

# Deliverable D7.7 Report on training activities

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# **Report on training activities**

**Deliverable D7.7** 

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 $^{1}$  PU = PUBLIC

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services) CO = Confidential, only for mbers of the consortium (including the Commission Services)

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## Publishable Executive Summary

Deliverable 7.7 "Report on training activities", presents the detailed presentation and description of the training activities implemented in the context of PureNano Project, as they were planed and presented in Deliverable 7.3 "Detailed training plan and material".

In this context, six training events were successfully implemented during the whole duration of PureNano project. Two training events were dedicated to the training of project partners, so as called, internal training activities; While four events were external training activities, aiming to present to relative stakeholders PureNano results and expected gains of the provided technology deployment in target markets.

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# Abbreviations and acronyms

- **Circular Business Models** CBM
- CE **Circular Economy**
- HSE Health, safety and environment
- Magnetic Nanoparticles **MNPs**
- Nanoparticles NPs
- PLs **Pilot Lines**
- **Research and Development** R&D
- SbD
- Safe by Design Waste Minimization WM



# **1** Introduction

PureNano project developed and presented a novel purification methodology of spent plating baths. In more details, PureNano provided two important solutions for this sector: an in-line and a portable purification system solving issues regarding transportation for the treatment of spent baths. The developed technology can be also applied to other sectors, such as wastewater treatment industry.

A crucial step that follows the invention, towards the successful implementation of a project is raising awareness. Thus, to identify target audiences and make them aware of PureNano developed novel methodology, could benefit both the project and stakeholders. To achieve a communication with a wider public and raise awareness, to disseminate effectively PureNano project, a concrete strategy also needs to be followed.

The objective of Deliverable 7.7 "Report on training activities is to present the implemented scheduled training activities and give a preliminary description of the content of these training courses. As described in Task 7.5 and in Deliverable 7.3 "Detailed training plan and material", in order to cover both technological, and managerial aspects of the project, training activities will include inter- and intralevels. In that sense, six different events (online, physical & hybrid), were planed and scheduled by PureNano partners, two internal for the consortium partners, and four for external stakeholders.

This document presents an overview of both internal and external training activities.

# 2 Training activities

Next chapters present the six scheduled training activities implemented in the framework of PureNano project including the schedule and contents covered in each event. PureNano training activities are presenting in **Table 1**. Among the implemented training events presented in Deliverable 7.3 and hereafter, AXIA, also implemented an online IPR management workshop in the context of WP9, Task 9.3. Thus, more details and information are presented in the relative Deliverable 9.4.

| Content  | Responsible<br>partner | Туре     | Date  | Scope   |
|--|------------------------|----------|---|---|
| MagnetoSponges:<br>innovative technology for<br>industrial wastewater<br>treatment | ASFIMET                | External | 11/11/2020<br>(Online)                                  | Presentation of the<br>PureNano technology<br>and possible<br>applications.   |
| Stakeholder engagement<br>for nanotechnology<br>applications                       | AXIA                   | Internal | 04/12/2020<br>(Online)                                  | Provide guidelines for<br>the stakeholder<br>engagement in<br>innovative projects.  |
| Safe-by-Design   | ISQ                    | Internal | 16/06/2021<br>(Online)                                  | Present the<br>processes required<br>for the application of<br>the Safe-by-Design<br>approach.  |
| Nanomaterials safety: The<br>PureNano technology                                   | ISQ                    | External | 22/09/2022<br>(Online)                                  | Demonstrate the<br>application of<br>standards and<br>present the results of<br>the risk assessment<br>and nanosafety of the<br>PureNano<br>technology. |
| Circularity of PureNano<br>technology  | AXIA                   | External | 27/09/2022<br>(Physical)<br>&<br>04/10/2022<br>(Hybrid) | Highlight the<br>importance of the<br>circular economy<br>concept in the plating<br>industry.   |
| Nanofluid integration in<br>waste water treatment in<br>the plating industry       | ASFIMET                | External | 04/10/2022<br>(Hybrid)                                  | Final demonstration<br>of the PureNano<br>activities.   |

## 2.1 Internal Training Events

In the context of PureNano 2 internal events have been implemented aiming the project partners, mainly to address technical and managerial issues to better design the different phases of new technology.

2.1.1 First (1<sup>st</sup>) internal PureNano training - Stakeholder engagement for nanotechnology applications (AXIA)

The first PureNano Internal Training about the Stakeholder engagement for nanotechnology applications was held online on December 4th, 2020.



Figure 1. First PureNano Internal Training Event (AXIA)

#### 2.1.1.1 Aims

The main objectives of the this first internal training event were to:

- Provide to partners some guidelines for the engagement process of stakeholders;
- Identify the main actors involved in the PureNano project and prioritize accordingly;
- Highlight the importance of the engagement of stakeholders in innovative projects;
- Highlight the challenges and the benefits regarding the engagement process;

#### 2.1.1.2 Activity description

In this stakeholder engagement training event, the wider scope was to train the partners on how to create connection with stakeholders in the framework of innovation management. One of the most challenging tasks in this procedure is to identify the key stakeholders and persuade them to be involved in innovation projects.



Training was divided into two parts; the first part was focused on stakeholder engagement and management, since these are the most important aspects for the successful implementation of a project. In more details, AXIA in the first part of the training, presented an overview of the meaning of engagement and the described the beneficial but in the same time challenging aspects of stakeholder engagement. Towards this direction more details were provided on the scope of engagement activity, and its necessity in stakeholder engagement procedure. AXIA included in the training some more generic points, that further developed in the second part of the training which was more interactive. In addition, AXIA presented information regarding the identification, categorization and understanding of relevant stakeholders; to be able to recognize the suitable stakeholders and the best timing to engage them. The second part was an interactive part, in which the partners were applied the information acquired during the first part.

#### 2.1.1.3 Contents & schedule:

The agenda of this online training event presented in **Table 2**.

| Stakeholder engagement for nanotechnology applications<br>Friday 4 <sup>th</sup> of December 2020 |  |              |
|---|--|--------------|
| 15:00-15:05   | Welcome – Introduction to the<br>workshop                              | POLIMI/ AXIA |
| 15:05-15:45   | Guidelines for stakeholder engagement in research projects             | ΑΧΙΑ         |
| 15:45-16:45   | Interactive section: Stakeholder<br>engagement in the PureNano project | ΑΧΙΑ         |
| 16:45-17:00   | Q&A  | All          |
| 17:00 End of the workshop   |  |              |

#### **Table 2**. First internal PureNano training agenda

#### 2.1.1.4 Materials

- Presentation
- Participants list



## 2.1.2 Second (2<sup>nd</sup>) internal PureNano training - Safe-by-Design (ISQ)

The second PureNano Internal Training in "Safe by Design" was held online on June 16<sup>th</sup>, 2020.



Figure 2. Second internal PureNano training (ISQ)

#### 2.1.2.1 Aims

The basic aim of the second internal training was to raise awareness regarding the Safe-by-Design (SbD) approach within the consortium partners, and to inform

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them about the required processes for the application of the Safe-by-Design approach to the PureNano technology.

#### 2.1.2.2 Activity description

The internal training session - Safe-By-design - which included a review of the current literature highlighting which variables and parameters serve to classify the PureNano technology as provisionally safe, including the identification of hazards, the conceptual pillars and core elements of Safe-by Design as the SbD challenges, the SbD strategies, the Stage Gate Cooper Innovation process, and the Step-by-step process for the implementation of SbD Roadmap.

This training also included an example that aims to help all participants understand the application of the SbD approach and the benefits that it will bring to promote PureNano technology in the market.

#### 2.1.2.3 Contents & schedule:

The agenda of this online training event presented in **Table 3**.

|             | Safe-by-Design (ISQ)  |     |
|-------------|---|-----|
|             | Wednes 16th of June 2021                                      |     |
| 15:00-15:10 | Welcome – Introduction to the<br>workshop                     | ISQ |
| 15:10-15:20 | Definition and goals of Safe-by-Design                        | ISQ |
| 15:20-15:35 | The conceptual pillars and core elements<br>of Safe-by-Design | ISQ |
| 15:35-15:50 | The Stage Gate Cooper Innovation<br>process                   | ISQ |
| 15:50-16:00 | SbD challenges  | ISQ |
| 16:00-16:30 | Mini SbD example: PureNano technology                         | ISQ |
| 16:30-17:00 | Q&A   | All |
|             | 17:00 End of the workshop                                     |     |

Table 3. Second internal PureNano workshop agenda

#### 2.1.2.4 Materials

- Presentation
- Participants list



## 2.2 External Training Events

External training activities targeted to reach stakeholders and possible customers as well as engineers that will make use of the technology. External trainings address coaching sessions aiming to the presentation, of the developed Purenano technology, the possible applications, its applicability, its success stories, and circularity and also address the safety of the developed NMs.

2.2.1 First (1<sup>st</sup>) External PureNano Training Event - MagnetoSponges: innovative technology for industrial wastewater treatment (ASFIMET)

The first external PureNano Training Event was held online on November 11<sup>th</sup>, 2020.



Figure 3. First external PureNano Training Event

#### 2.2.1.1 Aims

The aim of this first event was the presentation of the involved technology in PureNano project, and the improvements that were planned to be applied, since this workshop took place at an early stage of the project.

### 2.2.1.2 Activity description

ASFIMET and CaptiveS co-organized this workshop, taking also advantage of the MECSPE exhibition<sup>2</sup> which was dedicated to technology and innovation and is a reference point for the manufacturing sector in Italy. The workshop was initially

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<sup>2</sup> https://www.mecspe.com/it/programmaconvegni/dettaglio/1604016000/

planned to be held physically on the 30<sup>th</sup> of October 2020, but the health emergency restrictions applied in Italy on the 25<sup>th</sup> of October 2020 imposed the cancellation of the exhibition and the substitution of the physical workshop with an online workshop that took place on the 11<sup>th</sup> of November 2020, with the participation of 25 participants active in the metal finishing and industrial wastewater treatment sector.

However, an abstract regarding wastewater treatment, the technology, its aim and the expected results has been published in the exhibition's website, for the online event that held on the 3<sup>rd</sup> of December 2020 **Figure 4**.



Figure 4. Abstract of the 1st PureNano workshop organized during the MECSPE exhibition

#### 2.2.1.3 Contents & schedule:

During the first part of the workshop, ASFIMET introduced the project and the core partner, CaptiveS, that continued as the main presenter of the workshop.

The agenda of this online training event presented in **Table 4Table 3**.

Table 4. First External PureNano workshop agenda

| MagnetoSponges: an innovative technology for the industrial wastewater treatment (ASFIMET) |   |          |
|--|---|----------|
|  | Wednesday 11 <sup>th</sup> of November 2020   |          |
| 15:30-15:40  | Welcome – Introduction to the<br>workshop   | ASFIMET  |
| 15:40-15:55  | Magnetosponges: introduction to the technology  | CaptiveS |
| 15:55-16:15  | PureNano: Optimization of the technology<br>for wastewater treatment in the plating<br>industry | CaptiveS |
|  |   |          |

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# 16:15-16:45 Q&A 16:45 End of the workshop

All

## 2.2.1.4 Materials

- Presentation
- Participants list

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# 2.2.2 Second (2<sup>nd</sup>) External PureNano Training Event - Nanomaterials safety: The PureNano technology (ISQ)

The second external PureNano Training Event was held online on September 22<sup>nd</sup>, 2022.



#### **Risk Management - Control measures**



Figure 5. Second external PureNano Training Event

pureflafio

#### 2.2.2.1 Aims

When developing new technologies that include NMs, their safety is a major aspect. This workshop was aiming at demonstrating the application of ISO31000 concerning the risk associated to the PureNano technology and also to present the results of the risk assessment and nanosafety recommendations of the PureNano project. Additionally, provided to the participants an understanding of how the risks of the PureNano technology were minimized.

#### 2.2.2.2 Activity description

ISQ held the external training session - Nanomaterials safety: The PureNano technology – which aimed to raise awareness of the uncertainties about the dangers and risks to human health, arising from exposure to nanoparticles and the resources we have to control these risks. This training was based on the current knowledge of nanomaterials risk assessment and management as proposed by several international bodies (ISO, OECD) combined with approaches that were used by the PureNano technology. In this workshop, the definitions of nanomaterials and their sources, the applied regulation, general risk considerations and available control measures were presented.

The intent was that at the end of the session, participants understand the concepts and tools, including how to identify hazards, assess risk and correctly decide controls. This training was designed to reach the general public, researchers working with nanomaterials, as well as HSE professionals who carry out risk assessments and provide support to HSE management, policymakers, and policy analysts.

#### 2.2.2.3 Contents & schedule:

The agenda of this online training event presented in **Table 5**.

| Nanomaterials safety: The PureNano technology (ISQ) |   |     |  |
|---|---|-----|--|
|   | Wednesday 12 <sup>th</sup> of September 2022                          |     |  |
| 15:00-15:15   | Introduction to nanomaterials   | ISQ |  |
| 15:15-15:25   | Potential risks of nanomaterials                                      | ISQ |  |
| 15:25-15:40   | Current approaches to assess and<br>manage the risks of nanomaterials | ISQ |  |
| 15:40-16:00   | Risk assessment and nanosafety recommendations of the PureNano        | ISQ |  |

#### Table 5. Second External PureNano workshop agenda

## technology

|     | -  |     |      | _          |   |  |
|-----|----|-----|------|------------|---|--|
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|     | u. | UL. | ,- I | <b>U</b> . |   |  |

Q&A

All

## 16:15 End of the workshop

## 2.2.2.4 Materials

- Presentation
- Participants list



2.2.3 Third (3<sup>rd</sup>) External PureNano Training Event - Circularity of PureNano technology (AXIA)

## *Circularity concept in the finishing industry*

One important task of PureNano project is task 7.1 about Recyclability and the Circular Economy (CE). Within this task AXIA, starting from the PureNano concept, analysed the current end-of-life management chain in the plating industry and was responsible for the development of a methodology which had as main goals: i) the application of the so-called Waste Minimization (WM) approach to the pilot lines (PLs) installed in Gaser and Cnano and ii) the implementation of specific circular business model in the economic strategy of the two pilots.

This methodology was presented in two workshops organized on the 27<sup>th</sup> of September in Athens on the CNano premises and on the 4<sup>th</sup> of October in Milan on the PoliMi premises.

AXIA organized the workshops to raise awareness about the environmental issues generated by the waste produced by the finishing industry every year and to communicate to the expert in the field how the WM approach and the PureNano technology could contribute to the circular economy transition.

To build awareness, an effective and strong communication plan was developed, and the involvement of stakeholders throughout the project's lifetime assisted the consortium in ensuring that the PureNano solution is fit for purpose and is designed to meet end users' requirements and expectations.



#### 2.2.3.1 Workshop in Athens

AXIA organised the workshop in Athens which was held on the CNano premises and experts in the field coming from universities and coating and finishing industries joined the event.

#### Aims

The main objectives of the workshop were to:

- > Highlight the importance of the CE concept in the finishing industry;
- > Identify the current End of Life management chain in the finishing industry;
- Provide information about the Waste Minimization approach and its application to the PureNano PLs
- Analyze the Circular Business Model approaches present in literature and select the most suitable ones for the PureNano pilot lines

#### Activity description

The workshop was introduced by prof Luca Magagnin, the coordinator of PureNano, who explained the main concept of PureNano project and the sustainability of the process.

Afterwards, Cristina Onorato from AXIA Innovation explained the importance of the Circular Economy concept, the end-of-life management chain in the finishing industry and the methodology applied to support the circular economy transition in this industrial sector.



Figure 6. Structure of the circularity workshop

Starting from the PureNano concept, AXIA Innovation analyzed the current endof-life management chain in the plating industry. In the context of PureNano, AXIA was responsible for the development of a methodology which had as main goals: i) the application of the so-called WM approach to the PLs installed in Gaser and Cnano and ii) the implementation of specific circular business model in the economic strategy of the two pilots.

The first part of the workshop consisted of characterizing the waste of the finishing industry and the waste treatment technologies. During the workshop it was highlighted that the main wastes produced are spent bath, wastewater and drag out. However, many waste treatment technologies are applied after the waste is produced ("end of pipe" waste treatment) and this increase the costs and environmental concern. Industries have usually treated the waste after its production and before discharging it into the environment. The alternative solution aims at reducing waste production during the manufacturing process by applying WM approach.

When applied to the PLs of Gaser and CNano, the WM includes the implementation of a set of techniques for the process modification, the drag-out reduction, and the process solution treatment, which appear to increase the process efficiency and have economic benefits for the companies. The reduction of waste production reduces the waste treatment costs and maintenance costs showing that acting a priori instead of at the end of the pipe has a great advantage for the companies.

In the second part of the workshop, AXIA provided an overview of the main Circular Business Models (CBMs) present in literature and the methodology followed to identify the main circular business goals, technological and social innovation enablers and the application of the most suitable CBM to the PureNano use cases.

The workshop was considered an opportunity to check with the expert whether the developed methodology was in line with their business expectation. In general, the workshop got positive feedback with the suggestion to develop further the methodology including economic calculation in the analysis. For further information regarding the presentation content and the methodology, please refer to the public deliverable D7.4 Report on the circularity of PureNano technologies" available on the PureNano website.

After the workshop, the attendees were guided on a tour through CNano premises. The responsible for the in-line purification pilot, showcased the working principle of the purification system, highlighting the main compounds such as the magnetic trap designed ad hoc by another project partner (Kampakas) and also showed the techniques applied for the drag-out reduction.



Figure 7. CNano portable purification system

#### Contents & schedule:

The agenda of the workshop is presented in the following Table.

 Table 6. Agenda of the workshop in Athens

|             | Circularity concept in PureNano<br>Tuesday 27th of September 2022 |   |
|-------------|---|---|
| 14:20-14:30 | Welcome – Introduction to the<br>workshop                         | Prof. Luca<br>Magagnin,<br>Coordinator/<br>POLIMI |
| 14:30-15:00 | Circularity concept in PureNano                                   | Cristina Onorato,<br>AXIA                         |
| 15:00-15:30 | Tour in Creative Nano Premises,<br>Demonstration of PureNano PL   | Creative Nano                                     |
| 15:30-16:00 | Round table   | all   |
|             | 16:00 End of the workshop   |   |

## Materials

- Presentation
- Participants list



#### 2.2.3.2 Workshop in Milan

#### Aims

The circularity workshop in Milan was organized in the framework of the last consortium meeting.

Stakeholders from the Milan area joined the meeting in the PoliMi premises, while others were connected remotely.



Figure 8. Milan workshop presentation

Similar to the workshop in Athens, AXIA explained the main concept of circular economy applied in the Electroplating industry providing some solutions and input for further discussion. In Milan, the workshop focused more on the description of the Gaser pilot line and constructive feedback from the PureNano partners demonstrated that AXIA's methodology can be applied also to other pilot lines.

#### Activity description

For further information regarding the presentation content and the methodology, please refer to the public deliverable D7.4 Report on the circularity of PureNano technologies" available on the PureNano website.

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#### Contents & schedule:

The agenda of the workshop is presented in the following Table.

#### Table 7. Agenda of the workshop in Milan

|               | The circularity of PureNano technology ( | AXIA)  |
|---------------|--|--------|
|               | Tuesday 4 <sup>th</sup> of October 2022  |        |
| 11:00 - 11:10 | Registration and Short Introduction      | PoliMi |
| 11:10 - 11:40 | Circularity concept in PureNano          | ΑΧΙΑ   |
| 11:40 - 12:00 | Q&A                                      | AXIA   |
|               | 12:00 End of the workshop                |        |

## Materials:

- Presentation
- Participants list



2.2.4 Fourth (4<sup>th</sup>) External PureNano Training Event - Nanofluid integration in waste water treatment in the plating industry (ASFIMET)

The fourth external PureNano Training Event was held on Tuesday 4<sup>th</sup> of October, in Milan and Online (hybrid event), organized by ASFIMET



Figure 9. Fourth external PureNano Training Event

### 2.2.4.1 Aims

This topic was selected for this training activity as a final demonstration of PureNano technology integration in the plating lines participating the project. This event presented the progress achieved on the design and integration of the purification systems in the two end users including the first demonstration activities undertaken. The audience consists of stakeholders and engineers from the plating industry.

## 2.2.4.2 Activity description

ASFIMET held the final external training activity, started with a brief presentation of the results from the functionalization studies and the process model formulation and optimization of the two plating processes, including the equipment required and the instrumental diagrams. The feasibility of the purification process and the successful implementation of the project were also underlined, as the project is almost finished. To this end, the Project results were validated through the successful operation of the purification system in terms of capturing efficiency in the operational environment of the two end users. Relative results from purified spent baths performance were presented as they were completing the quality control validation of the process.

#### 2.2.4.3 Contents & schedule:

The agenda of this online training event presented in the next Table.

 Table 8. Fourth External PureNano workshop agenda

| Nanofluid integration in wastewater treatment in the plating industry (ASFIMET) |   |         |  |  |
|---|---|---------|--|--|
| Tuesday 4 <sup>th</sup> of October 2022   |   |         |  |  |
| 12:00-12:15   | Welcome – Introduction to the workshop  | ASFIMET |  |  |
| 12:15-12:25   | Nanoparticle functionalization for waste water treatment in the plating industry  | ASFIMET |  |  |
| 12:25-12:40   | Process model formulation and<br>optimization of the plating processes            | ASFIMET |  |  |
| 12:40-13:00   | Demonstrators: first runs and results of the operation of the purification system | ASFIMET |  |  |
| 13:00-13:15   | Q&A   | All     |  |  |
|   |   |         |  |  |

# 13:15 End of the workshop

#### 2.2.4.4 Materials

- Presentation
- Participants list



# 4. Conclusion

Deliverable 7.7 "Report on training activities" presents in detail the implemented training activities as had scheduled for the whole duration of the project, and presented in Deliverable 7.3 "Detailed training plan and material". These events, as also described in Task 7.5 aimed to train project partners to promote the knowledge generated during the project in a most efficient way, and also to attract targeted audiences. In this context, six different training activities were organized and implemented covering both technological and managerial tasks.

Two training events were dedicated to the training of project partners, so as called, internal training activities; aiming as mentioned above to provide a better understanding on the methodology to identify stakeholders and disseminate efficiently the project results. The four remaining events were planed as external training activities, aiming to present to relative stakeholders PureNano results and expected gains of the provided technology deployment in target markets. External events managed to attract industrial partners both from industrial wastewater treatment sector and the metal finishing sector with many participants interested in the PureNano technology.