SCAFFOLD: Innovative strategies, methods and tools for occupational risks management of manufactured nanomaterials in the construction industry

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Innovative strategies, methods and tools for occupational risks management of manufactured nanomaterials in the construction industry

Source: FIEC and EFBWW (2009)
Companies and workers are using and handling MNMs and nano-products in construction

- Exposures are produced at different stages of the construction life cycle
- Occupational Legislation: complex scenario (Stakeholders)

- **Uncertainty** for industry
- **Proactive approach**

SCAFFOLD is an **industry-oriented** idea specifically focussed on providing **practical, robust, easy-to-use and cost effective solutions** to the **European construction industry**, regarding current **uncertainties** about occupational exposure to MNMs.
The aim of the SCAFFOLD project is to develop, test, validate in real conditions and disseminate a new holistic, consistent and cost effective Risk Management Model (RMM) to manage occupational exposure to MNMs in the construction sector.

This will be done by integration of a set of innovative strategies, methods and tools developed by the project into consistent state-of-the-art safety management systems (OSHAS 18001 + ISO 31000).

**Project Duration:** Three years (2012 – 2015)

**Project Budget:** 3,7 M€

**Call identifier:** FP7-NMP-2011-SMALL-5

**Work program topic addressed:** NMP.2011.1.3-2 Worker protection and exposure risk management strategies for nanomaterial production, use and disposal.

**Project EC Funding:** 2,5 M€
## Innovative strategies, methods and tools for occupational risks management of manufactured nanomaterials in the construction industry

<table>
<thead>
<tr>
<th>No.</th>
<th>Beneficiary name</th>
<th>Short name</th>
<th>Country</th>
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<tbody>
<tr>
<td>1</td>
<td>Fundación TECNALIA Research and Innovation</td>
<td>TECNALIA</td>
<td>Spain</td>
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<td>2</td>
<td>Commissariat à l'Énergie Atomique et aux Énergies Alternatives</td>
<td>CEA</td>
<td>France</td>
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<td>3</td>
<td>National Centre for Scientific Research &quot;DEMOKRITOS&quot;</td>
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<td>Greece</td>
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<td>4</td>
<td>Centralny Instytut Ochrony Pracy - Państwowy Instytut Badawczy</td>
<td>CIOP-PIB</td>
<td>Poland</td>
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<td>Acciona Infraestructuras S.A.</td>
<td>ACCIONA</td>
<td>Spain</td>
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<td>6</td>
<td>Asociación Española de Normalización y Certificación</td>
<td>AENOR</td>
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<td>Mostostal Warszawa S.A.</td>
<td>MOSTOSTAL</td>
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<td>9</td>
<td>Tecnología Navarra de Nanoproductos S. L.</td>
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<td>NETCOMPOSITES Limited</td>
<td>NETCOMPOSITES</td>
<td>UK</td>
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<td>11</td>
<td>Institutul de Cercetari Pentru Echipamente si Tehnologii in Constructii</td>
<td>ICECON</td>
<td>Romania</td>
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<td>12</td>
<td>European Virtual Institute for Integrated Risk Management</td>
<td>EU-VRI</td>
<td>Germany</td>
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<td>Tyoeterveyslaitos</td>
<td>FIOH</td>
<td>Finland</td>
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<td>14</td>
<td>Regents of University of Minnesota</td>
<td>UMN-PTL</td>
<td>United States</td>
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Health and Environmental Impact of Nano-Enabled Products Along Their Life Cycle

nanoLCA 2013 - Joint workshop of NanoPolyTox, NanoSustain and NanoFATE. Barcelona, 8-05-2013

GA: 280535
Innovative strategies, methods and tools for occupational risks management of manufactured nanomaterials in the construction industry

SCAFFOLD initial roadmap

- 6 selected construction applications
- 5 selected MNMs (TiO$_2$, SiO$_2$, CelluloseNF, CNF and Nanoclays)
- 6 categories of selected exposure scenarios
- 5 Industrial Use Cases for demonstration

Information and data about strategies, methods and tools for MNMs
Risk Management in Construction

Selected industrial needs and gaps

Analysis and detection of industrial needs & gaps (WP1)

Relevant useful information

SCAFFOLD focused research on:
- MNMs Risk Prevention (WP2)
- MNMs Risk Assessment (WP3)
- MNMs Risk Protection (WP4)

SCAFFOLD intermediate outcomes:
New Strategies and methods for Risk Prevention, Risk Assessment and Risk Protection

INTEGRATION of solutions:
Risk Management Model & Toolkit (WP5)

RELEVANT information

Models for OHS Management (OHSAS 18001 - ISO 31000)

State-of-the-art knowledge

DEMONSTRATION in real industrial scenarios (WP6)

Main SCAFFOLD final outcomes:
- Risk Management Model (RMM)
- Toolkit for RMM implementation
- Customized RMM & Toolkit for SMEs

New knowledge:
innovation beyond the State-of-the-art

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Six applications of MNMs in construction:

1. Depollutant mortars
2. Self-compacting concretes
3. Stabilised, Bituminous road-surface
4. Self-cleaning external coatings
5. Fire-resistant panels and
6. Insulations

Five MNMs: TiO$_2$, SiO$_2$, Cellulose Nanofibres, Carbon Nanofibres and Nanoclays

Six categories of exposure scenarios (integrating 26 individual exposure scenarios):

1. Manufacturing NMs
2. Manufacturing products containing MNMs,
3. Preparation, mixing, and application on site
4. Assembly and machining
5. Demolition and disposal
6. Accidental fires (Combustion of MNMs)
Five Industrial Use Cases (IUC) – demonstration activities – covering three stages of the MNMs Life Cycle

1.- Manufacturing NMs
2.- Manufacturing CP containing NMs
3 & 4.- Preparation and use of CP containing NMs
5.- End of life of CP containing NMs

- Test the SCAFFOLD RMM into industrial construction companies in real-life situations to demonstrate their validity and use for effective management of MNMs occupational exposure along Life Cycle in the European Construction Sector.
- Focus research activities on some specific and priority industrial applications, scenarios and MNMs of the European Construction industry.
- Focus the project research tasks in the IUC (industrial demonstration) from the very beginning of the project.
- Develop demonstration activities (IUC) across Europe considering different safe-cultures and awareness levels as well us company scales (large and SMEs).
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SCAFFOLD
Risk Management Model (RMM)

OSHAS 18001
ISO 31000

SCAFFOLD Toolkit + SMEs

WP6 (DEMO)
IMPLEMENTATION:
Industrial cases

VERIFICATION:
Audits

WP7
STANDARDIZATION:
“OSHAS 18001 Application guide for construction industry regarding MNM risks”

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General status of the project (May 2013)

WP1. PROFILING THE EU CONSTRUCTION INDUSTRY FACE THE MNMs OCCUPATIONAL EXPOSURE (ACCIONA)

WP2. MNMs RISK PREVENTION (NETCOMPOSITES)

WP3. MNMs RISK ASSESSMENT (TECNALIA)

WP4. MNMs RISK PROTECTION AND CONTROL (CEA)

WP5. MNMs RISK MANAGEMENT: INTEGRATION OF SOLUTIONS (AENOR)

WP6. TESTING AND VALIDATION THE RMM & TOOLKIT IN CONSTRUCTION INDUSTRY (MOSTOSTAL)

WP7. DISSEMINATION AND EXPLOITATION (EU-VRI)

WP8. PROJECT MANAGEMENT (TECNALIA)

Health and Environmental Impact of Nano-Enabled Products Along Their Life Cycle

nanoLCA 2013 - Joint workshop of NanoPolyTox, NanoSustain and NanoFATE. Barcelona, 8-05-2013

GA: 280535
1. Objectives WP1: Profiling the European construction industry

1. To develop a Life Cycle Analysis (LCA) for each of project select MNMs (TiO$_2$, SiO$_2$, Cellulose Nanofibers, Carbon Nanofibers and Nanoclays) (Processes)

2. To collect and analyse sound available information on NMs occupational exposure

3. To develop a roadmap on occupational exposure to MNMs in the construction sector.
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LCA - Process

<table>
<thead>
<tr>
<th>Process Data Sheet</th>
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**BUILDING**
Residential, Educational, Commercial, Industrial, Military, Official, Sport

<table>
<thead>
<tr>
<th>2. Construction</th>
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</thead>
<tbody>
<tr>
<td>Clearance and demolition</td>
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<tr>
<td>Formwork and concrete</td>
</tr>
<tr>
<td>Foundation laying</td>
</tr>
<tr>
<td>Insulations and FR panels</td>
</tr>
<tr>
<td>Iron works Walls Plumbing</td>
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<tr>
<td>Finishing Paint Polish</td>
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<tr>
<td>Maintenance</td>
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<tr>
<td>Demolition</td>
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**EXPOSURE SCENARIOS:**

<table>
<thead>
<tr>
<th>1</th>
<th>FOUNDATION LAYING</th>
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<tbody>
<tr>
<td>ES7: Concrete mixing for piles, slabs and special structures</td>
<td></td>
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<tr>
<td>ES8: On-site Assembly/Machining</td>
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<tr>
<th>2</th>
<th>INSULATIONS AND FIRE RESISTING PANELS</th>
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<tbody>
<tr>
<td>ES19/ES23: Off-site manufacturing → Not considered in the project</td>
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<tr>
<td>ES20/ES24: Fitting of the panels and machining for the superficial installations of other elements</td>
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<tr>
<th>3</th>
<th>WALLS</th>
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<tbody>
<tr>
<td>ES15: Preparation, dosification of coatings</td>
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<td>ES16: Application of coatings, superficial machining</td>
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<th>4</th>
<th>MAINTENANCE</th>
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<tr>
<td>ES10/ES18/ES22/ES26: Accidental Fire: MNMs combustion</td>
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<th>5</th>
<th>DEMOLITION</th>
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<tr>
<td>ES9/ES17/ES21/ES25: Demolition, end of life</td>
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</table>
WP2: Risk prevention (Safer product)

1. To develop intrinsically **safe MNMs formulations** (stable dispersions)

2. To develop **fire retardant nanocomposite formulations** with minimum risk to health & safety

3. To develop strategies for **safe nano-filled concrete, bituminous pavements, coatings and insulation**

4. To **integrate** previous results in a **common vision** on new strategies, methods and tools for MNMs risk prevention
WP3: Risk Assessment

1. To test the effectiveness of the current solutions for collective protection efficiency to MNMs selected by the project
2. To test the effectiveness of the current solutions for personal protection efficiency (e.g., masks, gloves, clothing) to nanopowders and
3. To develop novel risk protection strategies and methods for the sector, including a proposal method for ISO standardization, a decision making strategy for PPEs selection and a new device for MNMs trapping.
4. To develop a control banding approach to be adapted for construction sector
5. To develop an exposure register model and the guidance for monitoring health of probably exposed workers
6. To integrate previous results in a common vision on new strategies, methods and tools for MNMs protection.
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MANUFACTURING

1. Decontaminant MORTAR TiO2
2. Self-compacting CONCRETE SiO2
3. Self-cleaning SOL-GEL coating TiO2
4. ROAD SURFACE NanoCell
5. FR PANELS Clay
6. COATINGS CNF
7. INSULATIONS Clay

FORMULATION & APPLICATION

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MACHINING

DEMOLITION
WP4: Risk Protection

1. To test effectiveness of current solutions for **collective protection** against the MNMs selected by the project

2. To test effectiveness of current solutions for **personal respiratory protection** (e.g., masks) (MNMs selected by the project)

3. To test effectiveness of current solutions for **dermal protection** (e.g., gloves, clothing) (MNMs selected by the project)

4. To develop **novel risk protection strategies and methods** for the sector, including a proposal method for ISO standardization, a decision making strategy for PPEs selection and a new device for MNMs trapping

5. To develop a **control banding approach** customized for the construction sector

6. To develop an exposure register model and the **guidance for monitoring health** of probably exposed workers

7. To integrate previous results in a **common vision** on new strategies, methods and tools for MNMs protection
WP5: Risk Management

1. To develop the Risk management Model (RMM) by using a convergent approach with requirements of the OHSAS 18001 and ISO 31000 standards: RMM structure, specific elements, implementation and audit process, compatibility and convergence with other management systems.

2. To construct an innovative Toolkit (Software) to facilitate the RMM initial review, planning, implementation, monitoring and audit in the construction companies.

3. To customize the RMM approach for construction SMEs.

4. To integrate previous results in a common vision on new strategies, methods and tools for MNMs risk management defining methods and tools to be used in each case.
WP7: Dissemination and exploitation

1. To disseminate the achieved results and knowledge via general dissemination (web, conferences, articles, papers…)
2. To communicate, share and transfer relevant knowledge about the project results to the European construction industry in particular and to the other interested parties in general.
3. To coordinate specific dissemination actions with the European Nanosafety Cluster and non-European partners
4. To convey the results of the project into the relevant standardization committees with pre-standards and CE marking activities
5. To formulate a proposal for an European strategy on MNMs occupational risk management in the construction industry
6. To guide the project towards an adequate exploitation strategy
Expected Impact

1. **European Construction Industry and Society:**
   - Workers exposed
   - SMEs are more vulnerable to occupational risks

2. **Market (products):**
   - Safe Nanoproducts (e.g. Nanocomposites)
   - Safety Management systems (e.g. OHSAS 18001)
   - New safety services for market (e.g. OHS, certification)

3. **European policies, regulations and standards:**
   - New information to elaborate better regulations and new standards (OHS and Safety of products)
   - Supporting deployment of new Community Strategy on Health and Safety at work, Action Plan for Construction of the Lead Market Initiative (LMI), European policy on nanotechnology, H2020, etc.

4. **Strategic Research Agendas** (SRAs) of the European Technology Platforms (ETPC, ETPIS, NANOFUTURE).
Thank you very much for your attention

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(http://www.scaffold.eu-vri.eu/)