Deliverable 3.4
Design and Definition of PREDIS training program, update (WP3)
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Abstract

The development of the PREDIS training program is the third task of the Knowledge Management Work Package (WP3, Task 3.3). The aim of this task is to organise training activities to transfer the existing knowledge on pre-disposal to the next generation of engineers and scientists. The training program consists of five types of activities: public webinars, topical tailored short courses, student workshops, roadmap domain insights (written documents) and e-learning self-study materials.

This deliverable is an update of the D3.4 submitted in month 16 (M16). It focuses on the strategy PREDIS follows to develop and provide training to both PREDIS partners and the wider community of stakeholders interested in radioactive waste management, how the trainings organised fit with the requests from Partners/Stakeholders, as well as the objectives for the forthcoming months until the end of the PREDIS project. Information is included about our cooperation with the European Joint Programme on Radioactive Waste Management (EJP-EURAD) community.

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HISTORY OF CHANGES

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1   Introduction

Work Package (WP) 3 Knowledge Management (KM) in PREDIS includes different activities, resources and tools to reach its goals. One of the key activities to be delivered by WP3 is training. The importance of this activity is supported by the feedback received during the December 2021 PREDIS Consortium meeting (Figure 1).

This deliverable focuses on activities related to training on pre-disposal for students, scientists and engineers – the next generation working in the radioactive waste sector.

Figure 1: Feedback from the Consortium meeting held on 3rd December 2021. Question answered by 13 attendees: "What do you expect from WP3 & KM?"

During the first year of PREDIS (2020-2021), several actions were made to compile information, design and develop the training program. A mapping of existing training offers indicated that, during the last 5 years, about 70 courses on subjects related at some point to predisposal activities have been organised for different education levels. The outcome of the mapping of training activities is collected in an excel-based database, containing detailed information on the different courses and activities, including title, dates and place of the course edition(s), type of course, target and attending audience. The mapping was made in close cooperation with EURAD, given the common interest that this type of training course has for both programmes.

Two surveys (see Annex 1) were launched to PREDIS partners and stakeholders in 2021 with the aim of identifying both the training capabilities of the organisations on predisposal topics and training needs that, according to their views, are not covered within the existing offered training. This allowed the identification of training gaps to help WP3 in tailoring future training activities. Those surveys also provided information on the preferred type and length of the training. This input was complemented by feedback from live polls conducted during various PREDIS events organised in 2021, such as consortium meetings and/or webinars. More details on the results of the analysed feedback are provided in Section 2.

The mapping and the feedback received has been valuable in planning and designing the events, activities and materials to be delivered within the PREDIS project during 2021-2024. The cross-check evaluation was presented at the Consortium Meeting (April 2022). It is worth mentioning that similar live polls are being used in PREDIS events to evaluate the progress of the knowledge management activities as well as to prioritize further training activities.

It is important to emphasise that WP3 is in charge of organising all training activities but not producing the technical content itself. Experts from PREDIS consortium and especially within the technical work packages (WP 4-7) are engaged to develop any of the below presented activities, thereby transferring their knowledge to the next generations and other interested parties. Budget is available within WP3 to cover the extra lecturing for those experts. For requested training that cannot be supplied by PREDIS partners, it is envisaged to arrange it in collaboration with external organisations. Budget is also dedicated within WP1 (Program Management) for communication and dissemination activities, which complements these training initiatives.

2 PREDIS Feedback

Two surveys were launched towards PREDIS partners, end-user group (EUG) and stakeholders with the aim of identifying both the training capabilities of the organisations on predisposal topics and training needs that, according to their views, are not covered by already existing training offers. The first survey is included in Annex 1. Partners were asked to answer all the questions while EUG and stakeholders were asked to answer questions 1-3, related to training activities. The results obtained from both surveys are presented here.

The survey was answered by 37 members of the PREDIS consortium, most of them are partners (Figure 2). They are members of 33 different organisations from 14 European countries (see Annex 2 for more details).
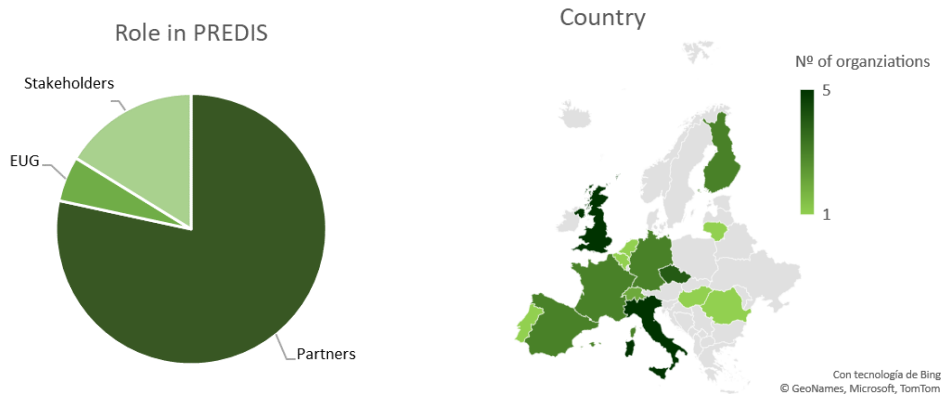

Figure 2: Role in PREDIS and country of the members answering the surveys.

Most of the partners that answered the survey can provide training (Figure 3, left side) on topics related to predisposal of radioactive waste. On the contrary, only 22% of the external organisations could be training providers (Figure 3, right side). Training that can be provided by the surveyed organisations is presented in Figure 4 and classified into 13 main topics, all of them related to the predisposal of the radioactive wastes. It can be observed that 8-9 organisations can provide training on characterisation and conditioning, but none can provide training on economic aspects. Only a few organisations can provide training on safety assessment or life cycle analysis.
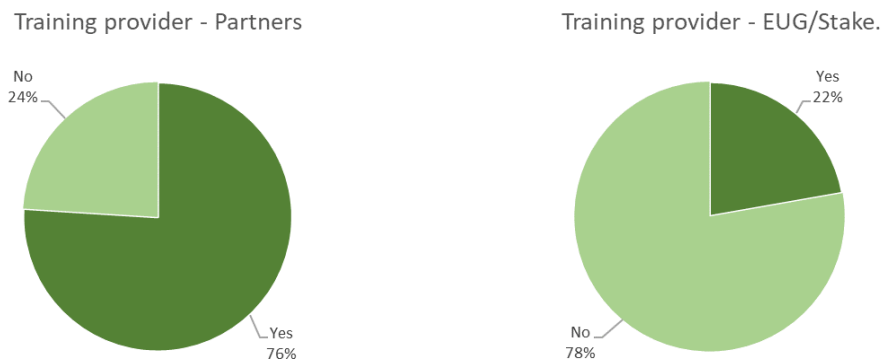

Figure 3: Answers from the question: "Does your organisation provide training or mobility opportunities in pre-disposal activities?"
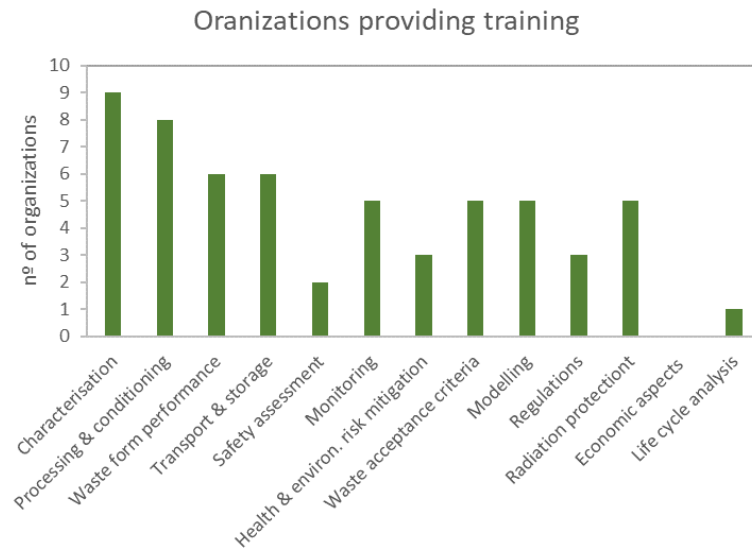
Oranizations providing training

Figure 4: Number of organisations that provide training for each topic.

In the survey, respondents were also asked for those topics that they would need, but where no training is available (to their knowledge) among the commonly offered training courses. By comparing requested and possibly supplied training topics, **about 80% of the proposed topics can apparently be covered by PREDIS partners.** Some examples of requested topics are given below:

- Geopolymer matrices
- Best practices
- Characterisation methods
- Life cycle analysis
- Decontamination processes

Finally, questions related to the format of courses to be organized by PREDIS were asked in order to understand partners' preferences. Figure 5 clearly shows that courses should be mainly focused on the needs of PhD, PostDoc and junior professionals. **1-2 days and one-week courses are the preferred length for future PREDIS courses**.
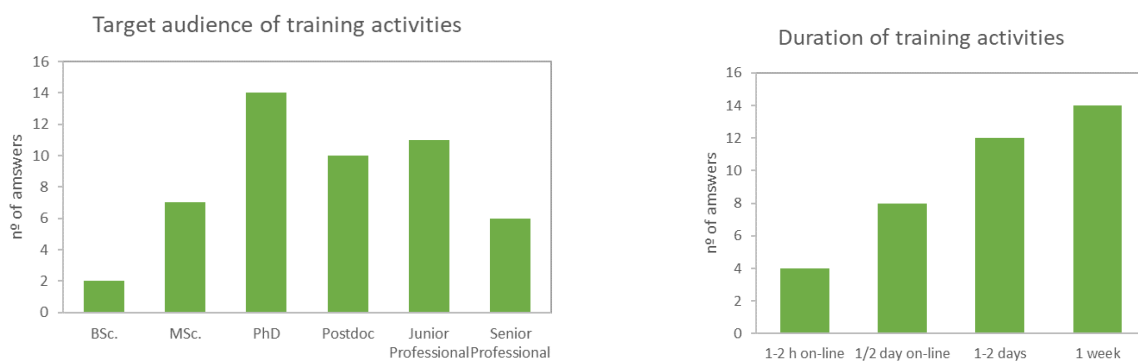

Figure 5: Preferences on target audience and duration of the training courses to be organized by PREDIS.

In addition to the abovementioned surveys, live polls were performed during virtual meetings such as consortium meetings and WP3 webinars. Feedback received on the topics of interest for future training activities and the format of training courses are in-line with the results obtained from the surveys.

A short report on the questions raised in live polls and the received answers is presented in Table 1.

Table 1: Summary of the events where WP3 has launched questions related to training activities and information on the answers received. *Note*: nº answ. = number of answers received.

Event	Question	nº answ.	Results
Consortium Meeting, (May 2021)	What specific training topics are you interested in?	46	
Consortium Meeting, (May 2021)	What is your preferred format of training activity?	23	
Consortium Meeting, (May 2021)	What is your preferred duration of training activity?	20	
Consortium Meeting, student session (May 2021)	What do students expect from WP3 & KM?	24	
KM Webinar (November 2021)	What do you understand by Knowledge Management?	29	
Consortium Meeting (December 2021)	What do you expect from WP3 & KM?	13	

Event	Question	nº answ.	Results
KM Webinar II (December 2022)	Do you think we are missing some relevant topic for training?	6	Free text was allowed: Repeat generic "pre-disposal" training course online How to select the best techniques/technologies? Approaches and technologies to keep waste burden as low as possible from arising to disposal. Lectures from waste generators on needed future R&D generic pre disposal training course online AI in RWM

3 Training program

Several types of activities are being organised in the PREDIS project to train and transfer knowledge to the next generations within the radioactive waste sector. These activities are summarised in Figure 6. This deliverable is focused on explaining the courses that already have been organized up to now as well as those planned to be done along years 2023-24.

Figure 6: Type of training activities covered by PREDIS.

3.1 Courses program

The preliminary plan was to organise 4 training courses per year (see Figure 7), with the exception of the last project year (2024). However, this was reduced to three courses: Two long courses plus one short course. The topics of these courses are complementary to webinars and other training activities developed by other projects or organisations such as EURAD or IAEA. The reasoning behind this decision is both not to have too many courses each year as well as being able to allocate more budget to mobility measures to respond to the high demand from students.

Figure 7: Preliminary schedule for training courses in 2022.

Three courses were organised in 2022, two of them in person (see Figure 8). Firstly, an introductory course to PREDIS project was held online in two half days. After the summer, one course targeted to students provided them an insight on the management of low and intermediate level wastes. The course was complemented with technical visits and a students' workshop. In November 2022, a technical course on the use of gamma spectrometry techniques for waste characterisation was organised focusing on professionals from the sector to enhance their capabilities on that topic.
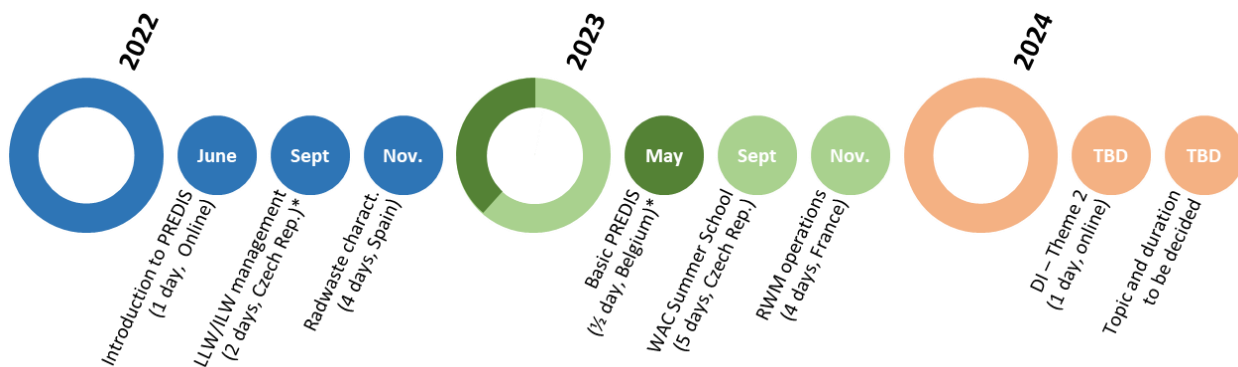

Figure 8: Training courses organised (dark coloured) or to be organised (pale coloured) during the PREDIS project. (*) stands for presential courses that could be followed online.

Two courses are organised as per request from PREDIS students:

- A short course on fundamental knowledge related with predisposal topics tackled in the PREDIS project was organised before the PREDIS Annual Meeting 2023, with the aim of helping students to understand the discussions and presentations given at WP meetings.
- Training course on radioactive waste management operation at La Hague (France) that will be held in November 2023, where attendance from both PREDIS and EURAD students is prioritized.

In September 2023, a summer school on WAC (Waste Acceptance Criteria) has been jointly organised between the EURAD and PREDIS projects. The course is a combination of lectures, technical visits and practical exercises. The outcome of that course and those that will be organised until the end of the PREDIS project will be provided in future deliverables.

In 2024, two courses are foreseen to be offered. The first is a 2-days training course focused on Theme 2 of the EURAD Roadmap: Predisposal. This specific training will provide a general overview and information on the complete EURAD Roadmap as well as detailed lectures on the 12 Domain Insights under the Theme 2 (pre-disposal) developed by PREDIS partners.

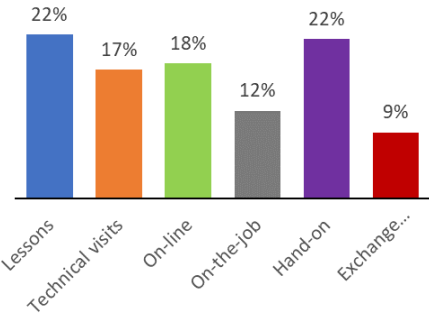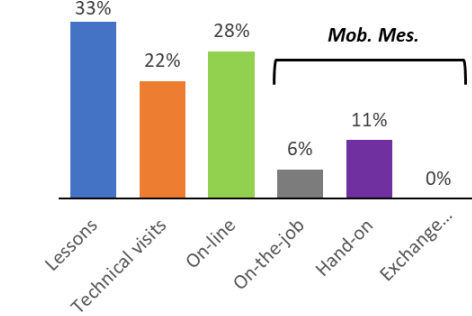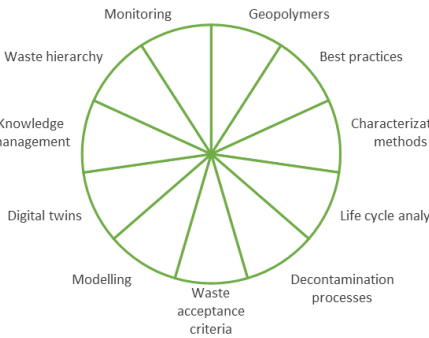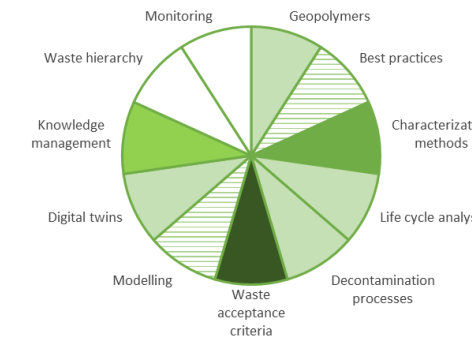The second, and the last training of the project, is not defined yet.

3.2 Program evaluation

After the third year of the project, a cross-check between the surveys and feedback received, SRA/Gap Analysis Report and the organised courses has been done to evaluate if PREDIS is providing answers to the needs of the PREDIS community.

Table 2 compares the integrated answers received from the surveys and live polls done during PREDIS activities. The evaluation of the course program considers the following aspects: duration and format of the courses, type of audience, type of training and topics to be offered. The table provides a conclusion for each of the evaluated aspects. The main conclusion is that PREDIS organised a series of courses in line with the requirements of Partners and Stakeholders. Moreover, some of those courses have been organised jointly with the EURAD project and an exchange between PREDIS-EURAD students has taken place. So that, several courses organised by PREDIS were attended by 1-2 students from EURAD.

Table 2: Crosscheck results between feedback from surveys + live polls and PREDIS courses both organised and scheduled. Focus is given to duration, format, activities and audience of the courses.

Course characteristic	Answers in surveys	PREDIS courses
Duration and format		
	Conclusions: PREDIS courses were focused on the received answers, providing short online and in person courses as well as 1 week-in person courses, such as the WAC Summer School. In order to fulfill, the requirements for very short training courses, webinars focused on specific topics has been organized (e.g. LCA, Digital Twins…). All information on webinars can be found in the PREDIS webpage (https://predis-h2020.eu/events/).	
Audience		
	Conclusions: The same profile of type of audience can be observed in both graphs, providing more training to PhD, PostDoc and Junior Professionals.	

Course characteristic	Answers in surveys	PREDIS courses
Type of training		
	Conclusions: A clear deviation can be observed between these graphs as trainings related to hands-on, exchange of lecturers/learners or on-the job were made through mobility measures.	
Topic*		

Topic	Status
Geopolymers	Webinar (3h): PREDIS developments of geopolymers for pre-disposal waste management (WP4-6 issues)
Best practices	During the second webinar on KM, best practices of PREDIS Knowledge Management activities where presented.
Characterisation methods	Course (4 days): Gamma Spectrometry on Waste Characterization: Practical-theoretical training session on GENIE 2K & ISOCS
Life cycle analysis	Webinar (2h): Life Cycle Assessment and Life Cycle Costing
Decontamination processes	Webinar (3h): Innovations in metallic material treatment and conditioning: Getting the most from optimised characterisation, efficient decontamination and advanced conditioning of both ferrous and more reactive metallic wastes.
Waste acceptance criteria	Webinar (3h): Waste Acceptance Criteria (WAC) 1 –information and resources
	Webinar (3h): Waste Acceptance Criteria (WAC) 2 – needs, challenges and opportunities
	Course (5 days): Joint Summer School on Waste Acceptance Criteria, with EURAD
Modelling	Modelling is a broad topic. It has not been handled as a such but it is mentioned in some of the trainings and webinars.
Digital twins	Webinar (3h): Digital Twins for Waste Management

Course characteristic	Answers in surveys	PREDIS courses
	Knowledge management	Webinar (3h): PREDIS State of Knowledge (WP3 – covering knowledge documents, training, mobility activities and opportunities) Webinar (3h): PREDIS WP3 Knowledge Management webinar, public.
	Waste hierarchy	--
	Monitoring	--
	Most of the topics requested by partners and End-Users have been tackled through different training activities, either courses or webinars. There is still a budget to perform one/two trainings, but the topics are not decided yet. The selected topic will be in line with the above results.	

* it also includes outcome from SRA

3.3 Courses sheets

This section summarises all courses performed and includes training feedback.

PREDIS Overview (online, 9-10th June 2022) – Amphos 21	
Objectives	Providing an overview of the activities performed in the project.
Participants	81 participants (students, partners, stakeholders,…)
Feedback	Only 7 participants answered the feedback questionnaire sent. Nevertheless, all lectures received a mean score above 4 out of 5. Less scores were received related to the communication before the course. The questionnaire included questions such as; the best session, the detail of information of the course, how to improve the course performance and their training needs for future trainings. All answers were very positive, thus provided good feedback. Participants´ main preferred topic to be covered in a future course is a course related to geopolymers under different conditions.

LLW/ILW management (Husinec, CZ, 7-9th September 2022) – UJV	
Objectives	Presenting a general overview of radioactive waste management to young specialists, just entering the field. It also provided an introduction to some of the techniques and facilities dedicated to radioactive waste management, that means UJV waste management centre and Laboratories of Fuel Cycle Chemistry department, supporting radioactive waste disposal in both LLW/ILW repositories.
Participants	21 participants (students)
Feedback	17 participants provided their feedback after the course finalisation and the mean score of all questions were over 4 out of 5, with the exception of the communication before the training course that obtained a score of 3.7 out of 5.

Practical-theoretical training session on GENIE 2k & ISOCS for waste characterisation (José Cabrera NPP, Spain, 21-24th November 2022) – ENRESA	
Objectives	Learning on the use of the Genie2K software for the management of an ISOCS device. It is based on the gamma spectrometry for the characterisation of waste packages, large items, walls, soils, etc. The subjects the course dealt with was: Gamma acquisition analysis, interactive peak location and area analysis. Energy and efficiency calibration, Minimum dateable Activity, Decision Threshold, Resolution, Detector characterization, Multi efficiency, Geometry Composer, Uncertainties, Quality Control, Case studies and Real Waste Measurements.

Practical-theoretical training session on GENIE 2k & ISOCS for waste characterisation (José Cabrera NPP, Spain, 21-24th November 2022) – ENRESA	
Participants	9 participants (students, young professionals, stakeholders, partners)
Feedback	The course feedback was very positive where the average score for all questions was above 4 out of 5. Furthermore, there were some open questions where feedback such as "… it has really helped me a lot in my practice …" and "… I would strongly recommend the training course to other colleagues …" was received.

PREDIS fundamentals (Mechelen, BE, 22nd March 2023) – GLS	
Objectives	Improving participants understanding of the technical background for each WP to support their engagement in the project, including understanding of the presentations and active participation in workshop discussions at the Annual Meeting.
Participants	26 participants (students, partners)
Feedback	14 out of 26 participants provided their feedback for the course where the mean score for each question is higher than 4 out of 5. The questionnaire included some open questions such as the best session, the detail of information of the course, how to improve the course performance and their training needs for future trainings. All answers were very positive and provided good feedback.

WAC Summer School (Husinec, CZ, 4-8th September 2023) – CV Rez, SCK·CEN, Amphos 21	
Objectives	Teach participants about the basics of WAC, WAC development and application, and examples of WAC in national programs. Theoretical lectures are complemented with exercises and two technical visits.
Participants	Maximum 60 participants.
Feedback	Not received yet

Radioactive Waste Management, Orano Case Studies (La Hague, France, 20-23rd November 2023) – Orano	
Objectives	The training session give a general overview of radioactive waste management to the young specialists involved in the PREDIS project. This training will consist of 4 days of lessons and visits to discover La Hague reprocessing plant, LLW and ILW management Operations, as well as Orano's container solutions and one of its container manufacturing plants.
Participants	Maximum 20 participants.
Feedback	Not received yet

Roadmap – Theme 2 (online, to be confirmed) – AMPHOS 21	
Objectives	The PREDIS roadmap on predisposal activities as part of the EURAD roadmap consisting of 12 lectures aiming to teach students how waste generators, identify and deliver solutions to optimise the management of radioactive waste throughout the predisposal phases of the radioactive waste management programme.
Participants	Target audience: partners, students, stakeholders and externals. No limit of participants.
Feedback	Not received yet

4   Communication tools

All training activities developed in the frame of the PREDIS project are announced on the project webpage (https://predis-h2020.eu/) as well as via internal e-mail distribution list, newsletters and social media (i.e. Twitter and LinkedIn).

The information is also sent to the EURAD training management team to be posted on the School of Radioactive Waste Management (https://euradschool.eu/) and distributed, if considered, to EURAD consortium.

5   Conclusions

This deliverable presents the training activities held so far and the ones planned until the end of PREDIS, taking into account the inputs received from the PREDIS Consortium. Feedback received from surveys and live polls were highly valuable and provided an important input for the design of the training program.

Compared to the initial preliminary training schedule, there are less activities per year. This is because a decision was made to not have too many events per year, but also to prioritise budget on mobilities due to students' high demand for mobility actions.

The feedback received from courses already held is predominantly positive and the courses given have been appreciated by the students. These evaluations have also been taken advantage of to do surveys and polls for further desired knowledge topics which has been considered for future planning.

Moreover, a cross-check between the feedback received on the required trainings and characteristics of these already performed or under organisation has been done. The trainings organised within PREDIS as well as other trainings organised jointly with EURAD are in line with the received feedback. Efforts will be made to continue in the same direction for those trainings that are to be organised in 2024.

Annex 1: Survey

PREDIS internal-partner survey on training and mobility

Name (optional)

Organization (optional)

Type of organization

Country

Role in your organization

Involved in PREDIS WP

MW: Metallic Waste
LOW: Liquid Organic Waste
SOW: Solid Organic Waste
CW: Cemented Waste
PW: Problematic/Challenging waste

1. Does your organisation provide training or mobility opportunities in pre-disposal activities?

Yes/No

If yes, please specify by indicating all applicable following options in the matrix below:

L: Lectures/Conferences
OTJ: On-The-Job Training
V: Visit: a short stay during which the visitor observes the activities performed at a certain institute or company
I: Internship: a period of time during which a student or a professional participates to the local activities in a certain institute or company in order to increase knowledge and /or skills
O: other

	MW	LOW	SOW	CW	PW	other
characterisation						
Processing/Treatment/Conditioning						
waste form performance						
transport and storage						
safety assessment						
monitoring						
health and environmental risk mitigation						
Waste Acceptance Criteria						
modelling						
regulations						
radiation protection						
economic aspects of predisposal						
life cycle analysis						
other training subject						

2. Are you aware of training activities not organized by your organization (in the country or abroad) that are relevant in pre-disposal activities? Please specify if possible -subject, duration, participants, etc.. You can mention courses done in the past.

Free text

3. Is there any training on pre-disposal subjects that your organisation needs, but is not available (to your knowledge) among the commonly offered trainings?

Yes/No

If yes, please specify:

Desired subject for training

Free text

Target audience (please add a cross in all applicable options below)

- ☐ BSc.
- ☐ MSc.
- ☐ PhD
- ☐ Postdoc
- ☐ Junior Professional
- ☐ Senior Professional

Preferred training model (please add a cross in all applicable options below)

- ☐ Lessons/Courses
- ☐ Hands-on-training
- ☐ Training on-the-job
- ☐ On-line learning
- ☐ Technical visits
- ☐ Exchange of lecturers and / or learners

Preferred training duration (please add a cross in all applicable options below)

- ☐ 1-2 h on-line
- ☐ 1/2 day on-line
- ☐ 1-2 days
- ☐ 1 week
- ☐ other

Please add the level of priority for PREDIS (1: low; 5 high)

4. Does any of your employees/students envisage any form of PREDIS related mobility, stated below (within project duration)?

Yes/No

If yes, please specify

Type of mobility (please add a cross in all applicable options below)

- ☐ Visit
- ☐ Internship
- ☐ On the job training
- ☐ Conference
- ☐ Exchange of lecturers and / or learners

If already known, please specify:

Type of participant (please add a cross in all applicable options below)

- ☐ MSc student
- ☐ PhD student
- ☐ Post-Doc
- ☐ Junior employee
- ☐ Senior employee
- ☐ Other

Target institution

Free text

Length of stay

Free text

5. Comments/Suggestions

Annex 2: Survey – Responding organisations

Answers were provided by 33 organisations.

Organisation	Country	Role in PREDIS
Amphos 21 Consulting SL	Spain	Partner
Andra	France	EUG
Anonymous	Switzerland	Partner
Anonymous	Finland	Stakeholder
BAM	Germany	Partner
Campoverde srl	Italy	Stakeholder
CEA	France	Partner
Centrum Výzkumu Řež (CVRez)	Czech Republic	Partner
CIEMAT	SPAIN	Partner
Contractor	UK	Stakeholder
CSIC	Spain	Partner
CTU in Prague	Czech Republic	Partner
ENEA	Italy	Partner
FTMC	Lithuania	Partner
Galson Sciences Ltd	UK	Partner
GRS	Germany	Stakeholder
INFN	Italy	Partner
Institute for Nuclear Research Pitesti	Romania	Partner
IRSN	France	Partner
ISOTOPTECH ZRT.	Hungary	Partner
IST-ID	Portugal	Stakeholder
KIT-INE	Germany	Partner
Nagra	Switzerland	EUG
NNL	United Kingdom	Partner
NRG	The Netherlands	Partner
Platom Oy	Finland	Stakeholder
SCK CEN	Belgium	Partner
SOGIN	Italy	Partner
SURO	Czech Republic	Partner
UJV Řež a.s.	Czech Republic	Partner
University of Sheffield	UK	Partner
URENCO	UK	Partner
VTT	Finland	Partner