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SUSTAINABLE WATERS
EMPEREST

Conceptual framework of the EMPEREST training package

EMPEREST – ELIMINATING MICRO-POLLUTANTS FROM EFFLUENTS FOR REUSE STRATEGIES

Technische Universität Berlin, 2023

Imprint

This publication has been developed within the project **EMPEREST – Eliminating Micro-Pollutants from Effluents for Reuse Strategies,** co-financed by the Interreg Baltic Sea Region Programme 2021–2027, and helping to drive the transition to a green and resilient Baltic Sea region.

The EMPEREST consortium consists of the following partners: Union of the Baltic Cities Sustainable Cities Commission c/o City of Turku (FI), Baltic Marine Environment Protection Commission – Helsinki Commission (HELCOM) (FI), University of Tartu (EE), Berlin University of Technology (DE), Turku University of Applied Sciences (TUAS) (FI), Gdańsk Water Utilities (PL), Water and Sewage Company Ltd of Szczecin (PL), Tartu Waterworks Ltd (EE), Tallinn Water Ltd (EE), "Kaunas water" Ltd (LT), Turku Region Wastewater Treatment Plant (FI), DWA German Association for Water, Wastewater and Waste DWA Regional group North-East (DE), Environmental Centre for Administration and Technology (LT), City of Riga (LV).

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Contract: EMPEREST – Eliminating Micro-Pollutants from Effluents for Reuse Strategies no. C013

Title: Conceptual framework of the training package

Version: 12/2023

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Cover picture: © Mariia Andreeva/UBC Sustainable Cities Commission.

How to cite: Tzoupanos, N. & Barjenbruch, M. (2023). Conceptual framework of the training package. Deliverable 1.4 of the EMPEREST project, co-funded by Interreg Baltic Sea Region. Technische Universität Berlin.

Project note

The EMPEREST project supports local authorities, service providers and policy-making community in finding ways to reduce PFAS (Per- and polyfluoroalkyl substances) and other organic micropollutants from the water cycle. The project has four activity strands to fulfil its aims. First, in close cooperation with HELCOM EMPEREST prepares methodological recommendations to monitor PFAS group in the aquatic environment. Second, local authorities address the subject on the city level by developing a PFAS risk assessment framework to identify and assess PFAS-related risks and propose relevant risk mitigation strategies. Third, EMPEREST supports water utilities in making informed decisions about cost-effective treatment strategies and investments for removing micropollutants from wastewater. Finally, capacity building takes place for both local authorities and public service providers to inform them about the recent developments in the field and train them with tailored materials and tools.

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Abbreviations

APRIORA	Project: Improved risk assessment for strategic water management to reduce micro-pollutant emissions in the Baltic Sea region
DWA	German Association for Water, Wastewater and Waste
HELCOM	Baltic Marine Environment Protection Commission - Helsinki Commission
IFAT	World's Leading Trade Fair for Water, Sewage, Waste and Raw Materials Management
PFAS	Per- and polyfluoroalkyl substances
PROMISCES	Project: Preventing Recalcitrant Organic Mobile Industrial chemicalS for Circular Economy in the Soil-sediment-water system
TTF	Training task force
TUAS	Turku University of Applied Sciences
TUB	Technische Universität Berlin
UBA	German Environmental Agency
UBC SCC	Union of the Baltic Cities Sustainable Cities Commission c/o City of Turku
WWT	Wastewater treatment
WWTP	Wastewater treatment plant

1. Introduction

The purpose of the training package activities is to address the lack of knowledge identified in the EMPEREST Seed Money project (October 2020 – September 2021) regarding per- and polyfluoroalkyl substances (PFAS) and to provide a training concept tailored to the specific needs of the target groups. The training package will include instructions for training courses, as well as training material for addressing PFAS within the interests and mandates of the municipalities. The training package will be hosted on the open portal Baltic Smart Water Hub (balticwaterhub.net) and it will be available for self-learning and/or to be used by any interested party for own training purposes, e.g. for training of own employees.

The activities relevant to the training package are summarised in Table 1. During the periods 1 & 2 of the project, the conceptual framework of the training package was developed, with the main purposes:

- To guide the organisation and implementation of trainings.
- To serve as a basis for pilot courses, project workshops and hands-on trainings.
- To enable collecting feedback from project partners – adaption and optimisation of training material.

Table 1. Summary of the activities per project period relevant to the training package.

<table>
<tr><th>GoA</th><th>Deliverable</th><th>P1
1–6/2023</th><th>P2
7–12/2023</th><th>P3
1–6/2024</th><th>P4
7–12/2024</th><th>P5
1–6/2025</th><th>P6
7-12/2025</th></tr>
<tr><td>GoA 1.4</td><td>D1.4 Conceptual framework (Responsible: TUB)</td><td colspan="2">· Definition of target groups, topics, formats
· Training material development
· Feedback from project partners and evaluation</td><td></td><td></td><td></td><td></td></tr>
<tr><td>GoA 2.4</td><td>D2.4 Transferable training package (Responsible: TUB)</td><td></td><td></td><td colspan="2">· Hands-on trainings
· Further development of training material
· Testing of training material (incl. externals)
· Feedback evaluation
· Adaptation and optimisation</td><td></td><td></td></tr>
<tr><td>GoA 3.2</td><td>D3.2 Report on the promotional campaign for local authorities (Responsible: TUAS)</td><td></td><td></td><td></td><td></td><td colspan="2">· Promotional campaign
· Feedback</td></tr>
<tr><td>GoA 3.3</td><td>D3.3 Report on the developed capacities of infrastructure and public service providers (Responsible: DWA)</td><td></td><td></td><td></td><td></td><td colspan="2">· Dissemination
· Transfer
· Capacity building</td></tr>
</table>

The conceptual framework includes detailed instructions for training content, formats, topics, sources of information, and feedback collection. It is based on updated and actual information regarding PFAS sources and properties, their impact on the environment and human health, pathways during wastewater treatment, monitoring, presence in the environment, treatment options for their removal and respective legislation and institutional framework.

In order to prepare the framework, reliable sources of information have been identified, and suitable formats and ways of presentation have been tested and evaluated. Training material has been prepared during the project's events, i.e. workshops and excursions, and presented to the project partners. Efforts have been made to involve all partners from the initial stages to the development of the conceptual framework, to gather feedback and to adapt accordingly the concept. The Training Task Force (TTF) was established with the participation of project partners with relevant experience, such as UBC SCC, TUAS, HELCOM, DWA, UT, to support the efforts of the TUB team. Exchange with experts from the water and wastewater sector and service providers through participation in external conferences and experts' meetings, local authorities (e.g. UBA), water associations (e.g. DWA) and other relevant Green Deal and Interreg projects (e.g. APRIORA, PROMISCES) and established collaborations have offered additional feedback and ideas.

Based on the conceptual framework, the training material will be further developed during the project periods 3, 4 and 5 (table 1). Hands-on trainings and additional theoretical training material will be prepared and tested. Feedback will be collected from project partners and externals, and after continuous evaluation, updating, adaption, and optimisation, the training package will be completed by the end of the period 5.

During period 5, the promotional campaign led by TUAS will start, targeting mainly local authorities in cities and municipalities. At the same time, dissemination actions led by DWA will be taken to support the transfer of the training material and to develop capacities. Main target group are the infrastructure and public service providers.

The local authorities and infrastructure and public service providers are in focus of the activities related to the training package during the last phase of the project. However, the training material will be available to all target groups of the project:

- Infrastructure and public service providers
- National and local authorities
- International governmental organisations
- Interest groups, e.g. national water associations, environmental training centres, NGOs.

The conceptual framework will be continuously updated, adapted, and optimised, according to the experience and new knowledge gained, the feedback of the project partners and externals and the ongoing developments and progress regarding micropollutants and specifically PFAS in the environment and wastewater, either on the technical, research or legislative basis.

2. Topics

In the following, the main topics of the training material and the respective subtopics are listed. In section 6.2 below, more details about the specific content of the topics are given.

2.1. Intro to PFAS

a) PFAS properties
b) Production and use of PFAS in daily products

c) PFAS releases to the environment and general pathways
d) Emerging health and environmental concerns

2.2. Environmental monitoring

a) PFAS: Environmental fate and concentrations (natural waters, soil)
b) Sampling, sample preservation (theoretical)
c) Sampling – Practical
d) Analytical methods for PFAS determination
e) PFAS analysis – Experience gained in the project EMPEREST
f) Methodological recommendations for monitoring and assessment of PFAS – EMPEREST output

2.3. PFAS risk management

a) Intro to risk assessment
b) Regional PFAS policies and regulations
c) National policies regarding PFAS of BSR countries
d) What we can do to reduce PFAS emissions
e) Potential replacement of PFAS – stakeholders' point of view
f) PFAS risk assessment plan – EMPEREST output

2.4. PFAS and other micropollutants removal in wastewater treatment

a) PFAS in wastewater
b) Advanced treatment technologies – PFAS and other micropollutants removal
c) Operation of selected treatment steps in full-scale plants (ozonation, GAK filtration, PAC treatment)
d) Strategies and technological means for minimising organic pollutant emissions - GAC and ozonation in pilot testing –EMPEREST output

2.5. Pilot cases (in the frame of project EMPEREST)

a) Pilot plant Gdansk
b) Pilot plant Tartu

3. Training formats

The training material will be hosted at the Baltic Smart Water Hub portal (see section 5). The main training format will be videos, accompanied by short text, presentation slides, self-tests, links to other sources of information (and podcasts). Particularly:

- Short text

  Short description of the topic. Mainly headlines, without details.
- Learning videos - Recordings of full presentations/interviews

Recordings of presentations during the project's events are processed, incl. adding of slides from the presentations and subtitles (English). Moreover, speakers are interviewed separately about a specific topic and recorded.

- Short learning videos

  Short learning videos with a max. length of ca. 5 min about a specific topic, prepared by assembling selected parts from several recordings of the full presentations and/or interviews. The purpose is to give a summary about a specific topic in a short, comprehensive way as possible. For more detailed information, the links to the respective (long) learning videos will be available.

- Self-made learning videos

  In case the recordings from project events will not cover all topics, the TUB team with the support of TUAS will prepare videos to complete the training material.

- Presentations – slides

  The slides of the presentations will be available in pdf format.

- Questionnaires and self-tests

  The questionnaires and self-tests will serve the feedback collection and evaluation of the effectiveness of the learning process. They will be used at the end of the training sessions in the project's workshops, but they will be available online as well (see sections 4.2 and 6.2).

- Additional links to verified sources of information

  Reliable external sources will be provided, for more information and as cross-references. The sources will be verified by the TUB team.

- Practical trainings

  The practical trainings will be relevant to the partners involved in the testing and monitoring of the pilot units (for more information see section 6.4).

- Podcasts

  According to the availability of resources, podcasts can be prepared (e.g. PFAS talk), with project participants and external experts.

- Development of a single module

  Slides with explanation (voice and/or video), covering all PFAS relevant topics (ca. 1 h).

- Easy understandable presentation slides for self-made workshops about PFAS will be provided.

The training materials will be first produced in English. Most material will also be translated into the local languages of project partners.

4. Sources of training material and of feedback collection

4.1. Sources of training material

Training material is prepared at the project events, at external events in which EMPEREST is participating and during discussions and interviews with experts outside of the project events. The sources of training

material are listed below, including the main events during the periods 1 & 2 of the project at which training material was created. Regarding the further development of the training material in relation to the coming events, see section 6.1.

- Project's workshops

  Kick-off Meeting, Turku, FI, 6.-8.02.2023; Workshop on risk assessment, Riga, LV, 25.-26.05.2023. From the two workshops several of the topics were covered (see section 6.2).

- External events

  Training material was created during the Zero PFAS II project Roadshow in Stockholm, SE, (2.-5.05.2023). Several of the topics were covered (see section 6.2).

- Excursions

  Training material was created during the excursion in the WWTPs of Zurich, CH, Immendingen, and Ulm, DE (22.-24.11.2023) about the large-scale applications of ozonation, GAC filtration and PAC treatment in the removal of micropollutants.

- Interviews with experts, surveys

  Discussions, interviews, and established cooperations with experts from the German Environmental Agency (UBA), the DWA, HELCOM, etc.

- Pilot units – hands-on trainings

  During the initial test runs of the pilot units in Gdańsk and Tartu, training material will be prepared related to the design, operation, maintenance and troubleshooting of the pilot units and the results evaluation. The hands-on trainings will be relevant mainly to the partners involved in the monitoring of the pilot units.

- Self-made material

4.2. Sources of feedback collection

The training material will be tested, and feedback will be collected during the whole project period until the finalisation of the training material (end of period 5). The aim is the adaptation and optimisation of the training material according to the needs of the target groups and the evaluation of capacity building. In this section, only the sources of the feedback are listed. For more information see section 6.3.

- Project events

  Training sessions will be integrated in the project's workshops (for more details see section 6). At the end of the training sessions, feedback will be collected from the participants by using questionnaires, self-tests, and interactive group activities. At selected events, externals will participate.

- Online training events

  The purpose of the online sessions is to involve, in addition to the project partners, externals from the whole BSR as well.

- Baltic Smart Water Hub portal

  The training material will be hosted on the Baltic Smart Water Hub portal. Comments will be allowed for feedback, questionnaires and self-tests will be available as well. Increased publicity and interaction with target groups is expected through the water hub portal.

- UBC TALKS webinars

  These webinar series could be used to increase publicity and to collect additional feedback.

5. General concept of the learning process

5.1. Training options

There will be two options for the learning process. The change from one option to another will be always possible:

- Self-study according to the topics

  All topics and subtopics will be listed, thus offering a complete training.

- Guided training according to the target group

  By choosing this option, only topics relevant to each target group will be displayed. All target groups of the project are considered. In section 6.2, the relevant to each target group topics are presented.

5.2. General structure of the training interface

The training material will be hosted on the **Baltic Smart Water Hub portal**, e.g. under the topic resources. The displayed information on the starting page will include (Figure 1.a): a short presentation of the EMPEREST project (video); a short introductory video about PFAS and other micropollutants, focusing on the media reports on PFAS, hazardous impacts, necessity for the respective research and the training material (e.g. PFAS for dummies, prepared by TUAS); an overview of the training material and instructions on how to use it (video and pdf). The main topics and sub-topics will be listed on the starting page. The option for filtering the topics according to the target group will be available.

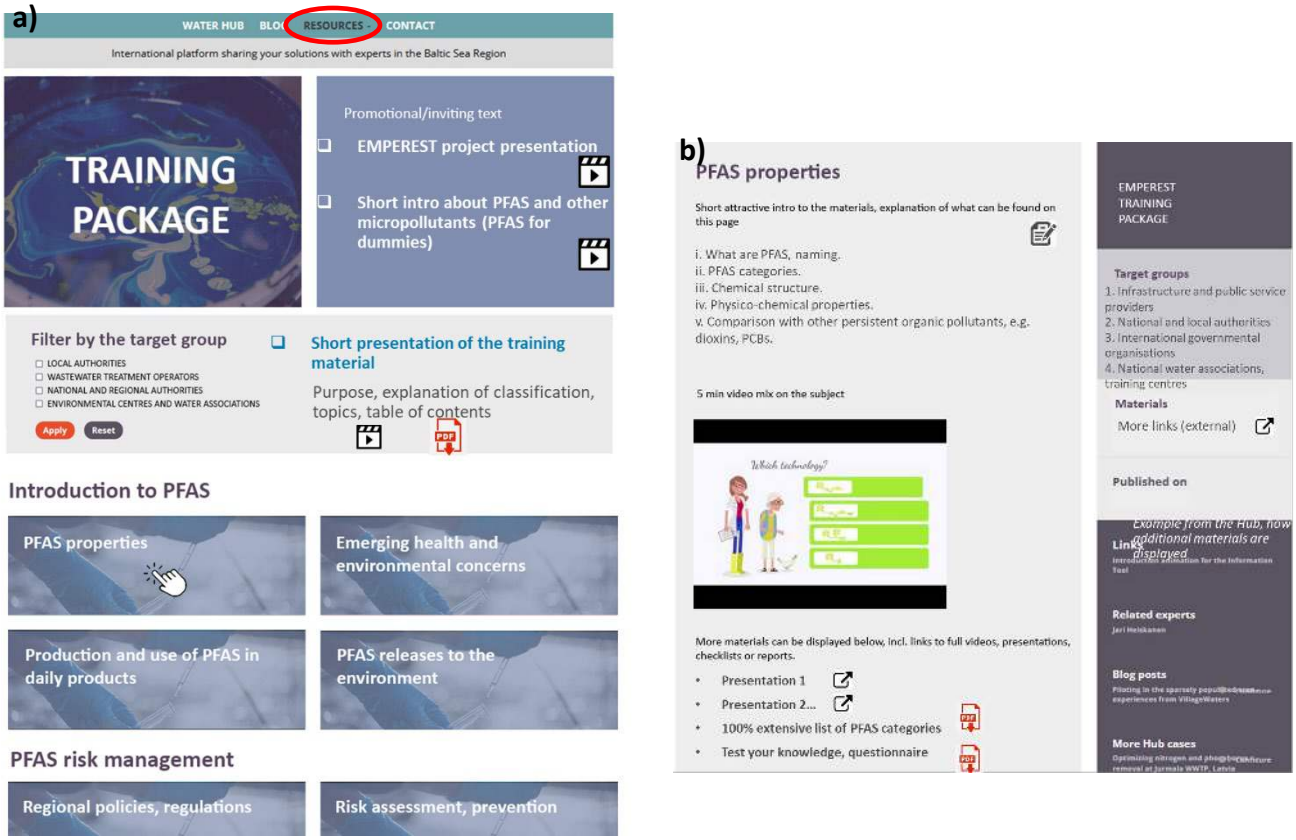

Figure 1. Possible visualisation of the training package in the Baltic Smart Water Hub a) starting page, b) page of a specific subtopic (with support from UBC SCC).

After choosing the subtopic, the new page will include a short intro about the respective material (text). A short, ca. 5 min, video will summarise all information about the subtopic in a comprehensive way. Together with the video, the slides will be available as pdf file. Additional sources for information will be given, including the recordings of the individual presentations/interviews from which the short summarising video was prepared and links to external reliable sources of additional information about the subtopic. In addition, a self-test for testing the knowledge gained and a questionnaire for getting feedback will be available.

6. Further development of the training material

6.1. Development of the training material in reference to the project's events

During the project's events in the periods 1 & 2, the presentations and interviews of invited speakers and/or operators were recorded and used for the preparation of training material. In total 23 videos have been prepared by the end of period 2 (end of Dec. 2023).

The prepared videos cover only a small part of the topics' content, as shown in section 6.2. Several short learning videos about a specific topic were prepared as well.

In the workshops and excursions during the periods 3, 4 and 5, additional training material will be prepared through recordings of the presentations and interviews of experts. Moreover, trainings will be conducted to share the gathered knowledge and test the training material. The trainings during the workshops can be held in one- or two-days training sessions, focusing on a main topic for which experts will be invited to cover relevant subtopics and content.

For each project workshop, open topics can be chosen from the tables presented in section 6.2, according to the respective conditions and needs of the project and of the training material at the specific time. The tables will be continuously updated, to include the latest developments in the training material and to support more efficiently the planning and organisation of the coming workshops. The TUB team will support the organisation of the workshops.

Interactive wrap-up sessions after the workshops, questionnaires, discussions, and self-tests based on the workshop content will enable the feedback collection from the participants, which will be used to evaluate, adapt, and improve further the training material and concept (see section 6.3).

Before the end of project period 4, the existing training material and the already covered topics will be thoroughly checked. The purpose is to evaluate the actual situation and completeness level of the training material. The possibility to cover the remaining open topics through the project workshops planned for the period 5 will be investigated in close cooperation with the workshop organisers. If needed, the TUB team with the support of TUAS will fill the gaps with the materials created by experts from these organisations.

6.2. Detailed description of the topics

In the following tables, all potential topics, subtopics, and the specific content are summarised. One table per topic (presented in section 2). In the last column of each table, the situation regarding the completeness of each topic is illustrated: ‘open’ stands for missing material, either completely or partially (indicated at each respective case); ‘covered’ means that all necessary information is available to cover a topic sufficiently. In addition, the target group for which the content of a topic could be relevant is given in brackets. The numbering of the target groups is as following:

1. Infrastructure and public service providers
2. National and local authorities
3. International governmental organisations
4. Interest groups, e.g. national water associations, environmental training centres, NGOs

Table 2. Main topic: Intro to PFAS.

Intro to PFAS		
Subtopic	**Content – (target group)**	**Comments**
PFAS properties	i. What are PFAS, naming - (1-4) ii. PFAS categories - (1-4) iii. Chemical structure - (1-4) iv. Physico-chemical properties (1-4)	i.-iv. Covered v. Open

	v. Comparison with other persistent organic pollutants, e.g. dioxins, PCBs - (1-4)	
Production and use of PFAS in daily products	i. Production of PFAS worldwide and in the participating countries. Specific data about amounts produced - (2-4) ii. Products with PFAS - (2-4)	i. Open (limited material available) ii. Covered
PFAS releases to the environment	i. Main sources of PFAS releases - (1-4) ii. Specific cases of PFAS contamination in the participating countries - (1-4)	i. Covered ii. Open (limited material available)
Emerging health and environmental issues	i. Toxicity and human health - (1-4) ii. PFAS levels in human's biological samples - (1-4) iii. Impact on ecosystems - (1-4)	i. Open (limited material available) ii. Open iii. Open

Table 3. Main topic: Environmental monitoring.

Environmental monitoring		
Subtopic	**Content - (target group)**	**Comments**
PFAS: Environmental fate and concentrations (natural waters, soil)	i. Environmental fate of PFAS: PFAS cycle and spreading - (1-4). ii. PFAS concentrations in natural waters (and drinking water?) - (1-4). iii. PFAS concentrations in soil - (1-4).	i. Limited material available ii. Open iii. Open
Sampling, sample preservation (theoretical)	i. Legal basis, standardisation, good practise - (1,2). ii. Sampling types - (1,2). iii. Quality assurance - (1,2). iv. Sampling for PFAS - (1,2).	All covered by 1 presentation (mainly DIN-based). Additional material could be feasible.
Sampling – Practical	i. Sampling equipment - (1, 2). ii. How to conduct sampling - (1,2).	During the preparation of training material about the pilot units, sampling and relevant instructions will be recorded as well.
Analytical methods for PFAS determination	i. Short description of PFAS chemical nature - (1,2) ii. Targeted analysis (HPLC-MS and MS/MS) - (1,2). iii. Sum-parameter methods, i.e. AOF, EOF, TOP - (1,2).	i. Covered ii. Covered iii. Covered up to date. Material can be added according to the developments in the field
PFAS analysis – Experience gained in the project EMPEREST	Recommendation on which analytical method should be preferred according to, e.g., expected PFAS and sample nature. Especially important for the sum-	Can be prepared only after gathering significant experience during monitoring and piloting

	parameter methods, which are still under development! The cooperation with 2 Departments of the German Environmental Agency (UBA) might be helpful - (1-4).	(e.g. during period 5). Can be a part of the projects' results
Methodological recommendations for monitoring and assessment of PFAS – EMPEREST output	Presentation of relevant EMPEREST results - (1-4).	After completion of D 2.1

Table 4. Main topic: PFAS risk assessment.

PFAS risk assessment		
Subtopic	**Content – (target group)**	**Comments**
Intro to risk assessment	i. What is risk assessment - (2-4) ii. General methodology - (2-4) iii. PFAS-related risk assessment - (2-4)	i. Open (limited material available) ii. Open (limited material available) iii. Open (limited material available)
Regional PFAS policies and regulations	i. Short history of EU regulatory development regarding PFAS - (1-4) ii. EU drinking water directive, new wastewater directive - (1-4) iii. REACH proposal PFAS ban - (2-4) iv. PARC related activities - (2-4) v. EUSBR PA Hazards activities - (2-4) vi. HELCOM regional policy - (2-4)	i. Open ii. Open iii. Covered iv. Covered v. Covered vi. covered
National policies regarding PFAS of BSR countries	i. National policy FI - (1-4) ii. National policy EE - (1-4) iii. National policy LT - (1-4) iv. National policy LV - (1-4) v. National policy PL - (1-4) vi. National policy DE - (1-4) vii. National policy SE - (1-4) viii. Limited to countries participating in the project	i. Open ii. Open - Tartu workshop, Feb. '24? iii. Open iv. Open v. Open - Gdansk workshop, Jun. '24? vi. Open v. Covered
What we can do to reduce PFAS emissions	Guidelines for individuals on how to choose products without PFAS (cookware, clothing, carpets, personal care products, etc.), to use suitable water filters, etc. - (2-4)	Open
Potential replacement of PFAS – stakeholders' point of view	i. Research efforts to replace PFAS – potential alternatives - (2-4) ii. Opinion of members of ChemSec's PFAS movement (companies) - (2-4) iii. Opinion of PFAS supporters - (2-4) iv. Opinion of public - (2-4)	i. Open ii. Open iii. Open iv. Open

PFAS risk assessment plan – EMPEREST output	Presentation of relevant EMPEREST results - (2-4)	Can be completed after the testing of the proposed risk assessment plans in the 5 municipalities, i.e. D2.1

Table 5. Main topic: PFAS and other micropollutant removal in wastewater treatment.

PFAS and other micropollutant removal in wastewater treatment		
Subtopic	**Content - (target group)**	**Comments**
PFAS in wastewater	i. PFAS concentrations in domestic (and industrial) wastewater (1-4) ii. PFAS fate during domestic WWT – impact of conventional treatment (1-4) iii. PFAS concentrations at the outlet of the WWTPs (1-4)	i. Open ii. Open iii. Open (very limited material from the excursion in the WWTPs)
Advanced treatment technologies – PFAS and other micropollutant removal	i. Intro into advanced WWT (1-4) ii. Membrane methods - (1) iii. Adsorption with activated carbon (GAC, PAC) - (1-4) iv. Adsorption with anion exchange and other sorbents - (1) v. Degradation (photocatalytic-, electro chemical-, super critical water-, chem.- oxidation, plasma, microbial) - (1) vi. Ozonation – (1-4) vii. Natural treatment methods - (1) viii. Foam fractionation – (1) ix. Combined methods – (1)	i. Open ii. Open (limited material exists) iii. Open (limited material exists) iv. Open (limited material exists) v. Open (limited material exists) vi. Open vi. Open (limited material exists) vii. Open (limited material exists) ix. Open (limited material exists)
Operation of selected advanced treatment steps in full-scale plants (ozonation, GAK filtration, PAC treatment)	i.Ozonation - WWTP Zurich - (1). ii.GAC filtration – WWTP Immendingen - (1) iii.PAC treatment – WWTP Ulm - (1) (incl. treatment efficiency, costs, energy consumption, operational issues) Incl. short interviews: Why MPs removal, why the specific method and what is the efficiency regarding MPs removal	Material exists from the excursion in Nov. 2023. More is needed, especially regarding PFAS removal. E.g., it is planned during the IFAT 2024 to visit as EMPEREST group several manufacturers of activated carbon and ozonation units, and consultancies regarding advanced WWT.
Strategies and technological means for minimising organic pollutant emissions – GAC and ozonation in pilot testing – EMPEREST output	i. Presentation of pilot testing results (compact) (1-4) ii. Evaluation of results - (1-4) iii. Comparison of GAC, ozonation, and combination - (1-4)	After the completion of the pilot testing

Table 6. Main topic: Pilot cases in the frame of EMPEREST project (mainly for project partners)

Pilot cases in the frame of EMPEREST project		
Subtopic	**Content - (target group)**	**Comments**
Pilot plant Gdansk	i. Design and operation ii. Maintenance iii. Troubleshooting iv. Results Gdansk, Szczecin, Kaunas - (1-4)	i. – iii. Material will be prepared on site, during the Workshop in Gdansk, June 2024 iv. Material will be prepared after completing the testing phase at each WWTP
Pilot plant Tartu	i. Design and operation ii. Maintenance iii. Troubleshooting iv. Results Tartu, Tallinn, Turku - (1-4)	i – iii. material will be prepared on site iv. Material will be prepared after completing the testing phase at each WWTP

6.3. How to collect feedback

During the periods 1 and 2, feedback was collected at two project events. The respective questionnaires can be found in Annex.

The first was the Kick-off workshop (Feb. 2023), with the main purpose to involve all partners from the beginning of the project in the development of the training concept. For this purpose, the questions mainly focused on the expectations concerning the training material, including the topics, content, and format (see Annex). There were two kinds of questions: three multiple choice and three open-ended questions, where the participants had to answer by short text. The **platform Socrative** was used. There was a participation of 100 %, except in one open-ended question where 90% participated.

The second event was the excursion in selected WWTPs with a post-treatment step for the removal of micropollutants (MPs), i.e. the WWTP of Zurich (ozonation), Immendingen (GAC filtration) and Ulm (PAC treatment), organised by TUB in November 2023. The main purpose of the excursion was to gain new knowledge about ozonation, GAC filtration and PAC treatment applications in large scale. The knowledge gained by the participants was evaluated by six multiple-choice and four open-ended questions. Participation was 100% in the multiple-choice and between 80 – 90 % in the open-ended questions. The platform Socrative was used.

Feedback was collected also in external events where TUB team participated, e.g. at two conferences relevant to water and wastewater treatment and management organized by the DWA in DE, where the important for EMPEREST target group of WWTP operators and public service providers in the water/wastewater sector was reached out. The feedback was mainly about the topics of the training material and was not collected by questionnaires, but through discussions after presenting the project EMPEREST and the general training concept.

Based on the experience gained, the questionnaires must be compact, precise and should preferably include multiple-choice questions. The feedback should be collected immediately after the training sessions. The purpose is to evaluate the knowledge gained in the training sessions, the achievement of the

scope of the sessions, the quality of the training process, and to collect new ideas and suggestions about the training material and process from the participants. The questionnaires should be prepared according to the specific topic of each workshop and the respective presentations. **Socrative** has been proven as a reliable, free of charge and easy to use tool for the preparation of questionnaires and feedback collection. The participants can take part in the survey easily by scanning a QR code. However, other tools could be considered as well, such as **Webropol**.

In table 7, general questions and possible ways of evaluation for the participants are given as examples for the preparation of a questionnaire. The questionnaires given in Annex can be used as well. The questionnaires for the coming workshops and training events will be prepared jointly by TUB and DWA. The results will be evaluated and used to further develop and optimise the training material, e.g.: new sub-topics and content could be added; the relevance of the topics according to the target groups could be revised; additional material for specific topics with more detailed explanation could be prepared; the materials could be modified to be more attractive, etc.

Table 7. Examples of questions to be used for feedback collection

<table>
<tr><td></td><td colspan="2">Multiple choice questions</td><td rowspan="2">Open-ended questions</td></tr>
<tr><td></td><td>Question</td><td>Evaluation</td></tr>
<tr><td rowspan="4">General questions</td><td>Were your expectations of the workshop met?</td><td rowspan="3">Applies, Rather applies, Rather doesn’t apply, Doesn´t apply
Or by Level 1-5
Or use of emoticons</td><td>What is your take away from the event?</td></tr>
<tr><td>Has your knowledge about micropollutants (PFAS) increased by this workshop?</td><td>Do you have open questions?</td></tr>
<tr><td>Do you feel more confident in the field of micropollutants in the water cycle now?</td><td>Do you have any comments?</td></tr>
<tr><td>Would you describe your knowledge about PFAS in the water cycle as:</td><td>superficial [ ]
average [ ]
founded [ ]</td><td>Do you have any recommendations?</td></tr>
<tr><td rowspan="3">Specific questions</td><td>Has this workshop helped to understand "…"</td><td rowspan="3">Applies, Rather applies, Rather doesn’t apply, Doesn´t apply
Or by Level 1-5
Or use of emoticons</td><td>What is your take away of "…"</td></tr>
<tr><td>Do you feel more confident now in the field of "…"</td><td>What was specifically interesting for you?</td></tr>
<tr><td>Would you be able to explain somebody, who has not attended the workshop the topic of "…."</td><td>Do you have open questions about "…"?</td></tr>
</table>

6.4. Hands-on trainings

During the project period 3, the two pilot units will be taken into operation. For the support of the project partners who will test the pilot units, respective training material will be prepared. As soon as the pilot units are constructed and will be ready for operation, test runs will be planned with project partners and other external parties, especially WWTPs operators and technical staff. The test runs will be organised during project events, e.g. the pilot unit constructed in Gdansk is expected to be ready by the end of April, thus test runs can be planned during the project workshop in Gdansk in June 2024.

The design and operation, maintenance issues and troubleshooting will be covered by the training material, topics which are relevant mainly to the partners which will test the pilot units. Sampling will be a topic as well. Recordings during operation with detailed explanations will be conducted. Special attention will be given to translate the relevant material to the national languages of the involved partners. In addition, the results and their evaluation after each testing phase will be included in the training material as well. This part will be relevant to all project partners and externals.

7. Annex

Questionnaires used in the project's events during the periods 1 and 2.

Kick-off workshop EMPEREST, 6-8 Feb. 2023
Question 1: What are your expectations from the trainings?
Question 2: Which additional topics regarding the treatment should we consider?
A. Sampling and sample preservation
B. Ozone
C. Active carbon
D. UV
E. Filtration
F. Membrane filtration
G. Advanced analytics
H. Other

Question 3. Which additional topics regarding micro-pollutions should we consider?
A. Pharmaceuticals residuals
B. Microplastics
C. Heavy metals
D. Cosmetics
E. Pesticides
F. Other industrial contamination
G. Other

Question 4: Are the offered training formats adequate?
A. Yes
B. No
C. No, I have other ideas

Question 5: Ideas on how we could increase the interest of the topic of PFAS?
Question 6: Can you also contribute to the training material with your expertise? If yes, please tell us who and how.

WWTPs' excursion in CH and DE, 22-24 Nov. 2023.
(Prepared with the support of DWA)
Question 1: My knowledge has expanded, and I now feel more confident in the topic of organic micropollutants removal from wastewater.
A. Applies
B. Rather applies
C. Rather doesn't apply
D. Doesn´t apply

Question 2: My knowledge has expanded and I now feel more confident in the topic of PFAS removal from wastewater.
A. Applies
B. Rather applies
C. Rather doesn’t apply
D. Doesn´t apply

Question 3: The tours in the WWTP helped to understand the processes.
A. Applies
B. Rather applies
C. Rather doesn’t apply
D. Doesn´t apply

Question 4: Which technology was more interesting for you?
A. Ozonation
B. GAC filtration
C. PAC

Question 5: What do you expect now regarding the potential efficiency of the pilot unit(s)?
A. Efficient micropollutants and PFAS removal
B. Efficient micropollutants removal (no PFAS)
C. None of both

Question 6: Which technology you would prefer in your WWTP for the removal of PFAS?
A. Ozonation
B. GAK filtration
C. PAK
D. Combination

Question 7: What is your take away from the trip?
Question 8: Was there something that was specifically interesting for you?
Question 9: Do you have any questions that are still open?
Question 10: About this topic(s), I would like to hear more: