

SENN2015 – International Congress on Safety of Engineered Nanoparticles and Nanotechnologies

With the advent of the next chapter of nanotechnology, there is an expectation to get more nanomaterials and nano-enabled products to the marketplace, requiring accelerated risk assessment and the ability to make decisions that can assist the environmental health and safety (EHS) governance of nanomaterials.

The 2nd International Congress on Safety of Engineered Nanoparticles and Nanotechnologies — SENN2015 — took place on 12-15th April 2015. Hosted by the Finnish Institute of Occupational Health, it is Europe's foremost gathering of experts in the field of nanosafety. It aims to promote nanosafety by improving the understanding of the biological basis of the potential risks of nanomaterials.

This year's conference was an overwhelming success, with over 200 international experts in attendance.

A diverse range of topics were lectured upon, with an emphasis on producing real solutions to the challenges that engineered nanomaterials and nanotechnologies pose. Also, various approaches to the future of toxicology were discussed. The congress provided a forum for reporting and demonstrating findings, methods, tools and approaches to safety and health at workplaces, while the plenary and free communication sessions allowed for more interaction between participants and presenters. The work and results achieved thus far within the NANOSOLUTIONS project were reported via poster presentations, keynotes and free communication sessions.

In this newsletter we hear from some of the participants at SENN2015 and what they were there to talk about.

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CONTACT DETAILS

PROJECT COORDINATOR

Kai Savolainen
Telephone: +358 40 742 0574
Email: kai.savolainen@ttl.fi
www.ttl.fi/en/Pages/default.aspx

DISSEMINATION

William Davis, IPL
Telephone: +44 (0) 1172 033 120
Email: info@ipl.eu.com
www.ipl.eu.com

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 309329



Work package updates

WP4: Life Cycle Analysis

The main objective of WP4 is to identify the most relevant stages in the life cycle of the different nano-enabled products, based on the selected engineered nanomaterials (ENMs) in the NANOSOLUTIONS project, and to determine in which stages ENMs release or transformation is most likely to happen, and experimentally simulate them.

The collected released materials during the simulation processes will be quantified, and their physical-chemical properties and hazard will be determined. Furthermore, the hazard characterization of the released materials will be used to derive ecotoxicological and human health impact factors using the "NANOSOLUTIONS hazard classifier".

Partners in WP4 (LEITAT, INKOA and TNO) selected one of the most representative applications for each ENM and, based on scientific data, identified the most relevant life cycle stage for the simulations: washing processes of

sportswear fabrics (with silver, copper oxide and titania ENMs), abrasion resistance of an antistatic cover fabric containing MWCNT, a household inkjet printing process with a CdTe-based ink, stability of nanodiamonds during their use in lubricant oils for car engines, and transformation of gold nanoparticles by body fluids after its administration to a patient. The data compiled, as well as the different setups designed, have been reported to the European Commission and presented in different conferences/workshops including the presentation of the latest results at the SENN2015 congress.

With the work still ongoing, results from the simulations processes indicate a significant material release to sewage waters from the sportswear fabrics during the first washings, and a detectable emission of airborne particles from the CdTe ink during the printing process, mainly ENMs in the 10-420nm range.

Cytotoxicity assessment of a CdTe quantum dot based ink during its use-phase

Thanks to the QualityNano project (Grant Agreement INFRA-2010-262163) and the Transnational Access Facility in the area of aerosol science in VITO (Belgium), it has been possible to perform some additional hazard studies for WP4 using the CdTe QDs ink from the NANOSOLUTIONS project.

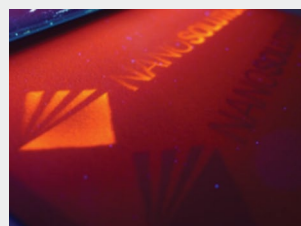
The selected case study was a water-based ink containing polyethyleneglycol-coated (PEG-CdTe) QDs developed by Plasmachem to be used in household inkjet printers, as its fluorescent properties are leading to novel products and applications in printed electronics, ink and pigment industries.

It is widely acknowledged that, in general, the use of printers has an influence on indoor air quality, including the concentration of ozone, volatile organic compounds (VOCs) or ultrafine particles (UFPs). These alterations depend on the printer type and printing conditions. Furthermore, from a life cycle perspective, CdTe QDs might be emitted during printing. This is especially relevant since several authors have reported the toxicity associated to CdTe QDs.

The work proposed was to evaluate the cytotoxicological potential of airborne particles emitted during inkjet printing

using a CdTe ink (8 mg/mL), in contrast to the pigment-free ink base. As a representative model the pulmonary epithelial cell line BEAS-2B was selected both for in vitro air-liquid interface cell exposure and in exposure in submerged conditions. The method of aerosolization was employed to artificially produce high-dose aerosol. Preliminary results indicate that the observed toxicity depends on the concentration of Cd²⁺ ions. Cells on the air-liquid interface are two orders of magnitude more sensitive compared to the cells submerged in the culture medium. Additional work is in progress to confirm these conclusions.

Present assessment provides a realistic view of the toxicity associated to nanotechnology enabled products from a holistic perspective, contributing to balancing the benefits and risks of this Key Enabling Technology.



Inkjet-printed sheet using the QDs-based ink.



In vitro air-liquid interface device used to expose the BEAS-2B cells to the QDs ink.

Dr André Nel

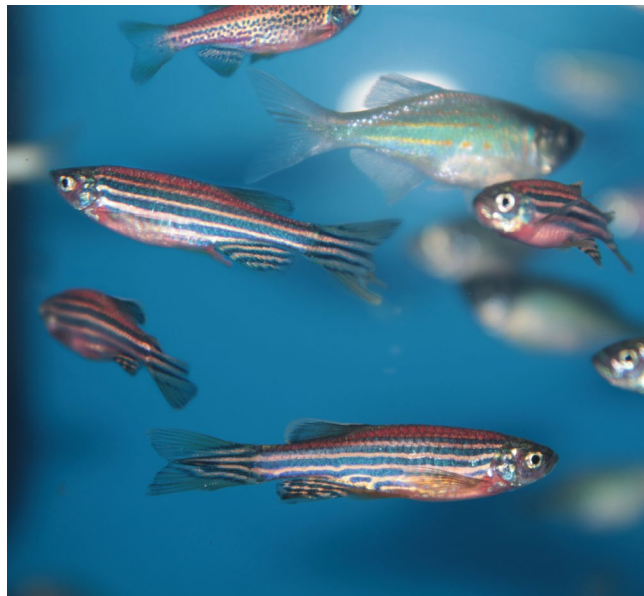
Dr André Nel is a peer-selected member of Best Doctors of America since 1998, and received the John Salvaggio Memorial Award recognising his outstanding service to the specialty of immunology. He is a recipient of the Harry Truman Award for research on safe nanotechnology implementation and nanomedicine, and has served as a panel member for President Obama's Council of Advisors for Science and Technology reviewing the National Nanotechnology initiative.

Dr Nel was at SENN2015 to promote the use of alternative test strategies for large category screening of new nanomaterials. The title of his talk was "Use of Alternative Test Strategies, Predictive Toxicological Approaches and Categorisation to expedite Decision Analysis of Nanomaterial Safety". He was advocating using non-animal testing to speed up the safety assessment of nanomaterials, and then developing decision trees that can assist regulation and safeguard the public environment through the development of safer nanomaterials.

According to Nel, the biggest preventative factor standing in the way of introducing alternative strategies is convention. Classical assessment methods use descriptive animal studies, but with the rate at which new materials are being produced it has come to a point where alternatives have to be considered. This is not to say that animal testing should be totally done away with, but if decision-making can be done more rapidly on broad groups of materials then alternatives might be better.

The chemical toxicity community currently views alternative test strategies as cellular studies that provide limited information and cannot predict what will happen in a living organism. The model that Nel proposes, however, doesn't involve random in vitro cellular studies, but rather uses cellular studies that have possible in vivo disease connections, and then uses that information to investigate large numbers of materials. This can provide an initial decision tree for whether a material poses a hazard and whether it is necessary to conduct further tests.

The model is a well-developed idea in terms of the infrastructures that have been developed. A



whole suite of technologies based on specific tests called adverse outcome pathways exist that predict pathophysiology of disease in terms of humans, zebrafish embryos or environmental organisms that are exposed to these materials. The model is no longer just theoretical – it is already at a stage where a lot of the data is being used.

Nel is now trying to invite a wider community of people who are involved in nanosafety — including regulators and industry — to become involved in a multi-stakeholder buy-in to the concept of alternative test strategies. He and his colleagues have already convened a number of multi-stakeholder studies that have brought together leading figures from industry, government agencies and academia to discuss this. He thinks it can work, but believes it will require transparency, a lot of discussion, and a patient step-by-step implementation of the programme.

The SENN2015 conference presented participants with a wide variety of topics, which Nel believes is a true indication that the nano-EHS community is rapidly accepting the idea that it is important to bring in new methods of analysis and decision-making. Now is the time that new technology needs to make it through to the market place without fear and unnecessary concerns if the field is to progress with the times.

Dr Anna Shvedova

Dr Anna Shvedova's lab is investigating toxicity of nanomaterials and mechanisms of adverse effects of nanoscale products. She has published over 150 scientific papers/book chapters in the toxicology field. She is the founder and past president of Dermal Toxicology Specialty Section/SOT.

Dr Shvedova's talk was about the immune response to nanomaterials. She specifically talked about the fact that nanomaterials can directly affect antigen presentation and

antigen processing of nanomaterials inside the immune cells. This is of great importance because it can affect immune protection against cancer, which is particularly affected by malfunctions of the immune system. She spoke about exposure to single carbon nanotubes, and her research that was looking to see whether they promoted metastatic growth in the lungs. Her research showed that myeloid derived suppressor cells were instrumental in cancer development. These cells were recruited for during carbon nanotube exposure.

Systems Biology Conference

On the 9-10th November 2015, the "Systems Biology in Nanosafety Research" conference will be taking place at the Nobel Forum in Stockholm, Sweden. This will mark the 3rd Mini-Conference on Nanotoxicology and will be chaired by Professor Bengt Fadeel and Professor Juha Kere.

Systems biology, defined as the computational and mathematical modelling of complex biological systems, is increasingly being applied in the field of nanosafety research for observing and predicting the biological perturbations inflicted by exposure to engineered nanomaterials. The aim of this two-day meeting is to provide an overview of the state-of-the-art of systems biology approaches in nanosafety research.

The conference is organised by Professor Bengt Fadeel with Professor Juha Kere within the EU-funded project FP7-NANOSOLUTIONS and in collaboration with the Working Group on Systems Biology in the EU NanoSafety Cluster, and will take place at the Nobel Forum, which is part of the world-renowned Karolinska Institutet.

The meeting is the third event in a series of Mini-Conferences on Nanotoxicology at the Nobel Forum organised by Professor Bengt Fadeel, the first which was organised in 2006 and the second in 2010 in the context of the FP7-NANOMMUNE project. The 2015 meeting is the first meeting to focus specifically on systems biology, a topic that is of central importance for the FP7-NANOSOLUTIONS project. The project coordinator, Professor Kai Savolainen, will provide the introductory remarks at this event.

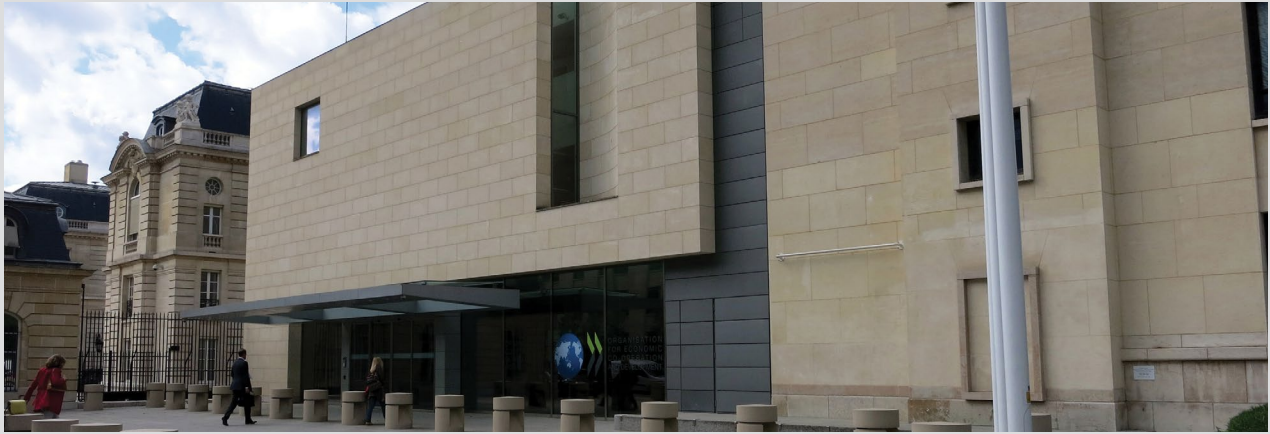
Dr Olli Ikkala (Finland) will present the opening keynote lecture oriented towards material sciences and emerging nanomaterial applications. In the closing keynote lecture Dr Martin Philbert (USA) will focus on the increasing number and diversity of engineered nanomaterials, which necessitates more sophisticated approaches in toxicological testing. The invited lectures with speakers from several European countries, the US, Canada and China are organised into sessions covering: "Nanosafety – setting the scene", followed by sessions on transcriptomics; proteomics; epigenomics and metabolomics; and bioinformatics and the application of these tools and approaches in nanosafety research.

“ Dr Olli Ikkala (Finland) will present the opening keynote lecture oriented towards material sciences and emerging nanomaterial applications ”

This international meeting is targeted at academic scientists with an interest in systems biology and nanosafety research, as well as representatives from nanotechnology related industries and regulatory agencies.

[Click here](#) to register for Systems Biology in Nanosafety research.

Diary Events



EU NanoSafety Cluster Meeting

OECD Conference Centre, Paris
30 September 14:00-18:00

The next NanoSafety Cluster Meeting will take place in the context of MARINA-NanoValid meeting.

[Click here](#) to find out more about the EU NanoSafety Cluster Meeting.

Global Summit on Regulatory Science - Regulatory Bioinformatics

Parma, Italy
October 12-13, 2015

In October, the Global Summit on Regulatory Science (GSRS15) will take place in Parma, Italy. This exciting conference will cover such presentation topics as Global Trends, Initiatives, and Opportunities, Health Applications of Bioinformatics and Food Applications of Bioinformatics. Speakers include Stephen Ostroff - Acting Commissioner of the FDA, Susanna-Assunta Sansone - Associate Director and PI of University of Oxford and Leming Shi - Professor and Director at the Centre for Pharmacogenomics, Fudan University.

[Click here](#) to register for the Global Summit on Regulatory Science.



NANOSOLUTION partners

Please find a list below of the NANOSOLUTION partners.

Finnish Institute of Occupational Health

<http://nanosolutionsfp7.com/partners/FIOH/>

Karolinska Institutet

<http://nanosolutionsfp7.com/partners/karolinska-institutet/>

Centre for BioNano Interactions (NUID UCD)

<http://nanosolutionsfp7.com/partners/nuid-ucd/>

Netherlands Organisation for Applied Scientific Research (TNO)

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National Institute for Occupational Safety and Health

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LEITAT

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The Technical University of Denmark, National Food Institute

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Telethon Institute of Genetics and Medicine

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North West University
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