

The European Commission's science and knowledge service

Joint Research Centre



The NANoREG Toolbox for the safety assessment of nanomaterials

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The Joint Research Centre at a glance

3000 staff

Almost 75% are scientists and researchers.

Headquarters in Brussels and research facilities located in 5 Member States.



NANOREG project

- European FP7 project 2013–17, *"A common European approach to the regulatory testing of Manufactured Nanomaterials"*
- JRC led WP1, *"Scientific answers to regulatory issues"*
- Outputs of NANOREG WP1 include these main project outcomes:
 - **NANOREG Framework for the safety assessment of nanomaterials** (contributions from a large number of project partners, coordinated and edited by JRC)
 - **NANOREG Toolbox for the safety assessment of nanomaterials** (dataset compiled by JRC)

The Framework and the Toolbox

- The Framework and the Toolbox are linked in structure and content
- **Framework:** .pdf report published in April 2017, DOI: 10.2760/245972
- **Toolbox:** dataset first published in September 2017, update published in January 2018
DOI: 10.2760/332209 (short introductory.pdf)
<http://data.europa.eu/89h/jrc-nano-ehs-ring-nanoreg-tb>
(.zip file containing two Excel® workbooks)
 - **Released at the JRC Data Catalogue**
 - **Under Creative Commons ShareAlike license (CC BY-SA 4.0)**

EU context vs. other regions

- Both the NANoREG Framework and the NANoREG Toolbox revolve mostly around **European Union's regulatory definitions and requirements concerning nanomaterials** (mainly under REACH regulation)
- However...
 - The **basic risk assessment paradigm** is universal
 - Regulatory **information/testing requirements** for chemicals in different countries are increasingly being harmonized by e.g. the implementation of the United Nations' Globally Harmonized system (GHS)
 - **Testing methodology** suited for NMs is being internationally harmonized by OECD, standardised by (e.g.) ISO

 **The Toolbox is applicable also outside the EU!**

Framework structure (part I)

1. INTRODUCTION

PART I – CURRENT REGULATORY CONTEXT FOR NANOMATERIALS

2. DEFINITION OF NANOMATERIAL IN A REGULATORY CONTEXT

3. SAFETY ASSESSMENT OF NANOMATERIALS UNDER REACH

3.1. SUBSTANCE IDENTIFICATION

3.2. INFORMATION REQUIREMENTS

3.3. RULES FOR ADAPTATION OF THE STANDARD TESTING

3.4. HAZARD ASSESSMENT

3.5. EXPOSURE ASSESSMENT

3.6. RISK CHARACTERISATION

Framework structure (part II)

PART II – FORWARD-LOOKING STRATEGIES FOR NANOMATERIALS

4. NANOSPECIFIC PRIORITISATION AND RISK ASSESSMENT

5. SAFE-BY-DESIGN

6. LIFE CYCLE ASSESSMENT

7. TAKE-HOME MESSAGES AND FINAL CONSIDERATIONS

ANNEXES I-V

The idea of the NANoREG Toolbox

- Supports the Framework by identifying & inventorying **tools** for the different steps and options of NM safety assessment
 - **Toolbox .xls workbook**: tools publicly available, ready to use
 - **Prospective tools .xls workbook**: tools promised to become available in the short or medium term
- The **workbooks** are organised into **worksheets** that correspond to the **sections** of the NANoREG Framework
 - E.g. "3.5 Exposure assessment", "6 Life Cycle Analysis"
- Tools within each worksheet are **categorised** according to:
 - **Purpose**
 - **Type**
 - **Regulatory [acceptance] status**



Concepts: “tool”

“An experimental, computerised, or decision procedure used for generating, collecting, assessing, and/or storing a certain type of output”

Gottardo, S. *et al.* 2016. NANoREG harmonised terminology for environmental health and safety assessment of nanomaterials, EUR 27808. DOI: 10.2788/71213


- Toolbox tools...
 - ...**must** be *directly* accessible
 - ...**may** require registration or payment
- These are **not** considered tools:
 - Technical instruments
 - Services (provided e.g. by consultants)

How tools were gathered

- Tools mentioned in the NANoREG Framework
- Tools suggested by NANoREG partners
- Tools (being) developed by nanosafety research projects
- Reviews and reports about existing tools
- Literature searches
- Web searches

All useful tools that were found were recorded – not only from European sources or context!

Toolbox in practice

- Each **worksheet** corresponds to a section of the Framework 
- Each row is a tool record 
- Each column provides an information item about the tool 

WORKSHEET 2 EC Nano Definition.
 Available tools for the implementation of the European Commission's Recommendation on the definition of nanomaterial (EC Nano Definition) - Linked to Section 2 of the NANOREG Framework
 This worksheet contains tools related to determining particle size distribution and volume specific surface area (VSSA) of nanomaterials
 Link to EC Nano Definition: http://ec.europa.eu/submitting_nanochemicals/nano_definition_en.htm
 Link to NANOREG Framework:

1	2	3	4	5	6	7	8	9	10
What is the tool for?	Name	Type	Regulatory status	Description	Documented applications	Other information	Project/organisation	Publication(s)	Link
Measuring Particle Number Size Distribution	ISO TC 229 Nanotechnologies	Guidance	Standardised	List of standards concerning nanotechnologies under the direct responsibility of ISO/TC 229 Secretariat			ISO		http://www.iso.org/iso/technical委员会/229/22930304.html
Measuring Particle Number Size Distribution	OECD Test Guidelines developed for physicochemical characterisation	Guidance	Regulatory document	Most OECD test guidelines (TGs) are suitable for NMs, but in some cases adaptations may be needed to address certain nano-specificities. The OECD test guidelines programme has started to work on adapting some specific test guidelines to NMs as well as to develop specific test guidelines and guidance documents for nanomaterials, which will lead to future regulatory test guidelines for NMs.			OECD	OECD, 2008 Preliminary Review of OECD Test Guidelines for their Applicability to Manufactured Nanomaterials. OECD Environment, Health and Safety Publications, Series on the Safety of Manufactured Nanomaterials N° 75. EMA/ENH/ND/2008/21. Organisation for Economic Co-operation and Development, Paris.	http://www.oecd.org/dataoecd/21/12/44622222.pdf
Measuring Particle Number Size Distribution	ECHA Guidance for implementation of REACH Recommendations for nanomaterials	Guidance	Regulatory document	ECHA guidance document that provides NM-specific recommendations for measuring particle number size distribution in order to fulfil REACH information requirements.			ECHA	ECHA, 2012. Guidance on information requirements and chemical safety assessment. Appendix P1-1 Recommendations for nanomaterials applicable to Chapter P1/a Endpoint specific guidance. European Chemicals Agency, Helsinki.	http://echa.europa.eu/documents/guidance_requirements_and_assessment
Measuring Particle Number Size Distribution	Requirements on measurements for the implementation of the EC Definition	Report	Regulatory document	Report on requirements on measurements for the implementation of the European Commission's definition of the term 'nanomaterial'.			JRC	Linsinger T, Rosbjen G, Billand D, Catala L, Rossi F, Gibson P, Klein C, 2012. Requirements on measurements for the implementation of the European Commission definition of the term 'nanomaterial'. JRC Reference Reports: EUR-25404 EN. Publications Office of the European Union.	http://ec.europa.eu/nano/docs/nanoreg/20120620_requirements_on_measurements_for_the_implementation_of_the_ec_definition.pdf
Measuring Volume Specific Surface Area (VSSA)	Towards a review of the EC Recommendation for a definition of the term	Report	Regulatory document	Report on practical experience gathered in implementing the European Commission's Recommendation for a definition of the term 'nanomaterial'.			JRC	Rosbjen G, Fleischer H, 2014. Towards a review of the EC Recommendation for a definition of the term 'nanomaterial'. Part 2.	http://ec.europa.eu/nano/docs/nanoreg/20140620_towards_a_review_of_the_ec_recommendation_for_a_definition_of_the_term_nanomaterial_part_2.pdf

4 | 2 EC Nano Definition | 3.1 REACH Substance ID | 3.2 REACH Info Requirements | 3.3 REACH Adaptation rules | 3.4 REACH Hazard assessment | 3.5 REACH Exposure assessment | 3.6 Risk characterisation | 4 Nanospecific risk assessment

Information items recorded

- **Purpose** (drop-down menu of options)
- Name of the tool
- **Type** (drop-down menu)
- **Regulatory status** (drop-down menu)
- **Description**
- Documented applications
- Other information
- Project or organisation
- **Publication(s)**
- **Link** to a relevant website

Concepts: “purpose” of tool

- Typically, purpose = endpoint served by the listed tool
- A drop-down menu with fixed options
 - Menu developed separately for each section of the Toolbox
 - Options are partly based on regulatory requirements or guidance, partly pragmatic

Purpose	Name
Identifying and reporting nanoforms	if
Measuring particle number size distribution	if
Measuring Specific Surface Area(SSA)	if
Characterising shape	if
Measuring aspect ratio	if
Chemical characterization	if
Characterising physchem properties	if
Identifying and reporting nanoforms	if

Purpose	Name
Characterising consumer exposure	if
Developing Exposure Scenarios(ES)	if
Characterising occupational exposure	if
Characterising consumer exposure	if
Characterising environmental exposure	if
Qualitative exposure characterization	if
Exposure / release simulation	if
Controlling exposure	if
Other	if

Concept: “type” of tool

- **Experimental protocol** - e.g. SOP/guideline for conducting a toxicological experiment or characterising a physicochemical property
- **Model** - e.g. a predictive algorithm of exposure or release into the environment, or a (Q)SAR application
- **Decision support tool** - e.g. a checklist or decision tree that helps to define a testing strategy, or a software system that provides relevant information for decision-making
- **Guidance** - a document prepared by a regulatory authority or international organisation to communicate official recommendations for implementing regulatory requirements or performing specific testing
- **Report** - a document by a research group or a public authority, giving independent advice on how to perform specific research activities or implement specific regulatory requirements
- **Data management tool** - a tool/system for data storage, handling or analysis
- **Repository** - a source of reference materials for analysis or testing

Concepts: “regulatory status”

The *regulatory acceptance level* of the tool

Disclaimer: the 'regulatory status' is provided purely for informative and user guidance purposes in the Toolbox files, and it does not engage any responsibility on its accuracy from the JRC or anyone else in the NANoREG project

- **Research product** - a research outcome that has not been tested / validated / standardised / harmonised for regulatory purposes (default option)
- **Validated** - has undergone a formal interlaboratory validation procedure
- **Harmonised** - has undergone a formal harmonisation process at OECD level
- **Standardised** - has undergone a formal standardisation process at e.g. ISO or CEN level
- **Regulatory document** - the tool is a document developed by a regulatory or competent authority, and it therefore has high regulatory relevance
- **Not applicable** - none of the options above properly apply

Nature of the recorded information

- The **primary source** of information about each tool: relevant publications, documentation and promotional material **by the developers of the tool**
- Any publications (e.g. reviews) analysing or applying the tool could also be used
- Prospective tools:
 - Project websites, newsletters etc.
 - Conference presentations, posters
 - Direct contact with the developers
- Expert judgment (of Toolbox developers and colleagues)
- Note: the NANOREG Toolbox has its **own criteria** for
 - the correct location(s) of a tool within the Toolbox
 - assigning each tool a type, a regulatory status etc.

November 2017 update

- Original dataset is from August 2017 (published in September)
- New version:
 - Each combination of tool identity, purpose, type and regulatory status is now a separate record (if the same tool e.g. serves several different purposes, it is also covered by several records)
 - Content updated, supplemented and corrected, including new records
- Reasons:
 - Easier to search for tools (e.g. by purpose) by using MS Excel Filtering and Sorting functions
 - Easier to handle the dataset
- Available online since January 10, 2018

NANOREG Toolbox contents

- November 2017 updated version: > 550 unique tools in total
- > 500 unique tools referenced in the 'Toolbox' (current tools)
 - **75 %** are **nanospecific**
 - **18 %** are **NANOREG products**
 - **Most common type** of tool is **experimental protocol (58 %)**
 - **Most common regulatory status** is **research product (61 %)**
- 29 tools (all unique and nanospecific) recorded as 'prospective tools'

Uses of the NANOREG Toolbox

- Entry portal to currently available tools
 - Can be browsed or searched using various Excel functions
 - Information provided about each tool helps to find appropriate tool(s) for a specific purpose, if available
 - Web link and/or literature reference provides access to each tool
- Inventory of what is currently available (Toolbox) or is expected to become available relatively soon (Prospective tools)
- Basis for a potential proper database
 - A Wiki based solution would give the users the opportunity to supplement and update the contents

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