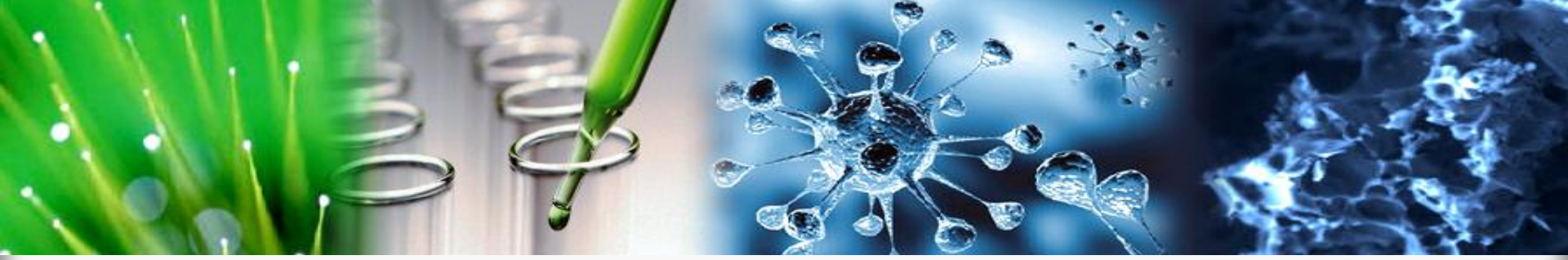
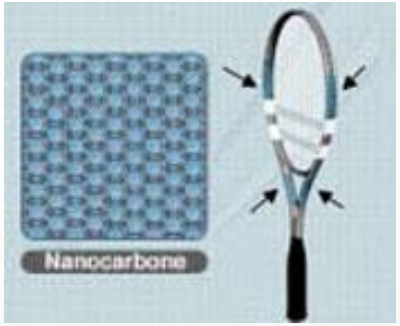


NANOMATERIALS RELATED ENVIRONMENTAL POLLUTION AND HEALTH HAZARDS THROUGHOUT THEIR LIFE CYCLE

SIMPOSIO DE NANOTECNOLOGÍA – NANOCODE
10 Noviembre 2011

Introduction

According to the ***Nanotechnology consumer products inventory*** –Woodrow Wilson International Center for Scholars– as of March 2011, **1317 nanoenabled products** or product lines are currently on the market.



1 – http://www.nanotechproject.org/inventories/consumer/

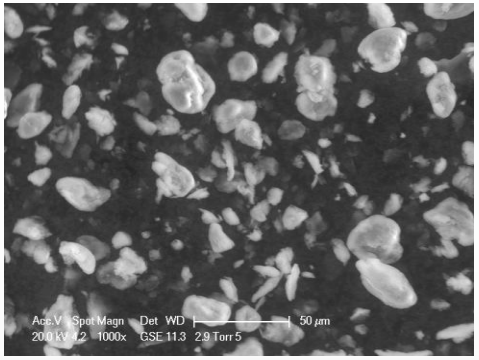
Introduction

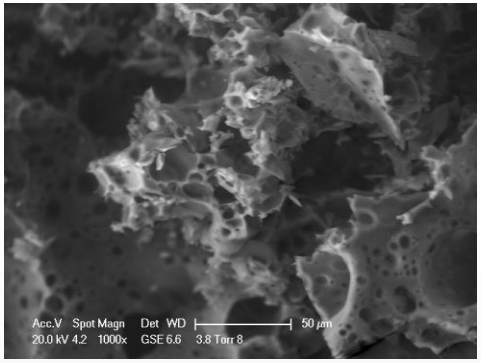
Future Markets Inc. in a recently published report[2] states that revenues for nanotechnology and nanomaterials in consumer products were approximately US$1545 million in 2009 at world level.

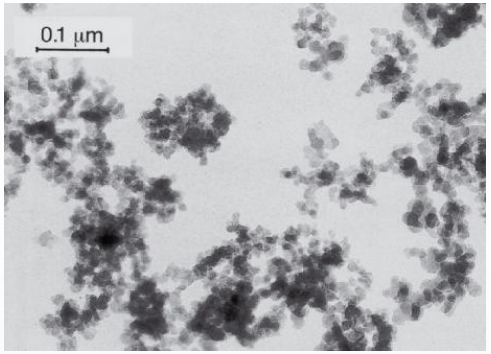
Moreover, present study estimates that the market for nanotechnology and nanomaterials in consumer products is expected to more than triple to **$5335million by 2015**, driven by the demand for innovative new products and increased competition in the consumer electronics and household cleaning products segments.

Due to the small size of nanoparticles, their **total surface** are grows exponentially, their **mobility** in solution is higher, their high curvature radius turns them **highly catalytic** and **quatum effects** occur.

Most applications at present exploit **advanced material properties** by adding nanoparticles either in the bulk material or on the surface. Example: **Nanocomposites**.







2 – The World Market for Nanotechnology and Nanomaterials in Consumer Products, 2010-2015. Future Markets Inc. May 1, 2010.

Why NEPHH?

Despite huge benefits, initial research has indicated that engineered nanoparticles can have a **negative impact on human health and environment**, being currently available knowhow on the environmental and human health hazards associated with the **manufacture**, **use**, **distribution** and **disposal** of certain manufactured nanomaterials still limited

Safe?

Why NEPHH? Project's Motivations

Harmful potential of nanoparticles

Lack of information on the bioacumulation and potential toxic effects of **embedded engineered nanoparticles** and their **long-term** implication for public health

Adequate methods to **detect** nanomaterials in cells and tissues **need further development.**

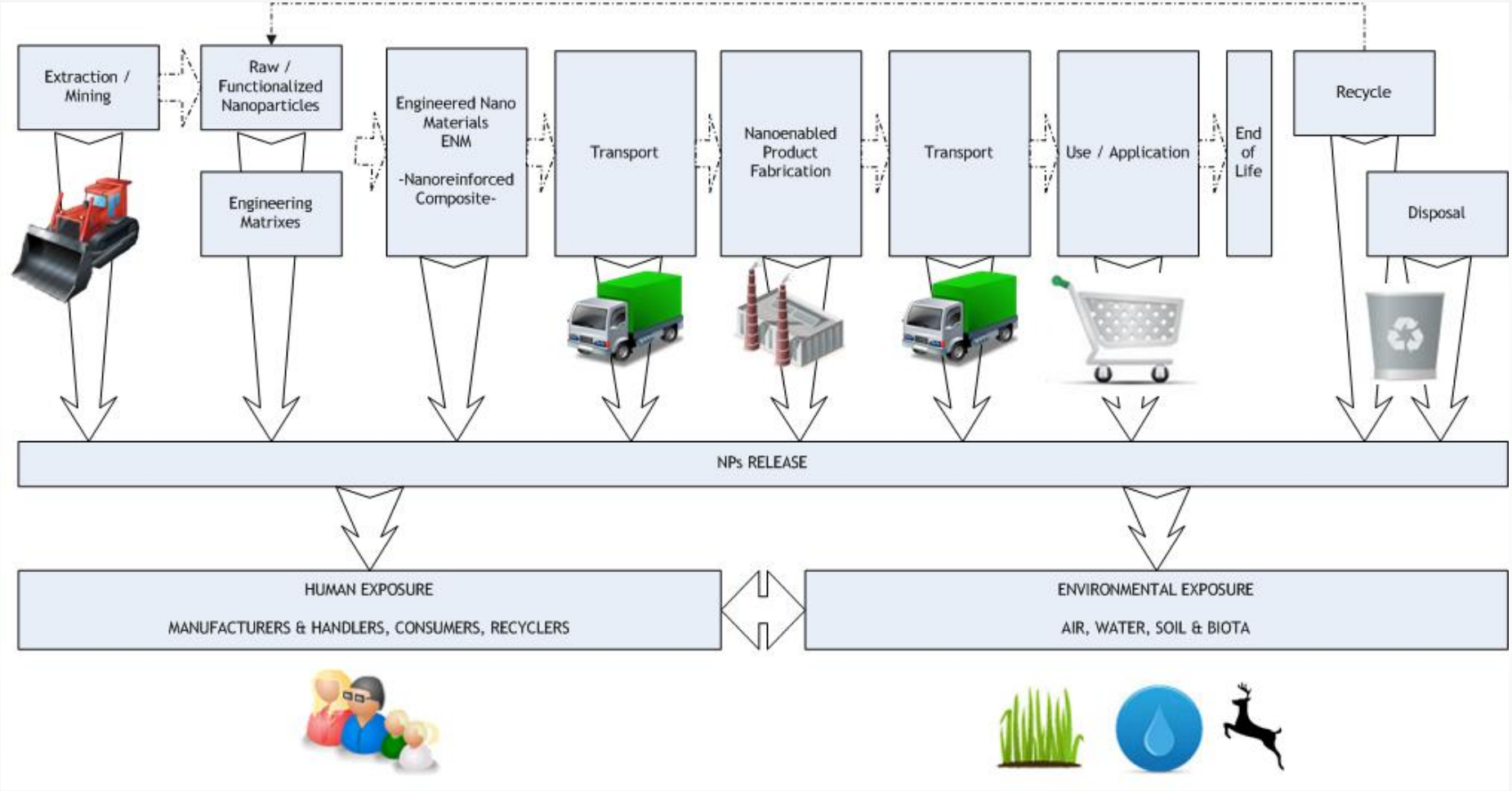
There is a **dearth of evidence** about the effects of **pollution of nanoparticles on the environment** and environmental consequences associated with the ultimate disposal of these materials

Health, safety and environmental risks associated with products and applications of Nanotechnology and Nanosciences **need to be addressed upfront and throughout their life cycle**

Research is needed in areas underpinning **risk assessment** like data on toxic and eco-toxic effects as well as test methods to generate such data, data on exposure assessment approaches, and analytical measurement techniques for the characterization of nanomaterials

The implications of the special properties of nanoparticles with respect to health and safety **have not yet been taken into account** by **regulators**

Where do we come from?



Where do we go to? Main Project's Objective

NEPHH Project aims to **identify and rate** important forms of nanotechnology-related environmental pollution and health hazards that could result from activities involved in silicon-based polymer nanocomposites **throughout their life cycle**, and also to suggest means that might reduce or eliminate these impacts

Where do we go to? Detailed Project's Objectives (1)

1. Development of a systematic, continuous practice for **selecting** and **prioritizing** ENMs.

2. Contribution to the **standardization and validation of test methods** and test schemes for ENMS as **adaptation** of current physicochemical sampling protocols.

3. Collection of **nancomposite samples**, including **laboratory** and **industrial** based Silicon based materials.

4. Better understanding of the **health impacts** of the selected nanomaterials.

Where do we go to? Detailed Project's Objectives (2)

5. Assessment of the **human and environmental exposure throughout the life cycle** according to the ISO 14.040:2009 and ISO 14.077:2006 standardized methodologies.

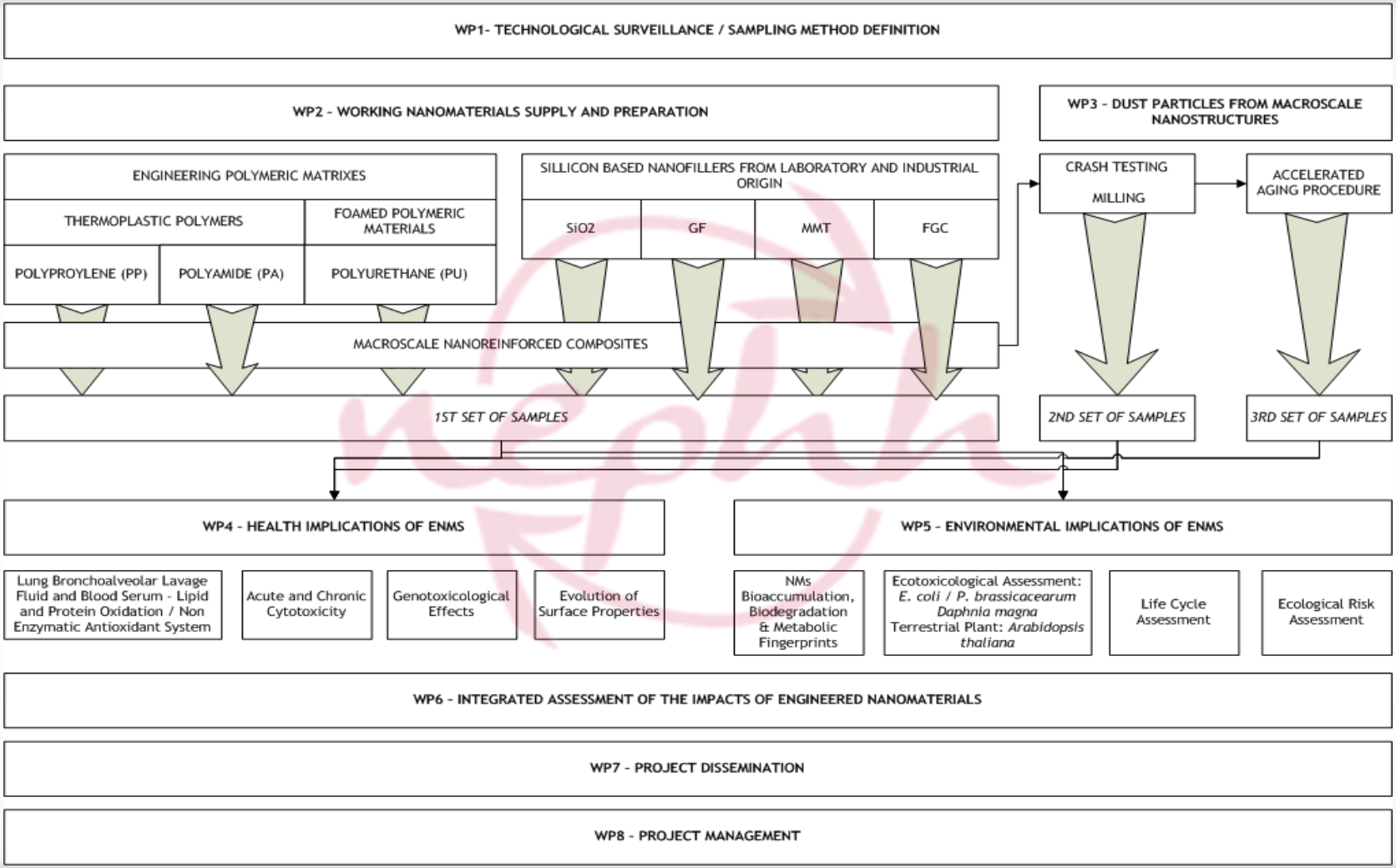
6. Assessment of the potential of ENMs to damage the **environment** (or human health through the environment).

7. Selection and dissemination of the **best practices** and **actuation guidelines** for **exposed workers**.

8. Contribution to the "**Code of Conduct for Responsible Nanosciencies and Nanotechnologies Research**".

9. Contribution to the **regulatory frameworks** which are applicable to Nanomaterials.

How will we get there?



Expected Impact – Main Project's Innovations

Life Cycle Approach – Integrated Assessment of the potential damage caused by ENM

A recent review paper[3] indicates that among the 428 papers listed dealing with biological effects (toxicity and ecotoxicity) related to nanotechnology/nanomaterials have so far predominantly been documented for **free nanoparticles**.

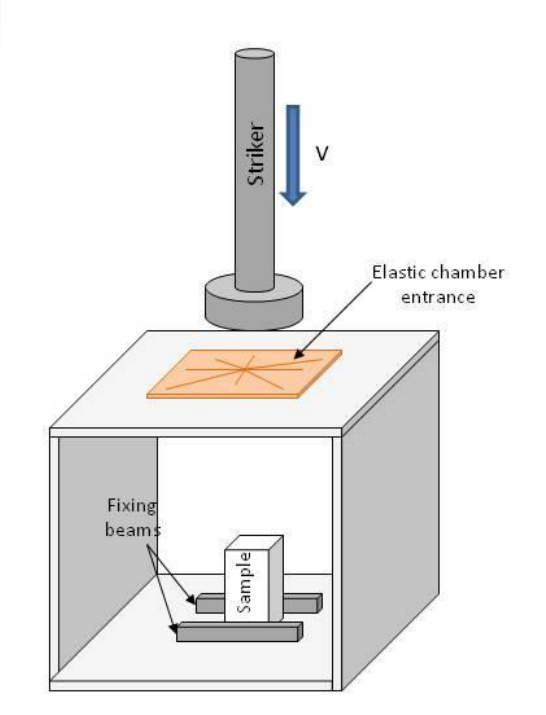
However, NEPHH accounts that NPs can be **surface modified** and are **generally embedded in a final product** and therefore do not come into direct contact with consumers or the environment.

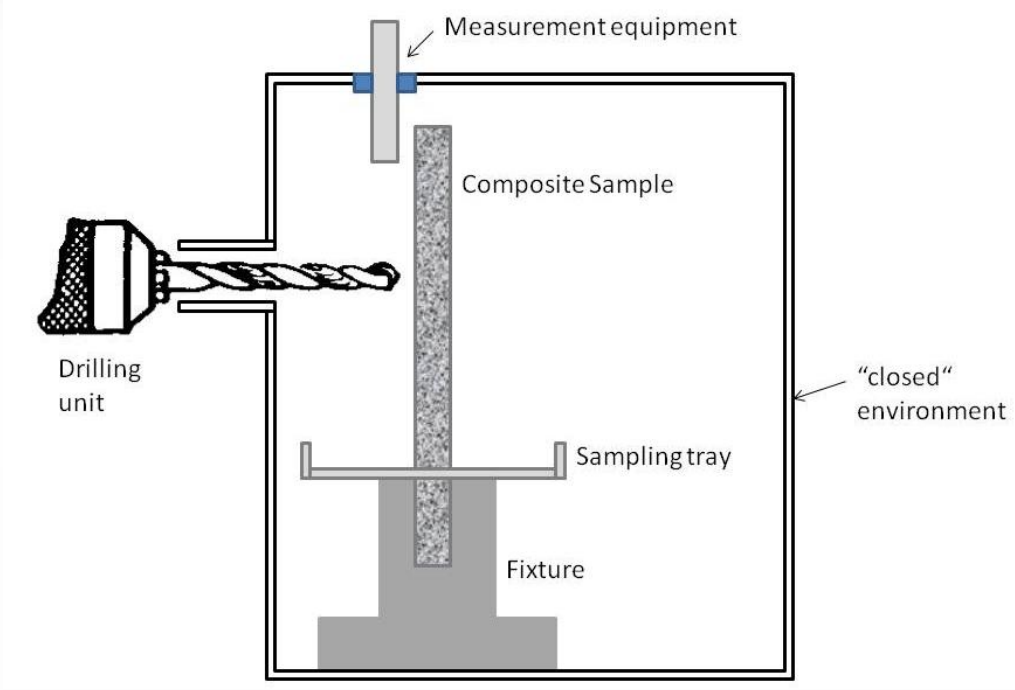
Examples: TiO_2 nanoparticles covered with AlOOH and with polydimethylsiloxane – for the use un sunscreens, or with CeO_2 or TiO_2 nanoparticles on glass surfaces for self-cleaning purposes….

There is an urgent need to assess the environmental and human health impact of commercialized nanomaterials and nanocomposites

3 – Hansen, S.F., Britt H.L., Stig I.O. and Anders B. 2007 "Categorization framework to aid hazard identification of nanomaterials". Nanotoxicology 1(3): 243-250

How will we get there?





Cranfield UNIVERSITY

SEVENTH FRAMEWORK PROGRAMME

Expected Impact – Detailed Description

STRATEGIC IMPACT	ENVIRONMENTAL IMPACT	SOCIAL IMPACT	ECONOMIC IMPACT
✓ Validated testing strategies for novel materials ✓ Contribution to regulation and risk assessment	✓ Understanding exposure potential at various trophic levels ✓ Responsible and safe development of nanotechnology based consumer and industrial applications ✓ Adaptation of Life Cycle Assessment (LCA) methodology	✓ Understanding mechanisms of toxicity for nanoparticles embedded in final products – nanocomposites– ✓ Improvement of working conditions	✓ Contribution to the acceptance of nanotechnology by the wide public, thus assuring its sustainable introduction into market ✓ Minimisation of remediation costs, both from health and environmental aspects

Main Project's Data (1)

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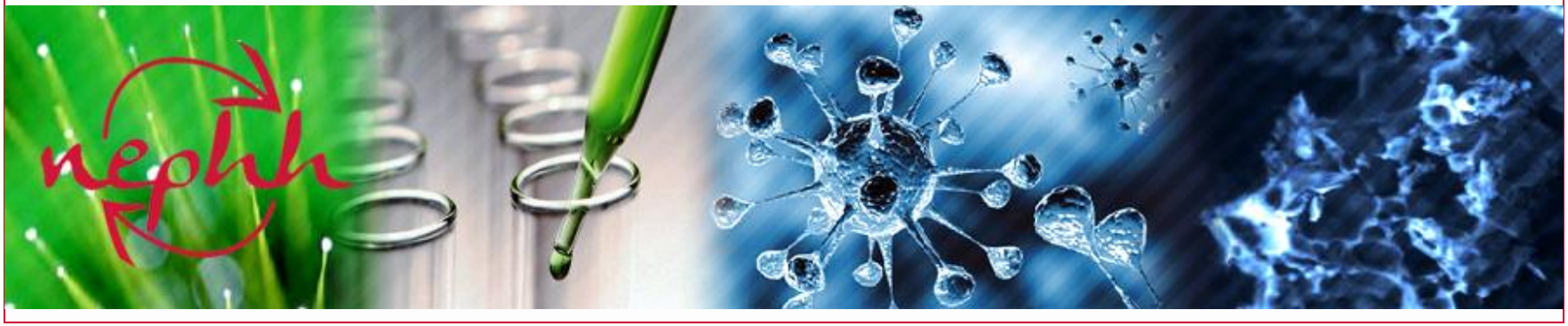
Main Project's Data (2)

Project Acronym	NEPHH
Project Reference	228536-2
Start Date	01/09/2009
Duration	36 Months
Project Costs	3.186.530 €
Contract Type	Small or medium scale collaborative project
Project Funding	2.496.277€
Subject Index	Nanosciences, nanotechnologies, materials & new production technologies
Key Words	Polymer Nanocomposites, Si-containing nanoadditives, engineered nanomaterials, lung, ecotoxicity, persistence

Main Project's Data (2)

Additional Information on:

http://www.nephh-fp7.eu



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QUESTIONS & DOUBTS

Thank you very much for your attention!!!