

ERASMUS+ KA210-VET

Strategic Partnerships for Vocational Education and Training

MICROLABSECURE

Developing a Biosafety Training Program for
Preparedness for Future Disasters and Increasing the
Vocational Skills of Microbiology Laboratory Health Professionals

BIOSAFETY TRAINING PROGRAM HANDBOOK

Enhancing the Vocational Skills of Microbiology Laboratory
Health Professionals for Disaster Preparedness

Intellectual Output | Training Material



1. Project Information and Purpose of the Handbook

1.1 Project Identity

Project Title: Developing a Biosafety Training Program for Preparedness for Future Disasters and Increasing the Vocational Skills of Microbiology Laboratory Health Professionals (MicroLabSecure)

Programme: Erasmus+ KA210-VET – Small-scale Partnerships (Vocational Education and Training)

Target Group: Health professionals working in microbiology laboratories (technicians, specialists, researchers, educators)

Main Focus: Strengthening biosafety and biosecurity practices before, during and after disasters; ensuring laboratory service continuity.

1.2 Purpose of the Handbook

This Handbook is one of the main Intellectual Outputs of the MicroLabSecure project. Its purpose is to equip microbiology laboratory staff with the skills to work safely, sustainably and in an organised manner under disaster and extraordinary conditions.

The Handbook consists of five integrated modules. Each module includes learning objectives, learning outcomes, methods, practical content and assessment tools. The material has been designed for use both in face-to-face training and in institutional continuous professional development activities.

The modules are sequenced to complement one another: starting from risk awareness, progressing through biosafety instructions, emergency response and crisis management, post-disaster recovery, and finally to the institutional disaster plan, offering a holistic learning pathway.

1.3 Target Audience

- Microbiology laboratory technicians and specialists
- Laboratory managers and quality officers
- Infection control and occupational health unit staff
- Disaster and emergency coordinators
- Trainers in vocational education institutions

1.4 Learning Approach

The Handbook is based on Problem-Based Learning (PBL), Case-Based Learning (CBL), Team-Based Learning (TBL) and scenario-based applications. Theoretical instruction is kept to a minimum; decision-making, prioritisation and team coordination skills are emphasised through realistic disaster scenarios.

In each module, knowledge, skills and attitude outcomes are defined separately; the learning process is supported by assessment tools (pre-test, post-test, exit survey, group presentation).

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3. MODULE 1 — Risk Management, Laboratory Risks and Disaster Awareness

3.1 Aim and Objective

Aim

This training module aims to teach health professionals working in microbiology laboratories how to systematically assess laboratory risks before, during and after disasters, and to understand and apply the fundamental differences between the concepts of biosafety and biosecurity. The module aims to ensure that participants are prepared for possible disaster scenarios and can effectively manage risks in the laboratory environment.

Objective

To define risk management strategies and laboratory safety procedures, to apply them by adapting them to disaster scenarios, and to develop the competence to manage biosafety and biosecurity risks simultaneously.

3.2 Learning Outcomes

- Distinguish between the concepts of hazard and risk, and correctly apply the 5x5 risk assessment matrix.
- Classify natural and human-induced disaster types and analyse their effects on laboratory processes.
- List and apply the control measures in the laboratory safety hierarchy in order of priority.
- Distinguish between the concepts of biosafety and biosecurity and manage them simultaneously in disaster situations.
- Recognise bioterrorism scenarios and explain CDC Category A agents and protection protocols.
- Create an institution-specific vulnerability map and prepare an improvement action plan.

3.3 Methods and Techniques

- Lecture
- Team-Based Learning
- Brainstorming
- Gamification

3.4 Hazard and Risk Concepts

In every profession, there are hazards related to the nature of the work that concern the health and life of the employee. The laboratory environment is a high-risk workplace that combines biological, chemical, physical and ergonomic hazards.

HAZARD:

A source or situation that has the potential to cause injury, illness, damage or harm.

RISK:

The combination of the probability of the hazard occurring and the severity of the consequence if that probability is realised.

$$\text{RISK} = \text{PROBABILITY} \times \text{SEVERITY}$$

3.5 5x5 Risk Assessment Method

Although there are many different methods for risk assessment, the 5x5 matrix is among the most frequently used tools. The 5x5 matrix is a systematic tool that visualises the risk score obtained by multiplying the probability of the hazard occurring (1-5) by the severity of the possible consequence (1-5).

Colour coding: Green (1-4) acceptable, Yellow (5-9) low, Orange (10-16) medium, Red (17-25) unacceptable risk level.

Probability / Severity	1	2	3	4	5
1 – Once a year (Negligible)	1	2	3	4	5
2 – Once every 3 months	2	4	6	8	10
3 – Once a month	3	6	9	12	15
4 – Once a week	4	8	12	16	20
5 – Every day	5	10	15	20	25

Application Example: The probability of a syringe needle stick during blood collection is “every day” (5 points), and the severity is calculated as “fatal” (5 points) due to the risk of HIV (0.3%) and HBV (~1%) transmission; consequently, $\text{RISK} = 5 \times 5 = 25 \rightarrow \text{UNACCEPTABLE}$ risk level is determined. In this case, measures must be taken either to reduce the probability of the event occurring or to reduce the severity of the consequence.

3.6 Laboratory Safety Hierarchy

The laboratory safety hierarchy is a pyramid structure that ranks control measures according to their effectiveness, with measures that eliminate the hazard at its source at the top. Safety measures that completely eliminate or reduce risk are ranked from strongest to weakest as follows:

1. Complete elimination of the hazard

2. Substitution of the hazard with a less risky alternative
3. Engineering Controls: BSC, sharps containers, automation
4. Administrative Controls: Training, procedures, rotation plans
5. Personal Protective Equipment (PPE): Gloves, gown, goggles, mask

3.7 Disaster Concept and Classification

A disaster is a set of events that disrupt the normal functioning of a community or institution, threaten human health and the environment, and require rapid response. Disasters are examined in two main categories. In addition, human-induced events that can lead to serious consequences in laboratories may also be encountered.

Natural Disasters:

Earthquake, volcanic eruption, landslide, avalanche, storm, typhoon, hurricane, tsunami, flood, drought, fire, insect infestation, epidemic and pandemic.

Human-Induced Disasters:

Nuclear, biological, physical and chemical warfare, explosion, bioterrorism and biological release, chemical exposure and poisoning.

Human-Induced Artificial Laboratory Incidents:

Laboratory accidents and equipment failures, improper waste management, human errors, infrastructure failures, biosecurity breaches.

3.8 Disaster Awareness and Risk Management

Disaster awareness encompasses recognising possible risks before an event occurs, anticipating their effects, and making the necessary preparations proactively.

Identification of Hazards

First, a situation assessment must be carried out to identify the hazards in the laboratory.

Hazard Category	Laboratory-Specific Examples
Physical	Fire, flood, earthquake, power outage, –80 °C freezer failure
Biological	Culture leakage, spill, aerosolisation, pathogen spread
Chemical	Disinfectant/solvent spill, flammable material fire
Human Resources	Staff loss, transport barriers, unsustainable shifts
Supply-Logistics	Culture media, antibiotic disc, consumable supply interruption

Risk Assessment Matrix (Probability × Impact)

After hazards have been identified, the probability and impact of each must be evaluated and a risk score calculated. Priority must then be determined according to the resulting score.

Risk Factor	Probability	Impact	Risk Score	Priority
Earthquake	High	Very high	5×5=25	Critical
Power outage	Very high	High	5×4=20	Critical
–80 °C freezer failure	Medium	Very high	3×5=15	Priority
Staff inability to reach	Medium	High	3×4=12	Priority
Culture spill	Low/Medium	Medium/High	2×3=6	Under control

3.9 Bioterrorism

When the word disaster is mentioned, natural disasters first come to mind and threats such as bioterrorism are overlooked. Microbiology laboratories must also be prepared for such attempts. Bioterrorism is the intentional release of biological agents with the aim of causing disease, death, fear or disruption of social order. Civilian populations, food and water sources, agriculture and livestock, and health systems may be among the targets.

In this context, the microbiological agents most likely to be used are classified within CDC Category A:

- Bacillus anthracis – Anthrax
- Yersinia pestis – Plague
- Variola virus – Smallpox
- Francisella tularensis – Tularemia
- Botulinum toxin – Botulism

3.10 Biosafety and Biosecurity

Biosecurity comprises all institutional and personal measures taken to prevent the unauthorised acquisition, unauthorised use and misuse of high-risk biological materials such as pathogens and toxins, vaccines and pharmaceutical products, and microorganism stocks.

Biosafety focuses on the safe handling of pathogens within the laboratory, control of aerosol formation, exposure to infectious agents, contaminated surfaces, secondary transmission, personal protective equipment, biosafety cabinets (BSC), disinfection and sterilisation practices. Biosecurity, on the other hand, prioritises the prevention of unauthorised access, pathogen theft, data security breaches and malicious use, as well as locked storage areas and access card systems.

BIOSAFETY	BIOSECURITY
Prevents accidental exposure	Prevents intentional misuse
Protects laboratory staff	Protects biological materials
Focused on safe handling of pathogens	Focused on access control and monitoring
Example: PPE use, BSC working rules	Example: Sample lock and access log

3.11 Specific Risks of Laboratories in Disaster Situations

In disasters, risk multiplies; systems collapse, human error increases and security vulnerabilities emerge. Therefore, rapid risk assessment, prioritisation and dual risk management (biosafety and biosecurity) are required. Biorisk management is not only about safety but is also the foundation of sustainable laboratory operations.

Critical principles in biorisk management:

- Risk always exists and must be managed
- The human factor is the greatest risk
- Training is the strongest control
- Biosafety and biosecurity are inseparable

If preparation and risk assessment have not been carried out before a disaster, the following errors are frequently encountered: starting work without risk assessment, PPE violations, neglect of sample tracking, failure to report incidents, and overlooking biosecurity.

3.12 Conclusion

First, hazards in laboratories must be identified; progress must be made according to the principle of “recognise the risk, control it, manage it”. During a disaster, biosafety and biosecurity risks emerge simultaneously. The greatest mistake in a disaster situation is “focusing only on transmission and forgetting security”. The correct approach is to manage both biosafety and biosecurity together through the approach of protect people, control the agent and manage the system. Biosafety protects you; biosecurity protects society.

4. MODULE 2 — Laboratory Biosafety Instructions

4.1 Aim and Objectives

Aim

The aim of this training module is to enable microbiology laboratory staff to systematically recognise biosafety risks and to develop the necessary knowledge, skills and attitudes to control these risks. The module particularly addresses why standard procedures become more critical under disaster and extraordinary conditions, how correct decisions are made in environments with limited resources and damaged infrastructure, and how individual intervention is linked to the institutional notification chain.

Objectives

1. Select appropriate PPE according to the risk level, and don and doff it in the correct sequence.
2. Apply the standard intervention algorithm (STOP – DON PPE – ISOLATE – NOTIFY – DECONTAMINATE – RECORD) in chemical and biological spill/release incidents.
3. Select the appropriate decontamination agent, comply with contact time, and perform mechanical cleaning before chemical disinfection.
4. Correctly determine the waste category, comply with colour coding, and apply the 48-hour temporary storage rule under disaster conditions.
5. Carry out incident notification within legal time limits and complete the incident record form fully.

4.2 Learning Outcomes

Knowledge Outcomes

- Distinguish between the concepts of biosafety and biosecurity; explain why simultaneous management of both is critical under disaster conditions.
- Define the BSL classification system and the PPE standards required for each level.
- Explain the risks arising in chemical and biological spill scenarios (types of exposure, transmission routes, toxic threshold values).
- Know the mechanisms of action, spectra of activity and limitations of decontamination agents under disaster conditions.
- Explain the category definitions under the Medical Waste Control Regulation 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.

Skill Outcomes

- Use the risk-level PPE selection table and apply the donning/doffing sequence without error.
- Apply the six-step spill management algorithm step by step on a real scenario.
- Select the decontamination agent, concentration and contact time according to the pathogen–surface combination.
- Correctly determine the waste category and colour code; apply the highest risk category as priority in mixed-pathogen waste.
- Fully complete the mandatory fields of the incident record form and operate the notification chain in the correct sequence.
- Keep a handwritten incident note when communication is interrupted and follow the physical notification route.

Attitude Outcomes

- Adopt compliance with biosafety procedures not as an individual preference but as a professional and legal obligation.
- Accept that habitual routines may be disrupted under disaster and extraordinary conditions and internalise being prepared for this situation in advance as an institutional value.
- Adopt the habit of record-keeping and reporting as the foundation of institutional learning and patient safety.
- Be willing to inform colleagues and take on an internal educator role.

4.3 Methods and Techniques

In this module, Problem-Based Learning (PBL) and Case-Based Learning (CBL) methodologies are used together. Participants develop solution strategies through realistic disaster scenarios; they construct knowledge in the context of application rather than passive reception.

Case 1 — Post-Earthquake Chemical Spill Accident (Selin Case)

Twenty minutes after a magnitude 7.6 earthquake, technician Selin working in a BSL-2 laboratory notices broken formaldehyde (formalin 10%) bottles under a toppled chemical storage shelf. 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 interrupted?

Case 2 — Earthquake: Biological Waste and PPE Crisis (Mehmet Case)

Forty-five minutes after the earthquake, the door of the BSL-2 laboratory waste depot has remained unlocked and the shelf has toppled. Cleaning staff Mehmet notices that biological waste bags containing samples from patients suspected of HIV, HBV and TB have scattered on the floor. It is 03:15 — only two people are on night shift, and liquid is seeping into the basement through a crack. 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 can an institutional emergency waste management plan be established to maintain minimum service while protecting biosafety in the first 72 hours after the earthquake?

In addition, Lecture and Visual Presentation, Team-Based Learning (TBL) and assessment tools (Kahoot pre-/post-test, exit survey) are used.

4.4 Personal Protective Equipment (PPE)

Personal protective equipment is the last line of defence against biological and chemical risks in the laboratory. However, it must not be forgotten that PPE alone is not sufficient and constitutes the final step in the control hierarchy (engineering → administrative → procedural → PPE).

Three determining factors exist in PPE selection: the procedure being performed, the agent being worked with, and the splash/aerosol risk. Four risk levels are defined:

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

Donning Sequence:

Hand hygiene → Gown → Mask/FFP2 → Goggles/face shield → Gloves (covering the gown cuffs)

Doffing Sequence:

Gloves (most contaminated component, fold inward) → Goggles/face shield (hold from the back) → Gown (roll inward) → Hand hygiene → Mask (hold by ties or elastic parts, without touching the front surface)

Under disaster conditions, PPE stock may be insufficient. In this case, priority must be given to high-risk areas and alternative PPE use must be documented with an institutional Standard Operating Procedure (SOP).

4.5 Spill / Release Management

In a biological or chemical spill/release incident, the instinctive reaction is “clean immediately”; however, this is the most dangerous decision. The standard intervention algorithm consists of six steps:

1. **STOP:** Do not approach the area. Warn those around, close doors. Assess structural safety (in disaster conditions, always question the risk of ceiling and shelf collapse).
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:** Establish the clean/dirty boundary. If necessary, clear the corridor. Place a “DO NOT ENTER” warning.
4. **NOTIFY:** Operate the chain Unit supervisor → Occupational Health → Infection Control → Management. If communication is interrupted, keep a handwritten record and physically deliver it to the first reachable supervisor.
5. **DECONTAMINATE:** Select the correct agent, take surface and agent compatibility into account. Comply with contact time. Perform mechanical cleaning (removal of organic matter) before chemical disinfection.
6. **RECORD:** Complete the incident form: time, place, agent, exposed person(s), PPE status, actions taken. Without records, institutional learning cannot occur.

4.6 Decontamination

Three critical rules always take priority in decontamination: (1) Mechanically remove organic matter, then apply chemical disinfectant — the reverse sequence reduces efficacy by 60–80%. (2) Comply with contact time — “wiping and moving on” is not sufficient; the duration of wet contact across the surface is critical. (3) Used cloths, mops and absorbent materials themselves become biological waste; 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; prepare and use — deteriorates in 24 hours
Glutaraldehyde 2%	Instrument sterilisation, including fungi	10–20 min	Strong irritant; DO NOT USE if no ventilation
70% Ethanol	Vegetative bacteria, enveloped viruses	3–5 min	INSUFFICIENT alone for TB. Fully wet the surface
Autoclave 121 °C	All microorganisms	15–30 min	Cannot be used during power outage — specify alternative in disaster plan

4.7 Waste Management

Under the Medical Waste Control Regulation (Official Gazette No. 25883, 22 July 2005), four waste categories and colour coding are defined:

Category	Container / Colour	Basic Rule
Infectious	Red bag (double layer)	Biohazard label + date + unit. Max 48 hours waiting before autoclave
Sharps	Yellow puncture-proof container	Broken glass MUST NOT BE COLLECTED BY HAND — forceps/tongs mandatory. Replace when full
Chemical	Purple-labelled leak-proof container	Use chemical-specific container. Mixing with other categories is PROHIBITED
Domestic	Black/transparent bag	Never mix with others. If contamination is suspected, treat as infectious

In mixed-pathogen situations, management is carried out according to the highest risk category. For example, broken tubes containing samples suspected of HIV, HBV and TB have both sharps and infectious characteristics; in this case the infectious category (red bag) takes priority.

Disaster / Extraordinary Condition Additional Protocol:

- Temporary storage: Maximum 48 hours. If it will be exceeded, contact the Provincial Health Directorate and request an alternative licensed carrier.
- Alternative disposal route: A pre-designated backup licensed carrier is activated; every delivery is recorded with a written document containing date, time and signature.
- Route safety and secondary packaging: Infectious waste must not be transported on damaged roads. When transport is mandatory, the waste bag must be placed in a leak-proof and lidded rigid outer container.

4.8 Notification and Recording

After any biological or chemical accident in the laboratory — needle stick, spill, aerosol exposure, waste leakage — a structured notification and recording process must be operated.

Notification Chain:

Unit supervisor → Occupational Health / OSGB → Infection Control → Management (primary chain)

SGK occupational accident notification: within 3 working days (Law No. 5510, Art. 13); late notification results in administrative fine.

Chemical spill: Notification to the Provincial Directorate of Environment is mandatory (Environmental Law No. 2872).

Biological/chemical accident under disaster conditions: Notification to AFAD and the Provincial Health Directorate is required.

If communication is interrupted: Keep a handwritten, time-stamped incident note → physically deliver to the first reachable supervisor → enter into the digital system when communication is restored. If the digital system has collapsed, the paper form is legally valid.

Legal Time Limits:

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

4.9 Conclusion

This module has been designed to enable microbiology laboratory staff to correctly apply biosafety instructions under ordinary and extraordinary conditions. This integrated framework, extending from PPE selection and use to spill management, from decontamination to waste disposal, from the notification chain to incident recording, covers both individual safety and institutional responsibility.

Disaster scenarios demonstrate when standard procedures are most needed: when infrastructure is damaged, communication is interrupted, and resources are constrained. 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 fundamental exit question of the module is: If you were to make a change tomorrow in these five areas in your institution — PPE, spill management, decontamination, waste management and notification — what would your first step be?

5. MODULE 3 — Emergency Response and Crisis Management

5.1 Aim and Objectives

Aim

The aim of this training module is to equip microbiology laboratory staff with the knowledge, skills and awareness necessary to maintain laboratory service continuity while protecting biosafety under disaster and emergency conditions, to effectively conduct crisis management processes, and to establish resilient laboratory systems.

In addition, the module aims to ensure the sustainability of laboratory organisation during disasters, the provision of staff safety, the continuation of critical diagnostic services, the protection of the communication and command chain, the planning of energy and data continuity, the development of sister laboratory collaborations, and the strengthening of the pre-disaster preparedness culture.

Objective

To enable microbiology laboratory specialists, researchers, technicians and other health professionals to reach a level of competence at which they can manage laboratory operations in a safe, sustainable and organised manner under disaster and emergency conditions.

At the end of the module, participants are expected to be able to make rapid, correct and prioritised decisions at the moment of disaster; apply the minimum service model during a crisis; evaluate staff safety and biosafety risks together; initiate and manage safe shutdown procedures; use alternative communication methods; plan energy, data and critical equipment management; prioritise critical samples and tests; provide coordination within the sister laboratory model; increase individual, institutional and regional preparedness levels; and manage post-disaster recovery and gradual return-to-service processes.

5.2 Learning Outcomes

- Be able to identify laboratory risks under disaster and emergency conditions
- Be able to explain the concept of the resilient laboratory
- Be able to adapt the Incident Command System (ICS) approach to the laboratory environment
- Be able to establish a disaster command chain
- Be able to plan safe shutdown processes
- Be able to develop a Continuity of Operations Plan (COOP)
- Be able to define minimum service levels
- Be able to prioritise critical tests
- Be able to plan energy resilience and generator capacity
- Be able to evaluate UPS and critical equipment management

- Be able to establish critical biological material and –80 °C archive protection strategies
- Be able to apply alternative communication methods in the event of communication collapse
- Be able to use the SITREP (Situation Report) logic
- Be able to organise staff and assign tasks during a disaster
- Be able to develop individual preparedness regarding earthquake kit preparation
- Be able to develop prioritisation and decision-making skills under resource constraints
- Be able to plan inter-laboratory collaboration within the sister laboratory model
- Be able to evaluate sample transfer and data continuity processes
- Be able to explain the basic principles of written collaboration protocols
- Be able to plan post-disaster reconstruction processes

5.3 Methods and Techniques

- Theoretical presentations
- Scenario-based learning
- Problem-solving-oriented group work
- Table-top exercises
- Role allocation and crisis simulations
- Interactive decision-making exercises
- Discussion sessions
- Risk assessment applications
- Disaster management algorithms
- Case analysis
- Brainstorming sessions
- Practical earthquake kit preparation activity
- Laboratory disaster management simulations

5.4 Resilient Laboratory Approach

This section addresses the organisational, technical and managerial approaches necessary for a microbiology laboratory to maintain operational continuity during a disaster. The aim is not only for the laboratory to remain physically standing, but also for it to be able to continue critical diagnostic services in a safe, controlled and prioritised manner.

Content headings:

- Basic principles in disaster management

- Laboratory disaster command chain
- Incident Command System (ICS) approach
- Leader loss and automatic command transfer
- Communication collapse scenarios
- Physical assembly protocols
- Call-tree systems
- Radio and alternative communication methods
- Continuity of Operations Plan (COOP)
- Level 0–1–2–3 service model
- Safe shutdown
- Critical test prioritisation
- Blood culture, CSF and critical sample management
- Biosafety cabinet management
- Energy resilience, generator and UPS planning
- –80 °C deep freezer protection strategies
- Critical material protection and transfer processes
- Chemical and gas safety
- Data security and manual recording systems
- 72-hour crisis management approach
- Post-disaster reconstruction and gradual normalisation

Within this section, practical discussions were conducted on the basis of night-time earthquake scenarios and daytime earthquake scenarios occurring while the laboratory is actively working. Participants were expected to evaluate the staff, energy, communication, biosafety and service continuity problems that may arise in different time periods, and to develop their decision-making skills regarding the command chain, safe shutdown, critical test prioritisation and reconstruction processes.

5.5 Earthquake Kit Preparation Activity

This section is a practical group activity aimed at developing participants' individual disaster preparedness, prioritisation, resource management and sustainability awareness.

Within the activity, participants: created a disaster kit with limited weight capacity, prioritised between basic needs and laboratory-specific requirements, rearranged their kits according to unexpected crisis scenarios, and gained experience in rapid and justified decision-making under limited resources.

Elements evaluated within the activity:

- Water and nutrition
- Safety equipment
- Personal health needs
- Hygiene materials
- Communication tools
- Basic lighting and energy supports
- Laboratory-specific emergency equipment

The activity aimed to enable participants to realise that during a disaster they need not only institutional plans but also an individual level of preparedness. Adaptation skills under changing conditions were evaluated through additional crisis scenarios (power outage, collapse of network and communication infrastructure, prolonged hospital stay, staff loss, cold weather conditions, deterioration of hygiene conditions, psychological stress and fatigue).

5.6 Sister Laboratory Model

This section addresses the collaboration model between a laboratory experiencing a disaster and a supporting sister laboratory. The aim is to demonstrate that service continuity during a disaster can be maintained not only with internal institutional resources but also through pre-planned inter-laboratory support mechanisms.

Content headings:

- Sister laboratory concept
- Continuity of Operations Plan (COOP) approach
- Operational resilience model
- Critical test transfer
- Alternative laboratory capacity planning
- Sample transfer protocols
- Data management and continuity of the laboratory information management system
- Establishment of written collaboration protocols
- Test compatibility and standardisation
- Staff support and shift planning
- Critical biological material transfer
- Regional and national laboratory networks
- Alternative centre planning
- Drills and field applications

Participants evaluated, through different disaster scenarios, which tests would be transferred to the sister laboratory, how capacity management would be carried out, how sample and data flow would be maintained, and how inter-laboratory coordination would be ensured. Thus, a regional resilience approach that would prevent the interruption of diagnostic services during disaster periods was discussed.

5.7 Conclusion

Disasters and emergencies constitute a serious threat for microbiology laboratories not only in terms of physical damage risk, but also in terms of biosafety, data security, energy continuity, staff organisation and the continuity of critical diagnostic services.

This module has presented a comprehensive and practical training approach that supports laboratory staff in being prepared for disasters, acting in an organised and safe manner at the moment of crisis, being able to prioritise, and being able to maintain laboratory service continuity.

Through headings such as the resilient laboratory model, safe shutdown processes, energy and communication resilience, individual preparedness activities and sister laboratory collaboration, the aim has been to develop both the theoretical knowledge levels and the practical crisis management skills of participants.

This training approach is expected to contribute to the reduction of laboratory-related risks in future disasters, the protection of biosafety, the maintenance of critical diagnostic services, and the support of health service continuity.

6. MODULE 4 — Post-Disaster Recovery, Psychological Resilience and Continuous Improvement

6.1 Aim and Objectives

Aim

The aim of this module is to ensure the safe, sustainable and effective reconstruction of microbiology laboratories after a disaster, to minimise biological risks, and to increase the psychological and operational resilience of laboratory teams.

Objectives

- Identify and prioritise the main problems encountered in the laboratory after a disaster (physical damage, power outage, staff shortage, biosafety risks).
- Understand and apply the reconstruction steps (safety assessment, minimum service, stabilisation, sustainability).
- Assess post-disaster epidemic risk; address possible agents in the context of geography and climate.
- Recognise the “red flags” of stress and burnout; apply the principles of psychological first aid and the Buddy System.
- Conduct a structured post-incident learning process using the After Action Review (AAR) method.
- Integrate the continuous improvement cycle into institutional culture through drills, training repetition and SOP updates.

6.2 Learning Outcomes

Knowledge Outcomes

- Explain the critical importance of microbiology laboratories for public health after disasters and the risks caused by loss of function.
- Define how biological risks multiply in a disaster environment; HEPA filter damage, aerosol risks, PPE shortages and waste management problems.
- Understand the mechanisms that increase epidemic risk after disasters (infrastructure damage, crowded shelter, loss of vector control).
- Know the effect of geography and climate on the spectrum of agents; assess regional epidemic risks.
- Explain the definition of psychological resilience and the categories of stress-burnout symptoms (cognitive, emotional, physical).

Skill Outcomes

- Plan and apply the four-step post-disaster reconstruction process (safety assessment, minimum service, stabilisation, strengthening).
- Perform service prioritisation according to the COOP level approach; determine the emergency test panel and coordinate sister laboratory collaboration.
- In reagent and stock management: perform damage assessment, alternative supply planning and consumable consumption estimation.
- Apply the psychological first aid approach (observe–listen–connect–reassure–identify need–refer) within the team.
- Structure an AAR (After Action Review) meeting; prepare an output table including root cause analysis, CAPA actions and verification criteria.

Attitude Outcomes

- Be aware of individual and institutional responsibility in post-disaster processes; adopt a non-blaming, learning-oriented approach.
- Internalise the direct relationship between staff psychological well-being and laboratory performance, and normalise help-seeking behaviour.
- Adopt continuous improvement as a habit and an element of institutional culture.

6.3 Methods and Techniques

In this module, the Problem-Based Learning (PBL) methodology is taken as the basis. Participants develop solution strategies through realistic disaster scenarios and construct knowledge in the context of application.

Scenario-Based Learning:

The case scenario entitled “The Laboratory on Fire” contains realistic elements such as a fire caused by an electrical short circuit, loss of the incubator and PCR device, and a 24-hour service interruption. Participants perform root cause analysis on this scenario, design corrective actions and formulate lessons learned.

AAR (After Action Review) Application:

As a structured post-incident learning tool, the AAR process offers a cyclical learning format that systematically answers the questions “What was planned?”, “What happened?”, “Why did it happen?” and “What will be done next time?”. Each group prepares an AAR output table containing action, responsible person, deadline and verification criteria.

Lecture and visual presentation as well as assessment tools (pre-knowledge test, learning outcome assessment test) are also used.

6.4 Importance of Microbiology Laboratories After Disasters

Microbiology laboratories perform four critical functions in the protection of public health in the post-disaster period: diagnostic support, infection surveillance and early epidemic warning, monitoring of water- and food-borne infections, and contribution to hospital infection control. Interruption of any of these functions means that health risks become invisible at the community scale. Therefore, the fundamental starting point of the module is the principle: the collapse of the laboratory is the collapse of public health.

The main problems encountered in laboratories after disasters are listed as physical damage, electricity–water–climate control interruptions, loss of equipment and kits, staff shortage, biosafety–biosecurity risks, difficulties in sample acceptance, and burnout due to increased workload.

6.5 Reconstruction Steps

1. Safety and Situation Assessment

In this first stage, a four-dimensional safety shield assessment is carried out before re-entering the laboratory. Under structural safety, electricity, water, gas and HVAC systems are checked. In biological risk assessment, spill, aerosol risk and waste management are reviewed. In equipment and sample assessment, the functionality of critical devices and the integrity of the cold chain are questioned. In staff assessment, the safety, accessibility and shortages of the team are identified. Given that biological risks will multiply in a disaster environment — damaged negative pressure, contaminated surfaces, HEPA filter damage, PPE inadequacy and improper waste storage — this assessment must not be skipped.

2. Minimum Service Delivery and Return to Normal (COOP Level)

In the gradual restart approach, the COOP 1 menu is first activated: vital tests such as blood culture Gram stain, CSF direct examination and critical sterile samples are started immediately. The second priority is epidemic monitoring and infection control; at this stage, collaboration with an alternative centre or sister laboratory is utilised. Deferrable routine services are left to the third stage. This 24–72-hour phase is the period in which the “emergency test panel” is operated and backup processes such as manual recording and alternative storage are activated.

3. Stabilisation and Revalidation

In this three- to fourteen-day phase, calibration of devices, performance checks, internal and external quality control applications and documentation are completed. Environmental cleaning verification is performed and the supply chain is restored. These steps, carried out without compromising quality assurance, directly affect the reliability of diagnostic results and patient safety.

4. Sustainability: Improvement and Strengthening

In this final phase extending beyond the fourteenth day, physical improvements (shelf securing, UPS installation), SOP updates and the establishment of a drill calendar take place. This phase encompasses structural transformations that make the system stronger beyond mere recovery.

6.6 Sustainability Phase: Operational Management

The sustainability phase has six main components: energy continuity and fuel plan, technical support, sample management, reagent–kit–stock management, and result reporting and communication.

Post-Disaster Sample Management:

Reorganisation of the physical space includes clean–dirty area separation, determination of new sample acceptance and waste exit routes, and, when necessary, recourse to mobile laboratory solutions. In the context of waste management, separate collection of infectious waste, establishment of temporary storage areas, application of autoclave or chemical decontamination, and maintenance of coordination with local authorities are mandatory.

Reagent, Kit and Stock Management:

Supply chain interruption is one of the most frequently encountered problems during disaster periods. Therefore, separation of damaged stocks, review of expiry and storage conditions, updating of the critical reagent list and recalculation of consumable consumption estimates are required. Within alternative supply planning, establishment of a supplier list containing at least two–three companies, establishment of a regional reagent sharing network, and determination of a minimum two–four-week emergency stock level are recommended. “Dependence on a single supplier” is evaluated as one of the greatest operational risks.

Preparation for Local Production:

Preservation of the laboratory’s local production capacity against extreme situations in which the supply chain may be completely severed is of critical importance. Stocking of basic and epidemic-oriented culture media such as blood agar, EMB, MacConkey, TCBS, BCYE and Sorbitol MacConkey in powder form; preservation of the functionality of autoclave, incubator and sterilisation systems; and control of pure water systems constitute the components of this preparation.

Coordination with the Infection Control Team and Other Units:

Laboratory recovery is not a process that can be managed alone. Joint work by hospital management, the infection control committee, technical service, purchasing, the occupational health and safety unit and the disaster coordination unit is mandatory.

6.7 Post-Disaster Epidemic Risk

Disaster environments significantly increase epidemic risk due to infrastructure damage, crowded living areas, reduced access to health services and increased difficulty of vector control. Expected infections are addressed under four main categories:

- Water-borne infections (Shigella, Salmonella, Vibrio cholerae, Hepatitis A and E)
- Respiratory tract infections (Influenza, RSV, COVID-19)
- Shelter-related infections (Norovirus, Adenovirus, scabies, lice)
- Vector-borne infections (malaria, Dengue, Leishmania)

Geography and climate conditions significantly affect this picture. In hot–humid climates, Dengue, Leishmania and cholera come to the fore; in dry–dusty conditions, tuberculosis and fungal infections become prominent. In cold climates, Influenza and RSV become dominant; in excessively rainy–flood conditions, Leptospira and water-borne diarrhoeas are observed.

Wound infections after disasters are also defined as a “silent threat”. In the presence of risk factors such as dirty wounds, delayed intervention and foreign bodies, Staphylococcus aureus, Streptococcus spp., Pseudomonas, Acinetobacter and Clostridium spp. can lead to serious clinical pictures (necrotising infections, tetanus, gas gangrene).

Laboratory preparedness against these risks requires stocking of rapid antigen and PCR kits, adoption of a syndromic panel approach, evaluation of mobile laboratory capacity, and updating of the critical pathogen list.

6.8 Psychological Resilience

The dimension of laboratory recovery that is most often overlooked is the psychological well-being of staff. A functional laboratory cannot be established without a functional team. Therefore, psychological resilience work must be carried out simultaneously with technical recovery.

Risks Specific to Microbiology Staff:

Invisible but critical task load, the requirement for continuous attention under biological risk, increased responsibility due to staff shortage, and fear of making mistakes. Psychological resilience is not the absence of stress, but the capacity to maintain functionality under stress.

Red Flags of Stress and Burnout:

- Cognitive symptoms: Distraction, difficulty in decision-making
- Emotional symptoms: Anger, numbness, anxiety, feeling of guilt
- Physical symptoms: Insomnia, somatic complaints, exhaustion

Psychological First Aid and the Buddy System:

Basic approach: observe, listen, connect, reassure, identify need, refer. Within the Buddy System (Pairing System), staff observe and support one another; symptoms such as severe panic, dissociation or thoughts of self-harm are referred to professional support; workload is shared and a non-blaming, safe communication environment is established.

Elements that Strengthen Resilience:

At the individual level: sleep and rest, meeting basic needs, social support, emotional awareness, taking breaks, clarity of task boundaries, and help-seeking behaviour. At the team level: a safe communication environment, a non-blaming approach, short team meetings, solidarity, balanced distribution of workload, and appreciation with visible support.

6.9 Continuous Improvement (AAR)

After a disaster, mere recovery is not sufficient; the goal is to make the system stronger and more resilient. This principle is put into practice through the continuous improvement cycle that feeds institutional memory.

After Action Review (AAR) Method:

AAR is the fundamental tool of structured post-incident learning. It seeks answers to four questions: “What was planned?”, “What happened?”, “Why did it happen?” and “What will be done next time?” This approach focuses on identifying structural vulnerabilities in the system rather than blaming individuals. The action table to be prepared as AAR output must include the responsible person, deadline, required resource and verification criterion for each corrective action.

Basic Tools of Continuous Improvement:

Incident evaluation, root cause analysis, corrective and preventive actions (CAPA), checklists, up-to-date Standard Operating Procedures (SOPs), drills and training repetition. Drill periods must be determined according to risk priority; high-priority topics every six months, medium-priority topics once a year, low-priority topics every two years.

Combating the Forgetting Curve:

It is known that learned knowledge is rapidly lost if it is not repeated. Research has shown that approximately fifty percent of knowledge can be recalled one day after learning, thirty percent after one week, and twenty percent after one month. Given that knowledge can be made permanent through regular repetition, periodic training, table-top drills, scenario applications, cross-task training and new staff orientation must be evaluated as indispensable components of the continuous improvement cycle.

Example Scenario — The Laboratory on Fire:

In this scenario in which a fire broke out on the night shift due to an electrical short circuit in the worn power cable of one of the incubators in the microbiology laboratory; while the fire extinguishing system was activated, the incubator and the adjacent PCR device were severely damaged, devices stopped with the power outage, and critical samples could not be processed for 24 hours. Root cause analysis revealed the absence of an up-to-date disaster risk analysis, the lack of a placement plan for critical devices, an overloaded electrical system, a non-functional residual current device, and the absence of a continuity of operations plan (COOP). Corrective actions include the mandatory annual electrical safety test, a device distance plan, a sister laboratory agreement, an annual disaster drill, and preparation of a fire emergency procedure.

6.10 Conclusion

This module has addressed post-disaster microbiology laboratory management within an integrated framework covering technical, organisational and human dimensions. Safety, service and quality; the sequential and mutually reinforcing maintenance of these three principles constitutes the fundamental axis of post-disaster laboratory functionality.

Every lesson learned in the reconstruction process contributes to the construction of a more robust system for the future. Post-disaster experiences only transform into genuine institutional memory when they are documented through root cause analyses, processed through AAR processes, and reinforced through drills. In this respect, the final question of the module is also a call: What would be the first thing you would change in your laboratory tomorrow?

7. MODULE 5 — Laboratory Disaster Plan and Incident Management

7.1 Aim, Objectives and Learning Outcomes

Aim

This training module aims to increase the awareness of health professionals working in microbiology laboratories regarding biosafety and biosecurity practices under disaster conditions and to develop their professional skills. The module aims to contribute to participants' understanding of laboratory management processes before, during and after disasters, and to their development of effective intervention strategies by recognising possible risks.

Under disaster conditions, laboratory staff must act not only as technical personnel but as individuals who assume a public duty, must make rapid decisions and carry institutional responsibility. Therefore, this module is supported by practical scenarios and interactive methods in addition to theoretical knowledge.

Objectives

1. Systematically assess laboratory-specific hazards and risks.
2. Prepare and apply laboratory emergency response plans for before, during and after disasters.
3. Apply safe intervention procedures in chemical, biological and physical disaster scenarios.
4. Recognise disaster communication protocols and notification obligations.
5. Fulfil sample safety, equipment protection and biosafety requirements under disaster conditions.
6. Explain the duties and responsibilities of laboratory personnel within the framework of legal legislation.
7. Understand the importance of drill and update processes in disaster preparedness.

Learning Outcomes

- Will be able to identify and prioritise laboratory environment-specific risks.
- Will be able to independently execute the protocols that must be applied before, during and after a disaster.
- Will be able to make notifications to the appropriate persons and institutions by effectively using intra-team communication channels.
- Will be able to manage samples and equipment according to biosafety level.
- Will be able to fulfil their obligations within the legal framework under disaster conditions.
- Will be able to actively participate in drill and update processes.

7.2 Methods, Techniques and Assessment

Methods and Techniques:



Direct Lecture: Short presentation sessions are used to convey the basic concepts and legal framework of the module.

Group Work and Oral Presentation: Each group presents the solution proposal it has prepared on the scenario to the other participants. This process reinforces both communication skills and intra-team collaboration.

Assessment Criteria:

1. Correctly identifies laboratory hazards and risk factors.
2. Lists and explains pre-disaster preparation steps completely.
3. Applies the emergency response protocol according to the disaster type.
4. Correctly executes communication protocols during and after the disaster.
5. Determines priorities related to sample and equipment safety.
6. Applies biosafety requirements according to BSL level.
7. Correctly conveys legal responsibilities and legislation.
8. Plans the post-disaster return-to-operation process.

7.3 Scenario: Rising Waters

The following scenario has been designed to enable participants to experience decision-making processes under disaster conditions. The scenario is presented in three successive stages.

Stage 1: Early Warning

Due to excessive rainfall lasting throughout the weekend, water begins to rise in the basement/ground floor where the laboratory is located. The first staff member arriving at the laboratory on Monday morning notices that there is 5–10 cm of water in the corridor and that water is rapidly seeping under the door.

Stage 2: Crisis Escalation

The water level has reached 20 cm. Acid bottles and waste containers on the ground-level cabinets are about to topple due to the buoyancy of the water.

Stage 3: Recovery

The waters have begun to recede; however, the laboratory floor is covered with mud and possibly leaking chemicals.

7.4 Pre-Disaster: Risk Assessment and Infrastructure Strengthening

Disaster preparedness begins long before the moment of the disaster. For the laboratory disaster plan to be effective, risk assessment, physical strengthening and documentation processes must be carried out meticulously.

Structural Preparedness:

- Building seismic resistance analysis
- Taking flood and inundation protection measures
- Securing critical equipment to the floor
- Arrangement of fire doors and evacuation routes
- Installation of emergency generator and UPS system

Planning and Documentation:

- Preparation of a written disaster response plan
- Backup and digital archiving of critical procedures
- Establishment of an emergency communication tree
- Establishment of an insurance and damage recording system
- Planning of regular drills and staff training programmes
- Preparation and updating of task cards
- Integration of notification management with HAP (Hospital Disaster Plan)
- Establishment of sister laboratory collaboration

Equipment, Chemical and Sample Safety:

Chemical Inventory: Keeping the SDS (Safety Data Sheet) archive up to date, preparation of a chemical storage compatibility map, keeping secondary containers and spill kits ready, compliance with flammable material quota limits.

Biological Samples: Provision of cold chain backup and UPS infrastructure, installation of refrigerator temperature alarm system, establishment of sample backup protocol, storage plan appropriate to BSL classification.

Equipment Protection: Preparation of critical device inventory, taking protective measures against humidity and voltage fluctuations, procurement of portable analyser backups, cloud backup of calibration records.

7.5 During Disaster: Emergency Response Protocols

At the moment of a disaster, panic is the greatest danger. Taking the correct steps in the first 60 seconds directly affects both life safety and laboratory safety.

1. STOP: Immediately stop all experiments and chemical processes. Close ovens and gas valves.
2. PROTECT: Don personal protective equipment. Close biological and chemical containers, lock the lids.
3. NOTIFY: Call the security supervisor, laboratory director and 112. Activate the disaster communication tree.

4. EVACUATE: Go to the safe assembly point according to the evacuation plan. Do not use the lift.

Communication Protocol:

The disaster communication tree must have been prepared in advance and communicated to all staff. Emergency numbers of all team members must be recorded. Radio and alternative communication tools must be kept ready. Timely notification must be made to other institutions (hospital, provincial health directorate). A social media and press information protocol must have been determined.

Crisis Management:

Initiate the incident management process according to the disaster type. Carry out staff task allocation in accordance with the task cards. Ensure sample safety within the scope of the priority list. Contact the sister laboratory and redirect priority tests.

Preventing Critical Losses:

- Prepare a mobile cooler for research samples
- Check cloud backup to prevent data loss
- Activate the portable generator waiting in a safe area
- Protect vital devices (PCR, centrifuge) with covers
- Place damaged chemicals in a sterile bag and label them

7.6 Post-Disaster: Damage Assessment and Decontamination

The post-disaster process must be managed with a systematic and staged approach. Rushed returns can create danger in terms of health and increase equipment damage.

First 24 Hours:

Entry to the laboratory is carried out only with authorised and equipped teams. Structural damage assessment is performed accompanied by an expert engineer. Check whether there is hazardous material leakage. Mark and isolate chemical and biological spill areas.

First 1–7 Days:

Activate the decontamination team. Perform electrical and mechanical safety checks of devices. Carry out biological hazard assessment according to BSL level. Record damaged materials and prepare a destruction plan.

First 1–4 Weeks:

Apply the laboratory reopening protocol. Renew and verify calibrations. Initiate insurance and damage compensation processes. Provide psychological support to staff and organise briefing sessions.

Biosafety Assessment and Sample Recovery:

Apply standard contact precautions for BSL-1/2 samples. Activate an isolated evacuation procedure for BSL-3/4 samples. Perform microbiological environmental testing with air and surface sampling. Record and report biological waste destruction. When necessary, notify the reference laboratory and request support.

Sample Recovery Priority Ranking:

6. Critical research samples (irreplaceable)
7. Standard reference materials
8. Diagnostic samples (patient-based)
9. Other routine clinical samples

7.7 General Principles of the Disaster Plan

For a laboratory disaster plan to be effective, it must possess the following fundamental qualities:

- **Simplicity:** The plan must be written in clear and plain language that all staff can easily understand.
- **Clarity:** Responsibilities, procedures and communication steps must be defined in an open and unambiguous manner.
- **Flexibility:** The plan must be designed to adapt to different disaster types and conditions.
- **Adaptability:** It must be easily adaptable to different working hours and staff numbers.
- **Updatability:** The plan must be reviewed at regular intervals and kept up to date by being tested with drills.

7.8 Legal Responsibilities of Personnel

Under disaster conditions, laboratory staff act not only as technical personnel but also in the capacity of public officials. In this framework, the following legal obligations apply:

Sample Safety:

During evacuation, staff are responsible for taking the critical samples on the “priority sample list” (for example, analysis samples belonging to an active epidemic suspicion) into a safe box and evacuating them. This duty is fulfilled without putting their own life safety at risk.

Reporting Obligation:

In the event of biological leakage or sample loss in the laboratory, staff are obliged to report this situation to the Institutional Disaster Manager and the Provincial Health Directorate Communicable Diseases Unit as soon as possible.

Not Leaving Duty Station and Working Hours:

When a disaster is declared at “S3” or “S4” level under the Türkiye Disaster Response Plan (TAMP), all health personnel including laboratory specialists may not take leave; they are obliged to remain at their duty station or to report for duty when called.

Relevant Legislation:

- ISO 22301:2012 – Business Continuity Management Systems (accepted by 156 countries)
- 25 May 2021 – Regulation on Health Services in Disasters and Emergencies
- Regulation Article 6/I: Planning of mobile hospital services and staff training (at Ministry level)
- Regulation Article 8: Uninterrupted continuation of routine health services
- Principle Decision No. 2025/42: Rules to be observed by public officials in disasters and emergencies (ethical and social media sharing restrictions)
- TAMP – Recording of the names and working hours of personnel participating in response activities

7.9 Conclusion

This module brings together all the elements required for the preparation, implementation and continuous updating of the laboratory disaster plan. Pre-disaster preparedness, correct intervention at the moment of the disaster, and systematic post-disaster recovery constitute the three complementary pillars. Staff knowing their legal responsibilities and fulfilling these responsibilities within a safe framework is the foundation of both individual and institutional resilience.

8. General Conclusion and Institutional Recommendations

This Handbook brings together the five training modules developed within the scope of the MicroLabSecure project in a coherent, applicable and institutionally ready structure.

The fundamental message is clear: under disaster conditions, biosafety and biosecurity must be managed simultaneously. The collapse of the laboratory means the collapse of public health. Therefore, preparedness requires an integrated approach that covers technical, organisational and human dimensions together.

Recommendations to Institutions:

- Review institutional SOPs for each module and update them according to disaster scenarios.
- Put sister laboratory protocols into writing and conduct drills at least once a year.
- Re-dimension PPE, decontamination agent and critical reagent stocks according to disaster scenarios.
- Establish an AAR culture; strengthen institutional memory by operating a structured learning process after every incident.
- Plan staff psychological resilience simultaneously with technical recovery.

What would be the first thing you would change in your laboratory tomorrow? This question is the common exit point of every module of the Handbook.

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