?), actions taken, and need for medical intervention.

Legal Timeframes

Period	**Obligation**
Same day	Infection control + Occupational Health notification. 72-hour critical window for PEP decision in HIV exposure.
3 working days	SGK occupational accident notification (Law No. 5510, Art. 13). Administrative fines for late notification.
End of month	Closing and signing of the incident record book.
After the incident	Root cause analysis (DÖF) and corrective action plan.

5. Conclusion This module has been designed to ensure that microbiology laboratory workers correctly apply biosafety instructions under both normal and extraordinary conditions. This integrated framework — from PPE selection and use to spill management, decontamination, waste disposal, notification chain, and incident recording — covers both individual safety and institutional responsibility.

Disaster scenarios demonstrate when standard procedures are needed the most: when infrastructure is damaged, communication is cut, and resources are limited. Therefore, every rule and every step addressed in the module has been designed not only for routine laboratory practice but also with crisis conditions in mind.

The main exit question of the module is: If you were to make a change in your institution tomorrow in these five areas — PPE, spill management, decontamination, waste management, and notification — what would your first step be?

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