DeTER

Detection, **T**oxicology, **E**nvironmental fate and **R**isk assessment of nanoparticles in the aquatic environment

2014-HW-MS-1

Project Team

OÉ Gaillimh NUI Galway	UCD Dublin	AIT Athlone Institute of Technology	Ulster University
Dr. Dearbháile Morris	Dr. Enda Cummins	Dr. Andrew Fogarty	Dr. Patrick Dunlop
Dr. Eoin McGillicuddy	Mr. David Shevlin	Mr. Iain Murray	
Dr. Liam Morrison			
Prof. Martin Cormican			
Prof. Peter Dockery			

OÉ Gaillimh NUI Galway
UCD Dublin
AIT Athlone Institute of Technology
Ulster University
Centre for Health from Environment
Ionad Sláinte ó Chomhshaol
Ryan Institute

Report No. **259**

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Detection, Toxicology, Environmental Fate and Risk Assessment of Nanoparticles in the Aquatic Environment (DeTER)

Authors: Eoin McGillicuddy, Iain Murray, David Shevlin, Liam Morrison, Martin Cormican, Andrew Fogarty, Enda Cummins, Peter Dockery, Patrick Dunlop, Neil Rowan and Dearbháile Morris

http://www.epa.ie/pubs/reports/research/health/research259.html

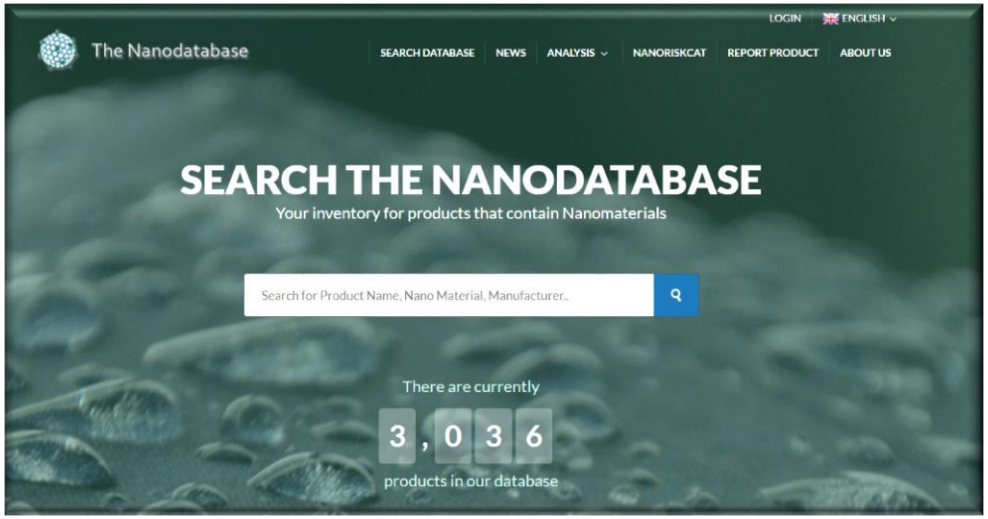
Background

- Nanotechnology is an emerging technology which is expected to form the basis of several technological innovations and advances in the 21st century.

- The European Commission defines a nanomaterial as *"a natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm - 100 nm".*

Background

- The production and demand for products containing nanomaterials has increased significantly in recent years.



- The Nanodatabase (http://nanodb.dk/) developed by the Technical University of Denmark is a “living” inventory of commercially available products in the European consumer market that claim to contain engineered nanomaterials (ENMs).

Background

- Nanomaterials can be naturally occurring (e.g.bacteria), inadvertently generated (e.g. production of soot from combustion) and engineered.

- Engineered nanomaterials (ENMs) are intentionally produced, and exhibit unique properties.

- Examples of ENMs include fullerenes (such as carbon and silicon nanotubes), quantum dots, metal and metal oxide nanoparticles (Nps) (such as silver (Ag)).

- Nanomaterials have a wide range of potential applications, from everyday uses (such as improvements in fabrics, paints, cosmetics and packaging) to medical applications, water and soil remediation and renewable energy production.

Background

- Concern that the unique properties of ENMs may result in potential hazards for both humans and the environment.
- ENMs can be released into various environmental matrices such as soil, sediment, air and water during their production, use and disposal.
- ENMs pose a potential risk to human health through ingestion, inhalation and contact.

Background

- ENMs are covered by the definition of substance within the REACH (Registration, Evaluation and Authorization of Chemicals)regulations (Regulation (EC) No. 1907/2006), however there is no consensus as to how REACH applies to ENMs.

- The Scientific Knowledge for Environmental Protection (SKEP) Nanomaterials in REACH Report[1] concluded that most REACH provisions and assessment tools are not appropriate to evaluate the safety of nanomaterials

- It is therefore anticipated that ENM-specific regulation will be developed.

[1]SKEP. 2011. SKEP Nanomaterials in REACH Report. www.skep-network.eu/SKEP_Nanomaterials_in_REACH_Report

Background

- Within Europe, France has been the leader in terms of governmental regulation of nanomaterials.
- Obligation on companies to declare the quantities and uses of substances at nanoscale produced, distributed or imported to ANSES (the French agency for food safety,t he environment and labour).
- Belgium, Denmark and Norway have also initiated similar inventories of products.
- Italy, Germany, the UK and Sweden are proposing to introduce some form of regulation.
- Currently, in Ireland there is a lack of knowledge across sectors on the quantities and uses of substances at nanoscale.

Background

- Evidence is lacking regarding the potential impact AgNps present in consumer products have on human health or the environment and safe levels have not been established.

- Several studies provide evidence that ENMs in consumer products can accumulate in water the majority of studies to date rely on modelling data.

- Lack of monitoring and detection data, or an agreed methodology for ENM monitoring in waters and other environmental matrices.

- Lack of data in the scientific literature regarding the toxicity of silver nanoparticles in natural raw water.

[4]DEHLG and Camp. Dresser and McKee Ltd. (2004). Economic Analysis of Water use in Ireland. http://www.wfdireland.ie/docs/35_Economics/Economic%20Analysis%20of%20Water%20use.pdf

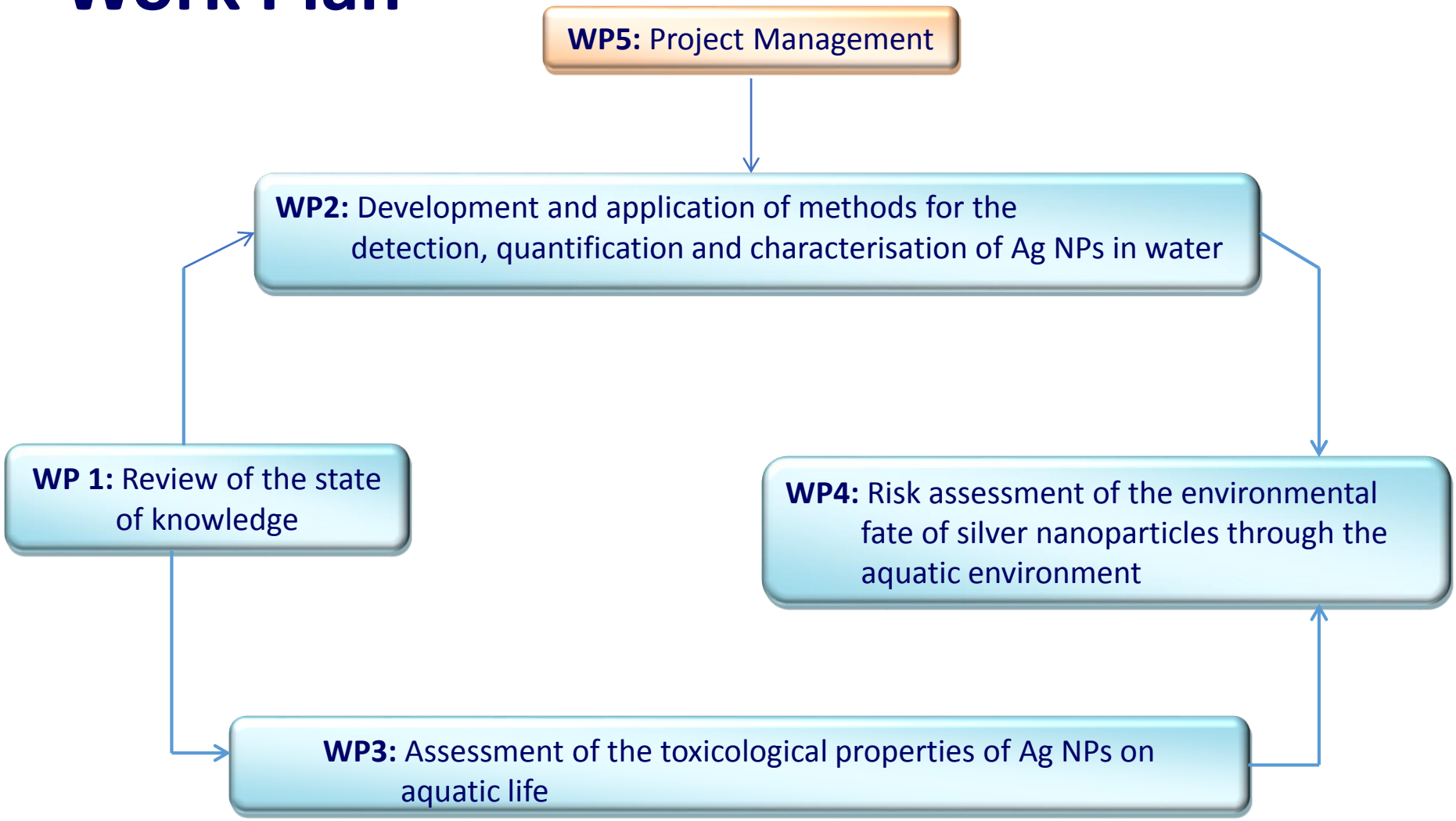
Aims of DeTER

1. To develop and implement methods for the detection, characterisation and quantification of silver nanoparticles in water.

2. To determine the toxicological properties of silver nanoparticles in the aquatic environment.

3. To develop risk assessment protocols which can be used to evaluate the environmental fate and likely risk from silver nanoparticles through aquatic pathways.

Work Plan


WP5: Project Management
WP2: Development and application of methods for the detection, quantification and characterisation of Ag NPs in water
WP 1: Review of the state of knowledge
WP4: Risk assessment of the environmental fate of silver nanoparticles through the aquatic environment
WP3: Assessment of the toxicological properties of Ag NPs on aquatic life

Key Recommendations

- An Irish national inventory of all products containing nanoparticles should be established and updated on a regular basis. A similar legislative framework to that in operation in France could be considered, which would require industry reporting to the inventory and ensuring the quality and accuracy of the information gathered.

- Further investigations should be carried out to determine the levels of AgNPs in the Irish environment. These studies should allow for examination of their impacts on the environment and associated risks.

Key Recommendations

- This study substantiates the need for international bodies such as the EU, ISO and OECD to develop and harmonise a suite of ecotoxicology bioassays for the risk assessment of Ag nanomaterials, taking cognisance of bioavailability issues, test matrix interference and the very low PECs.

- Given the rapid uptake of nanotechnology in various sectors, and the consequential likely increased environmental release of ENMs, environmental and human exposure will change and should be constantly monitored and re-evaluated.

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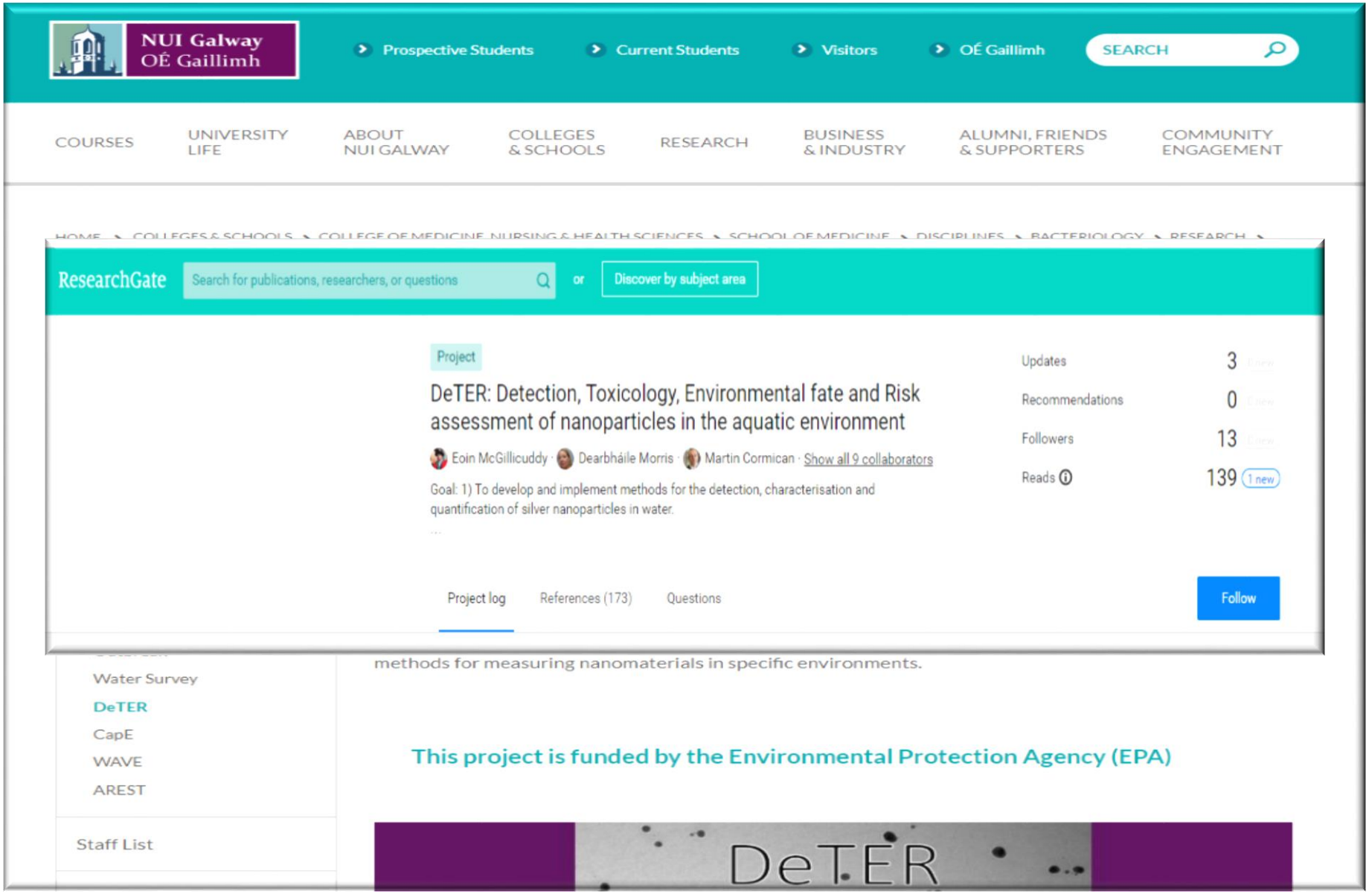

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AIT Institiúid Teicneolaíochta Bhaile Átha Luain Athlone Institute of Technology

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Acknowledgements

Environmental Protection Agency for funding under EPA Research Programme 2014–2020

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Project Steering Committee:

- Dr. Brian Quinn (University of the West of Scotland),
- Dr. Aisling O'Connor (EPA),
- Dr. Brian Donlon (EPA),
- Dr. Alan Stephens (EPA),
- Dr. Rachel Clarke (EPA).

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