Fate and Exposure models for you - www.nanofase.eu

NanoFASE final newsletter – Fall 2019

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MAKING TEAM SCIENCE WORK

by Dr Claus Svendsen, UKRI-CEH, Coordinator

NanoFASE : It's a wrap! With 45 partners and 100 people involved, only Team Science could deliver our spatiotemporal Exposure Assessment Framework. Here is stakeholder feedback on the new knowledge we created, our online resources, and our fantastically well-trained young people. Look for our Hot Papers, upcoming White Paper and Fact Sheets. Enjoy!

Nanomaterials exposure in the environment: ***How much is released, from***

We set out in 2015 to produce a new state-of-the-art framework for streamlined evaluation of environmental release, fate, transfer

products and industrial processes, and where does it go?

Providing tools to understand and answer these questions is even more important in the run-up to 2020 when REACH dossiers for nanoforms must engage a broader evidence base.

and exposure for Engineered Nanomaterials (ENMs), taking into account transformations, and moving from mass-based lifecycle and release flow approaches, towards systems that can render spatial and temporal variability.

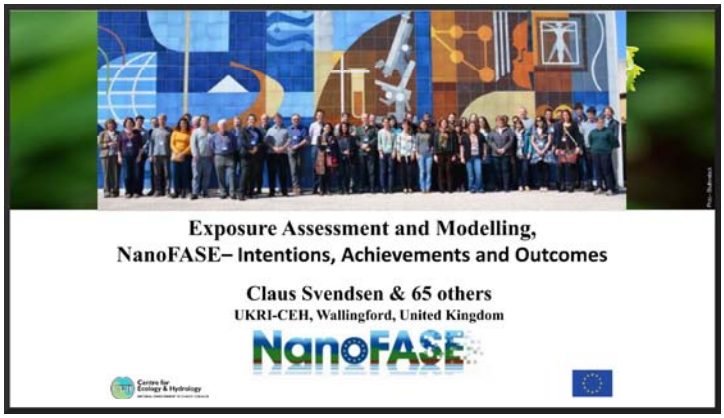
Our ambition was to bring nano environmental assessment up to or beyond the level achieved for conventional chemicals. Our work required a truly transdisciplinary approach, seamlessly integrating expertise in (eco)toxicology, environmental science, modelling, exposure and risk assessment, manufacturing, industrial innovation and design, life cycle analysis, instrumentation, materials science, characterisation, standardisation, communication... Throughout 4 years of intensive cooperation, we've shown together that team science works.

As NanoFASE wraps up, that experience is brought to H2020 projects Gracious, NanoCommons, and NanoSolveIT, new proposals and collaborations within the EU-US CoRs and NanoSafety Cluster. Our understanding of environmental transformation of ENM is being translated into international standards (TG 318 and 305, Tests 312 and 106…). NanoFASE partners look forward to teaming up with you in future!

At a major review in 2018, visionary EC DG-Research and Innovation Project Officer Georgios Katalagarianakis told us to: '*Go on being a small project*…

See Claus' full [summary presentation](#) from our Concluding Conference

Visit our [website](#), our [Library](#), our [Clickable Framework](#).



Our work

Stakeholder comments on the [Clickable Framework](#)

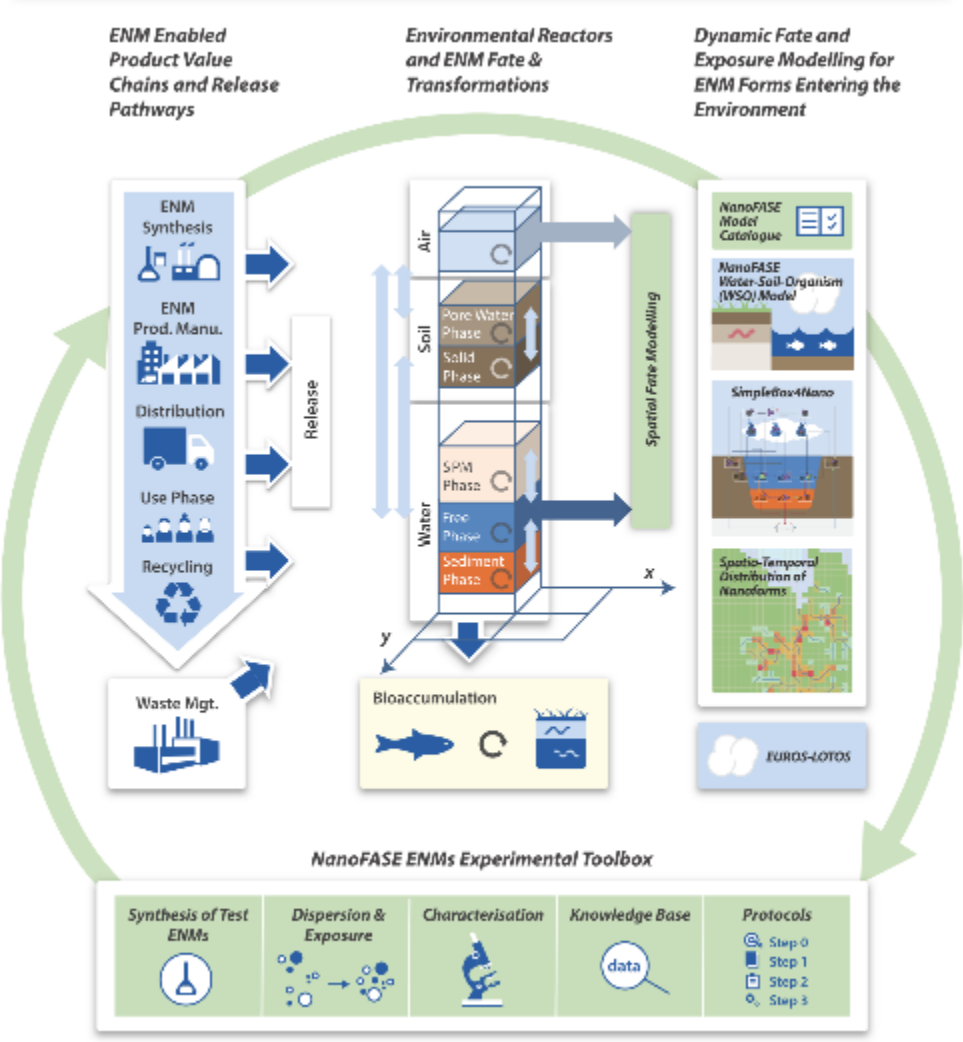
"An open access textbook, easily used in the university classroom; exercise could be: *design an environmental assessment strategy taking account of transformation processes, fate descriptors and tiered approach*"

"Understanding the language used by specialists in the field: of value for future reading and technical reviews"

"Customer awareness, knowledge on environmental compartments, very interesting notions on all the possible transformations of nanomaterials"

"Gives our company & clients access to environmental assessment information"

"Shows release pathways as a vehicle for conducting life cycle analyses"



Thanks Frank von der Kammer, Water and Sediments lead investigator, for hosting the NanoFASE Concluding Conference at UniVie alongside ICEENN 2019 *where NanoFASE authors provided 21 plenary presentations*

Stakeholder Talks at NanoFASE Concluding Conference

We invited a panel of Regulatory, Industry and Academic stakeholders from our Advisory Board and project partners to reflect on NanoFASE, the Clickable Framework and the way forward. Highlights below.

Andrzej Kinart (Amepox), **Martí Busquets** (Applied Nanoparticles - AppNps), **Olga Chybová** (inoTEX), and **Patrick Hole** (Malvern Panalytical) explained how participation in NanoFASE allowed them each to move to a new level with their company's specific nano-enabled products, synthesis capability, and off-the-shelf research support instrumentation. Read about their NanoFASE experience and flagship products:

Vienna Stakeholder Talks

Beyond these Vienna panellists, NanoFASE thanks all our further practical industry partners who synthesised experimental materials (Promethean bespoke particles), developed advanced techniques (PerkinElmer for (sp)ICP-MS), or tested nano-enabled products (FCCCO, Hempel)!

For **Anu Kapanen (ECHA)** as regulator, NanoFASE has added value by increasing understanding of the fate and exposure of ENMs: covering the different environmental compartments and processes, bringing out fate descriptors (attachment efficiency and rate, dissolution rate constant, sedimentation rate, sulfidation rate constant); and providing a variety of models. NanoFASE has achieved 'a leap' in developing protocols and procedures and contributing to standardisation; designing an Exposure Assessment Framework and reinforcing the regulatory-accepted SimpleBox4nano screening model; grouping based on fate properties; and creating public access to the Clickable Framework.

Consultant **Kai Paul (Blue Frog)** showed how the Clickable Framework opens access to critical principles (e.g. algorithms and their inputs), critical research (for instance NanoFASE Report D4.2 Release estimates), some protocols, and models (Tier 1 and higher). To complete REACH dossiers it is best used in conjunction with guidelines (e.g. ECHA 2017).

Wendel Wohlleben (BASF) analysed whether current research and knowledge address urgent questions that arise in view of REACH requirements for 2020. NanoFASE helps identify which properties and (functional) assays are necessary and sufficient to assess similarity for grouping; and which compartments shall (or should) be prioritized for environmental risk assessment.

Gregory Lowry (Carnegie Mellon) showed how NanoFASE has made strides in filling knowledge gaps: providing data on emissions; improving descriptions of heteroaggregation, transport, and reactive nanomaterial chemistry; developing labelled particles to enable environmental tracing. He said that NanoFASE has been especially successful in **parametrizing modelling by coordinating the design and execution of experiments** to collect the needed values.

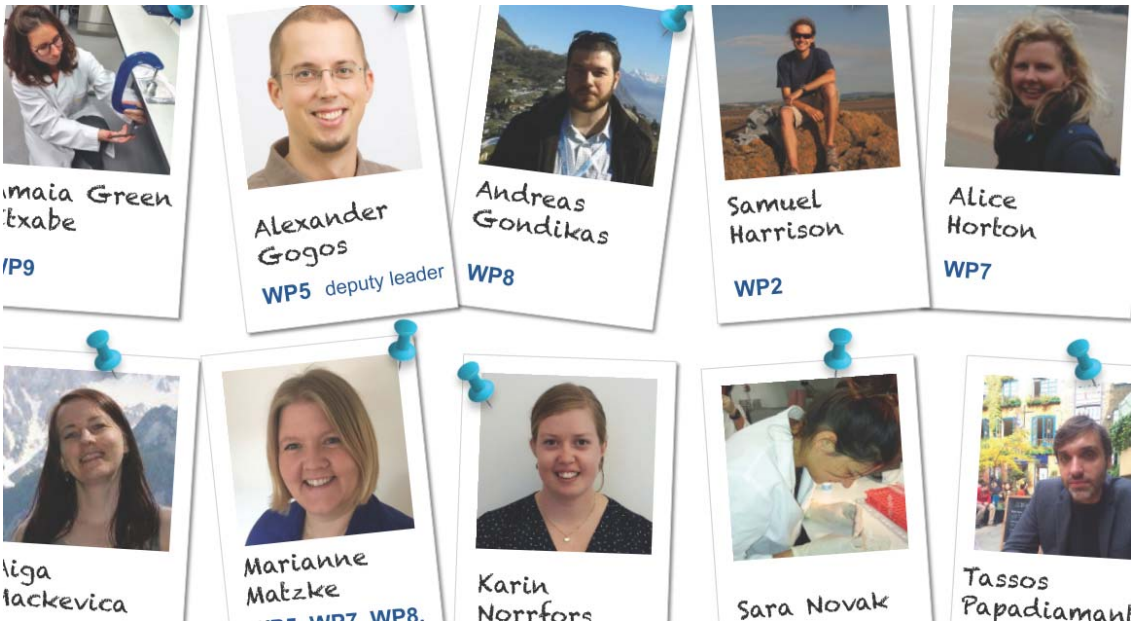
Jason Unrine (U. of Kentucky) presented thoughts on bioavailability and toxicokinetics, hitting the highlights of numerous major papers published by NanoFASE collaborators. He concluded that NanoFASE did an 'incredible job' developing tools and frameworks to organize knowledge of fate and transport. Grounded in mostly metal-based NPs in consumer product contexts, these should now be applied to higher-exposure, more sophisticated materials and uses.

Francisco Huertas (ITENE) showed what the tiered Environmental Exposure Assessment framework offers: release ratios, NP fate and behaviour, new modelling approaches; ability to determine hotspots. NanoFASE learning is meaningful to EU collaborations Interreg Sudoe, NanoDESK, NanoXplore, NanoMONITOR, NanoRIGO and BIORIMA.

Christine Hendren (CEINT, Duke University) and **Iseult Lynch** (University of Birmingham) spoke of integrating international nanomaterials communities around FAIR data generation, **data management and nanoinformatics** to support risk and hazard assessment of ENMs. CEINT, NanoFASE and Serenade developed curation of the NanoInformatics Knowledge Commons (NIKC) for Europe, and NanoFASE data are accessible now through H2020 project **NanoCommons**' Transnational Access scheme.

Ongoing legacy of NanoFASE through sister H2020 projects

§ NanoCommons project promotes the use/acceptance/implementation of the NIKC database for Europe using training materials produced as part of NanoFASE.
§ Gracious project adopts NanoFASE concepts of functional fate grouping (FFG) and environmentally realistic nanoforms, adapting these in hazard assessment for ENMs.
§ NanoSolveIT project applies NanoFASE's water-soil-organism model in ENM-focussed integrated approaches to testing and assessment (IATA).



The future of the field: Ever wonder about the 3 dozen incredible Young NanoScientists released to the environment by NanoFASE? Read their thoughts about what they learned and contributed, and the craziest moments.

Young NanoScientists Look Back

Our publications

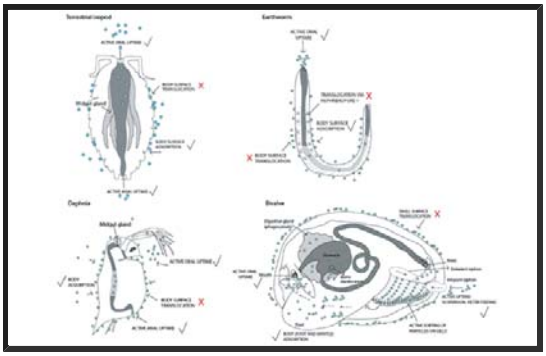
50 peer-reviewed publications

150 more expected

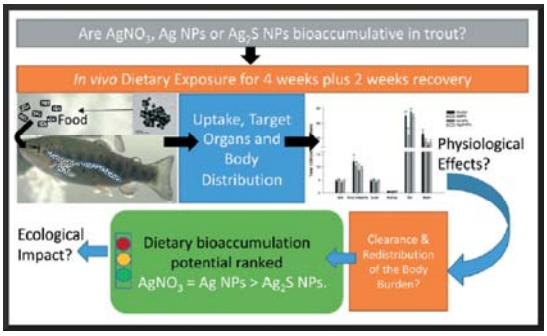
Visit our online Library

NanoFASE scientists produce HOT articles! Distinguished by *Environmental Science: Nano*

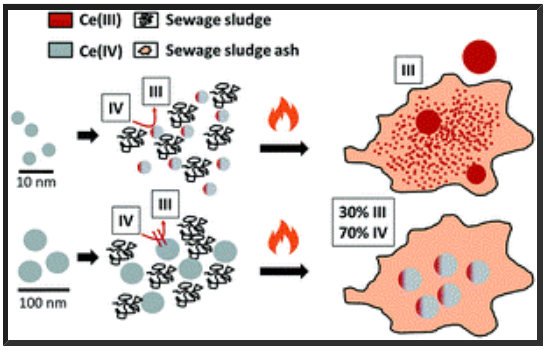
Four NanoFASE articles are *Environmental Science: Nano* HOT papers, placed in the top 10% of publications of Spring 2019. Each received exceptionally positive peer referee reports and the Editor called them 'significant and impactful'. Bravo to our Young NanoScientists for this remarkable performance!



Tools and rules for modelling uptake and bioaccumulation of nanomaterials in invertebrate organisms *by Brink NW van den, Kokalj AJ, Silva PV, Lahive E, Norrfors K, Baccaro M, Khodaparast Z, Loureiro S, Drobne D, Cornelis G, Lofts S, Handy RD, Svendsen C, Spurgeon D & Gestel CAM van*. Environ Sci: Nano 2019, **6**, 1985-2001.

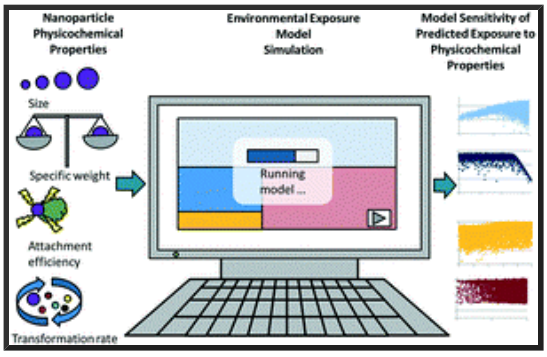


Dietary exposure to silver nitrate compared to two forms of silver nanoparticles in rainbow trout: bioaccumulation potential with minimal physiological effects *by Clark NJ, Boyle D, Eynon BP & Handy RD*. Environ Sci: Nano 2019, **6**, 1393-1405.



Transformation of cerium dioxide nanoparticles during sewage sludge incineration *by Gogos A, Wielinski J, Voegelin A, Emerich H & Kaegi R.* Environ Sci: Nano 2019, **6**, 1765-1776.

A model sensitivity analysis to determine the most important physicochemical properties driving environmental fate and exposure of engineered nanoparticles *by Meesters JAJ, Peijnenburg WJGM, Hendriks AJ, Van de Meent D & Quik JTK.* Environ Sci: Nano 2019, **7**, 2049-2060.



Our next steps

We are drawing together our NanoFASE learning and conclusions into major publications in prestigious outlets - including a virtual special collection detailing the *empirical methods and findings, exposure modelling, and overall impact on environmental risk assessment.*

Follow us on Twitter to capture them at release!