www.ecvetlab.projectsgallery.eu
info@ecvetlab.eu

November 2017

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MODULAR TRAINING PROGRAMME for competence

E.Co lab technician

Study:
INSTITUTE FOR SUSTAINABLE TECHNOLOGIES – PIB, Poland

Cooperation:

For internal use within the partnership

ECVET-Lab. Implementation and Validation of the Non-Formal Training on Sustainability for Environmental Testing Laboratories workers 2016-1-ES01-KA202-024977

Co-funded by the Erasmus+ Programme of the European Union

Author:
Paweł Religa, PhD. Eng.

Coordination and translation:
Katarzyna Skoczylas, ITeE-PIB

Consultation and methodological guidance:

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GLOSSARY

Modular programme of a professional training	Documentation of professional training defining learning outcomes (learning), the scope and arrangement of teaching and learning, methods and teaching aids (including materials for the implementation of activities). The selection of modular training programme`s content is based on the analysis of professional tasks occurring in the profession, which correspond to the modular units in the training programme.
Modules of Employable Skills – MES	Scope of work corresponding to the professional competence separated in the standard of professional competence for particular profession, expressed in the form of modular units. It is a separate part of the modular training programme consisting of a set of learning outcomes associated with a given professional competence. The learning outcomes are being detailed the modular units, leading learners to achieve learning outcomes in the form of knowledge, skills and personal and social competences.
Modular Unit	A logical and acceptable part of work within the profession with clearly defined beginning and end, corresponding to a specific professional task. Its result is a product, service or important decision. The professional task requires from an employee to influence the following elements: tools, equipment, other people, information, data, events, conditions, environment, etc. A modular unit of a training programme is a separate section of the training programme, described as a professional task, the performance of which the learner has to master. It is a coherent and independent/separate didactic unit (an element of the module of professional training), which has precisely formulated, measurable and detailed learning outcomes and the corresponding teaching material together with a set of exercises that allows the development of skills and personal and social competences.
Instructional Unit	A way of writing and organizing the content of training classes in a modular unit, which facilitates the systematic planning and preparation of classes for tutors. Instructional units can also form the basis for the development of teaching materials in the form of educational packages and those to build the content in the e-learning form.
Learning Package	A set of materials for teaching and learning constituting the didactic materials for the training programme and referring to the modular unit. It consists of among others: a learner`s guide and a teacher's guide, information about the equipment and teaching aids, sets of exercises and teaching materials, as well as a set of tools for checking the progress and achievements of the learning outcomes.
Teaching map of modular vocational training programme	It is a graphical block diagram showing the correlations that exist between the modules and modular units separated in the professional training programme. A correlation system of modules and modular units enables the optimal organization of training classes and division into groups.
Progress Check	It is an accurate reflection of the learning outcomes set for the modular unit (and the training unit). It has to provide a reliable evidence that the learner is able to demonstrate the learning outcomes achieved, learned according to the standards and conditions set out in the description of the objectives. The progress check is to be performed at the end of the training unit as a self-assessment by a learner supervised by a tutor.
Performance Test	It refers to the learning outcomes assigned to the modular unit. It provides reliable evidence that the student can do the professional task specified in the modular unit, in accordance with certain standards and under the circumstances. Performance tests become partial tests if the training programme includes several modular units. The test can be carried out in the form of a test of knowledge and / or test as a work trial in real conditions.

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INTRODUCTION

Environmental Testing Laboratory operations have significant environmental impact ranging from energy and resource consumption to chemical and equipment use and disposal. Moreover, the management of air pollution from laboratory fume hoods, greenhouse gas emissions from cooling appliances, noise from certain lab equipment and wastewater from lab sinks, are issues that all staff working in Environmental Testing Laboratories must know and participate in their improvement.

Experience shows in many cases that this impact could be reduced or avoided in cost-effective ways without compromising safety and they can often be enhanced. Minimising chemical usage in particular can create tangible results such as reduced costs through better chemical management, improved safety and more effective compliance with regulations.

Also, laboratories are a main producer of hazardous waste in the EU. The Hazardous Waste Directive and the Waste Framework Directive cover identification, storage, managing hazardous waste, but the industry finds it difficult to interpret; in particular the associated technical guidance identifying and explaining management of hazardous waste in the care of the laboratory. ECVET-Lab will also respond to the need for new/improved skills on chemicals and their safe use considering REACH (EC 1907/2006) to reduce the use of chemicals within the EU that are harmful and hazardous to human health and the environment. Most laboratories, especially smaller ones, do not have staff dedicated specifically to environmental management.

Modular training programme is composed of one "vocational training module" and corresponding three "modular units" constituting equivalents of professional tasks performed at the workplace.

In the modular programme structure the following elements are distinguished:

- Programme and organisational assumptions of training
- Curricula
- Vocational training module and modular units

A vocational training module includes educational outcomes, a list of modular units, a scheme of modular unit system, recommended literature and source materials.

A didactic map of the vocational training programme and organisational assumptions presents the connections (correlations) among modular units and defines the sequence of their implementation. It is to facilitate the training organisers and trainers to plan and organise the educational process and development of individual "paths of vocational training" for candidates for trainers.

The training programme has a flexible structure, e.g. a module and modular unit in it can be updated (modified, supplemented or replaced) without disturbing the overall programme structure. In this way contents can be adjusted to labour market changing needs, as well as development of science and technology and learners' predispositions.

Training implementation based on this modular programme is characterised with the following features:

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- Teaching and learning process is oriented towards the achievement of specific, measurable educational outcomes in the form of knowledge, skills and social competence allowing for the performance of specific professional tasks
- The principle of transfer of knowledge, skills and social competence previously acquired by a participant in the course of formal, non-formal education or informal learning in the working environment is applied in a wide range
- Teaching takes place mainly through actions with use of activating teaching methods (learning by doing), which, on the one hand, stimulate activity, creativity, learner's ability of self-assessment, while on the other hand form the trainer's role towards advisor, partner, designer, organiser and evaluator of an educational process

After completion of all modular on –line units foreseen in the programme, the training participant shall obtain a training certificate (diploma), confirming its competence within the area of "Laboratory technician with eco-principles".

The programme allows to confirm (through the issue of a separate certificate) the successful completion of separate modular units if a candidate did not complete the entire course for unforeseen reasons. It shall allow for the supplementation of a full set of requirements under the programme in a different time selected by the participant or during another training, without the need for repeated passing out modular units confirmed with an independent certificate.

PROGRAMME AND ORGANISATIONAL ASSUMPTIONS OF TRAINING

1. Description of competence

Laboratory employee - a laboratory technician performing professional tasks has to do with various types of substances, preparations and waste, including hazardous waste. That is why this technician and its surrounding, including natural environment, are exposed to a series of risks: chemical and/or bacteriological (substances, waste components that may cause e.g. poisoning) and mechanical risks (handling/lifting containers with substances, preparations and waste, tipping/pouring/throwing substances, preparations and waste, operation of apparatuses and devices). Therefore, it is particularly important to organise and conduct the laboratory employee's professional activities according to the sanitary and hygienic requirements, principles and provisions of occupational health and safety, fire provisions, as well as according to the principles of sustainable development.

The laboratory technician with eco-principles is a laboratory employee who applies the sustainable development principles in its professional activity in the conscious and competent way. Application of these principles concerns both activities conducted in a laboratory, a warehouse, on preparatory premises, but also activities performed in the office.

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2. Training plan

Name of training module	Name of modular unit	Approximate number of hours per implementation
M1. Laboratory technician with eco-principles	M1_JM_01 Use of resources and management of air & water discharges	10
	M1_JM_02 Management of substances applied in laboratory	10
	M1_JM_03 Hazardous waste management in laboratory	10
	Total	**30**

3. Requirements concerning the teaching and learning process organisation

Implementation of the training process should be compliant with the attached proposal (scheme below) of "Didactic map of a modular programme of vocational training". It is a system of connections between a module and modular units of the programme, specifying the sequence of their implementation. It shall be used by training organisers to plan educational courses.

The trainer should participate in the organisation of technical and didactic base and in the evaluation of curricula. It is recommended that the trainer should develop educational packages supporting the curriculum implementation. Educational packages constituting the programme's educational underpinnings should be developed according to the methodology of modular education.

It is recommended that modular training is conducted with activating methods, such as the guiding text method, supervised independent study method, situational method and method of projects and practical exercises. Practical exercises constitute the dominant teaching method. During the programme implementation one should pay attention to self-education with use of materials other than textbooks, such as standards, instructions, guidebooks and extratextual sources of information. Modern technologies, materials, tools and equipment should be considered in the implementation of learning content, including exercises.

Conducting classes with activating methods requires the preparation of methodical materials, such as guiding text, instruction for the project method, instructional cards for supervised independent study, instructions for exercise performance, work manuals, OHS manuals. A system of verification and assessment of training participant's achievements constitutes an important element of the educational process organisation. Diagnostic, formative and summative assessment is recommended.

Diagnostic assessment aims at the identification of the scope and level of knowledge and skills of training participants in an initial phase of education.

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Formative assessment conducted during the programme implementation aims at the delivery of valid information of teaching-learning efficiency. Information obtained due to the assessment allow for necessary adjustments of the teaching and learning process.

Summative assessment should be conducted after the end of implementation of the programme of modular unit, module and entire course.

Assessment should make participant aware of its level of achievements against requirements, accustom it to regular work, self-control and self-assessment. Assessment of participants' achievements should be conducted with use of tests (oral, written and practical), observation of participant's activities, didactic measurement. Verification and assessment of achievements requires from the trainer the determination of criteria and standards of assessment, development of achievement tests, observation cards and progress assessment sheets.

Educational resources, necessary in the modular training process, include didactic aids and materials, technical educational resources, didactic operating resources.

Approximate number of hours per implementation provided in the training plan may be subject to changes, depending on applied teaching methods and educational resources.

Programme of module and modular units separated in it may be implemented in various organisational forms, depending on the learning content: in labs, in groups on practice sites, in training institutions, in enterprises in the field.

Labs, practise sites and real workplaces should be equipped with educational resources specified in programmes of particular modular units.

In the modular training there is no division into theoretical and practical activities. Organisational forms of participants' work should be adjusted to the teaching content and methods.

It is recommended that general activities are conducted in groups of up to 20 persons, while organisation of exercises in two-four-person teams and as individual work.

A centre conducting education in the modular system should have relevant premises conditions, as well as technical and educational equipment. A lab for practical exercise, where it is recommended to conduct the educational process, should be equipped with:

- Practical exercise sites including essential tools, equipment and devices
- Working sites for participants, adjusted to various organisational forms (group work, individual work)
- Working site for the trainer, equipped with audio-visual and multimedia equipment
- Carry-on library corresponding with the needs of individual and group learning
- Carry-on set of training materials

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DIDACTIC MAP OF VOCATIONAL TRAINING PROGRAMME

M1. E.Co lab technician (Environmentally Competent laboratory technician)

M1_JM_01.
Use of resources and management of air & water discharges

M1_JM_02.
Management of substances used in laboratory

M1_JM_03.
Hazardous waste management in laboratory

TRAINING MODULE AND MODULAR UNITS
M1. E.Co lab technician (Environmentally Competent laboratory technician)

1. Educational (learning) outcomes:

M1. E.Co lab technician (Environmentally Competent laboratory technician)	
KNOWLEDGE – Knows and understands:	**SKILLS – Is able to:**
• Need for water saving • Need for energy saving • Principles of sustainable management of raw materials and municipal solid waste • Principles of assessing the environmental impact of substances and preparations applied in laboratory • Principles of performance of basic actions in laboratory reducing their environmental impact • Principles of storage of substances and preparations in laboratory and ancillary premises reducing their environmental impact • Need for the provision of basic technical equipment reducing the environmental	• Apply principles of efficient water use • Apply principles of efficient energy use • Apply principles of sustainable management of raw materials and municipal solid waste • Assess environmental impact of substances and preparations applied in laboratory • Perform basic actions in laboratory in the way reducing their environmental impact • Organise distribution of substances and preparations in laboratory and ancillary premises reducing their environmental impact • Make decisions concerning task performance within the scope of waste management in laboratory

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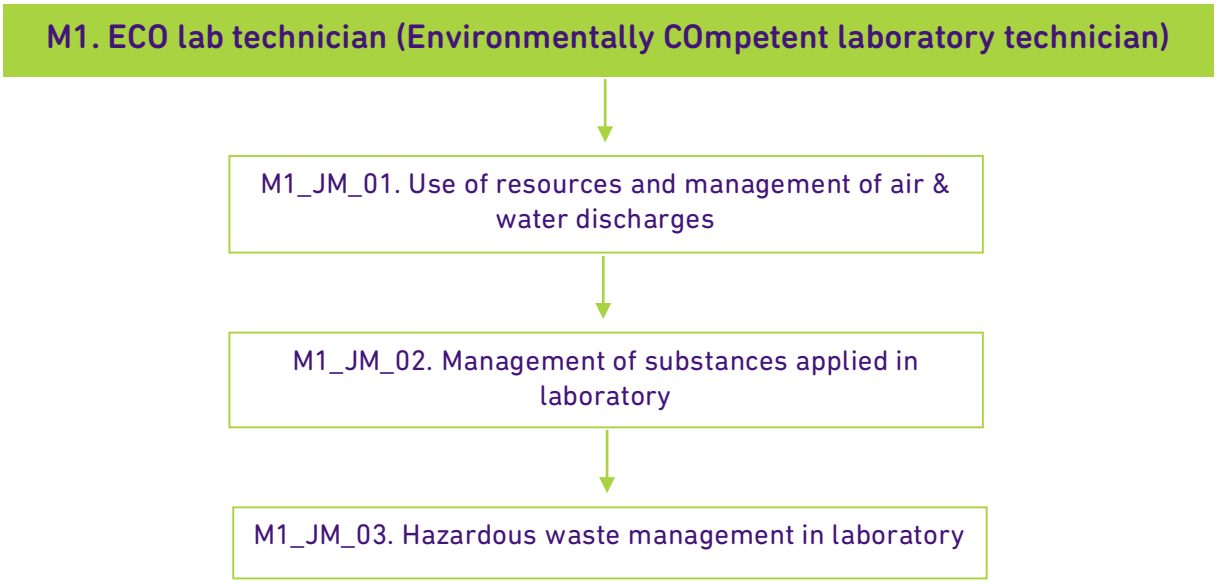
impact of waste produced in laboratory • Need for the performance of organisational actions reducing the environmental impact of waste produced in laboratory	• Perform actions related to waste management in laboratory
SOCIAL COMPETENCE – Is ready to:	
• Take individual responsibility for pro-ecological actions integrated into professional activity; • Follow the principles of sustainable development in its activity • Foster awareness laboratory staff • Monitor the implementation of environmental practices	

2. List of modular units:

Code of modular unit	Name of modular unit	Approximate duration [hours]
M1_MU_01	Use of resources and management of air & water discharges	10
M1_JMU_02	Management of substances applied in laboratory	10
M1_MU_03	Hazardous waste management in laboratory	10
	Total	30

3. Scheme of modular unit system:

The scheme below presents the correlation of modular units in the educational module M1. Laboratory technician with eco-principles



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Modular unit M1_MU_01
Use of resources and management of air & water discharges

1. Specified educational (learning) outcomes:

KNOWLEDGE (training participant knows and understands)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Need for water saving	• Reasons of efficient use of water resources
	• Effects of non-efficient use of water resources
	• General principles of sustainable management of water resources
	• Good practice concerning sustainable water use
	• Best practice concerning sustainable water use
• Need for energy saving	• Reasons of efficient energy use
	• Effects of non-efficient energy use
	• General principles of sustainable management of energy
	• Good practice concerning sustainable energy use
	• Best practice concerning sustainable energy use
• Principles of sustainable management of raw materials and municipal solid waste	• Reasons of efficient use of natural resources
	• Effects of unlimited consumerism
	• General principles of sustainable management of raw materials and municipal waste
	• Good practices related to raw materials and municipal waste
	• Best practices related to raw materials and municipal waste
• Principles of sustainable management of air emissions	• General principles of sustainable management of air emissions • Best practices related to air emissions • Good practice related to air emissions
• Principles of sustainable management of wastewater	• General principles of sustainable management of wastewater • Best practices related to management of wastewater • Good practice related to management of wastewater
• Need for reducing noise	• General principles of need for reducing noise • Best practices related to reducing noise • Good practice related to reducing noise

SKILLS (training participant is able to)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Apply principles of efficient water use	• Estimate periodically amount of water use during its professional activity
	• Indicate potential places/situations of excessive and unjustified water use during everyday professional activity
	• Propose actions reducing water use during everyday professional activity
	• Apply the proposed actions reducing water use during everyday professional activity
	• Use product eco-labelling to assess their impact on the amount of water use;
• Apply principles of efficient energy use	• Estimate periodically amount of energy use during its professional activity

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	• Indicate potential places/situations of excessive and unjustified energy use during everyday professional activity
	• Propose actions reducing energy use during everyday professional activity
	• Apply the proposed actions reducing energy use during everyday professional activity
	• Use product eco-labelling to assess their impact on the amount of energy use
• Apply principles of sustainable management of raw materials and municipal solid waste	• Identify secondary raw materials; know periodically amount consumed
	• Propose actions to use recycling materials
	• Segregate municipal solid waste produced during everyday professional activity
	• Estimate periodically amount of produced municipal solid waste during its professional activity
	• Indicate potential places/situations of excessive and unjustified production of municipal solid waste during everyday professional activity
	• Propose actions reducing the amount of produced municipal solid waste during everyday professional activity
	• Perform proposed actions reducing the amount of produced municipal solid waste during everyday professional activity
• Apply principles of sustainable management of air emissions	• Identify the air emission resources • Propose actions to air emissions reduce during everyday professional activity
• Apply principles of sustainable management of wastewater	• Identify the wastewater • Propose actions to reducing the wastewater • Apply the proposed actions reducing wastewater during everyday professional activity
• Apply principles of sustainable management of noise	• Identify the noise • Propose actions to reducing the noise during everyday professional activity • Apply the proposed actions reducing noise during everyday professional activity

SOCIAL COMPETENCE (training participant is ready to)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Take individual responsibility for pro-ecological actions integrated into professional activity	• Make decisions on its own
	• Foresee effects of its actions
	• Respond to deviations or problems
	• Propose improvements in good practices implementation and application of best practices
	• Conduct continuous self-assessment of its actions and be subject of regular external assessment
	• Regularly improve its competence within the scope of sustainable development with use of results of self-assessment and external evaluation
• Follow the principles of sustainable development in its activity	• Organise its working site according to the principles of sustainable development
	• Conduct its activity according to the principles of sustainable development

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	• Search for effective solutions in case of emerging conflicts
• Foster awareness of lab staff	• Cooperate with others involved in the process of sustainable development in the lab • Anticipate effects of own actions
• Monitor the implementation of environmental practices	• Supervise and monitor the work of others within specific tasks • Including the assessment and improvement of these tasks

Modular unit M1_MU_02
Management of substances applied in laboratory

1. Specified educational (learning) outcomes:

KNOWLEDGE (training participant knows and understands)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Principles of assessing the environmental impact of substances and preparations applied in laboratory	• Sources of information concerning a type of substances and preparations
	• Sources of information concerning a risk type related to substances and preparations
	• Symbols (pictograms) informing on a risk type related to substance or preparation
	• Risk phrases H and safety phrases P
	• Principles of label creation
	• Safety marks and their purpose
	• Procedures of dealing with risks
	• Type and principle of operation of OHS and fire equipment in laboratory;
• Principles of performance of basic actions in laboratory reducing their environmental impact	• Main sources of environmental risks during chemical reactions
	• Main sources of environmental risks during biochemical and microbiological reactions
	• Main reasons of environmental risks during chemical reactions
	• Main reasons of environmental risks during biochemical and microbiological reactions
	• Laboratory technical equipment necessary to reduce adverse environmental impact of actions performed in laboratory
	• Methods of performance of basic actions in chemical laboratory reducing their environmental impact
	• Methods of performance of basic actions in biochemical and microbiological laboratory reducing their environmental impact
• Principles of storage of substances and preparations in laboratory and ancillary premises reducing their environmental impact	• Planning principles of distribution of substances and preparations in laboratory
	• Planning principles of distribution of substances and preparations in ancillary premises (warehouse, preparatory room)
	• Safety marks and their purpose
	• Necessary technical equipment of laboratory and ancillary premises reducing environmental impact of stored substances and preparations

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SKILLS (training participant is able to)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Assess environmental impact of substances and preparations applied in laboratory	• Use the sources of information on risk types related to substances and preparations and make decisions on their basis
	• Know the potential environmental impact of hazardous substances
	• Identify pictograms and define a type of risk for substances and preparations on their basis
	• Correctly label substances and preparations applied/stored in laboratory
	• Apply the safety marks
	• Respond in case of risk
	• Use OHS and fire equipment in case of risk
• Perform basic actions in laboratory in the way reducing their environmental impact	• Identify the sources of environmental risks during reactions
	• Use laboratory technical equipment (fume cupboards, water, gas systems, separated working zones, etc.)
	• Use laboratory glassware
	• Conduct heating operations
	• Mix, pour, tip substances and preparations
	• Select relevant personal and collective protective equipment for the performed task
• Organise distribution of substances and preparations in laboratory and ancillary premises reducing their environmental impact	• Select the method of storage of substances and preparations in laboratory and ancillary premises
	• Plan the area of laboratory and ancillary premises to store substances and preparations
	• Select technical equipment of laboratory and ancillary premises
	• Conduct periodical control of the condition of stored substances and preparations
	• Apply safety marks properly in sites for storage of substances and preparations

SOCIAL COMPETENCE (training participant is ready to)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Take individual responsibility for pro-ecological actions integrated into professional activity	• Make decisions on its own
	• Foresee effects of its actions
	• Respond to deviations or problems
	• Propose improvements in good practices implementation and application of best practices
	• Conduct continuous self-assessment of its actions and be subject of regular external assessment
	• Regularly improve its competence within the scope of sustainable development with use of results of self-assessment and external evaluation
• Follow the principles of sustainable development in its activity	• Organise its working site according to the principles of sustainable development
	• Conduct its activity according to the principles of sustainable development

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	• Search for effective solutions in case of emerging conflicts
• Foster awareness of lab staff	• Cooperate with others involved in the process of sustainable development in the lab • Anticipate effects of own actions
• Monitor the implementation of environmental practices	• Supervise and monitor the work of others within specific tasks • Including the assessment and improvement of these tasks

Modular unit M1_MU_03
Hazardous waste management in laboratory

1. Specified educational (learning) outcomes:

KNOWLEDGE (training participant knows and understands)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Need for the provision of basic technical equipment reducing the environmental impact of waste produced in laboratory	• Principles of selecting waste collection sites in laboratory
	• Criteria for selecting containers to collect selected waste types
	• Effects of improper waste management
	• Principles of disposal of selected types of hazardous waste
• Need for the performance of organisational actions reducing the environmental impact of waste produced in laboratory	• Sources of information on the procedures of dealing with waste produced in laboratory
	• Criteria for classification of waste produced in laboratory
	• Principles of waste marking according to specific criteria
	• Principles of marking waste collection sites in laboratory
	• Document types for registration of waste produced in laboratory

SKILLS (training participant is able to)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Make decisions concerning task performance within the scope of waste management in laboratory	• Use the sources of information on the procedures of dealing with waste in laboratory and make decisions on their basis
	• Define waste types
	• Know the potential environmental impact of hazardous waste
	• Select appropriate containers to collect selected waste types
	• Determine sites for waste collection in laboratory
	• Establish a schedule of waste transfer to warehouse or disposal
• Perform actions related to waste management in laboratory	• Mark selected waste groups according to specific criteria
	• Mark sites for waste collection
	• Dispose of selected types of hazardous waste
	• Keep documentation for registration of waste produced in laboratory

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SOCIAL COMPETENCE (training participant is ready to)	
educational outcomes in module	**specified educational outcomes in modular unit**
• Take individual responsibility for pro-ecological actions integrated into professional activity	• Make decisions on its own
	• Foresee effects of its actions
	• Respond to deviations or problems
	• Propose improvements in good practices implementation and application of best practices
	• Conduct continuous self-assessment of its actions and be subject of regular external assessment
	• Regularly improve its competence within the scope of sustainable development with use of results of self-assessment and external evaluation
• Follow the principles of sustainable development in its activity	• Organise its working site according to the principles of sustainable development
	• Conduct its activity according to the principles of sustainable development
	• Search for effective solutions in case of emerging conflicts
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