LIFE NANOHEALTH

LIFE20 ENV/ES/000187

Reducing nanoparticle exposures in industrial workplaces

EUROPEJSKIE ŚRODOWISKOWE PROJEKTY LIFE
- NABÓR 2020

Idea of the project

Assessment of exposure to nanomaterials in industrial workplaces is a widespread challenge because of the diversity of NP sources:

- **Manufactured nanomaterials (MNM),** which are intentionally designed and manufactured for specific aims.
- **Process generated nanoparticles (PGNP),** which are unintentionally generated and released to workplace air during industrial activities in which raw NP are not handled. These industrial activities are high-energy processes such as:
  - Thermal spray processes (HVOF, plasma, etc), firing, welding, grinding, engine combustion, plasma and laser cutting, etc.

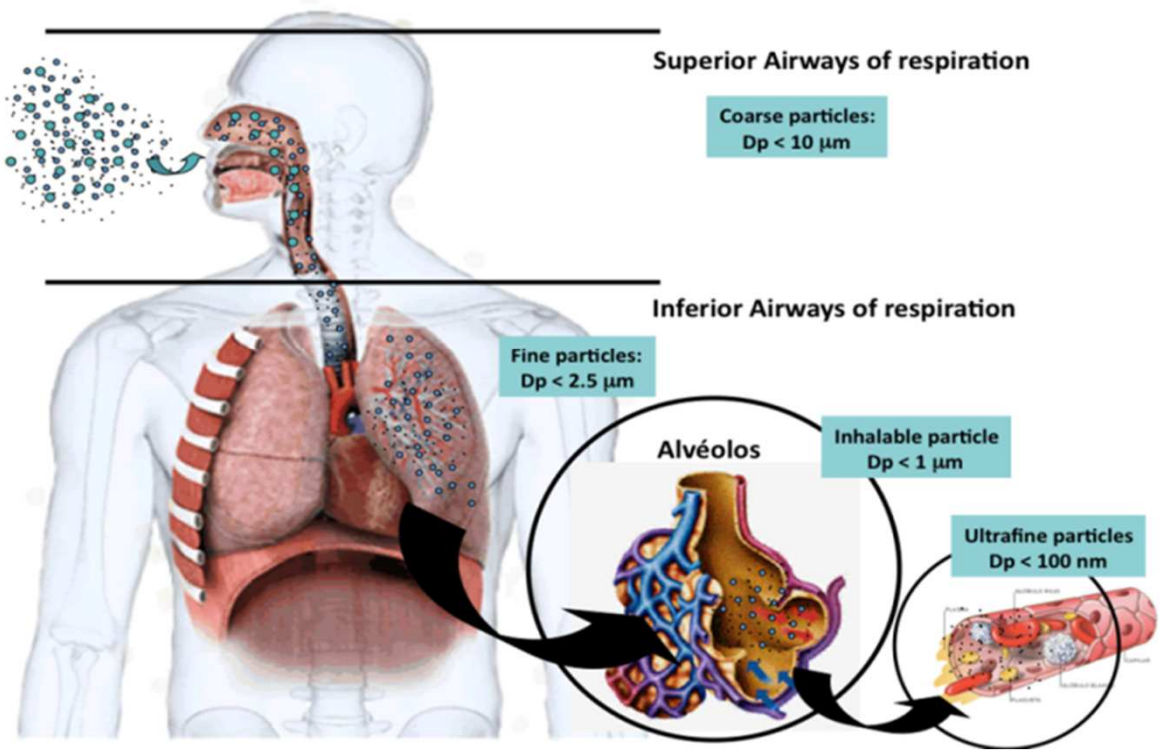





These industrial processes can be defined as permanent releasers of PGNP (up to several millions of NP/cm^3) which may lead to chronic exposures if these sources are not recognized and if control measures are omitted or not adequately designed.

Idea of the project

Health effects of aerosols



NPs <100nm, can penetrate by inhalation into the different segments of the respiratory tract, can be deposited on the alveolar walls by diffusion and can translocate into the lung, reaching the circulatory system and the organs it accesses.

Idea of the project

Currently, exposure assessment to PGNP faces several barriers:

1. Scope of the legislative framework: MNM are covered by the regulatory framework (REACH and CLP regulations). For PGNP there is a lack of dedicated legislation. Only nanoreference values (NRV) are available, being the limit established for MNM group 2b typically applied to PGNP (NRV: $4 \cdot 10^4$ cm^{-3}), but **there are no specific limit values for PGNP.**

2. Absence of Risk Assessment Tools (RAT): RAT have been designed for MNM in the REACH regulation, and therefore do not apply to PGNP**. The most promising methodology for PGNP exposure assessment in industrial settings is mass-balance modelling**. This type of tool requires well-characterized particle emissions in industrial settings under real world operating conditions.

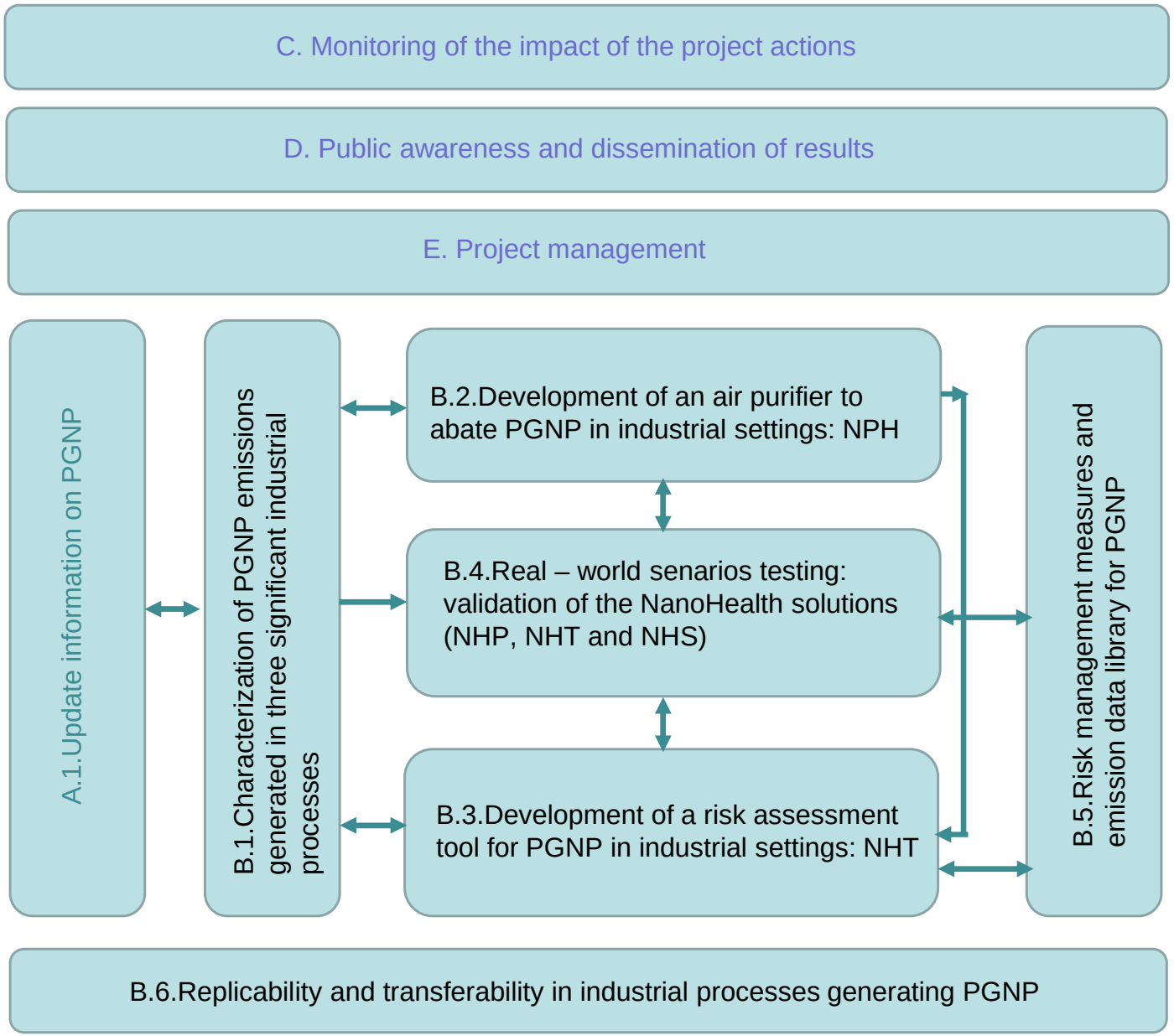
3. Lack of targeted Risk Management Measures (RMM): The efficacy of engineering controls are often inconclusive, especially in industrial environments under real-world operating conditions. The large diversity of industrial processes that generate PGNP requires the development of engineering controls which are easily adaptable to the needs of each industrial plant, and easy to monitor over time.

Objectives and scope

Reduction of occupational exposure to Process Generated Nanoparticles (PGNP) from industrial processes in indoor industrial scenarios

- Determination of the **levels and hazard of PGNP generated** during the three selected industrial processes: HVOF, APS and ceramic tile firing to assess the suitability of the current NRV.
- **Improvement of the accuracy of a mass balance model** to simulate the PGNP dispersion in indoor air.
- Identification of **hotspots** in industrial settings and PGNP dispersion simulation to select **the most appropriate Risk Management Measures (RMM).**
- Design of a user-friendly decision-support tool called **NANOHEALTH TOOL (NHT).**
- **Improvement of PGNP emission data and effectiveness of RMM** to reflect the reality in industrial settings under real-world operating conditions. These data will populate the **library for NHT.**
- Development of engineering control measures: **NANOHEALTH PURIFIER (NHP)** based on creating microenvironments with reduced PGNP concentrations.
- Design of a service for the control and minimization of PGNP in industrial settings called **NANOHEALTH SERVICE (NHS).**

Proposed actions



Timetable Start 01/01/2022 - End 31/12/2024

Action number	Name of the action	From	To	Months
A. Preparation actions				
A.1	Update information on PGNP	01/01/2022	28/02/2022	2
B. Implementation actions				
B.1	Characterization of PGNP emissions generated in three significant industrial processes	01/01/2022	30/09/2022	9
B.2	Development of an air purifier to abate PGNP in industrial settings: NHP	01/01/2022	31/12/2023	24
B.3	Development of a risk assessment tool for PGNP in industrial settings: NHT	01/01/2022	31/12/2023	24
B.4	Real-world scenarios testing: validation of the NanoHealth solutions (NHT, NHP and NHS) in three case studies	01/01/2023	31/12/2023	12
B.5	Risk management measures and emission data library for PGNP	01/07/2023	30/06/2024	12
B.6	Replicability and transferability in industrial processes generating PGNP	01/07/2023	30/06/2024	12
C. Monitoring of the impact of the project actions (obligatory)				
C.1	Monitoring of the impact of the project	01/01/2022	31/12/2024	36
C.2	Monitoring and measurement of LIFE key project level indicators	01/04/2022	31/12/2024	33
D. Public awareness and dissemination of results (obligatory)				
D.1	Networking and dissemination actions	01/01/2022	31/12/2024	36
E. Project management and monitoring of the project progress (obligatory)				
E.1	Project management	01/01/2022	31/12/2024	36

Project's Implementors:

✓ Coordinating Beneficiary:

✓ Associated Beneficiaries:

Research centres:

Private companies:

Risk prevention services:

Policymakers involved in the project

- Advisory Board (AB):

GOBIERNO DE ESPAÑA
MINISTERIO DE TRABAJO Y ECONOMÍA SOCIAL

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EU NanoSafety Cluster

AICE jtc UNIVERSITAT JAUME I

Product demonstrators

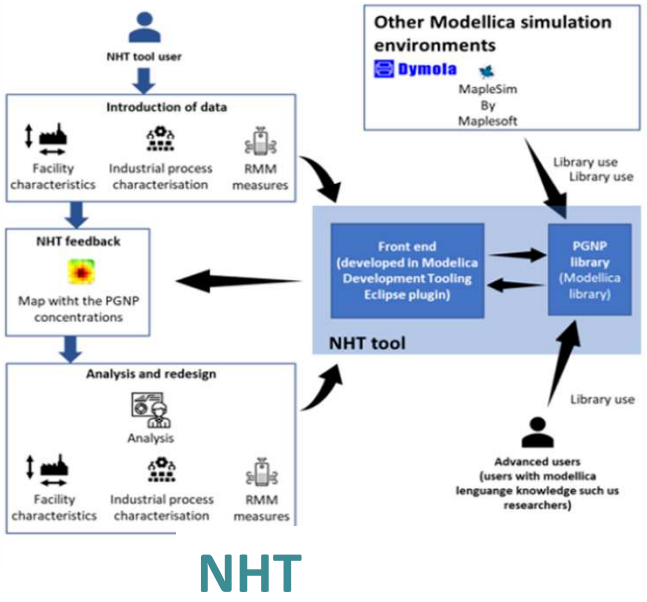
I. Product demonstrator 1: NANOHEALTH TOOL (NHT)

Action B3

Duration: 01/2022 – 12/2023

NHT is a user-friendly decision-support tool to:

- map PGNP concentrations;
- identify PGNP hotspots in industrial settings;
- select the set of optimal RMM for minimizing occupational exposures;
- quantify the effectiveness of the selected RMM in industrial environments under real world operating conditions.



NHT

PGNP library (action B5) will include all the elements to carry out simulation of the dispersion of PGNP emissions inside industrial settings and an open access **database of PGNP emissions** (for at least 10 industrial processes) and **effectiveness for at least 30 RMM engineering controls and personal protective equipment (PPE)**.

Product demonstrators

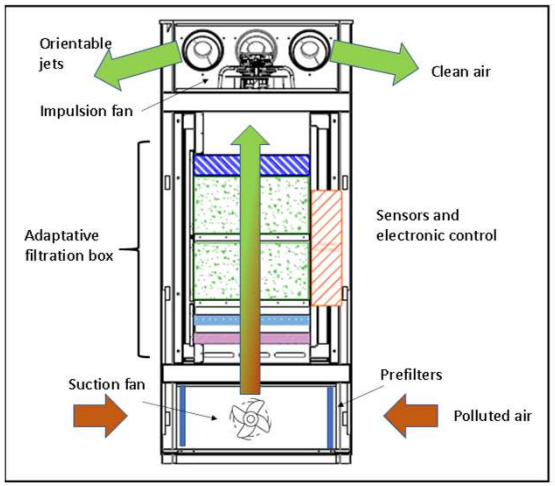
II. Product demonstrator 2: NANOHEALTH PURIFIER (NHP)

Action B2

Duration: 01/2022 – 12/2023

NHP is a prototype of an air purifier to:

- create microenvironments in the worker area covering an area of 600 m^2 .
- minimize PGNP levels in industrial settings with an abatement efficiency of >90%.



NHP

The NHP will be developed with a **versatile design** (flow range 2000 - 8000 m^3/h) and could be installed in a wide variety of industrial settings, being **transportable and adaptative.**

Product demonstrators

III. Product demonstrator 3: NANOHEALTH SERVICE (NHS)

Action B4

Duration: 01/2022 – 06/2024

NHS is a control guideline which include the NHT simulation module to:

- evaluate occupational exposure to PGNP in industrial settings making it more available to prevention services.
- develop specific Risk Minimization Plans.
- assess the technical and economic viability of the RMM proposed in the Risk Minimization Plan.
- evaluate experimentally the minimisation of PGNP emissions after the implementation of the RMM.

NHS

Project's pilot

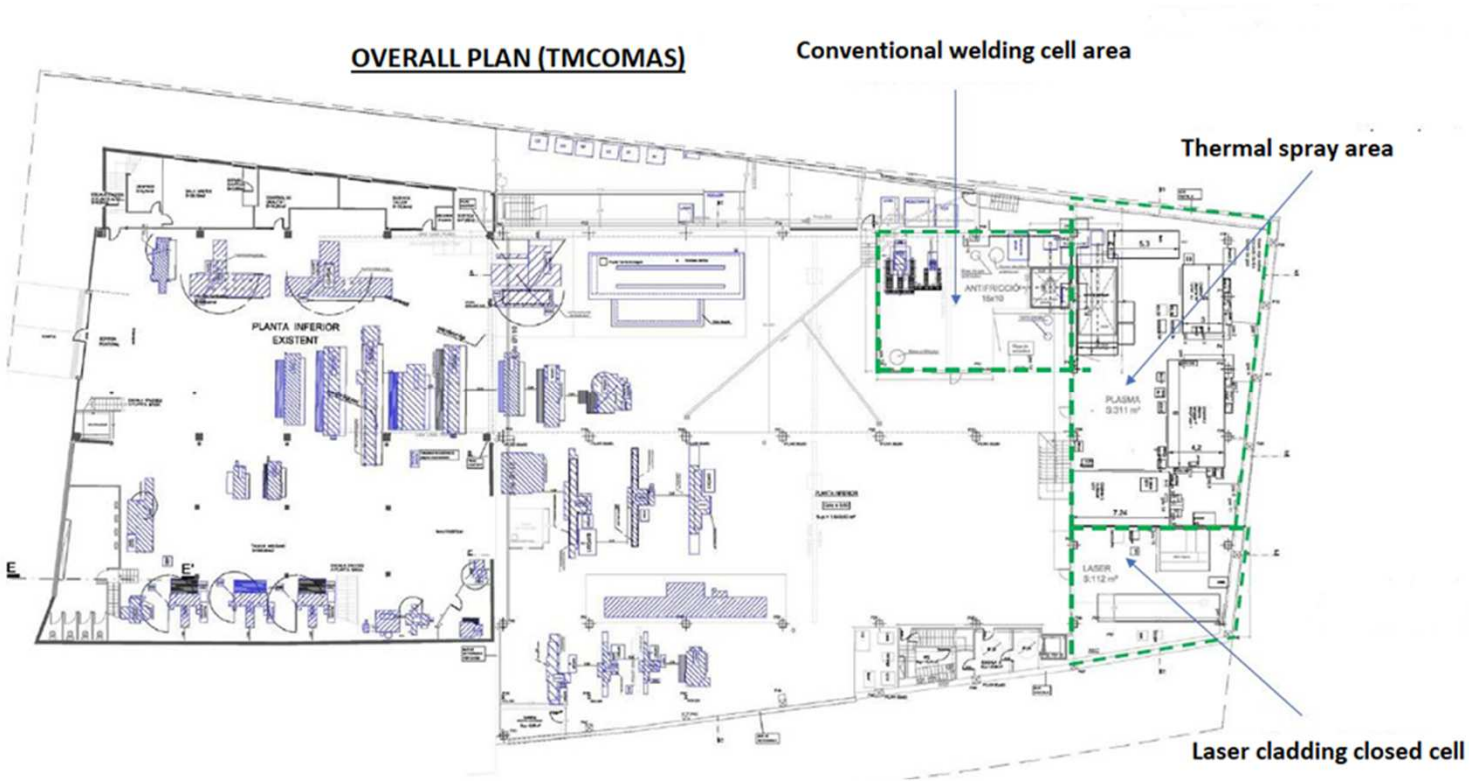
I. TMCOMAS plant

The experimental campaigns (B1 and B4) will focus on some specific closed areas as HVOF and APS

Thermal spray area is about 310 m^2

The spraying process take place in specific spraying booth (3 in total) (ACH=50-100)

Exposure risk 5 days a week



Project's pilot

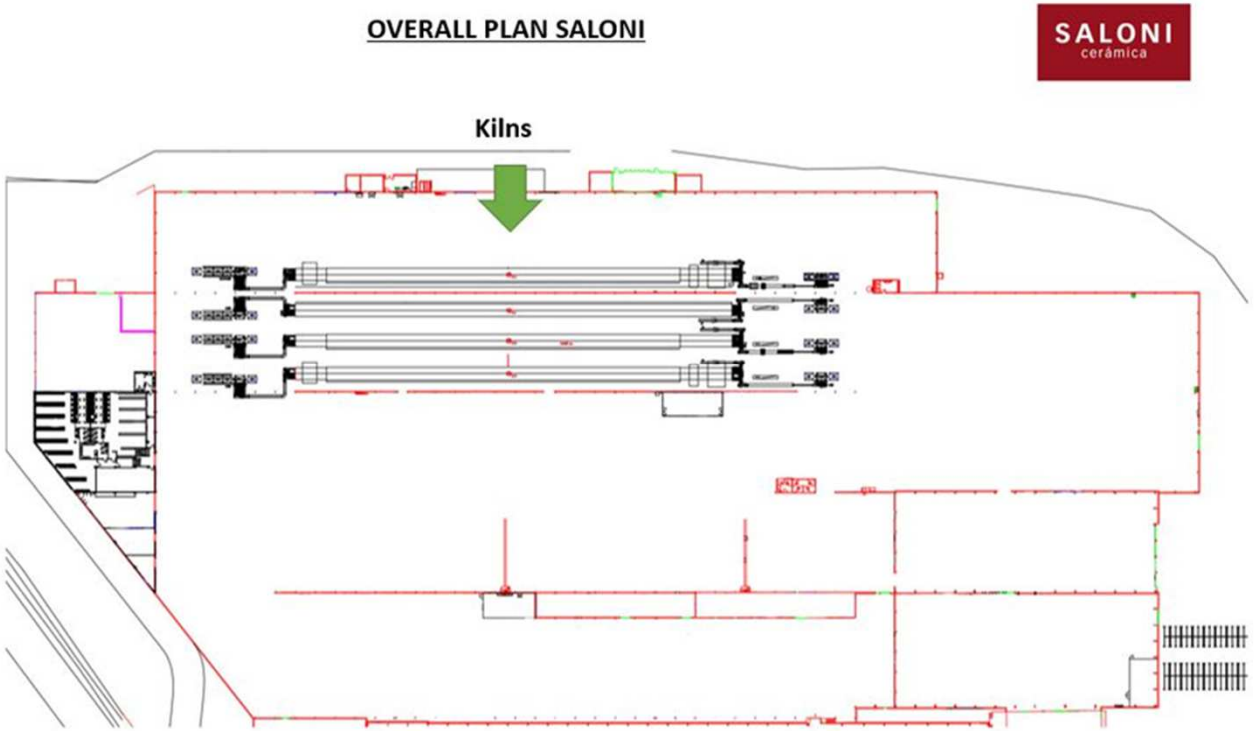
II. SALONI plant

The experimental campaigns (B1 and B4) will focus in the ceramic tile firing (5 ceramic kilns)

The kilns are not separated from the rest of the sections (no air extraction systems)

Productive area 275000 m^2

Exposure risk 7 days a week



Industrial process studied during the NANOHEALTH project

Industrial processes		Facilities
Case studies to develop the NHT, NHP and NHS	3 processes: HVOF, APA and ceramic tile firing	2 facilities: TMCOMAS and SALONI
Case studies for replicability	2 processes: APA and ceramic tile firing	2 facilities: UNIVERSITAT JAUME I and CERAMICA NULENSE
Case studies for transferability	5 processes: Welding, electrostatic spray paint application, combustion process of automotive engines, injection moulding and metal casting	4 facilities: FROST-TROL, CIA VALENCIANA DE SERVICIOS, PLASTICOS VICENT, AMADEO MARTI CARBONELL
After Life	3 processes: Ceramic tile firing, laser cladding and paint spraying	3 facilities: KERABEN, TMCOMAS, INDUSTRIAS SALUDES

Monitoring of the impact of the project actions

- **Monitoring the environmental problem addressed**
  - ✓ Particle number concentration
  - ✓ Particle mass concentration
  - ✓ Particle size distribution
  - ✓ Nanoparticle morphology and chemical composition
  - ✓ Particle cytotoxicity
  - ✓ Energy consumption
- **Socio-economic impacts of the project**
  - ✓ Number of jobs
  - ✓ Number of replication
  - ✓ Number of transferability
  - ✓ Market uptake indicators
- **Monitoring and measurement of LIFE key project level indicators**

Who benefits from LIFE NANOHEALTH?

LIFE NANOHEALTH firstly benefits exposed workers to PGNP

- ✓ The RMM selected will minimise worker exposure to by at least 75% (from 4-9. 105 to < 4. 104 cm^{-3}).
- ✓ The NHP purifier will achieve an abatement efficiency of PGNP > 90% in microambients covering an area of 600 m^2.

LIFE NANOHEALTH also benefits policymakers

- ✓ The suitability of the current Nano Reference Values (NRV) for PGNP will be benchmark tested in industrial settings under real operation conditions.

And LIFE NANOHEALTH also benefits the industrial sectors offering solutions to minimize PGNP emissions

- ✓ The NHT tool to obtain concentration maps, with an accuracy >60% if general project information is available and >75% if detailed information is available.
- ✓ The NHP purifier with a versatile design so that its abatement efficiency can be achieved in different industrial processes.
- ✓ The NHS service to evaluate occupational exposure to PGNP in industrial settings by health and safety departments.

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THANKS FOR YOUR ATTENTION