

Bringing Nanosafety expertise from research to industry via training / tutorials

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Context :

During the last decade, progress in nanosafety has allowed to mitigate and control the risk induced by using nanomaterials. Even if nanoforms hazards are still mostly unknown, means of prevention to be implemented in order to protect workers are well established [1]

[2]. Besides, specific risk assessment methods exist [3] [4]. However, industries are not fully aware of this emergent risk and the associated mitigation strategies. The popularisation of nanosafety and especially nanosafety training is thus crucial in several fields.

[1]C. Ostiguy, M. Debia, B. Roberge, et A. Dufresne, « Best Practices Guidance for Nanomaterial Risk Management in the Workplace », p. 113.

[2]W. Fransman, J. Schinkel, T. Meijster, J. Van, E. Tielemans, et H. Goede, « Development and Evaluation of an Exposure Control Efficacy Library (ECEL) », p. 9.

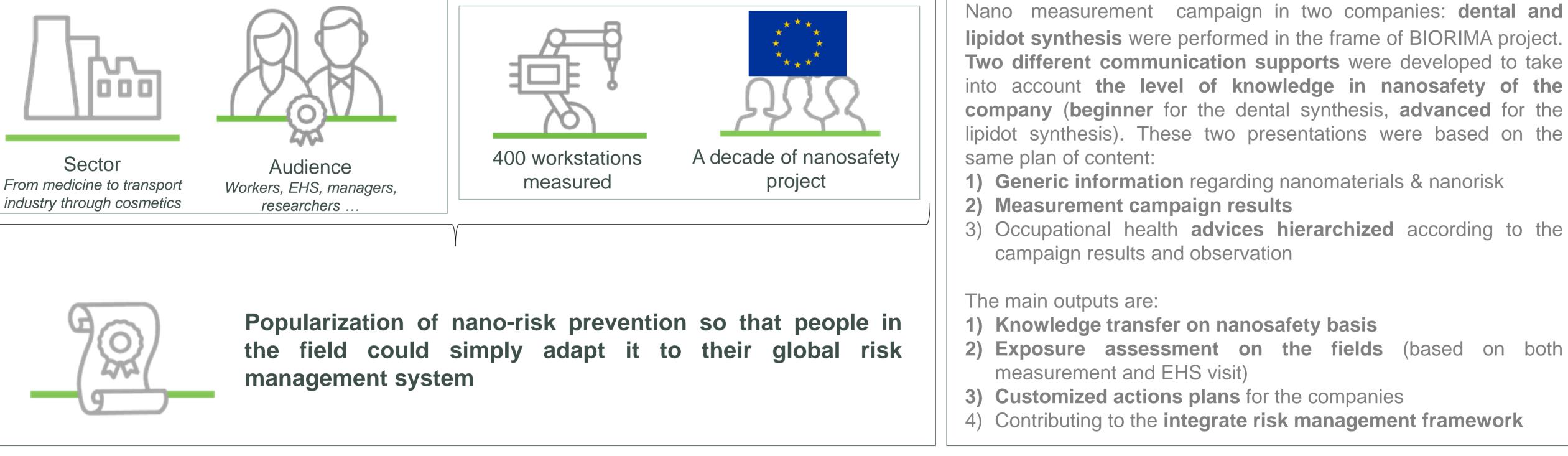
[3]D. Hristozov et al., « Frameworks and tools for risk assessment of manufactured nanomaterials », Environment International, vol. 95, p. 36-53, oct. 2016, doi: 10.1016/j.envint.2016.07.016.

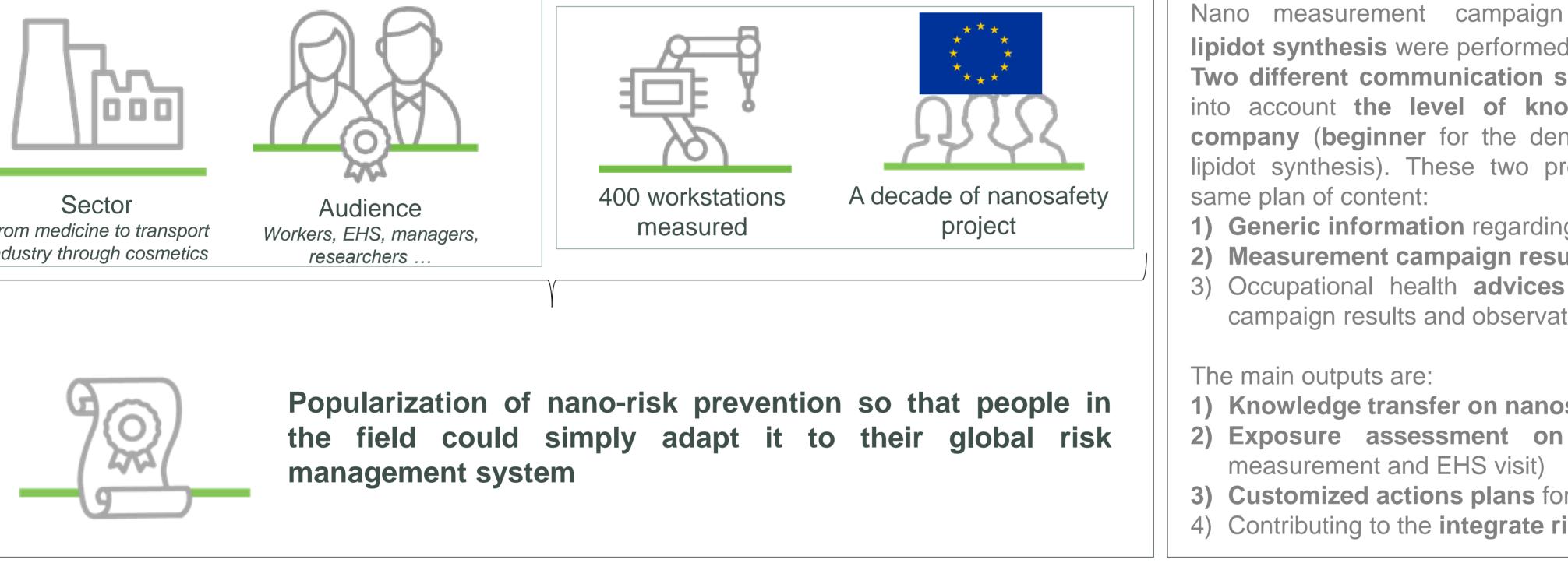
[4]A. Sánchez Jiménez, J. Varet, C. Poland, G. J. Fern, S. M. Hankin, et M. van Tongeren, « A comparison of control banding tools for nanomaterials », Journal of Occupational and Environmental Hygiene, vol. 13, no 12, p. 936-949, déc. 2016, doi: 10.1080/15459624.2016.1200191.

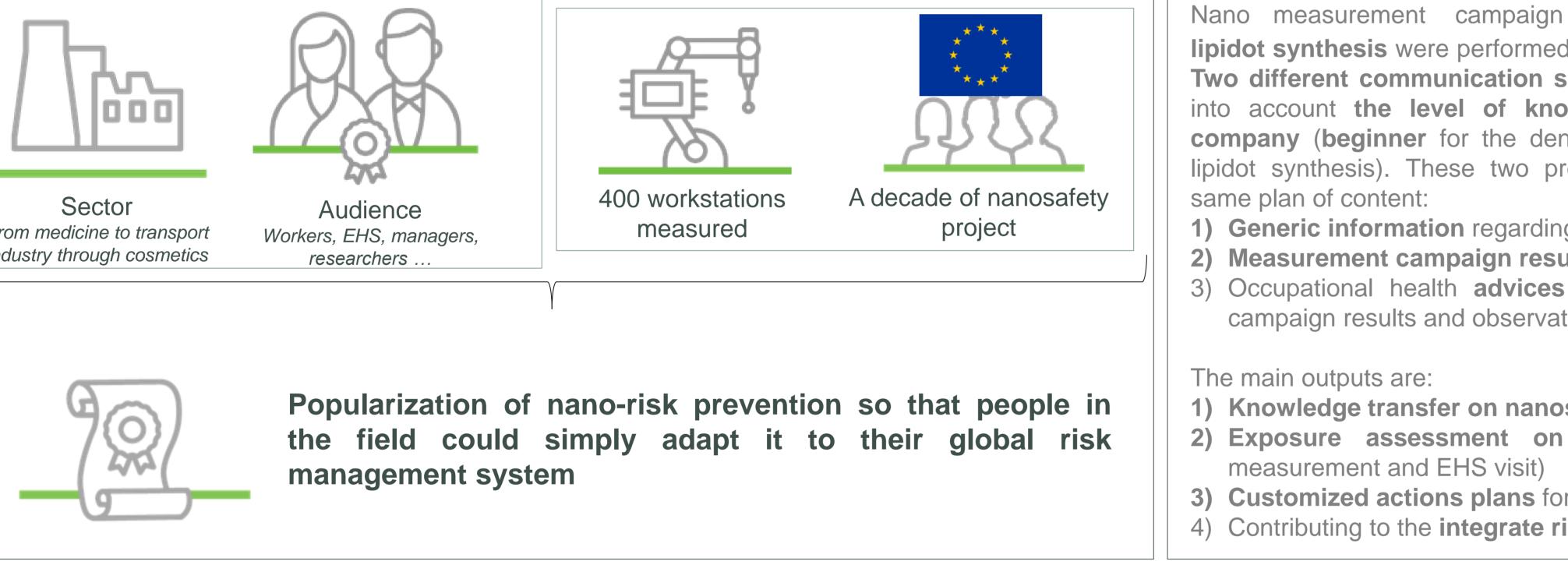
Specific trainings

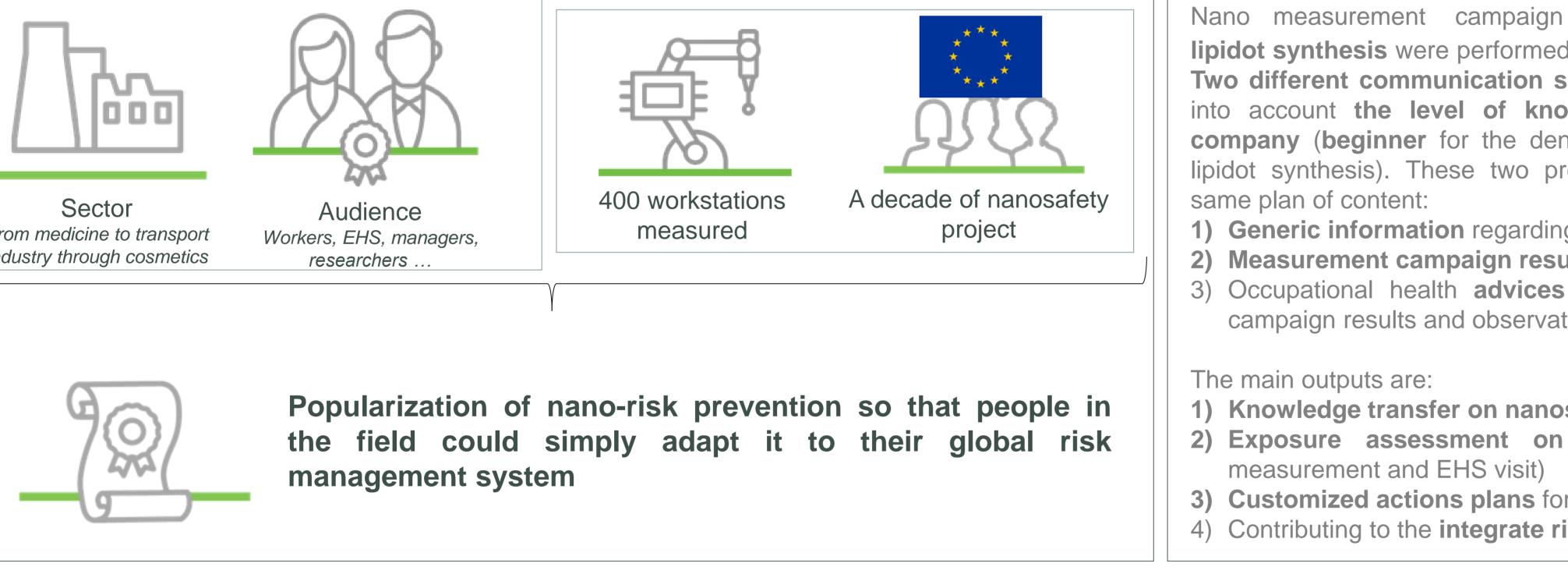
	BIORIMA	LILIAM	ENDURCRETE	CEA
Fields	Healthcare companies	Additive Manufacturing	Construction companies	All
Objectives	Raising companies awareness following measurement campaigns	Professional certification for three different audiences	Raising companies awareness	Organise nano-related prevention
Duration	2 hours	1 day ➔ 2 days	1 hour	1 day 3 days
Modalities	Face to face presentation	Face to face presentation	E-learning	Face to face presentation
Attendees	Employers or EHS engineer	Operators, Product or Process Engineer and Manager	Beginners in EHS issues	Operators or EHS engineers

Method









BIORIMA – Nano medicine

Nano measurement campaign in two companies: dental and lipidot synthesis were performed in the frame of BIORIMA project. Two different communication supports were developed to take into account the level of knowledge in nanosafety of the company (beginner for the dental synthesis, advanced for the





ENDURCRETE - Construction

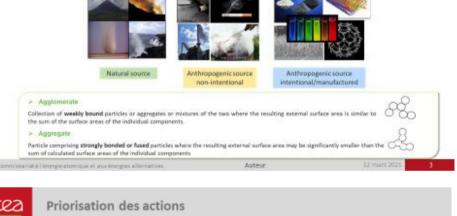
In ENDURCRETE project an one hour e-learning is dedicated to EHS issue in construction industry. The course contains the following sections :

- 1) Introduction to EHS
- 2) Occupational risk in construction industry
- 3) Emergent risk related to nanoforms
- 4) Organization and workers involvement

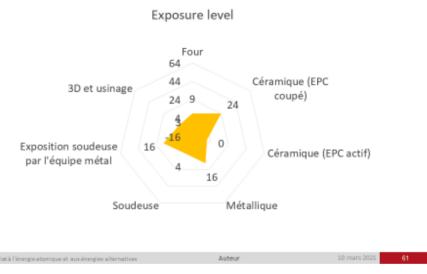
The section dealing with nanoforms last twenty minutes over the complete hour and focusses on:

Exposure assessment

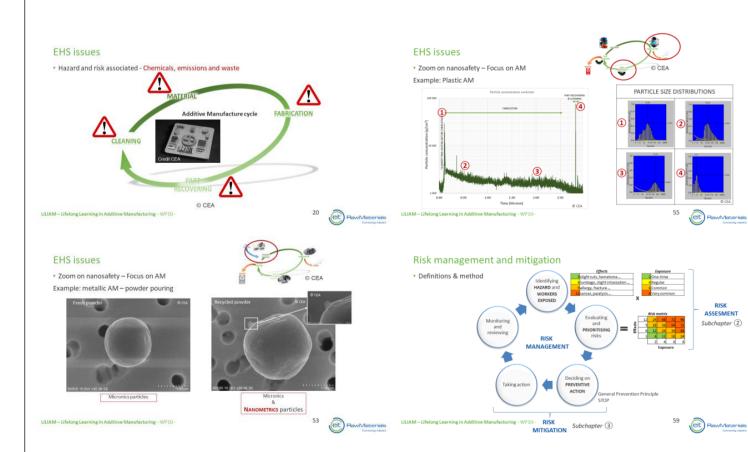
Example : Measurement during sanding operation



Objectif de priorisation des actions de prévention



LILIAM – Additive manufacturing



The EHS chapter contains information linked to : - Regulation & Definition

LILIAM, Lifelong Learning in Additive Manufacturing (AM), aimed to tackle the lack of multidisciplinary by setting up European competences an training program for specialists, professional engineers and managers in the field of AM technologies. An entire work package was dedicated to safety and one chapter to nanosafety. This course is fully adapted to the audience (table below) and based on CEA experiences in nanosafety issues related to AM:

Product Process Engineer Plan of content Manager Engineer / Operator audience

Nanoforms in construction industry

Structural function and durability improvement roperties Clay Fire resistance ements, mortars and Carbon nanotube ightness, mechanical resistance jurability and electrical conductivity Amorphous silica luidifier, mechanical resistance hermal protection Wood coatings cratch resistance Aluminium Oxyde Amorphous silic ratch resistance Amorphous silica ahtness and fire resistance

Mechanical resistance and lightness

Carbon nanotube

- Definition and terminology

-	Hazards and risks associated to AM	
-	Nanosafety	

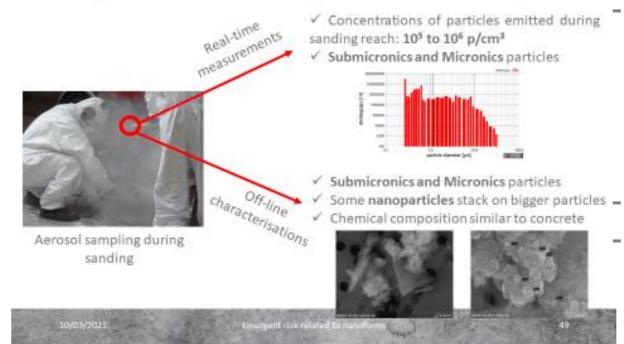
The EHS management and mitigation sections deals with:

- Risk assessment
- Risk prevention and mitigation

The LCA and LCC includes:

- Definition
- LCA: AM impact on product lifecycle
- LCC: costing models and applications to AM
- Case studies

EHS issues		Complete	Summary	
Risk management and mitigation		Complete	Summary	
Life Cycle Assessment & Cost	Complete	Complete	Complete	
Duration	1 day	2 days / 1 day	1.5 days	



How to address and measure nanoforms. The complexity of nanoforms measurement is defined. Methods, tools and equipment related to these measurements are presented. An example of measurement campaign in construction industry is shown.

Nanoforms in construction industry

"Nano-risk prevention" present the different steps of prevention against nano-risk. This section aims to help attendees in their choice.

Conclusions and perspectives:

Making industries aware of the available nanosafety tools, methods and means of prevention is crucial to avoid health and safety issues. Specific trainings should be developed for industry sector, professional workers as well as beginners in occupational health and safety issue. Through different EU projects, the CEA Nanosafety Platform currently develops specific training to bring existing resources to their intended industrial users. This type of initiatives enable companies to increase their nanosafety awareness in a sustainable way.

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