



Practical implementation of management of nano-risks in construction. Models and tools.

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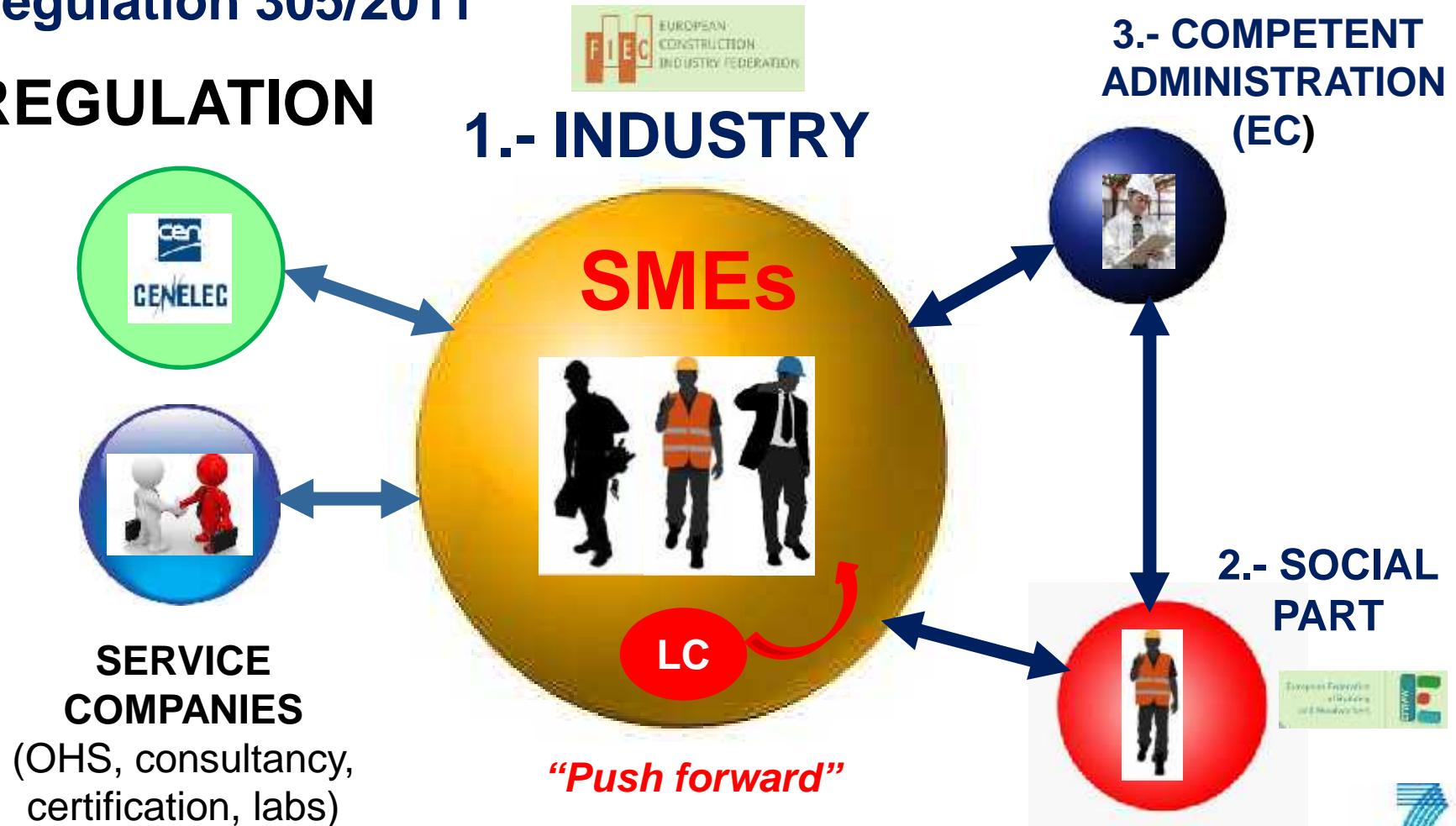
CONSTRUCTION (EU28, 2013)

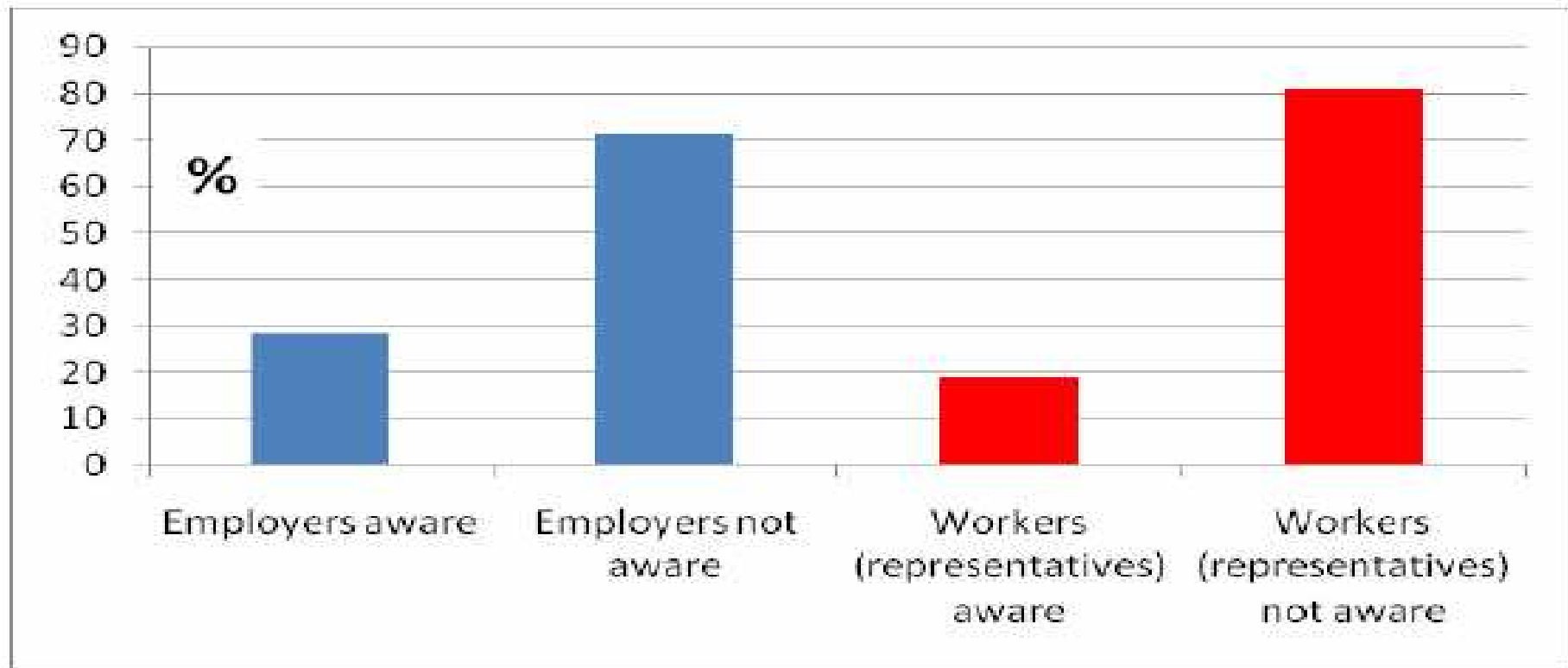
- **Biggest employer:** 13,9 M jobs (6,4 % total employment and 29 % of industrial employment)
- **Industry dominated by SMEs:** 2,9 M of enterprises (99,9 % SMEs, 93 % < 10 workers)
- **Economic power:** 8,8 of GDP
- **Subcontracting:** (45 %)
- **Poor OHS performance:** Close to one in four (23.1 %) fatal accidents at work took place within the construction sector



- Directive 89/391/EEC, 98/24/EC, 2004/37/EC
- Regulation 305/2011

REGULATION





Source: FIEC and EFBWW (2009)

- Nanomaterial (MNM) vs Nano-enable product (NEP)
- Low concentrations of MNM in NEP (Aerosols)
- Cohexistence of open sites and confined sites
- **Safety vs Cost**

Workshop Scaffold-nanoMicex-Sanowork, SENN2015 Helsinki 15/04/2015


- “In the light of current knowledge and opinions of the EU Scientific and Advisory Committees and independent risk assessors, nanomaterials are similar to normal chemicals / substances **in that some may be toxic and some may not.** Possible risks are related to specific nanomaterials and specific uses” *COM(2012) 572 final, Second Regulatory Review on Nanomaterials*
- “The **employer** shall have a **duty to ensure** the safety and health of workers **in every aspect related to the work**” (Directive 89/391/EEC).
- “The **employer** shall be **alert** to the need to adjust these measures to take account of **changing circumstances** and aim to improve existing situations” (Directive 89/391/EEC).
- **Reduce the level of uncertainty**

Some Significant results (Project on going))

1. **Safer nano-enabled products for construction:** new dispersions (TiO_2 , SiO_2), formulations for fire-retardant panels, concretes, bituminous pavements, coatings, insulations.
2. **General quantitative** (CB ISO 12901-2) and **qualitative approaches for Risk Assessment**, including specific procedures, strategies and methods for measuring exposures (TiO_2 , SiO_2 , CNF, CNF and nanoclays), proposals for OELs, models,,etc (5 IUCs on-going)
3. Assessment of **18 specific exposure scenarios at lab, pilot and IUC scales (Database)**, involving on-line equipment (portable + advanced), personal samplers, chemical-SEM-EDX .. analysis of samples, ...
4. Evaluation of the **efficiency of collective protections** (LEV, glove-box, ..) and **PPEs** typically used in construction (suits, respirators, gloves) .
5. **New device** for trapping nanoparticles
6. **Library of solutions for risk management (Handbook, Quick guides, Toolkit, NWI)**

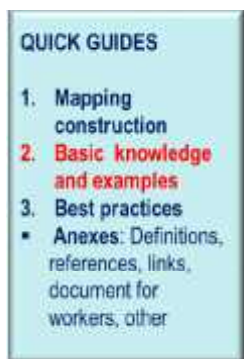
WP5. Risk Management objectives

- ✓ Develop an **innovative RMM** (MNM) and a **set of advance tool (Toolkit)** to support the diagnosis, implementation, monitoring and audit of the RMM in construction.
- ✓ RMM based on **OSHAS 18001**, supported by **ISO 31000** guidelines
- ✓ Providing **specific elements** for managing nano-risks
- ✓ Approach **customized for SMEs** to ensure full applicability
- ✓ **Fully compatible** with other management systems
- ✓ Achieved by the **integration on innovative solutions** provided by project Scaffold in the fields of Risk Assessment, Risk Prevention, Risk Protection and RisksManagement.
- ✓ **INTEGRATION (WP5) and VALIDATION (WP6)**

 Rossal					4.1 General requirements	4.2 OHS Policy and management commitment	4.3.1 MNMs hazard identification, risk assessment, and determination of controls	4.3.2 Legal and other requirements	4.3.3 Objectives and programmes	4.4.1 Resources, roles, responsibility and authority	4.4.2 Competence, training and awareness	4.4.3.1 Communication	4.4.3.2 Participation and consultation	4.4.4 y 4.4.5 Documentation and control of documents	4.4.6 MNMs operational control	4.4.7 MNMs emergency preparedness and response	4.4.8 Recuperation from an organization activity interruption	4.5.1 Monitoring and measurements of MNMs risk management activities	4.5.2 Legal compliance evaluation	4.5.3 Event and incidents investigation	4.5.3.2 Nonconformity, corrective action and preventive action	4.5.4 Control of records	4.5.5 Internal audit	4.6 Management Review
DAY	CENTRE	TIME	AUDITOR	PROCESS/ DEPARTMENT/ DOCUMENT/ ACTIVITY																				
1	1	9:00-9:30	SCM/LOA	Initial meeting																				
1	2	9:30-10:30	SCM/LOA	General Direction	X																			
1	2	10:30-12:00	SCM	Technological Innovation Direction			X																	
1	2	10:30-12:00	LOA	Prevention Department			X																	
1	2	12:00-14:00	SCM/LOA	Work site				X							X	X			X					
1	2	14:00-15:00	SCM/LOA	Pause																				
1	2	15:00-16:00	SCM/LOA	Technological Innovation Direction							X													
1	1	16:00-17:00	SCM/LOA	Preparation of the audit report by the audit team																				
1	1	17:00-18:00	SCM/LOA	Closing meeting																				

2. FOUR QUICK GUIDES:

1. Risk Prevention Guide
2. Risk Assessment Guide
3. Risk Protection Guide)
4. Risk Management Guide



(Delphi workshops)



*Library of solutions
for
Risk Management*

Scaffold



1. SCAFFOLD HANDBOOK
(Project knowledge, contributions from partners, IAB, OIP/US)



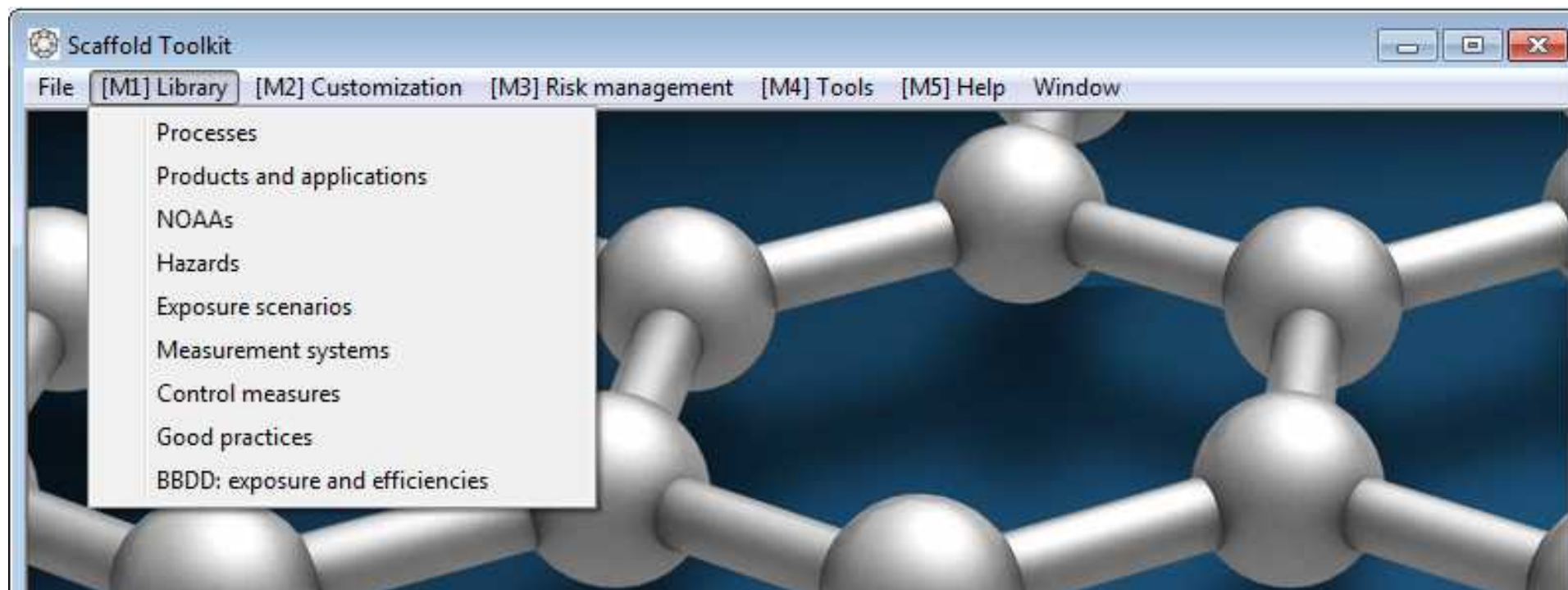
3. TOOLKIT
(Integration)



4. STANDARDIZATION
(CEN TC 352/WG 3/PG 5/Scaffold)

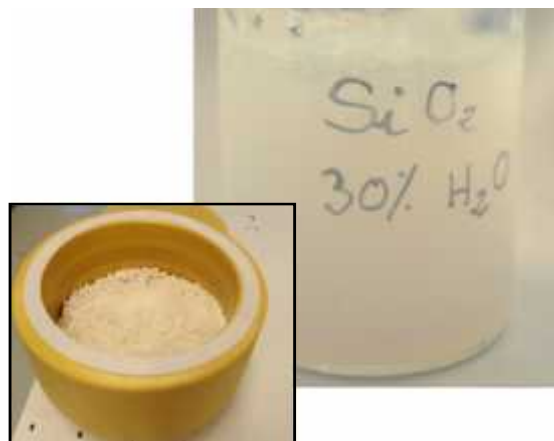
3.- The SCAFFOLD-Toolkit represents the integration of solutions for risk management developed by the project, in a software tool, friendly, easy to use and customizable for SMEs.



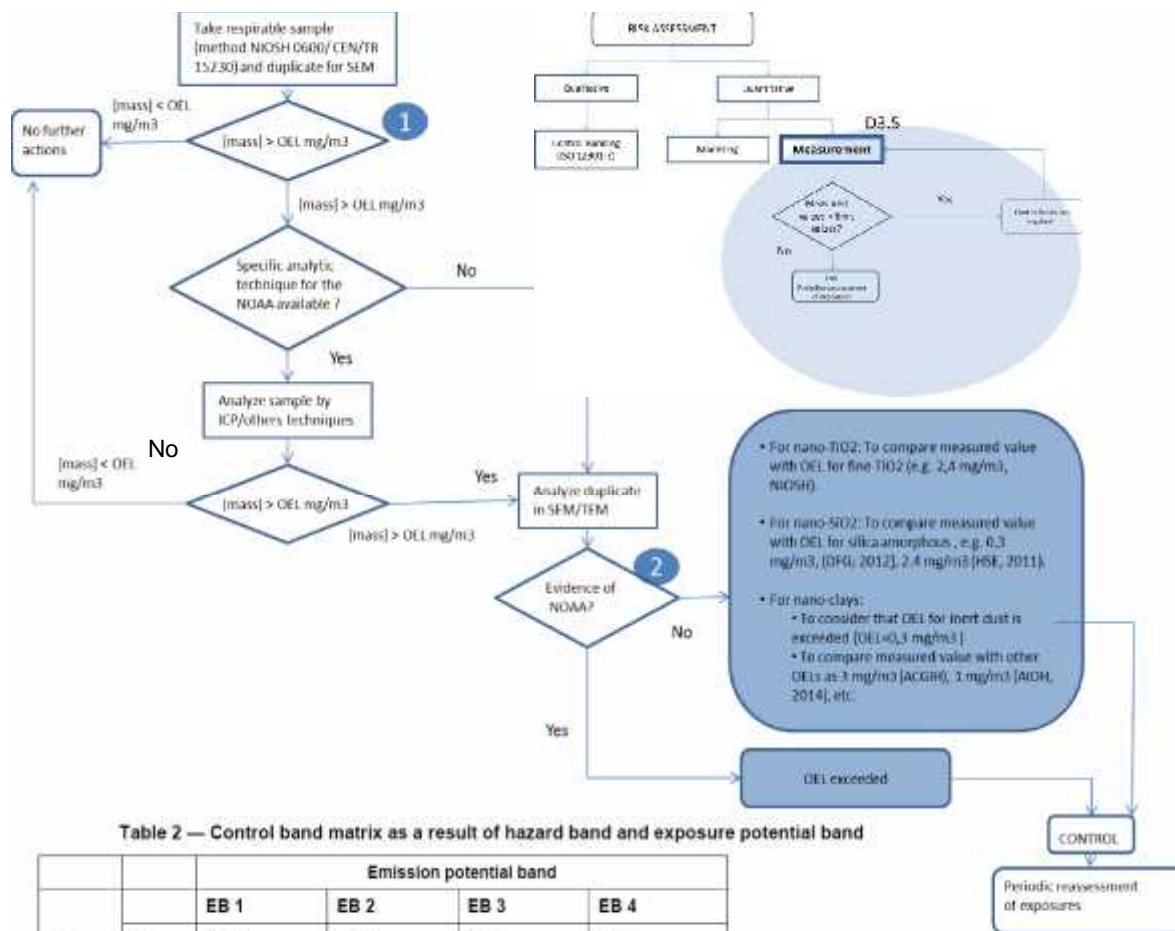


MODULE	DESCRIPTION
1. Library	It provides a library with documentation for managing nano-risks in construction (RP, RA, RPo, RM)
2. Customization	It allows companies to customize the application to their processes, tasks, scenarios and size. It uses the Module 1 to facilitate data input and generate the company profile.
3. Risk Management	It enables the initial assessment, implementation and audit of RMM guided by a step-by-step dialog. This module deploys two different setups, depending on the company profile (Large company or SME).
4. Tools	It contains the toolbox for nanosafety management: Risk management (scored checklist for diagnostic, implementation or audit), Risk assessment (Qualitative and quantitative approaches), Planning, KPIs, Documents and templates.
5. Help	It gives access to miscellaneous options: file management, configuration, and help (User manuals).

WP2. Risk prevention



WP3. Risk Assessment



PROCESS									
PROCESS Operation	Nano-Object	Application	Code	Exposure Scenario	Task Description	Engineering Controls	Measurement procedure	Particles Device	Particle Mean (#/cm ³)
Building	Nano-clay	FR panels	ES20	On site assembly/Machining- Control	Machining	Out door	1. Release	ELPI (#/cm ³)	5,04E
Building	Nano-clay	FR panels	ES20	On site assembly/Machining- Material B	Machining	Out door	1. Release	ELPI (#/cm ³)	5,90E
Building	Nano-clay	FR panels	ES20	On site assembly/Machining- Material C	Machining	Out door	1. Release	ELPI (#/cm ³)	6,28E
Building	Nano-clay	FR panels	ES20	Background	Background	Out door	1. Release	ELPI (#/cm ³)	4,54E
Building	Nano-clay	FR panels	ES21	Demolition-Composite (PA - 50% FV) (control)	Shredding	Out door	1. Release	ELPI (#/cm ³)	1,91E
Building	Nano-clay	FR panels	ES21	Demolition-Composite (PA - 40 %FV) (Material B 5 %nanoclay))	Shredding	Out door	1. Release	ELPI (#/cm ³)	1,90E
Building	Nano-clay	FR panels	ES21	Demolition-Composite (PA - 30% FV) (Material C 5 %nanoclay))	Shredding	Out door	1. Release	ELPI (#/cm ³)	1,55E
Building	Nano-clay	FR panels	ES21	Background	Background	Out door	1. Release	ELPI (#/cm ³)	3,96E
Building	Nano-clay	FR panels	ES22	Accidental fire: MNMs combustion Material A	Fire				
Building	Nano-clay	FR panels	ES22	Accidental fire: MNMs combustion Material C (1.25 % nano-clay)	Fire				

not, background-
ated average number
oparticles/cm³ during
ks (data from
007).
TWA calculated
ing 8 h/day, 40 h per

Particle

1.E+03

1.E+02

T1

T2

Material A

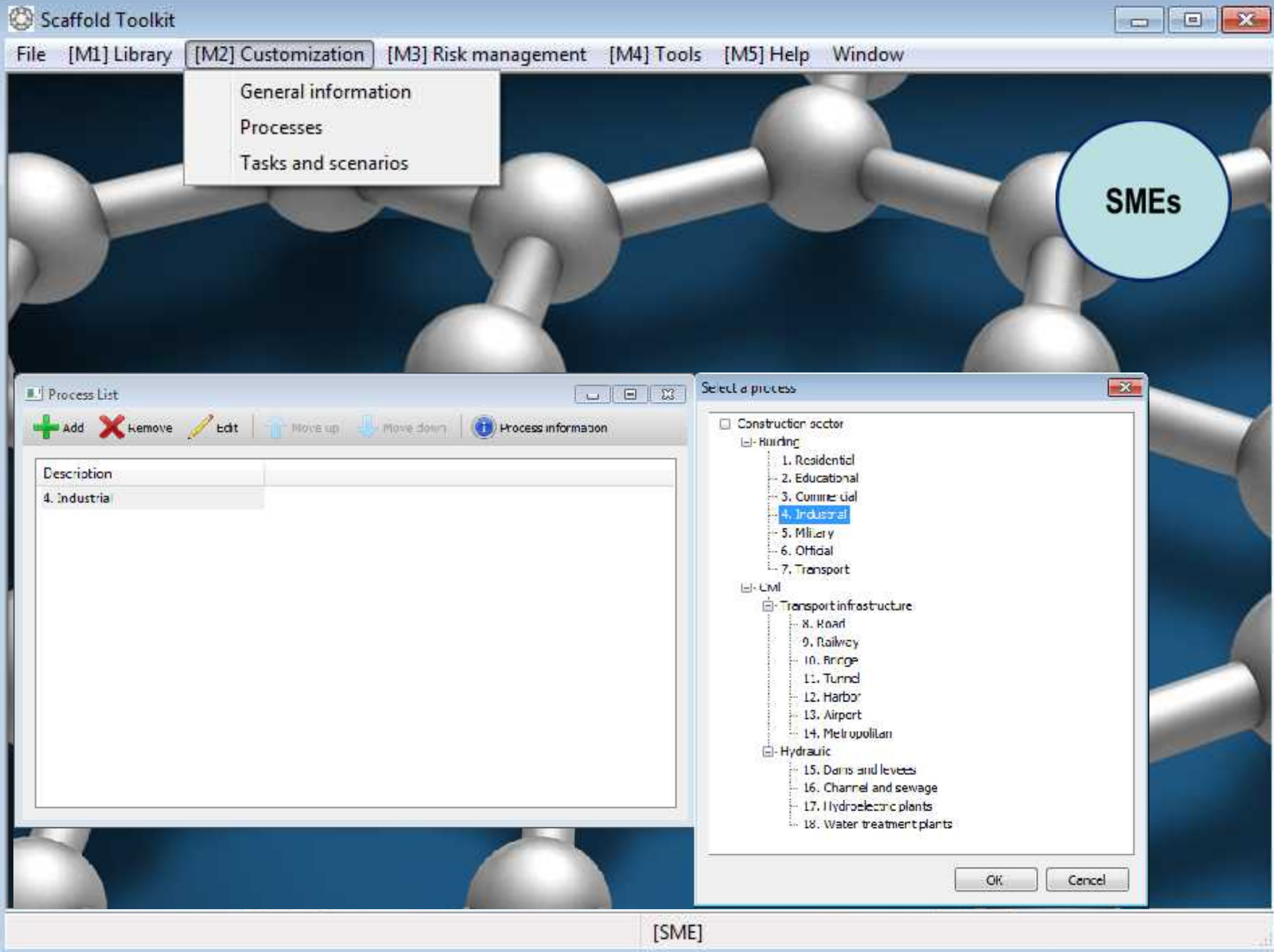
PPEs	SiO ₂ aerosol	SiO ₂ hydrosol	TiO ₂ aerosol	Nanocellulose aerosol	Nanoclay aerosol	Carbon NanoFibers aerosol
100% polyester (fleece jacket)	Efficient	Not efficient	Efficient	Not efficient	Not efficient	Not efficient
Polyester 65%/ cotton 35%	Efficient	Not efficient	Not efficient	Not efficient	Not efficient	Not efficient
PU coated PA	Efficient	Efficient	Efficient	Efficient	Efficient	Efficient
Rain cloth	Efficient	Efficient	Efficient	Efficient	Efficient	Efficient

Table 1. OELs proposed in Scaffold project.

Nano-object	OELs Mass (mg/cm ³) / Fibers (fibers/cm ³)
nano-TiO ₂	0.1 (respirable)
nano-SiO ₂	0.3 (respirable)
nano-clays	0.3 (respirable)
"inert dust (granular nanomaterial)"	0.3 (respirable)
CNF	4 (inhalable)
nano-cellulose	0.01 (a)

(a) In fibers/cm³

WP4. Risk protection

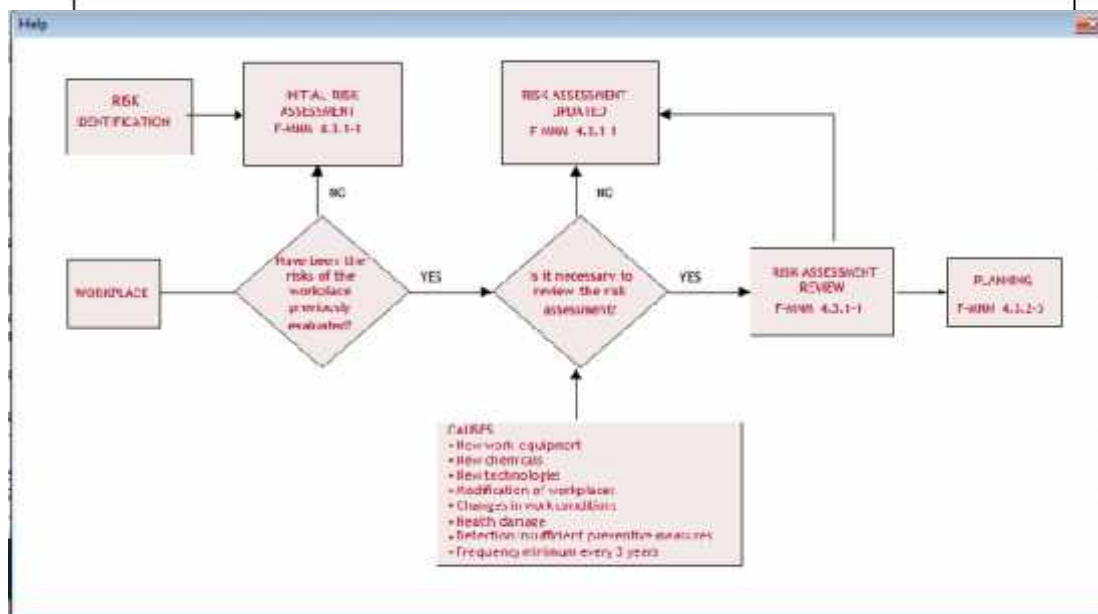


Templates

- F-MNM 4.1-1 Context report
- F-MNM 4.1-2 Interest group necessities identification
- F-MNM 4.3.1-1 Risk identification
- F-MNM 4.3.1-2 Risk assessment of the workplace
- F-MNM 4.3.2-1 Registration of statutory and other requirements
- F-MNM 4.3.2-1 Management Objectives
- F-MNM 4.3.2-2 Management Program
- F-MNM 4.3.2-3 Planning of preventive activity
- F-MNM 4.4.3-1 Training plan
- F-MNM 4.4.3-2 Training card
- F-MNM 4.4.3-3 Training evaluation
- F-MNM 4.4.3-4 Relevant external communications registry
- F-MNM 4.4.3-5 Risk communication to workers
- F-MNM 4.4.3-6 Risk communication to hire
- F-MNM 4.4.3-7 Risk communication to stakeholders
- F-MNM 4.4.3-8 Minutes of Management Committee
- F-MNM 4.4.4-1 Management Manual
- F-MNM 4.4.4-2 External documentation
- F-MNM 4.4.4-3 Associated documents control
- F-MNM 4.5-1-1 Records control
- F-MNM 4.5-1-2 Process card
- F-MNM 4.5-2-1 Work permit
- F-MNM 4.5-3-1 Chemical products registration
- F-MNM 4.5-4-1 PPE assignment to the worker
- F-MNM 4.5-5-1 PPE supply to the worker
- F-MNM 4.5-6-1 Suppliers list
- F-MNM 4.5-7-1 Order form
- F-MNM 4.7-1-1 Emergency plan
- F-MNM 4.7-2-1 Emergency records

[COMPANY NAME]	RISK MANAGEMENT OBJECTIVES	Page 1/1
		FORMAT F-MNM 4.3.2-1

MANAGEMENT OBJECTIVES LIST	DATE



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nd date

WP5. Risk management

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Scaffold Toolkit

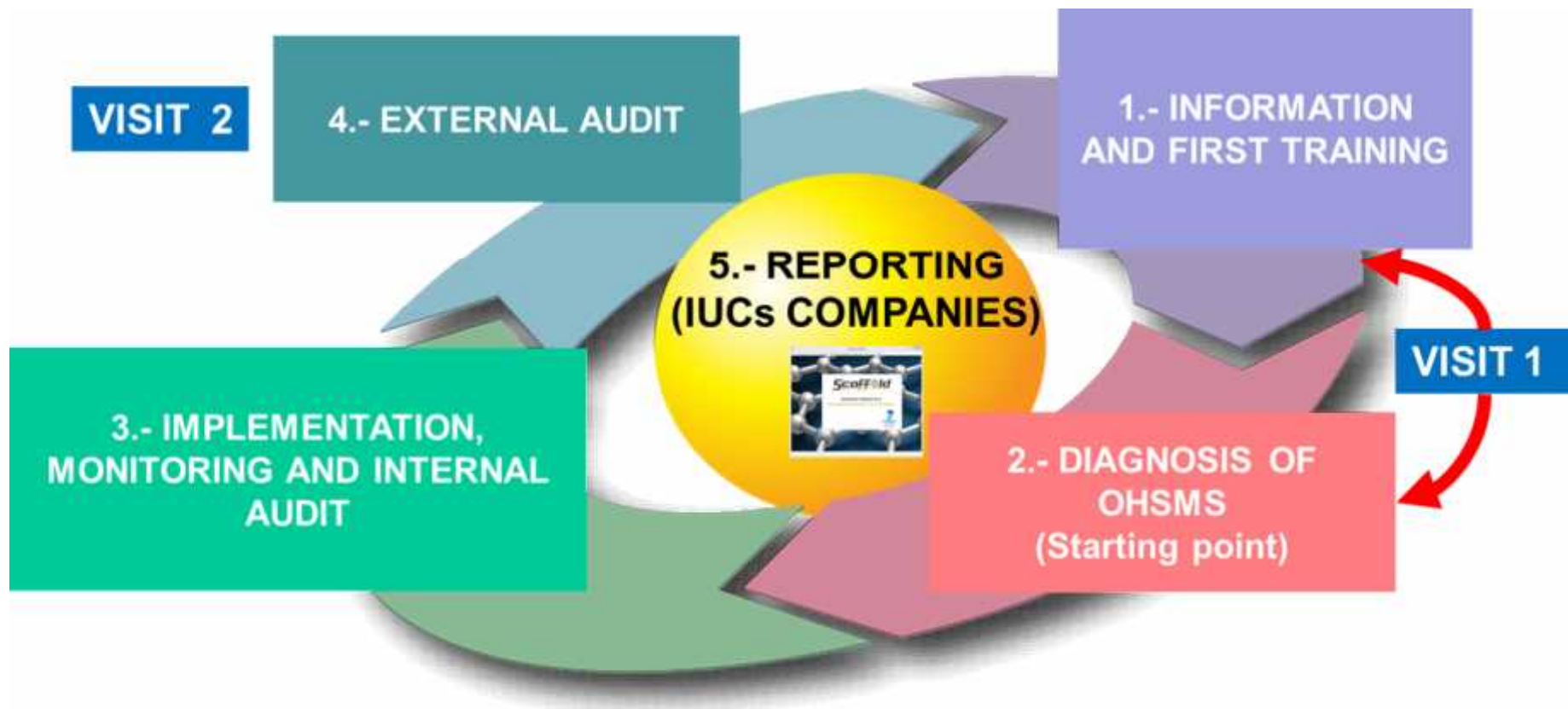
File [M1] Library [M2] Customization [M3] Risk management [M4] Tools [M5] Help Window

Risk management
Risk assesment
KPIs
Planning
Document templates [OK]
Training
Regulations and standards [OK]
Terms and definitions [OK]
FAQ [OK]

OPERATION MODE	DESCRIPTION
Learning	The toolkit is used for training (e.g. toolbox), general information and communication (e.g. NOAA, hazards, control measures, good practices, etc). Only modules 1 and 4 are operating.
Risk Management	Customized mode. The toolkit is used for diagnosis, implementation, monitoring, auditing and improving the management of nanorisks in a specific construction company. All modules are operating.

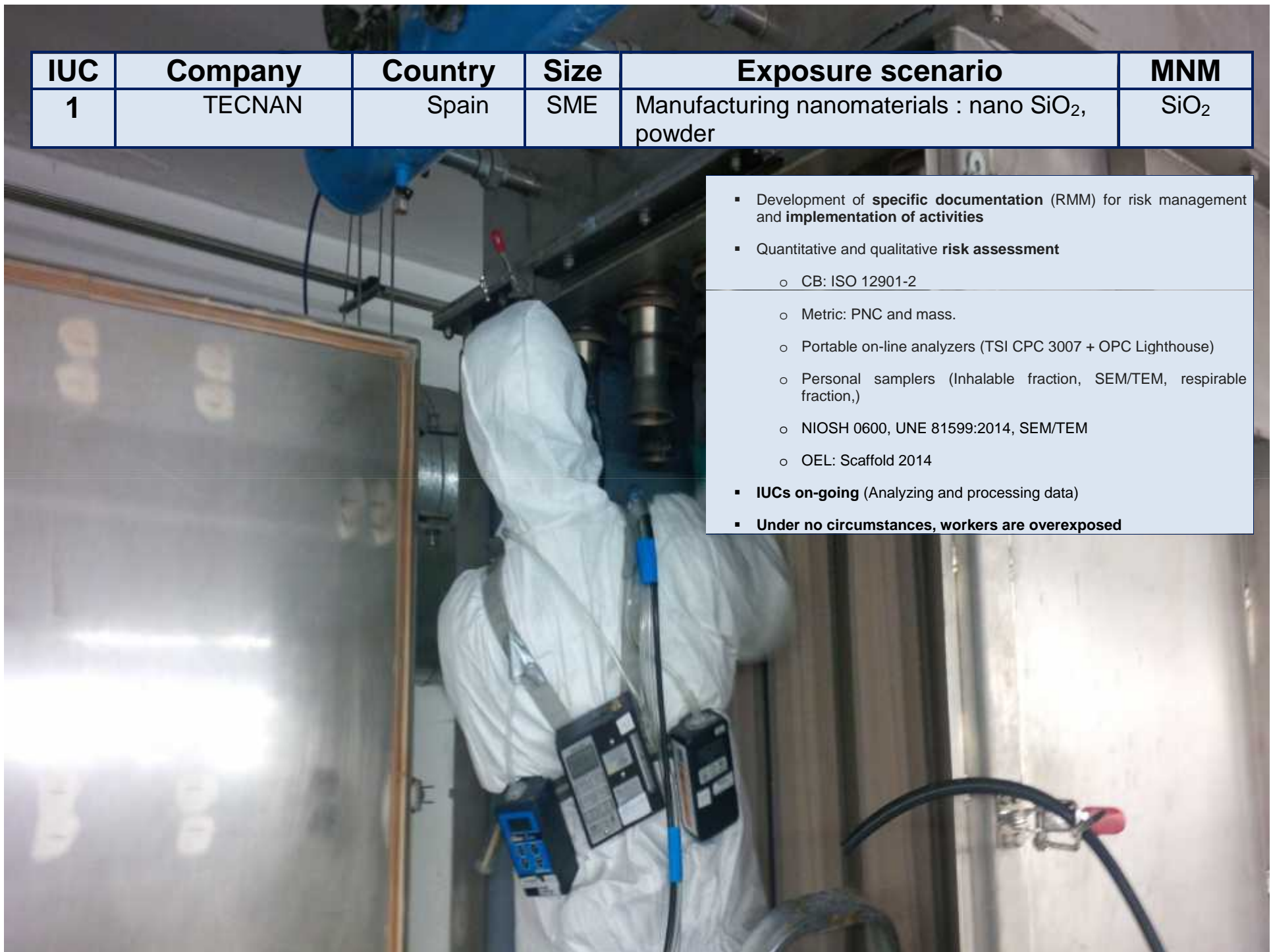
[SME]

Stages for the deployment of the Industrial Use Cases (IUC) in construction companies, during the demonstration stage of project SCAFFOLD



IUC	Company	Country	Size	Exposure scenario	MNM
1	TECNAN	Spain	SME	Manufacturing nanomaterials : nano SiO ₂ , powder	SiO ₂

- Development of **specific documentation** (RMM) for risk management and **implementation of activities**
- Quantitative and qualitative **risk assessment**
 - CB: ISO 12901-2
 - Metric: PNC and mass.
 - Portable on-line analyzers (TSI CPC 3007 + OPC Lighthouse)
 - Personal samplers (Inhalable fraction, SEM/TEM, respirable fraction,)
 - NIOSH 0600, UNE 81599:2014, SEM/TEM
 - OEL: Scaffold 2014
- **IUCs on-going** (Analyzing and processing data)
- **Under no circumstances, workers are overexposed**



IUC	Company	Country	Size	Exposure scenario	MNM
2	ICECON	Romania	Large	Manufacturing NEP: Fire resistant panels	Nanoclay



IUC	Company	Country	Size	Exposure scenario	MNM
3	MOSTOSTAL	Poland	Large	Use of NEP in building construction: Application of coatings with three methods: brush, roller and spray gun)	SiO ₂



IUC	Company	Country	Size	Exposure scenario	MNM
4	ACCIONA	Spain	Large	Use of NEP in civil construction: Construction of a concrete slab	SiO ₂



IUC	Company	Country	Size	Exposure scenario	MNM
5	ROSSAL	Romania	SME	End of life of NEP: Demolition of fire resistant panels	Nanoclay



4.- STANDARDIZATION (CEN TC 352/WG 3/PG 5/Scaffold)



- AENOR proposed to set up a **CWA** (T7.4/D7.7)
- **Project liaison** was established between SCAFFOLD Project and CEN//TC 352
- **CWA was disapproved** by CEN/TC 352 and CEN/BT

“ ... based in considering that health and safety issues ought to be excluded from being the subject of Workshop Agreements, because these documents do not grant the same levels of transparency and consensus as ENs.”.

- CEN TC 352 agreed to include the **TS “Scaffold”** proposal on the **work programme of CEN TC 352** as a **PWI** and allocated the coordination of the project to the Mr. Jesus M. López de Ipiña – Tecnalía (Project Leader)
- On March 31st 2015, **Kick of Meeting of CEN TC 352/WG 3/PG 5 Scaffold (JRC-Ispra, Italy)**

Manufactured nanomaterials (MNMs) in the construction industry — Guidelines for occupational risk management

Nanomatériaux manufacturés dans l'industrie de la construction — Lignes directrices pour la gestion des risques professionnels

CEN/TC 352

Date: 2015-02

TC 352 WI 00352023

CEN/TC 352/WG 3/PG 5/

Secretariat: AFNOR

Scope

This Technical Specification provides recommendations on occupational risk management of manufactured nanomaterials (MNMs) in the construction industry.

The aim is the customization of guidelines for implementation of OHSAS 18001 for manufactured nanomaterials risks on construction sector activities, including guidelines and best practices for risk management.

- **Guidance:** recommendations for the implementation of each requirement, based on the conclusions of project SCAFFOLD.
- **Examples:** to illustrate in a realistic approach, the implementation of the requirement in construction.
- Considerations from **ISO 31000:2009**

SOME CONCLUSIONS LOOKING TO THE FUTURE (I)

- Nanotechnology is making its advance **faster** than the safety management related to it (**Risk them PC**)
- The European construction industry is already using and handling MNM and NEP and **workers are exposed to nano-risks**.
- The development of a full scientific knowledge to manage nano-risks in construction **might take a long time**.
- The **general regulatory requirements** on safety and health at work (**Directive 89/391/EEC, 98/24/EC**) apply to workers exposed to nano-risks.
- Consequently, until having the whole knowledge available, efforts should be made to provide the construction industry with intermediate management solutions, based on the state of the art, to **enable decisions with minimal uncertainties**.

SOME CONCLUSIONS LOOKING TO THE FUTURE (II)

- It means the need to **translate and encapsulate results of the current research** in a battery of practical methods, strategies and tools directly usable by industry and companies providing OHS services to the industry.
- All these tools should be periodically **updated** with the evolution of the state of the art.
- The **project SCAFFOLD** follows this approach and is providing the construction industry with a **practical library of solutions** to enable the management of nano-risks in large companies and SMEs.
- **Initial positive feedback** from industrial companies involved in project SCAFFOLD, employers and employees associations in construction (FIEC, EFBWW, Sectoral Social Dialogue Committee for "CONSTRUCTION") (Results of IUCs will be available at the end of April 2015).



Thank you very much for your attention

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

