

## **CEA NANOSAFETY PLATFORM**

NFFA – Nanosafety workshop, Lund, January 10th, 2020 | Simon Clavaguera





## THE CEA: A NANOSAFETY PRECURSOR



When concerns about the potential hazards of nanoparticles emerged, the CEA immediately implemented a policy of precaution. Ensure the lowest exposure for all employees Hazard Exposure Χ Ris If exposure  $\rightarrow 0$ **Risk remains acceptable** In 2004, launch of a large R&D nanosafety  $\geq$ program Ensure the same level of safety Transfer safe technologies to CEA's for nanomaterials as for other industrial partners hazards, for all CEA employees

NFFA workshop, Lund Sweden | Simon Clavaguera | 2



## THE NANOSAFETY PLATFORM (PNS)



#### **KEY FIGURES**

A complete team of around **150** people

€25 million in investments

**2,000** sq.m of lab space dedicated to R&D

400 workstations assessed

One of the broadest range of nanosafety services in Europe







## THE NANOSAFETY PLATFORM



All these different services have one thing in common: nanosafety A large number of actors

- R&D Laboratory
- Medical Biology Laboratory
- The Occupational Health Department
- > The Local Safety Unit
- > The Training Department
- Expertise and Operational Support Unit





## THE NANOSAFETY PLATFORM MISSIONS



A comprehensive approach of nanosafety to manage appropriately the risks, to strenghten people trust and to the boost EU industry competitiveness. Four clearly defined missions:

- Develop and transfer innovative, responsible and **safe** technologies for **industrial competitiveness**
- Reduce the environmental footprint and mitigate the risks associated with the development of new technologies
- Contribute to strengthening employees' and the community's trust to enable nanomaterials development
- To allow the emergence of safe and sustainable technological solutions to support the **transition** to green and low-carbon energy / mobility





## **R&D LABORATORY**



# 33 people in 2019 (PFNC and PNS)

21 permanent employees

**12** non-permanent employees (Interns, PhD students, post-docs)



## R&D laboratory on nano-characterization and nanosafety

## Safe-by-Design approaches

- Materials and products over their whole life cycle
- Production processes

## Monitoring tools, instrumentation and methods

- Development of tools and robust methods suitable to industry
- Airborne particle sampling and monitoring at workplace ; low cost sensors
- Particle characterization in various media ; SOPs and standards
- Regulatory compliance

## Expertise and support in nanosafety

- Industrial health and safety / prevention of the nano risks
- Risk assessment, risk management
- · Assessment of the effectiveness of protective equipments
- Consulting services to design and implement appropriate risk management measures

## Assessment of potential environmental impact

- · Life cycle analysis approaches adapted to 'nano'
- Simulated use of nano-enabled products (release & emission)
- Enf of life : waste management, recycling, potential transfer to different environment compartments



## THE TRAINING DEPARTMENT (UECG - INSTN)



**164** people trained in 2019 on the nano theme

www.instn.cea-fr



The INSTN offers 3 training courses in link with nanosafety

- Nano Risk Management awareness training
- Nanocert trainings (in partnership with Ineris)
  - OperaNano Training course (operators)
  - NanoPrev Training course (pre-sellers)



Each of these training course can be declined according to two modes of access:

- *Customs, company-specific training courses (intra)*
- Generalist training courses (inter)

At the same time, the INSTN offers a diploma course, within the framework of the COMUE Université Grenoble Alpes





## THE NANO LIFE CYCLE MANAGEMENT







Platform funded by the French government up to 10.2 M€ « Investissements d'avenir »

Partners :



# CHARACTERIZATION OF ENPs IN COMPLEX MATRICES : EQUIPEX NanoID





# **EQUIPEX NANOID**







*Partners:* CEREGE, ISTerre, ANSES, UIC, INSERM, laboratoire Chimie Provence, Arkema

#### **Open national Platform**

- Composed of specific characterization prototypes equipment
- Able to detect and identify the chemical nature of nanoparticles
- CEA is the scientific and technical manager of the EQUIPEX, composed of 5 main prototype equipments

#### $\mu \text{waves}$ reactor for core-shell NPs synthesis



cea

High Resolution Cryo Tomo TEM solids, liquids

Micro & nanotomography X 3D solids



Laser Ablation Aerosol Particle Time of Flight Mass Spectrometry (LAAP-ToF-MS)









## NANOMATERIAL CHARACTERIZATION



PNS: BET, DLS
PFNC: Microscopy (SEM/ TEM)



R-Nano.fr Déclaration des substances à l'état nanoparticulaire

anses 🗘

#### • 2 levels of characterization for a quick reply

- Situation of doubt
- Complete characterization







# NANOPARTICLES METROLOGY IN COLLOIDAL SOLUTIONS



Physico-chemical characterization of nanoparticles in colloidal solutions An important range of means and applications

#### Objectives

- Size measurements
- Chemical composition analysis
- Evaluation of the surface state of the particles
- Fractionnation and characterization of complex matrices

#### Means

- DLS
- Chemical analysis single particle ICP-MS
- Microwave mineralizer
- AF4 coupled to ICP-MS and various other detectors

#### **Applications**

- Contamination
- Life cycle, aging study, release,...
- Environment, traces analysis
- Regulation
- Nanomedicine characterization



# DE LA RECHERCHE A L'INDUSTRIE

Serenade Safe(r) Ecoderign Rerearch and Education applied to NAnomaterial Development.

## A Midex Initiative d'excellence Aix-Marseille

# Partners: National consortium 11 academics plus 2 industrials



# SAFE-BY-DESIGN APPROACHES : LABEX SERENADE



Laboratory of Excellence for Safe(r) Ecodesign Research and Education applied to NAnomaterial DEvelopment







## 10/04/2020, Opening call for abstracts

Characterization, metrology and standardization Assessment of release, emission and exposure Hazard assessment: - Mechanisms and Mode of Action - Cheap and robust tests - Long term low dose exposure Anthropogenic particles and cocktail effects of mixtures Risk assessment, risk management and risk governance Nano-enabled technologies for the medicine of the future Safe-by-Design and Eco-conception as an innovation driver Nanosafety towards digitalization Regulation and tools available to industry

#### International Scientific Committee

Christof Asbach (IUTA, DE) Anthony Bochon (ULB, BE) Marie Carriere (CEA, FR) Claude Emond (U. Montreal, CA) Emeric Frejafon (BRGM, FR) Keld Alstrup Jensen (NRCWE, DK) Denise Mitrano (EAWAG, CH) David Pui (U. Minnesota, USA) Myriam Ricaud (INRS, FR) Jérôme Rose (CNRS CEREGE, FR) Araceli Sanchez (IOM, UK) Frederic Schuster (CEA, FR) Eva Valsami-Jones (U. Birmingham, UK) Ulla Birgitte Vogel (NRCWE, DK) Olivier Witschger (INRS, FR) Da-Ren Chen (VCU, USA)

# Thank you for your attention!

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