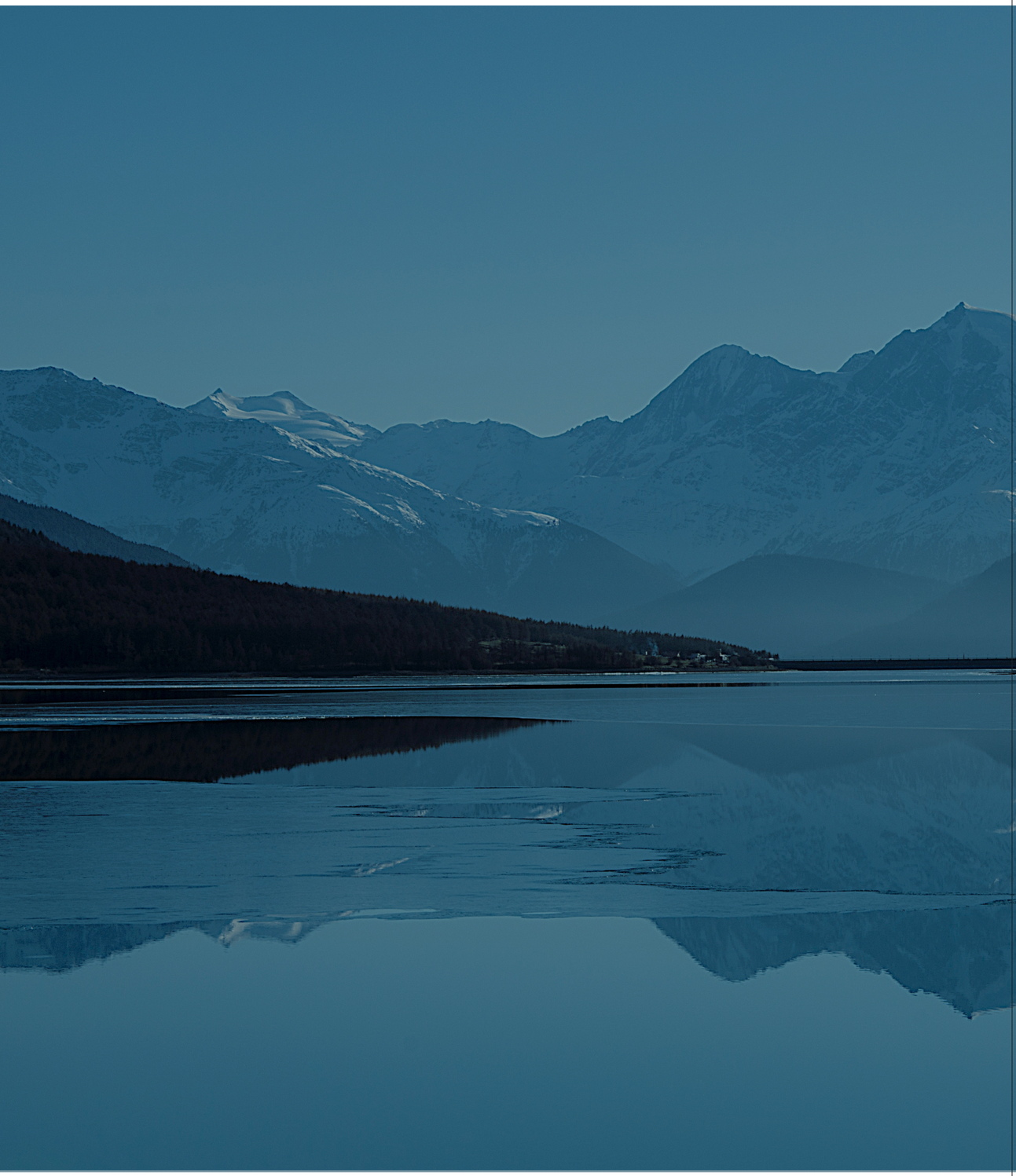
nanoMONITOR

LAYMAN´S REPORT

Development of a real-time information and monitoring system to support the risk assessment of nanomaterials under REACH (NanoMONITOR)

LIFE14 ENV/ES/000662



DATA PROJECT

Project location	Valencia, Spain
Project start date	01/01/2016
Project end date	31/12/2018
Total budget	1,131,582 Euro
EC contribution	678,947 Euro
(%) of eligible costs	60 %

DATA BENEFICIARY

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PROBLEM TARGETED

Advancements in the fields of nanoscience and nanotechnology have resulted in a myriad of possibilities for industrial and consumer product applications (Vance, M.E. et al., 2015), facilitating major breakthroughs in different application domains. However, the nanoscale opens the doors to new or different potential risks on human health and the environment that are still not fully explored.

The evaluation of the potential impact of engineered nanomaterials (ENMs) in human health and the environment requires data on both effects and exposure. In this sense, current nanosafety research has dedicated large efforts into gaining knowledge on the biological effects that ENMs can provoke, and how these may influence human health and the environment. In contrast, research aiming to improve our understanding of the possible exposure arising from all stages of the production, use and disposal of ENMs is far less advanced (Fito-López, C. et al., 2015).

Moreover, current studies focused on the environmental release of ENMs and exposure to ENMs in areas other than industrial settings (e.g. urban areas) are scarce. This is mainly due to the lack of techniques to quantitatively monitor ENM emissions to and concentrations in urban areas and/or the environment. Therefore, very little is known about the presence, type, composition and form of released ENMs.

In a situation when several nanomaterials have already entered the market, a better knowledge on the concentration of ENMs at workplaces, urban areas and the environment are of special relevance to support the risk assessment. In addition, last April 26th, 2018, Member states voted in favour of amending several REACH annexes to clarify registration requirements of NMs, considering that information on uses of and exposure to NMs should be provided to demonstrate their safe use. Therefore, robust and reliable exposure data are needed to meet the growing demand to support a high level of protection of the human health and the environment.

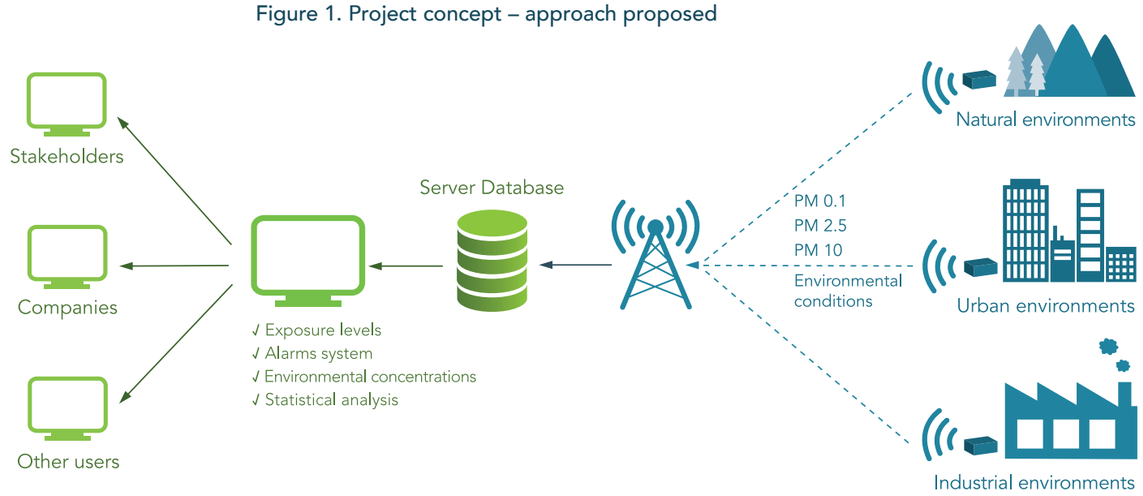
NanoMONITOR SOLUTION

The overall objective of the project is to improve the use of environmental monitoring data to support the implementation of REACH regulation and promote the protection of human health and the environment when dealing with engineering nanomaterials (ENMs), a new class of emerging pollutants. To this end, the project takes the challenge of developing an innovative monitoring system to characterise the concentration of ENMs in indoor workplaces, urban areas and relevant environmental compartments.

This system is composed of two integrated elements:

- A new monitoring station prototype designed to measure the concentration of key airborne nano-pollutants in terms of particle number concentration, mass, surface area and average particle diameter.
- A web-based software data analysis tool for collecting and archiving data on the environmental concentration of ENMs.

Figure 1. Project concept – approach proposed



PROJECT DEVELOPMENT

The project has been coordinated by ITENE, a technological institute located in Valencia (Spain), with wide experience in nanotechnology and safety issues. The scheduled actions are supported by the Mediterranean Centre for Environmental Studies (CEAM), a research organisation located in Valencia (Spain); the Greek company AXON Envirogroup, selected due to its extensive experience in the development and application of integrated models and tools for the prediction and estimation of air pollutants levels; UK-based company Yordas Group, selected due to its wide experience in REACH implementation and relevance to support the promotion at a regional and national scale.

The specific actions conducted are depicted in the table:

ACTION NUMBER	ACTION TITLE	ACTION LEADER
Preparatory Actions		
A.1.	Identification and characterisation of environmentally relevant nano-pollutants	ITENE
A.2.	Definition of monitoring data information and quality requirements according REACH	ITENE
A.3.	Information gathering and analysis of the existing environmental monitoring data	CEAM
A.4.	Definition of the functionalities and implementation plan of the LIFE NanoMONITOR monitoring system	AXON
Implementation Actions		
B.1.	Development of a web-based library of exposure scenarios and measured data on the exposure and release of ENMs	ITENE
B.2.	Development of the web-based NanoMONITOR software	AXON
B.3.	Design of the monitoring stations and measurement devices	ITENE
B.4.	Implementation and integration of the monitoring system in the existing remote sensing network	CEAM
B.5.	Guidance on the sampling methods and analytical techniques for the analysis and monitoring ENMs in the environment	ITENE
B.6.	Testing and validation of the NanoMONITOR information and monitoring system by target stakeholders	ITENE
B.7.	Test activities for end users and stakeholders	YORDAS
Monitoring Actions		
C.1.	Definition of the starting situation regarding the use of environmental monitoring data under	ITENE
C.2.	Strengthening of the knowledge on the concentration of nanomaterials in air, water and soil	YORDAS
C.3.	Promotion of the use of exposure/environmental monitoring data in the protection of human health and the environment	CEAM
C.4.	Promotion of REACH fulfilment	ITENE
C.5.	Assessment of the socio-economic impact of the project actions	ITENE
Communication and dissemination actions		
Project management and monitoring of the project actions		

Considering the objectives of the project and in view of the project scheduled actions, the activities conducted has been focused on:

1. The design and development of the monitoring station prototype;
2. The programing of the web-based data acquisition software;
3. The design and development of a web based exposure scenario library, and;
4. The edition of a complete guidance intended to be used by health and safety advisors, researchers and policy makers for undertaking sampling and monitoring activities in indoor workplaces, urban areas and relevant environmental compartments, including surface water, ground water, wastewater, sediments, and soils.

In detail, the most relevant tasks and activities conducted can be summarised as follows:

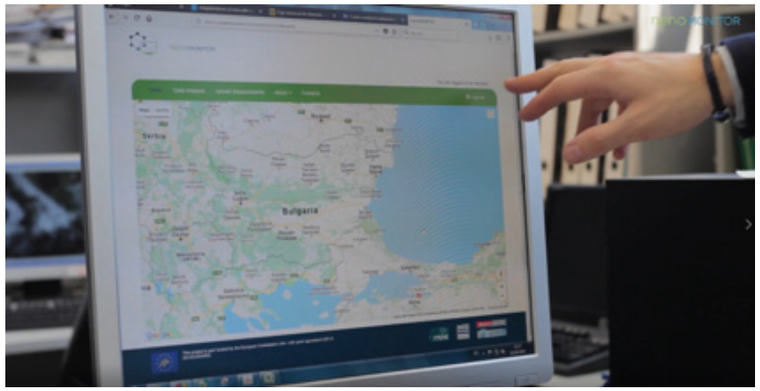
1. Selection of the most relevant ENMs in the context of REACH, including carbon-based materials, metal and metal oxide nanoparticles, layered nanoclays and nanocellulose whiskers;
2. Characterisation and description of the main activities and processes that are conducted across the life cycle stages of the target ENMs, describing in detail those processes that affect exposure and release in the workplace;
3. Identification and description of the quality criteria and information requirements that shall satisfy measured data to be used for risk assessment purposes under the context of REACH, as well as the definition of a step-wide procedure to evaluate the validity of measured data upon REACH registration, risk assessment and environmental impact studies;
4. Development of an on-line inventory of exposure scenarios and exposure monitoring data to ease the access and promote the use of the data generated within the project for risk assessment purposes;
5. Development and deployment of a back-end Application Server accompanied by a web-based client application to support the visualisation and management of data by stakeholders;
6. Design and development of the monitoring station prototype based on the functionalities identified by the members of the consortium, as well as the information requirements and data quality criteria to support the risk assessment of nanomaterials;
7. Monitoring of PM0.1 data in urban areas by means of the integration of the monitoring stations in existing air quality cabins of the monitoring network of the Valencian Community (Spain), the municipality of Thessaloniki (Greece) and Lancaster (UK);

8. Design and development of the guidance to support the standardisation of the sampling methods and analytical techniques to be used under occupational exposure and environmental monitoring campaigns;
9. Definition of a priority list of actions to comply with REACH regulation according with the information generated on the levels of exposure and effectiveness RMMs studied;
10. Dissemination of the main outcomes of the project to the target audience by means of dedicated materials, workshops, webinar and networking events.

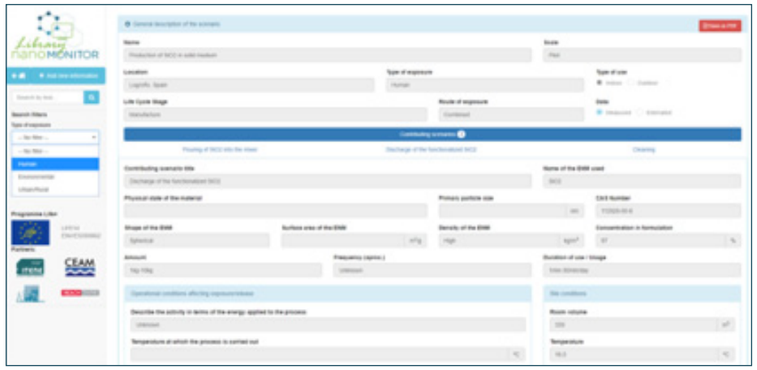
RESULTS

Following results were accomplished:

√ An online software application to support the data processing in real-time



√ A database containing information on the concentration of ENMs, designed and structured according to the information requirements laid down in REACH and relevant monitoring programs



√ A proven low-cost monitoring station prototype

√ A complete guidance on the use of environmental monitoring data under REACH, including detailed decision trees to support the use of monitoring data

√ New information on tonnage levels and release rates to air, surface, fresh and marine water, waste water and soil of relevant ENMs

√ New knowledge on the airborne behaviour of the target ENMs, including new data on their aggregation/ agglomeration patterns and deposition factors

√ A structured compendium of free webinars and workshops to support the training of end-users and stakeholders

√ A set of informative material to disseminate the project actions at a Regional, National and EU level

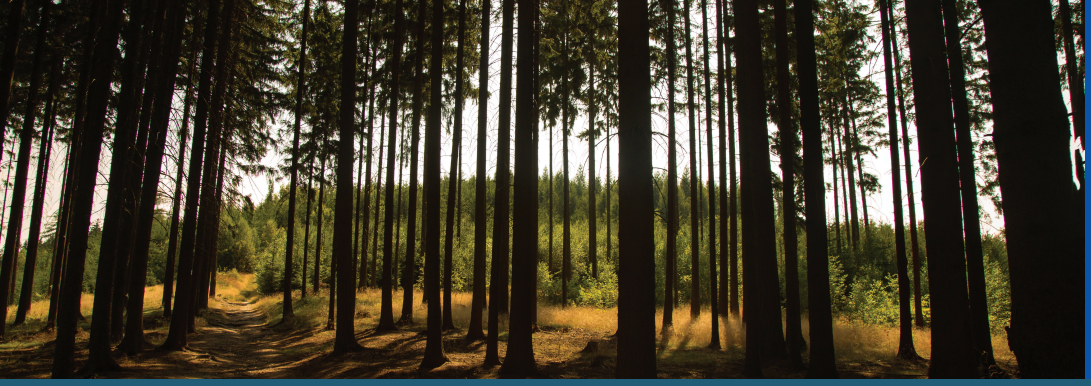
CONCLUSIONS

A proper understanding of the concentration of engineered nanomaterials (ENMs) will support the identification of critical activities in industrial sites, as well accumulation areas in the environment. Both are key to support the implementation of measures to control and reduce release.

In industrial sites, the new data that has been generated on the concentration of ENMs in workplaces during relevant activities support the definition of strategies to control the release by small and medium-sized enterprises (SMEs) and large enterprises (LEs) on-site. Additionally, the data contributes to decision-making by emergency response teams and regulatory bodies, which will be able to define new procedures and controls specifically implemented to limit the release of ENMs.

In urban areas, the use of the monitoring station contributes to a proper design of the ventilation systems in subway stations, detecting leaks of ENMs through currently implemented filtering units.

As long-term results from the project, it is estimated an overall reduction of unintentional emissions from the production process to the main environmental compartments by at least 10 % due to a better knowledge of the of current concentration levels in indoor and outdoor areas, helping companies on the identification of emission sources and the implementation of risk management measures to control unintentional emissions.



INSTITUTO TECNOLÓGICO DEL EMBALAJE, TRANSPORTE Y LOGÍSTICA

ITENE

CEAM

FUNDACIÓN CENTRO DE ESTUDIOS AMBIENTALES DEL MEDITERRÁNEO

AEON

yordas Group

Business through Science