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ENVIRONMENT DIRECTORATE
JOINT MEETING OF THE CHEMICALS COMMITTEE AND
THE WORKING PARTY ON CHEMICALS, PESTICIDES AND BIOTECHNOLOGY

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ANALYSIS OF THE SURVEY ON AVAILABLE METHODS AND MODELS FOR ASSESSING EXPOSURE TO MANUFACTURED NANOMATERIALS

Series on the Safety of Manufactured Nanomaterials
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OECD Environment, Health and Safety Publications

Series on the Safety of Manufactured Nanomaterials

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ANALYSIS OF THE SURVEY ON AVAILABLE METHODS AND MODELS FOR ASSESSING EXPOSURE TO MANUFACTURED NANOMATERIALS

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

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Environment Directorate
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
Paris, 2015

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No.41, *Report of the OECD Expert meeting on the Physical Chemical Properties of Manufactured Nanomaterials and Test Guidelines (2014)*

No.42, *Report of the questionnaire on regulatory regimes for manufactured nanomaterials 2010-2011 (2014)*

No.43, *Genotoxicity of Manufactured Nanomaterials: Report of the OECD expert meeting (2014)*

Nos. 44-54, These items are the dossiers derived from the Testing Programme on Manufactured Nanomaterials which are located at:
http://www.oecd.org/chemicalsafety/nanosafety/testing-programme-manufactured-nanomaterials.htm

No. 55, *Harmonized Tiered Approach to Measure and Assess the Potential Exposure to Airborne Emissions of Engineered Nano-Objects and their Agglomerates and Aggregates at Workplaces (2015)*

ABOUT THE OECD

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation in which representatives of 34 industrialised countries in North and South America, Europe and the Asia and Pacific region, as well as the European Commission, meet to co-ordinate and harmonise policies, discuss issues of mutual concern, and work together to respond to international problems. Most of the OECD's work is carried out by more than 200 specialised committees and working groups composed of member country delegates. Observers from several countries with special status at the OECD, and from interested international organisations, attend many of the OECD's workshops and other meetings. Committees and working groups are served by the OECD Secretariat, located in Paris, France, which is organised into directorates and divisions.

The Environment, Health and Safety Division publishes free-of-charge documents in eleven different series: **Testing and Assessment**; **Good Laboratory Practice and Compliance Monitoring; Pesticides; Biocides; Risk Management; Harmonisation of Regulatory Oversight in Biotechnology; Safety of Novel Foods and Feeds; Chemical Accidents; Pollutant Release and Transfer Registers; Emission Scenario Documents;** and **Safety of Manufactured Nanomaterials.** More information about the Environment, Health and Safety Programme and EHS publications is available on the OECD's World Wide Web site (www.oecd.org/chemicalsafety/).

This publication was developed in the IOMC context. The contents do not necessarily reflect the views or stated policies of individual IOMC Participating Organizations.

The Inter-Organisation Programme for the Sound Management of Chemicals (IOMC) was established in 1995 following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. The Participating Organisations are FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organisations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

This publication is available electronically, at no charge.

**For this and many other Environment,
Health and Safety publications, consult the OECD's
World Wide Web site (www.oecd.org/chemicalsafety/)**

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FOREWORD

The OECD Joint Meeting of the Chemicals Committee and Working Party on Chemicals, Pesticides and Biotechnology (the Joint Meeting) held a Special Session on the Potential Implications of Manufactured Nanomaterials for Human Health and Environmental Safety (June 2005). This was the first opportunity for OECD member countries, together with observers and invited experts, to begin to identify human health and environmental safety related aspects of manufactured nanomaterials. The scope of this session was intended to address the chemicals sector.

As a follow-up, the Joint Meeting decided to hold a Workshop on the Safety of Manufactured Nanomaterials in December 2005, in Washington, D.C. The main objective was to determine the "state of the art" for the safety assessment of manufactured nanomaterials with a particular focus on identifying future needs for risk assessment within a regulatory context.

Based on the conclusions and recommendations of the Workshop [ENV/JM/MONO(2006)19] it was recognised as essential to ensure the efficient assessment of manufactured nanomaterials so as to avoid adverse effects from the use of these materials in the short, medium and longer term. With this in mind, the OECD Council established the OECD Working Party on Manufactured Nanomaterials (WPMN) as a subsidiary body of the OECD Chemicals Committee in September 2006. This programme concentrates on human health and environmental safety implications of manufactured nanomaterials (limited mainly to the chemicals sector), and aims to ensure that the approach to hazard, exposure and risk assessment is of a high, science-based, and internationally harmonised standard. This programme promotes international co-operation on the human health and environmental safety of manufactured nanomaterials, and involves the safety testing and risk assessment of manufactured nanomaterials.

This document is published under the responsibility of the Joint Meeting of the Chemicals Committee and Working Party on Chemicals, pesticides and Biotechnology of the OECD.

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Background and Purpose

1. The OECD work group members of the Working Party for Manufactured Nanomaterials (WPMN) Steering Group 8 agreed to conduct an informal survey as an initial step in compiling information regarding methods and models for assessing exposure to manufactured nanomaterials. The results from the survey were intended to develop an inventory of available methods and models used to assess human and environmental exposure to manufactured nanomaterials. Methods and models used in a qualitative or quantitative exposure assessment were of primary interest, but other relevant information could also be provided.

2. A survey instrument was subsequently developed to include the following information:

- Method or model
- Type (priority setting, screening, qualitative, detailed, other)
- Target group (consumer, worker, children, general population, environment)
- Exposure Pathway (ingestion, inhalation, dermal, soil, air, water, food chain, bioaccumulation/fish, drinking water, other)
- Status (interim guidance, peer reviewed publication, other)
- Synopsis and other information

3. The survey gathered information on a variety of types of methods and models, including those used to set priorities, to screen nanomaterials, to develop detailed assessments of exposure, and other types of methods or models. Methods or models suitable for prioritization often compare materials in a relative sense, but are not sufficient to quantitatively assess exposure to specific nanomaterials. In contrast, screening level methods or models are often used for semi-quantitative assessment of exposure to specific nanomaterials, but are biased towards developing conservative (protective) estimates which can be used to identify those exposures which are higher priority for further analysis. Finally, more detailed (higher tier) assessments are often developed where more accurate assessments are needed, for example, to initiate specific risk management action for major commodity chemicals. Analytical methods were also collected as a result of the survey, and these would fall in the “other” category.

Summary of Survey Responses

4. Thirty six responses were received from sixteen countries. Additionally, one final report and two abstracts were submitted. Of the surveys received, over half described analytical methods, three responses described computer models and the remaining responses were either guidance or risk assessment/management documents.

5. The information obtained from the surveys is detailed in a separate document, “Compilation of Available Methods and Models Used for Assessing Exposure to Manufactured Nanomaterials”.

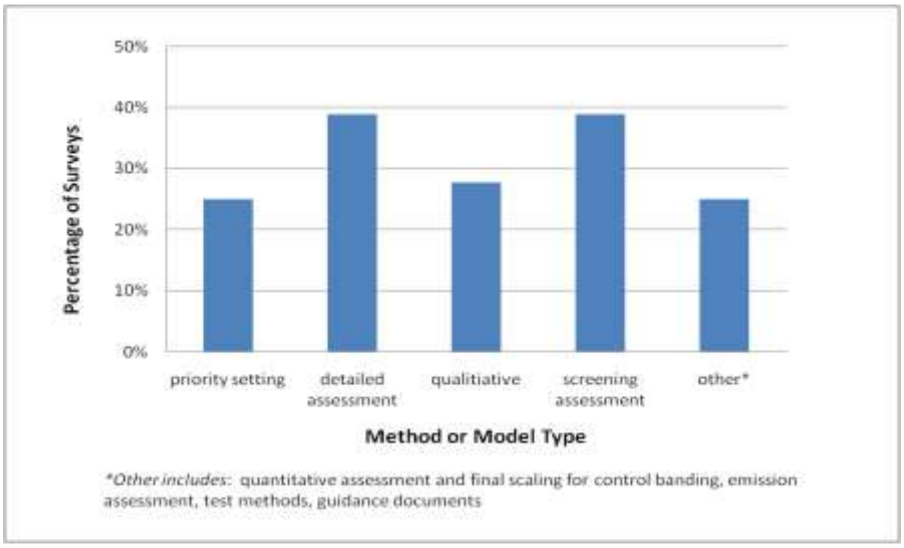

Figure 1. Methods and Models Type

6. The percentage of each type of method or model was tabulated and is shown in Figure 1. There was a nearly uniform distribution of the different types of models or methods; however, note that more than one category could be chosen in any one survey submission. Methods or models that were described as being "other" included quantitative assessment and final scaling for control banding, safety guidance for working with nanomaterials, experimental set-ups for examining the presence of nanoparticles in dust generated from the physical processing of products containing NMs, and an emission assessment interim draft guidance document.

7. Of the analytical methods used, at least half employed readily available instrumentation such as a scanning mobility particle sizer (SMPS), differential mobility analyzer (DMA), or a condensation particle counter (CPC) either alone or incorporated as part of a research scale analytical tool. The remainder were non standard test set-ups.

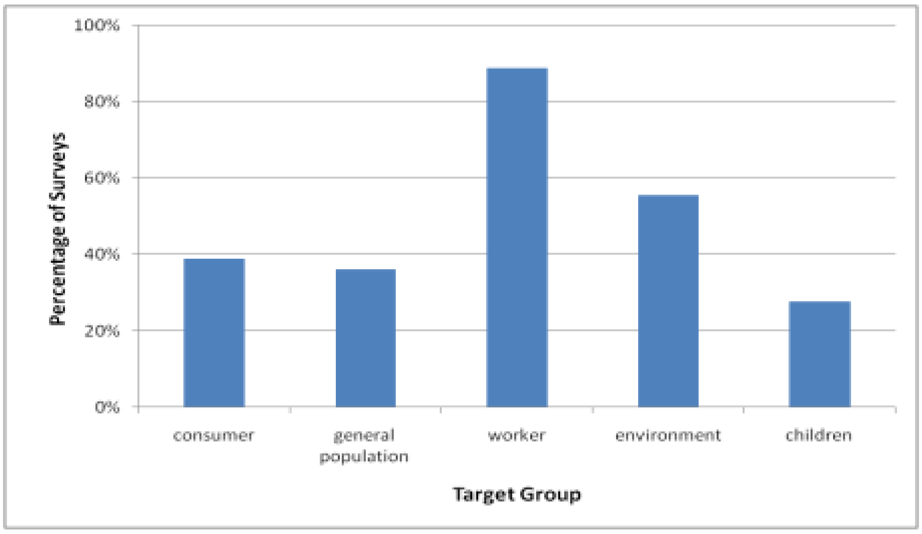

Figure 2. Methods and Models Target Group

8. The percentage of methods and models addressing each target group is shown in Figure 2. The majority of the methods address worker exposure as reflected in Figure 2, although a fair number of surveys indicated that consumer, general population, children and environmental exposures are also taken into account.

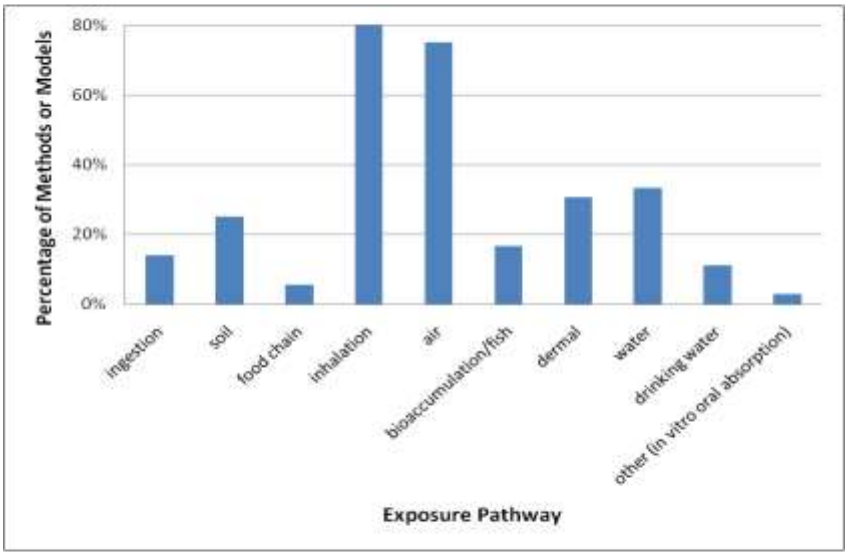

Figure 3. Methods and Models Exposure Pathways

9. The exposure pathways are tabulated in Figure 3. Based upon the information provided in the submitted surveys, most of the methods address airborne particulate however other lab scale methods described exposures via aging and weathering and release from impact and drilling. Two responses concerned toxicity (interactions between nanomaterials and biointerfaces and *in vitro* intestinal absorption) and one response was specifically geared toward carbon nanofibers.

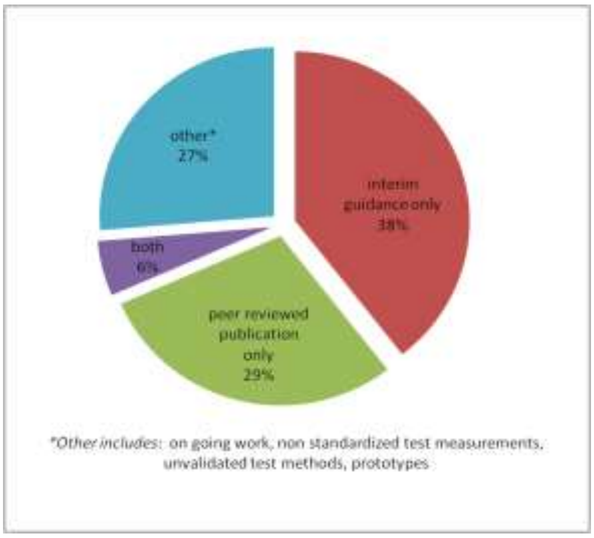

Figure 4. Current Status of Method or Model

10. The current status of the methods and models described in the survey responses is shown in Figure 4. A little over one third of the methods and models described in the survey results were used for interim guidance only and have not under gone external peer review. Another third of the methods and models were identified as publications which have undergone peer review. A small percentage of the methods and models included in the survey results were described as being both interim guidance and peer reviewed publications. For example, one is a method developed by the U.S. on assessment techniques for estimating sources and releases of nanomaterials. The method has been peer reviewed but will be updated as we learn more about releases of nanomaterials, and thus is characterized as interim guidance. The remainder of the responses described methods and models which are non standardized test measurements, not yet validated test methods, ongoing work, and prototypes.

Ideas for Next Steps

11. Based on the information gathered from the survey, some suggested future activities may include a more detailed review for:

- Most of the methods or models pertained to worker exposure assessment. Thes methods or models include analytical and sampling methods, and methods for evaluating exposure, release, or risk. One could evaluate the methods to determine whether the available methods could be used to develop emission/release scenarios.

- A number of the survey responses pertain to sampling and analytical methods. One could evaluate the methods and determine characteristics of direct exposure sampling and measurement approaches for specific environmental compartments (i.e. for environmental exposure).

- A small number of methods pertain to assessment of either worker or consumer exposure. One could evaluate the worker and consumer exposure assessment methods to determine whether specific exposure pathways could be linked to product manufacturing and use (e.g. worker and consumer exposure).

- A few of the survey results pertain to data sources or published review summaries. An analysis and ranking of data sources identified through this project, and identification of data gaps and recommendations for filling those gaps could be conducted.

Appendix I: Compilation of Available Methods and Models Used for Assessing Exposure to Manufactured Nanomaterials

*** This compilation is based on responses from delegations to "*A Survey on Available Methods and Models for Assessing Exposure to MNs*" which was issued in March 2011.**

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1. General Information

COUNTRY	METHOD OR MODEL REPORTED IN THE SURVEY	PREPARER OF THE SURVEY RESULTS	TECHNICAL CONTACT FOR THE METHOD OR MODEL
AUSTRALIA	(a)OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance and (b)NIOSH Method 5040	Howard Morris howard.morris@SafeWorkAustralia.gov.au Safe Work Australia	Peter McGarry Peter.McGarry@justice.qld.gov.au p.mcgarry@student.qut.edu.au Queensland University/ Workplace Health & Safety Queensland
	Stable Isotope Tracing	Maxine McCall Maxine.mccall@csiro.au CSIRO	Prof. Brian Gulson (retired) Brian.gulson@mq.edu.au Macquarie University
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)	Alexander Graff alexander.graff@auva.at AUVA	Alexander Graff alexander.graff@auva.at AUVA
	Acoustic Dust Tester (ADT)	Dr. Andreas Kornherr andreas.kornherr@mondigroup.com Mondi Uncoated Fine & Kraft Paper GmbH	Dr. Andreas Kornherr andreas.kornherr@mondigroup.com Mondi Uncoated Fine & Kraft Paper GmbH
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	David Rickerby david.rickerby@jrc.ec.europa.eu European Commission Joint Research Centre	Ch. Studer (FOPH) christoph.studer@bag.admin.ch A. Weber (FOEN) andreas.weber@bafu.admin.ch Ch. Rüegg (SECO) christoph.rueegg@seco.admin.ch M. Tellenbach (Terraconsult) mtellenbach@bluewin.ch J. Höck (TEMAS AG) juer-gen.hoeck@temas.ch
CANADA	(New Research Project) Techniques for distinguishing background “ambient” nanoparticles (NPs) from process-related NPs in the workplace.	Dr. Pat E. Rasmussen pat.rasmussen@hc-sc.gc.ca Health Canada/University of Ottawa	Dr. Pat E. Rasmussen pat.rasmussen@hc-sc.gc.ca Health Canada/University of Ottawa
DENMARK	NanoSafer	Keld Alstrup Jensen kaj@nrcwe.dk	Keld Alstrup Jensen kaj@nrcwe.dk

		National Research Centre for the Working Environment	National Research Centre for the Working Environment
FINLAND	Direct NP concentration measurement method	Joonas Koivisto joonas.koivisto@ttl.fi Finnish Institute of Occupational Health	Joonas Koivisto joonas.koivisto@ttl.fi Finnish Institute of Occupational Health
	Stoffenmanager Nano (published currently in Dutch, to be published in English in a near future, and to be translated into Finnish by the end of 2011)	Milja Koponen milja.koponen@ttl.fi Finnish Institute of Occupational Health	Henri Heussen henri.heussen@arbounie.nl ArboUnie
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)	Sabine Plitzko plitzko.sabine@baua.bund.de Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA)	GRIMM Aerosol Technik GmbH Mühlenbecker Weg 18, 06774 Pouch, Germany Web: http://www.grimm-aerosol.com/
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)	Sabine Plitzko plitzko.sabine@baua.bund.de Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA)	TSI GmbH Neuköllner Strasse 4, 52068 Aachen, Germany Telephone: +49 241-52303-0 Fax: +49 241-52303-49 tsigmbh@tsi.com Web: http://www.tsi.com/
	Thermophoretic personal sampler	Sabine Plitzko plitzko.sabine@baua.bund.de Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA)	Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) Nöldnerstraße 40-42, 10317 Berlin plitzko.sabine@baua.bund.de
	Nanometer Aerosol Sampler (NAS)	Sabine Plitzko plitzko.sabine@baua.bund.de Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA)	TSI GmbH Neuköllner Strasse 4, 52068 Aachen, Germany Telephone: +49 241-52303-0 Fax: +49 241-52303-49 tsigmbh@tsi.com Web: http://www.tsi.com/
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials	Dr. Iseult Lynch Iseult.Lynch@cbni.ucd.ie	Dr. Iseult Lynch, Centre for BioNano Interactions, University College Dublin,

	(NM) – influence on NM fate & behavior	Centre for BioNano Interactions, University College Dublin	Belfield, Dublin 4 (Iseult.Lynch@cbni.ucd.ie) Dr. Marco Monopoli, Centre for BioNano Interactions, University College Dublin, Belfield, Dublin 4 (Marco.Monopoli@cbni.ucd.ie).
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor	Laura Manodori laura.manodori@venetonanotech.it Veneto Nanotech Scpa	
JAPAN	XPONA	Yasuto Matsui ymatsui@risk.env.kyoto-u.ac.jp Graduate School of Engineering, Kyoto University	Yasuto Matsui ymatsui@risk.env.kyoto-u.ac.jp Graduate School of Engineering, Kyoto University
NETHERLANDS	(risk assessment and risk management model)	Hildo Krop hkrop@ivam.uva.nl IVAM UvA NL	rcornelissen@ivam.uva.nl
	(Nanotracer)	Hildo Krop hkrop@ivam.uva.nl IVAM UvA NL	fvbroekhuizen@ivam.uva.nl
	Setting NRVs	Hildo Krop hkrop@ivam.uva.nl IVAM UvA NL	pvbroekhuizen@ivam.uva.nl
	Stoffenmanager Nano	dick.brouwer@tno.nl Wouter.fransman@tno.nl	dick.brouwer@tno.nl Wouter.fransman@tno.nl
	DREAM Nano	dick.brouwer@tno.nl	dick.brouwer@tno.nl
NORWAY	Survey	Astrid Lund Ramstad astrid.lund.ramstad@arbeidstilsynet.no	Astrid Lund Ramstad The Norwegian Labour Inspection Authority astrid.lund.ramstad@arbeidstilsynet.no
SLOVENIA	Detection of nanoparticles	Nataša Kramar Natasa.kramar@gov.si	Prof. dr. Maja Remškar maja.remskar@ijs.si,

		Ministry of Labour, Family and Social Affairs	Jozef Stefan Institute http://www.ijs.si/ijsw/JSI Center of Excellence: Nanoscience and Nanotechnology (http://nin.ijs.si/nano.htm)
SPAIN	In vitro assessment of oral absorption	Maya Vilà mvila@leitat.org LEITAT Technological Center	mvila@leitat.org gjaner@leitat.org
	Nanofilters for sample collection in air and water compartments	David Amantia damantia@leitat.org LEITAT Technological Center	David Amantia damantia@leitat.org LEITAT Technological Center
	Release evaluation during accelerated aging/weathering processes	Socorro Vázquez-Campos svazquez@leitat.org LEITAT Technological Center	Socorro Vázquez-Campos svazquez@leitat.org LEITAT Technological Center
	Control banding Nanotool	Encarnación Sousa Rodriguez esousaro@mtin.es Spanish Institute for Safety and Health at Work, INSHT	
	Drilling chamber (methods have been developed within the frame of NEPHH FP7 founded European Project but are being used in UK/France)	María Blázquez maria@inkoa.com INKOA GROUP - EKOTEK	James Njuguna Cranfield University +441234754186 j.njuguna@cranfield.ac.uk
	Crash chamber (methods have been developed within the frame of NEPHH FP7 founded European Project but are being used in UK/France)	María Blázquez maria@inkoa.com INKOA GROUP - EKOTEK	James Njuguna Cranfield University +441234754186 j.njuguna@cranfield.ac.uk
SWITZERLAND	Near-field-far-field and Bayesian	Michael Riediker michael.riediker@hospvd.ch Institute for Work and Health, filled on behalf of NanoImpactNet	See reports
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials	Vladimir Murashov vem8@cdc.gov U.S. National Institute for Occupational Safety and Health	Ken Martinez U.S. NIOSH KMartinez@cdc.gov

	Mobile direct-reading sampling of carbon nanofibers	Vladimir Murashov vem8@cdc.gov U.S. National Institute for Occupational Safety and Health	Douglas Evans U.S. NIOSH
	Exposure, Fate Assessment Screening Tool (E-FAST)	Cathy Fehrenbacher fehrenbacher.cathy@epa.gov The U. S. Environmental Protection Agency	Cathy Fehrenbacher, U.S. EPA/OPPT fehrenbacher.cathy@epa.gov Conrad Flessner, U.S. EPA/OPPT flessner.conrad@epa.gov
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	Cathy Fehrenbacher fehrenbacher.cathy@epa.gov The U. S. Environmental Protection Agency	Cathy Fehrenbacher, U.S. EPA/OPPT fehrenbacher.cathy@epa.gov Laurence Libelo, U.S. EPA/OPPT libelo.laurence@epa.gov
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"	Nhan Nguyen nguyen.nhan@epa.gov The U. S. Environmental Protection Agency	Anjali Lamba, U.S. EPA lamba.anjali@epa.gov Scott Prothero, U.S. EPA prothero.scott@epa.gov
	CHEMSTEER MODEL	Nhan Nguyen nguyen.nhan@epa.gov The U. S. Environmental Protection Agency	Nhan Nguyen, U.S. EPA nguyen.nhan@epa.gov Scott Prothero, U.S. EPA prothero.scott@epa.gov
	Emission Scenario Documents	Nhan Nguyen nguyen.nhan@epa.gov The U. S. Environmental Protection Agency	Nhan Nguyen, U.S. EPA nguyen.nhan@epa.gov Greg Macek, U.S. EPA macek.greg@epa.gov
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy	Dr. Antonietta Gatti ECOS (Belgium)	Dr. Antonietta Gatti Universities of Modena, of Pisa , of Genova, of Bologna, CNR of Italy and ICGEB gatti@nanodiagnostics.it

Note: 1. Information from ECOS (Belgium) includes available information on Disposal and Treatment Technologies of Manufactured Nanomaterials.

2. Type of method or model

COUNTRY	METHOD OR MODEL USED	TYPE OF METHOD OR MODEL				
		Priority Setting	Detailed Assessment	Qualitative	Screening Assessment	Other
AUSTRALIA	(a)OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b)NIOSH Method 5040		●			
	Stable Isotope Tracing		●			
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)		●			
	Acoustic Dust Tester (ADT)		●			
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials				●	
CANADA	(New Research Project) Techniques for distinguishing background "ambient" nanoparticles (NPs) from process-related NPs in the workplace.		●			
DENMARK	NanoSafer	●	●			quantitative assessment and final scaling for control banding
FINLAND	Direct NP concentration measurement method		●			
	Stoffenmanager Nano			●		
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)	●	●			
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)	●	●			
	Thermophoretic personal sampler			●		

	Nanometer Aerosol Sampler (NAS)			●		
IRELAND	Protein (biomolecule) corona determination around Nanomaterials (NM) – influence on NM fate & behavior		●	●		
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor				●	
JAPAN	XPONA	●		●		
NETHERLANDS	(risk assessment and risk management model)					Guidance Safe working with NM
	(Nanotracer)			●		
	Setting NRVs	●				Guidance Safe working with NM
	Soffenmanager Nano	●	●	●	●	Stoffenmanager is a web-based tool that enables an iterative process by adjusting exposure control measures.
	DREAM Nano	●			●	Structured observational method
NORWAY	Survey			●		
SLOVENIA	Detection of nanoparticles		●			
SPAIN	In vitro assessment of oral absorption	●			●	
	Nanofilters for sample collection in air and water compartments	●			●	
	Release evaluation during accelerated aging/weathering processes	●				
	Control banding Nanotool			●		
	Drilling chamber		●		●	The presence of NPs in dust generated from the physical processing of

						products containing NMs
	Crash chamber		●		●	The presence of NPs in dust generated from the physical processing of products containing NMs
SWITZERLAND	Near-field-far-field and Bayesian	●	●	●	●	
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials			●	●	Emission assessment
	Mobile direct-reading sampling of carbon nanofibers				●	Emission assessment
	Exposure, Fate Assessment Screening Tool (E-FAST)				●	
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"				●	Interim Draft Guidance Document
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"				●	Interim draft internal guidance document for Chemical Engineering Branch (CEB)/EETD/OPPT
	CHEMSTEER MODEL				●	
	Emission Scenario Documents				●	
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy					

3. Target group

COUNTRY	METHOD OR MODEL USED	TARGET GROUP				
		Consumer	**General Population**	**Worker**	**Environment**	**Children**
AUSTRALIA	(a)OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b)NIOSH Method 5040			●		
	Stable Isotope Tracing	●	●	●	●	●
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)			●	●	
	Acoustic Dust Tester (ADT)	●	●	●	●	●
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	●		●	●	
CANADA	(New Research Project) Techniques for distinguishing background “ambient” nanoparticles (NPs) from process-related NPs in the workplace.			●		
DENMARK	NanoSafer			●		
FINLAND	Direct NP concentration measurement method			●	●	
	Stoffenmanager Nano			●		
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)			●	●	
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)			●	●	

	Thermophoretic personal sampler			●	●	
	Nanometer Aerosol Sampler (NAS)			●	●	
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials (NM) – influence on NM fate & behavior		●		●	
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor			●		
JAPAN	XPONA	●	●	●	●	
NETHERLANDS	(risk assessment and risk management model)			●		
	(Nanotracer)			●		
	Setting NRVs			●		
	Stoffenmanager Nano			●		
	DREAM Nano			●		
NORWAY	Survey	●		●		
SLOVENIA	Detection of nanoparticles	●	●	●	●	●
SPAIN	In vitro assessment of oral absorption	●	●	●		●
	Nanofilters for sample collection in air and water compartments	●	●	●	●	●
	Release evaluation during accelerated aging/weathering processes	●	●	●	●	●
	Control banding Nanotool			●		
	Drilling chamber	●	●	●	●	●
	Crash chamber	●	●	●	●	●
SWITZERLAND	Near-field-far-field and Bayesian	●	●	●	●	

US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials			•		
	Mobile direct-reading sampling of carbon nanofibers		•	•		
	Exposure, Fate Assessment Screening Tool (E-FAST)	•	•		•	•
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	•			•	•
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials”			•		
	CHEMSTEER MODEL			•	•	
	Emission Scenario Documents			•		
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy					

4. Exposure pathways

COUNTRY	METHOD OR MODEL USED	EXPOSURE PATHWAYS									
		ingestion	**soil**	**food chain**	**inhalation**	**air**	**bioaccumulation/ fish**	**dermal**	**water**	**drinking water**	**other**
AUSTRALIA	(a)OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b)NIOSH Method 5040				●	●					
	Stable Isotope Tracing	●	●	●	●	●	●	●	●	●	
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)				●	●					
	Acoustic Dust Tester (ADT)				●						
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials		●			●			●		
CANADA	(New Research Project) Techniques for distinguishing background “ambient” nanoparticles (NPs) from process-related NPs in the workplace.				●						
DENMARK	NanoSafer				●	●					
FINLAND	Direct NP concentration measurement method				●	●					
	Stoffenmanager Nano				●						
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)				●	●					
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)				●	●					
	Thermophoretic personal sampler				●	●					

	Nanometer Aerosol Sampler (NAS)				●	●					
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials (NM) – influence on NM fate & behavior	●			●		●				
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor				●						
JAPAN	XPONA				●	●					
NETHERLANDS	(risk assessment and risk management model)					●					
	(Nanotracer)					●					
	Setting NRVs					●					
	Stoffenmanager Nano				●						
	DREAM Nano							●			
NORWAY	Survey				●	●		●	●		
SLOVENIA	Detection of nanoparticles				●	●		●			
SPAIN	In vitro assessment of oral absorption										In vitro oral absorption
	Nanofilters for sample collection in air and water compartments					●			●		
	Release evaluation during accelerated aging/weathering processes				●	●	●		●		
	Control banding Nanotool				●						
	Drilling Chamber		●		●	●		●	●		
	Crash Chamber		●		●	●		●	●		
SWITZERLAND	Near-field-far-field and Bayesian	●	●	●	●	●	●	●	●	●	

US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials				●	●					
	Mobile direct-reading sampling of carbon nanofibers				●	●					
	Exposure, Fate Assessment Screening Tool (E-FAST)	●	●		●	●	●	●	●	●	
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	●	●		●	●	●	●	●	●	
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"				●			●			
	CHEMSTEER MODEL		●		●	●		●	●		
	Emission Scenario Documents		●		●	●		●	●		
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy										

5. Short synopsis or abstract of the method or model

COUNTRY	METHOD OR MODEL USED	SHORT SYNOPSIS OR ABSTRACT
AUSTRALIA	(a)OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b)NIOSH Method 5040	Assessment of measurement techniques for different types of engineered nanomaterials & measurement of exposures in workplace settings by Queensland University of Technology and Workplace Health & Safety Queensland. This involves investigation into the characteristics, transport and fate of nanoparticles generated from nanotechnology processes nanotechnology processes and an intercomparison of SMPS, Nanoparticle Surface Area Monitor, CPC,OPC, DustTrak, TEM and SEM. A number of different processes and different nanomaterials have been examined. It involves using, examining and validating approaches in the OECD WPMN Emissions Assessment document, plus NIOSH Method 5040 for measurement of carbon nanotubes in air. Expected publication of report: Early 2012
	Stable Isotope Tracing	Nanomaterials containing metals (M) that have stable (non-radioactive) isotopes can be traced by this method, including detection of the metal in the nanomaterial against a background that might contain the naturally-occurring metal (M) in any other chemical form. The nanomaterial is made with the metal enriched with a stable isotope (aM), and is traced by determining changes in ratios of the enriched stable isotope relative to another stable isotope (bM) of that metal. Relevant samples are collected, and increases in aM/bM in those samples indicate the presence of the nanomaterial containing the metal M. Levels of the stable isotopes are measured by inductively-coupled plasma mass spectrometry (mc-ICPMS).
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)	Measuring nanoparticles with a SMPS (Scanning Mobility Particle Sizer) and/or with a FMPS (Fast Mobility Particle Sizer) in ambient air and on workplaces
	Acoustic Dust Tester (ADT)	A R&D project, which is co-funded by the Austrian Research Promotion Agency, aims at the establishment of the ADT method into a standardized routine method for quantitative and qualitative measurement of the dust emissions of flexible substrates (e.g. paper, packaging materials, textiles, etc.) in the micro- and nano range.
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	The precautionary matrix is designed to assess existing or new products and processes by means of a structured approach to allow identification of the potential risks. The following stages in the life-cycle are considered: (i) research and development; (ii) production (iii) use; (iv) disposal. The precautionary matrix depends on a limited number of evaluation parameters. The potential effect is estimated on the basis of reactivity and stability. The probability and potential exposure of humans and release into the environment are estimated from data on the physical surroundings of

		the nanoparticle, the quantity marketed and the anticipated emissions during development, production or use. The precautionary need is assessed in relation to the potential effect and the potential exposure of humans or release into the environment. Specific framework conditions are introduced to take into account uncertainties due to gaps in knowledge about the background and eventual fate of the nanomaterials. Precautionary need is sub-divided into: (i) normal (correct) use; (ii) worst case considering workers, consumers and environment.
CANADA	(New Research Project) Techniques for distinguishing background "ambient" nanoparticles (NPs) from process-related NPs in the workplace.	The goal of the research is to recommend approaches and techniques for distinguishing background "ambient" NPs (< 100 nm) from process-related NPs in the workplace. "Ambient" NPs (also called incidental NPs) may arise from multiple overlapping sources such as diesel exhaust, soot (black carbon) and other combustion products, and natural sources. Recent guidance documents on monitoring occupational exposures to manufactured nanomaterials (OECD 2009; NIOSH 2010) stress the importance of distinguishing background NPs from emissions at source, and recognize the need to develop sampling and analytical protocols to conduct this type of assessment.
DENMARK	NanoSafer	The exposure model calculates maximum near-field and far-field exposure levels using a box model (near-field, far-field and ventilation air). The calculations are based on process emission rates or dustiness and contextual information of the working situation (process and work area). Ranking of exposure risk is done taking nanomaterial surface area and exisiting OELs into consideration. Paper is in preparation.
FINLAND	Direct NP concentration measurement method	First, particle sources are identified. Then, aerosol concentrations are continuously measured in real time. Measurements are carried out near background particle sources, process site, and workers breathing zone. NP size sectioned concentrations are then quantified by subtracting measured concentration before process and during process. Then, NPs are separated from possible concentrations emitted by process machinery by analyzing samples collected during the process with electron microscope. Choice of the aerosol instruments vary depending on the process and process environment. Typically used instruments are condensation particle counter, scanning mobility particle sizer, electronic low pressure impactor, tapered oscillating micro balance, optical particle counter, and escape or capturing current monitors.
	Stoffenmanager Nano	In the absence of information on dose-response relationships and exposure data, presently quantitative risk assessment is beyond scope. However, qualitative risk assessment tools using risk banding may provide a useful first tier for risk management. Stoffenmanager Nano supports especially SME's in their risk management.
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)	The GRIMM SMPS+C systems are designed to measure size distributions in the size range 5 - 1110 nm. The SMPS+C system includes a • Condensation Particle Counter (CPC) and

		• Differential Mobility Analyser (DMA) Both components are carefully manufactured and calibrated.
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)	Model 3007 is one of the smallest Condensation Particle Counters (CPC). At only 3.8 pounds, it provides versatility not common with larger particle counters. Yet it offers a surprising list of performance features. Like a particle size range of 0.01 to greater than 1.0 µm, a concentration range of 0 to 100,000 particles/cm3, an LCD display, and a built-in RS-232 serial data port. Plus, it operates on alkaline batteries and includes programmable data logging.
	Thermophoretic personal sampler	A new Thermal Precipitator (TP) was modelled, designed, built and evaluated to sample nanoparticles homogeneously on a substrate thereby simplifying subsequent examination by microscopic methods e.g. SEM, by reducing the analysis time
	Nanometer Aerosol Sampler (NAS)	The Nanometer Aerosol Sampler (NAS) allows you to sample charged particles, like those from the output of a Differential Mobility Analyzer (DMA), onto sample substrates for further analysis. This aerosol sampler lets you control the spot size of the deposition using two electrode sizes and get a uniform deposition size that is optimal for your analysis system.
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials (NM) – influence on NM fate & behavior	Suite of methods to understand the biointerface and interactions between NMs and biomolecules (proteins, lipids, sugars, surfactants, natural organic matter, etc.). Methods include in situ characterisation of thickness and stability of adsorbed layer (e.g. via Differential Sedimentation centrifugation) and identification and quantification of the bound biomolecules (e.g. via mass spectrometry).
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor	This method applies a double and complementary approach: (1) real time monitoring of particles number concentration in air, and (2) characterization of size-segregated particles samples. The first step requires the use of a Condensation Particle Counter (CPC) to characterize the temporal variation of the total concentration of particles (approx range: 4-400 nm) with a short time resolution (generally up to 1 second); successively, samplings are performed with a CPC coupled with a Differential Mobility Analyzer (DMA) to evaluate the particles size distribution. Chemical and morphological characterizations are performed on size segregated occupational aerosol collected by low pressure cascade impactor (typical size range: 30 nm - total suspended particles; typical number of stages: 13). The method requires an accurately evaluation of particles background and contamination given by external sources and other occupational processes, so the above mentioned steps have to be performed during the process run and in non-working conditions as well.
JAPAN	XPONA	Company persons who are making or treating industrial nanomaterials know well there is an adverse effect to a human health nowadays. On the other hand, they are confronted with the

		question that a composition or product has the same effects such as nanomaterials. Our project focuses on exposure assessment to compositions or products including nanomaterials in the market by using a XPONA chamber method. When those products are used in a chamber controlled background concentration under a constant flow, emitted nanomaterials are able to measure exactly. Nanomaterials are collected to a filter after measurement and distinguished from generated them through the use in the chamber by an instrumental analysis.
NETHERLANDS	(risk assessment and risk management model)	Complete risk assessment and risk management model for safely working with NM
	(Nanotracer)	Nanotracer used as apparatus at several construction sites
	Setting NRVs	Method to derive Nano reference Values at the workplace
	Stoffenmanager Nano	Stoffenmanager Nano consists of a hazard and exposure banding system and these bands are combined in a risk matrix. The hazard banding is a binary decision tree system to assign a hazard band, whereas for assignment of exposure bands the underlying model taken from the conceptual model described by Schneider et al. (2011), Basically , it is the same source–receptor approach as for the generic Stoffenmanager. The relative exposure score underlying the exposure bands within Stoffenmanager Nano are derived by multiplication of relative multipliers (on a logarithmic scale) for the various modifying factors using the same exposure algorithm as used for the generic Stoffenmanager. The hazard and risk bands are combined in risk matrix, which can be used for risk prioritization.
	DREAM nano	The DREAM method is a semi-quantitative observational method to assess dermal exposures by a systematic evaluation of factors affecting exposure using preassigned default values. Key items of the DREAM exposure evaluations are assessment of probability and intensity of three dermal exposure routes: emission, deposition, and transfer. Emission is defined as dermal exposure occurring directly from the source of exposure, transfer as exposure due to contact with contaminated surfaces, and deposition as exposure through skin contact with small particles present in the air compartment. The DREAM method comprises two parts: a multiple-choice questionnaire, which collects information about exposure environments, and an evaluation of dermal exposures. The inventory collected in the questionnaire comprises six modules: company, department, the agent used, job title, performed task, and exposure. The questionnaire is completed by an occupational hygienist after observing workers performing their tasks. If it is not feasible to collect all information by observation, information has to be obtained by interviewing workers. Results from the inventory are collected in a Microsoft Access database. Each answer in the questionnaire is linked with a pre-assigned value that is subsequently put into an evaluation algorithm that is programmed using SAS software resulting in a semi-quantitative estimate of

		dermal exposure levels (the DREAM scores).
NORWAY	Survey	We wanted to achieve a representative overview of type of nanomaterials, type of products, physical state, the quantity of production, import, use of nanomaterials, and which industries and R&D institutions were producing and working with nanomaterials. An electronic quest back was sent to a sample of enterprises (industry and research & development institutions including universities) which were assumed to have activities that involved nanotechnology were the main stakeholders. The survey was based on experiences from corresponding studies in Switzerland and Germany.
SLOVENIA	Detection of nanoparticles	Detection of nanoparticles: The SMPS (Scanning Mobility Particle Sizer) measures particle concentration depending on their size. The particles are selected depending on their electrical mobility when they pass the DMA unit (Differential Mobility Analyser). After the selection they enter the CPC (Condensation Particle Counter) where they are enlarged to the detectable size. The SMPS can measure particles from 5-1000nm in air with the concentration limit $2*10^7$ particles/cm^3.
SPAIN	In vitro assessment of oral absorption	Use of in vitro cell barriers (Caco2 cells) to evaluate intestinal absorption of nanoparticles.
	Nanofilters for sample collection in air and water compartments	Development of nanofilters by electrospinning techniques for air and water filtration to trap nanoparticles which can then be analyzed and quantified
	Release evaluation during accelerated aging/weathering processes	Release evaluation during accelerated aging/weathering processes
	Control banding Nanotool	The overall risk level is based on the severity score and probability score. The severity score is calculated from nanomaterial and parent material toxicological data. The nanomaterial severity is determined from the following data: Surface reactivity, Particle shape, Particle diameter, Solubility, Carcinogenicity, Reproductive toxicity, Mutagenicity, Dermal toxicity and Asthmagen. The parent material severity is determined from the following data: Toxicity, Carcinogenicity, Reproductive toxicity, Mutagenicity, Dermal toxicity and Asthmagen. The probability score is the sum of all exposure factors, such as: Estimated amount of chemical used during task, Dustiness/mistiness, Number of employees with similar exposure, Frequency of operation and Operation duration. The four risk levels are: RL 1: General Ventilation RL 2: Fume hoods or local exhaust ventilation RL 3: Containment RL 4: Seek specialist advice
	Drilling chamber	A specially designed drilling chamber is used in order to replicate different stages of

		nanocomposites life cycle. The chamber is built of plexiglass. The chamber has two openings, one for the coupling with the measurement instruments (SMPS+C) and the other opening is designed for easy extraction of the fracture dust particles. The chamber is designed for collection of the generated nanoparticles and moreover to prevent contamination from other sources. Microspecimens are mounted on a fixture inside the chamber. The sampling tray help collecting the turnings produced while drilling. In a typical procedure, an angle drill (Makita BDA351Z 18V LXT angle drill, drill bit Ø 10 mm) is used for drilling with and maximum speed of 1800 min-1. Drilling is performed over a time period of 14min, after this period the drill bit is removed from the chamber and the opening is sealed. The chamber is kept sealed until airborne particle concentration fall to a pre-test rate.
	Crash chamber	Low impact tests are conducted in nanocomposites using a Rosand instrumented falling weight impact tester Type 5. The drop weight device is equipped with data acquisition system to acquire force versus time data. Impact energy and velocity can be varied by changing the mass and height of the dropping weight. The velocity of the falling drop mass is measured just before it strikes the specimen. It is also fitted with pneumatic rebound brake which prevents multiple impacts on the specimen. During the testing, the specimen is held in the fixture placed at the bottom of the drop tower which provided a clamped support span. The weight of the cross-head is maintained at a specific value and it is guided through two frictionless guide columns. The impactor end of the drop mass is fitted with an impact load sensor to record the transient response of the specimens. To carry out the impact tests, test samples are placed in a specially dedicated chamber between the clamps and the height was adjusted depending on the desired energy level. The impactor have 30 mm diameter flat tip. The transient force signal obtained during the test is measured using a piezoelectric load cell located above the impactor tip and was routed through an amplifier and logged against a time-base. The crash chamber has been specially designed collect the fractures or released nanoparticles during drop weight impact tests. The chamber was built of plexiglass. The lid is made of steel and the top opening is made of flexible PU foam, so that the striker can impact the specimen in free fall. The chamber has two openings, one for the coupling with the measurement instruments (SMPS+C) and the other opening is for designed for easy extraction of the fracture dust particles. The chamber is designed for collection of the generated nanoparticles and moreover to prevent contamination from other sources. The particles generated from macroscale structures are classified into two categories: - The first category deals with the airborne particles which will be measured by Scanning Mobility Particle Sizer (SMPS) and will be collected by and Electrostatic Precipitator (ESP). The SMPS measures the particle number size distribution while the ESP collects the airborne particles on a sampling tray. The collected particles will be used for further microscopy investigations via

		Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). - The second category deals with samples obtained from fracture and contained in the crash chamber. Those samples will be diluted in solution –DDW- and via several filtration processes separated in size fractions. Characterisation of these samples are through microscopy (SEM, TEM), X-Ray Diffraction (XRD), Energy Dispersive X-Ray Spectroscopy (EDX), Nanosight and Dynamic Light Scattering (DLS).
SWITZERLAND	Near-field-far-field and Bayesian	Research groups discuss approaches for modelling, see reports.
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials	This technique allows a semi-quantitative evaluation of processes and tasks in the workplace where releases of engineered nanoparticles may occur. Several sampling approaches are used simultaneously with the goal of obtaining key physicochemical particle metrics: number concentration, qualitative size, shape, degree of agglomeration, and mass concentration of elemental constituents of interest.
	Mobile direct-reading sampling of carbon nanofibers	A mobile aerosol sampling platform, equipped with an aerosol instrument array, was used to characterize emissions at different locations within the facility. Particle number, respirable mass, active surface area, and photoelectric response were monitored with a condensation particle counter (CPC), a photometer, a diffusion charger, and a photoelectric aerosol sensor, respectively. CO and CO(2) were additionally monitored. Combined simultaneous monitoring of these metrics can be utilized to determine source and relative contribution of airborne particles (CNFs and others) within a workplace.
	Exposure, Fate Assessment Screening Tool (E-FAST)	A personal computer-based software program that uses exposure and assessment estimation methods to generate screening level estimates of consumer, general public, and environment exposure to a chemical released from manufacture, processing and/or use in industrial and commercial operations and work places (resulting in general population and environmental exposures), and use in consumer products (resulting in consumer exposure). Exposure, Fate Assessment Screening Tool (E-FAST) is used to estimate consumer, general public, and environmental exposures to a chemical from release during the course of its lifecycle (from manufacture to final use), and from use of consumer products. Currently used by EPA for: • Assessing new chemicals submitted for PMN review under TSCA Section 5 • Assessing existing chemicals The model extimates, at a screening level, consumer, general public, and environmental exposures to a chemical from releases associated with industrial/commercial/consumer settings and use by consumers; the results are intended to be conservative.
	Guidance document "Interim Technical Guidance for Assessing	This draft document developed by the U.S. EPA's Exposure Assessment Branch in the Office of Pollution Prevention and Toxics (OPPT) is an interim guide used when developing screening

	Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	level exposure and environmental fate and transport assessments for nanomaterials. This guide is applicable for neat nanomaterials (i.e., powdered or particulate forms) as opposed to nanoscale particles embedded within composites. At this time, the EPA does not have models or methods capable of predicting, with a high level of confidence, the fate of, or exposure to, nanoscale particulates in the environment. This fact, combined with the limited amount of measured data for nanomaterials, means that there is uncertainty in estimating removal efficiencies, degradation half-lives, partitioning, and transport of nanomaterials. To address the uncertainty, we recommend using conservative (protective) bounding "what if" scenarios which are described in the document. These assumptions should be modified according to the specific properties of the nanomaterial being evaluated.
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"	This draft document contains approaches recommended by CEB for assessing, monitoring, and controlling releases and exposures to new and existing nanomaterials in the workplace. The document focuses primarily on CEB's methodology for evaluating Pre-Manufacture Notice (PMN) nanomaterials within OPPT's New Chemicals Program (NCP). Because of the swiftly changing and challenging nature of nanotechnology, this document represents interim approaches that are based on the best available information to date in the specific areas that it addresses.
	CHEMSTEER MODEL	A personal computer-based software program that uses exposure and assessment estimation methods to generate screening level estimates of environment release and worker exposure to a chemical manufactured, processed and/or used in industrial and commercial operations and work places. ChemSTEER - Chemical Screening Tool for Exposures and Environmental Releases - is used to estimate environmental releases of and/or worker exposures to a chemical within a particular operation or during the course of its lifecycle (from manufacture to final use). Currently used by EPA for: • Assessing new chemicals submitted for PMN review under TSCA Section 5 • Assessing existing chemicals The model calculates environmental releases of and worker exposures to a chemical within an industrial/commercial setting and the results are intended to be conservative.
	Emission Scenario Documents	Development and use of Emission Scenario Documents (ESD) is intended to provide information on the sources, use patterns, and potential release pathways of chemicals used in various industries. The documents include Chemical Engineering Branch(CEB)'s various standard models and approaches for estimating the environmental releases of and occupational exposures to chemicals being addressed. These approaches are intended to provide conservative, screening-level estimates resulting in release and exposure amounts that are likely to be higher, or at least higher than average, than amounts that might actually occur in the real world setting.

Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy	Materials containing nanoparticles are incinerated, a common way of disposal for such materials. The fumes are driven into a green house where plants and animal models grow and live (tomato and rice plants, bombi, bacteria, zebra fish, sea urchins and earth worms). The nanoparticulate matter impacts the plants and pollutes soil and water.

6. Legal framework, project or program

COUNTRY	METHOD OR MODEL USED	LEGAL FRAMEWORK
AUSTRALIA	(a) OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b) NIOSH Method 5040	This project was commissioned under Safe Work Australia's Nanotechnology Work Health & Safety Program, in support of Australia's National Enabling Technologies Strategy. The focus areas of the program are: • Ensure nanotechnology is covered appropriately within the Australian Work Health and Safety Regulatory Framework. • Improve understanding of the hazardous properties of engineered nanomaterials. • Assess the effectiveness of workplace controls in preventing exposure to engineered nanomaterials. • Develop procedures for detecting and measuring emissions and exposure in workplaces. • Provide information and guidance for Australian nanotechnology organizations. • Ensure consistency with international approaches & contributing to international work. The work will contribute towards global harmonisation of emissions and exposure measurement approaches, and development of a validated emissions & exposure procedure for use by Australian Occupational Hygienists. The research is also informing the OECD WPMN Phase 2 Project - "Evaluate data and provide recommendations on measurement techniques and sampling protocols for determining concentrations of manufactured nanomaterials in air" Led by Queensland University of University, Workplace Health & Safety Queensland and Safe Work Australia Project team: Peter McGarry (Leader), Lidia Morawska, Luke Knibbs & Howard Morris
	Stable Isotope Tracing	The method has been used in a collaborative project conducted by Macquarie University and CSIRO to determine dermal absorption of zinc from sunscreens (applied to humans at a beach) containing zinc oxide particles enriched with the stable isotope 68Zn.
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)	--
	Acoustic Dust Tester (ADT)	Patent application WO 2011/047399
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	Developed by the Swiss Federal Office for Public Health and Federal Office for the Environment
CANADA	(New Research Project) Techniques for distinguishing background	Research conducted under Government of Canada's Chemicals Management Plan

	"ambient" nanoparticles (NPs) from process-related NPs in the workplace.	
DENMARK	NanoSafer	--
FINLAND	Direct NP concentration measurement method	This exposure assessment method is used for scientific studies.
	Stoffenmanager Nano	--
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)	Research project: NanoDevice, NanoValide, NanoGEM, CarboSafe, CarboLifeCycle
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)	Research project: NanoDevice, NanoValide, NanoGEM, CarboSafe, CarboLifeCycle
	Thermophoretic personal sampler	Research project: NanoDevice, NanoValide, NanoGEM, CarboSafe, CarboLifeCycle
	Nanometer Aerosol Sampler (NAS)	Research project: NanoDevice, NanoValide, NanoGEM, CarboSafe, CarboLifeCycle
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials (NM) – influence on NM fate & behavior	Developed initially within EU FP6 NanoInteract and now also being implemented in SFI BioNanoInteract, FP7 NeuroNano, FP7 QNano etc.
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor	voluntary exposure evaluation in our institution labs
JAPAN	XPONA	By using this method, company peoples are able to measure a dose and size by themselves. A wide variety of used compositions and products including nanomaterials are developed and soldin the world. A government or U.N. agency can not set regulations to this huge variegation. We hope that XPONA method will be standardized internationally.Some compositions will be bear a certified label or some products will be designed for removable easily to a part including nanomaterials ultimately through this assay.
NETHERLANDS	(risk assessment and risk management model)	Joint program of Ministry of Labour, Employers and employees organisations
	(Nanotracer)	Project commissioned by St Arbouw and FNV bouw
	Setting NRVs	Joint program of Ministry of Labour, Employers and employees organisations

	Stoffenmanger Nano	Stoffenmanger nano is recommended by the Labor Inspection for an initial risk assessment, with focus on SMEs.
NORWAY	Survey	This was a collaboration project between The Federation of Norwegian Industries, the Norwegian Confederation of Trade Unions (LO), The National Institute of Occupational Health (STAMI), The Climate and Pollution Agency. The Product Register and the Norwegian Labour Inspector Authority: The Directorate of Labour Inspection. The Directorate of Labour Inspection led this study. The Nano Project 2009-2010 - A Descriptive Study on Use, Production and Import of Nanotechnological Products in the Norwegian Worklife The aim: The nanotechnology development has increased rapidly for the last years. Many nanotechnological products have entered the marked, also in Norway, and the activity in research is substantial. On the other hand the consequences for the health and environment are still less known. Therefore, it is important to get knowledge on the potential occupational exposure to nanomaterials at different Norwegian workplaces.
SLOVENIA	Detection of nanoparticles	--
SPAIN	In vitro assessment of oral absorption	FP7 Project: NANOPOLYTOX FP7 Project: NANOTEST
	Nanofilters for sample collection in air and water compartments	FP7 Project: NANOPOLYTOX
	Release evaluation during accelerated aging/weathering processes	FP7 Project: NANOPOLYTOX
	Control banding Nanotool	--
	Drilling chamber	NEPHH FP7 Founded Project
	Crash chamber	NEPHH FP7 Founded Project
SWITZERLAND	Near-field-far-field and Bayesian	--
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials	NIOSH Nanotechnology Program; OECD WPMN Emission Assessment guidance
	Mobile direct-reading sampling of carbon nanofibers	NIOSH Nanotechnology Program

	Exposure, Fate Assessment Screening Tool (E-FAST)	U.S. EPA's (OPPT) New Chemicals Program (NCP)
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	U.S. EPA's (OPPT) New Chemicals Program (NCP)
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"	U.S. EPA's (OPPT) New Chemicals Program (NCP)
	CHEMSTEER MODEL	U.S. EPA's (OPPT) New Chemicals Program (NCP)
	Emission Scenario Documents	U.S. EPA's (OPPT) New Chemicals Program (NCP)
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy	--

7. Status of the method or model

COUNTRY	METHOD OR MODEL USED	LEGAL FRAMEWORK		
		INTERIM GUIDANCE	PEER REVIEWED PUBLICATION	OTHER
AUSTRALIA	(a) OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b) NIOSH Method 5040			Validation of procedures completed
	Stable Isotope Tracing		●	
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)	●		
	Acoustic Dust Tester (ADT)			Method is already working and open to whole industry.
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	●		
CANADA	(New Research Project) Techniques for distinguishing background “ambient” nanoparticles (NPs) from process-related NPs in the workplace.			3-yr research project (May 2011-April 2014)
DENMARK	NanoSafer	●	●	
FINLAND	Direct NP concentration measurement method			Not validated method, for scientific purposes
	Stoffenmanager Nano		●	
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)		●	Accepted method
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)		●	Accepted method

	Thermophoretic personal sampler	●		
	Nanometer Aerosol Sampler (NAS)		●	Accepted method
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials (NM) – influence on NM fate & behavior		●	
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor	●		
JAPAN	XPONA			This project will be open later this year.
NETHERLANDS	(risk assessment and risk management model)	●		
	(Nanotracer)			Non-standardized measurement method
	Setting NRVs	●		
	Stoffenmanager Nano	●	●	Publication (van Duuren et al. Ann. Occup. Hyg., Vol. 56, No. 5, pp. 525–541, 2012
	DREAM Nano		●	Publication: van Duuren et al INT J OCCUP ENVIRON HEALTH 2010;16:399–405
NORWAY	Survey	●		The results were published (in Norwegian) July 2010. The project will be continued/updated.
SLOVENIA	Detection of nanoparticles			Prototype
SPAIN	In vitro assessment of oral absorption	●		
	Nanofilters for sample collection in air and water compartments	●		
	Release evaluation during accelerated aging/weathering processes	●		

	Control banding Nanotool		●	
	Drilling chamber			No specific publication on this method has yet been released
	Crash chamber		●	
SWITZERLAND	Near-field-far-field and Bayesian			See reports
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials	●	●	
	Mobile direct-reading sampling of carbon nanofibers	●		
	Exposure, Fate Assessment Screening Tool (E-FAST)		●	
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	●		Has been reviewed by EPA scientists.
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"	●		
	CHEMSTEER MODEL		●	
	Emission Scenario Documents		●	
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy			1st year completed. Some abstracts were presented at various conferences. Fetal Malformations of sea urchins have been already recorded by nanocontamination of water with nanosilver.

8. Website URL or reference/citation for the method or model

COUNTRY	METHOD OR MODEL USED	WEBSITE URL OR REFERENCE/CITATION
AUSTRALIA	(a) OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b) NIOSH Method 5040	--
	Stable Isotope Tracing	Gulson, B. & Wong, H. (2006) Environ Health Perspect. 114(10), 1486–1488 "Stable isotope tracing - a way forward for nanotechnology". Gulson, B. et al (2010) Toxicol. Sci. 118 (1): 140-149 "Small amounts of zinc from zinc oxide particles in sunscreens applied outdoors are absorbed through human skin".
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)	http://www.oesbs.at; http://www.auva.at; http://www.tsi.com/
	Acoustic Dust Tester (ADT)	*ipw – The magazine for the international pulp and paper industry* 06, 13-16, 2011
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	http://www.bag.admin.ch/nanotechnologie/12171/12174/index.html?lang=en
CANADA	(New Research Project) Techniques for distinguishing background “ambient” nanoparticles (NPs) from process-related NPs in the workplace.	– Rasmussen, P.E. J. Niu and H.D. Gardner (2010). Characterization of Airborne Nanoparticles Using Filter-Based Methods: Metals and Gravimetric Analysis. Tri-National Workshop on Standards for Nanotechnology, National Research Council, Ottawa, Feb 3-4, 2010. – Rasmussen, P.E., Gardner, H.D. and Niu, J. (2010) Buoyancy-corrected Gravimetric Analysis of Lightly Loaded Filters. Journal of Air and Waste Management Association, 60 (9):1065-77. – Niu, J, Rasmussen, PE, Hassan, N., Vincent, R. (2010) Concentration distribution and bioaccessibility of trace elements in nano and fine urban airborne particulate matter: influence of particle size. Journal of Water, Air and Soil Pollution. 213 (1) p.211.
DENMARK	NanoSafer	http://nanosafer.i-bar.dk/Account/Login.aspx use requires establishment of user (opret konto)
FINLAND	Direct NP concentration measurement method	--
	Stoffenmanager Nano	https://stoffenmanager.nl/

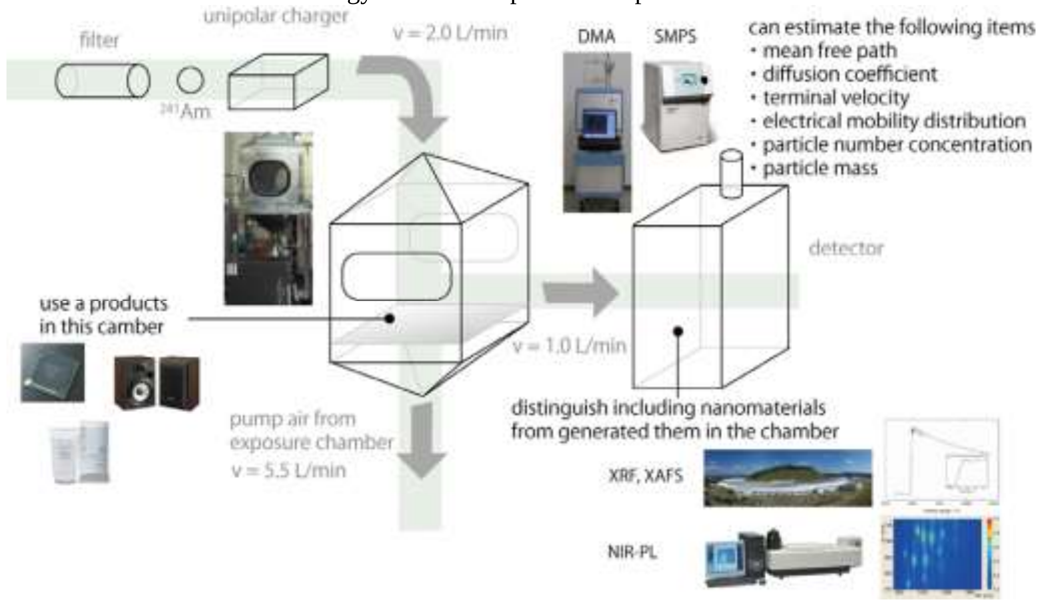
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)	http://www.grimm-aerosol.com/products/nanoparticle-measurement-systems/index.php
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)	http://www.tsi.com/en-1033/models/13864/3007.aspx
	Thermophoretic personal sampler	--
	Nanometer Aerosol Sampler (NAS)	http://www.tsi.com/en-1033/models/3284/3089.aspx#
IRELAND	Protein (biomolecule) corona determination around Nanomaterials (NM) – influence on NM fate & behavior	– Monopoli MP, Walczyk D, Campbell A, Elia G, Lynch I, Bombelli FB, Dawson KA. Physical-chemical aspects of protein corona: relevance to in vitro and in vivo biological impacts of nanoparticles. J Am Chem Soc. 2011 Mar 2;133(8):2525-34. Epub 2011 Feb 2. – Lesniak, A., Campbell, A., Monopoli, M.P., Lynch, I., Salvati, A., Dawson, K.A. Serum heat inactivation affects protein corona composition and nanoparticle uptake. *Biomaterials.* **2010**, 31, 9511-9518. – Walczyk, D., Baldelli-Bombelli, F., Campbell, A., Lynch, I., Dawson, K.A. What the Cell "Sees" in Bionanoscience, *JACS*, **2010**, 132, 5761-5768. – Lynch, I., Salvati, A., Dawson, K.A.Protein-nanoparticle interactions: What does the cell see? *Nature Nanotechnol.* **2009**, 4, 546-547. – Hellstrand, E., Lynch, I., Andersson, A., Drakenberg, T., Dahlbäck, B., Dawson, K.A., Linse, S., Cedervall, T. Complete high-density lipoproteins in nanoparticle corona. *FEBS J*. **2009**, 276, 3372-3381. – Lundqvist, M., Stigler, J., Cedervall, T., Elia, G., Lynch I., Dawson K. Nanoparticle Size and Surface Properties determine the Protein Corona with possible implications for Biological Impacts. *PNA*S, 2008, 105, 14265-14270.
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor	--
JAPAN	XPONA	The web page is under construction. That will be open by this summer.
NETHERLANDS	(risk assessment and risk management model)	http://www.ivam.uva.nl/fileadmin/user_upload/PDF_documenten/Artikelen_en_Publicaties/NANO/Guidance%20on%20how%20to%20work%20safely%20with%20nanoparticles.pdf
	(Nanotracer)	http://www.ivam.uva.nl/
	Setting NRVs	--
	Stoffenmanager Nano	http://nano.stoffenmanager.nl/

		Stoffenmanager Nano (van Duuren et al. Ann. Occup. Hyg., Vol. 56, No. 5, pp. 525–541, 2012
	DREAM Nano	van Duuren et al INT J OCCUP ENVIRON HEALTH 2010;16:399–405
NORWAY	Survey	--
SLOVENIA	Detection of nanoparticles	http://videolectures.net/nanomaterials2011_remskar_iskra_nanohealth/
SPAIN	In vitro assessment of oral absorption	--
	Nanofilters for sample collection in air and water compartments	--
	Release evaluation during accelerated aging/weathering processes	--
	Control banding Nanotool	– http://controlbanding.net/Services.html – Samuel Y. Paik, David M. Zalk and Paul Swuste, Application of a Pilot Control Banding Tool for Risk Level Assessment and Control of Nanoparticle Exposures. Ann. Occup. Hyg., Vol. 52, No. 6, pp. 419–428, 2008. – David M. Zalk, Samuel Y. Paik , Paul Swuste. Evaluating the Control Banding Nanotool: a qualitative risk assessment method for controlling nanoparticle exposures. J Nanopart Res (2009) 11:1685–1704. – NTP 877: Evaluación del riesgo por exposición a nanopartículas mediante el uso de metodologías simplificadas.
	Drilling chamber	http://www.nephh-fp7.eu
	Crash chamber	http://www.nephh-fp7.eu
SWITZERLAND	Near-field-far-field and Bayesian	http://www.nanoimpactnet.eu
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials	– U.S. NIOSH. Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials. DHHS (NIOSH) Publication Number 2009-125. Available at http://www.cdc.gov/niosh/docs/2009-125/ – Methner, M., Hodson, L. and Geraci, C.(2010) 'Nanoparticle Emission Assessment Technique (NEAT) for the Identification and Measurement of Potential Inhalation Exposure to Engineered Nanomaterials — Part A', Journal of Occupational and Environmental Hygiene, 7: 3, 127 — 132 – Methner, M., Hodson, L., Dames, A. and Geraci, C.(2010) 'Nanoparticle Emission Assessment Technique (NEAT) for the Identification and Measurement of Potential Inhalation Exposure to Engineered Nanomaterials—Part B: Results from 12 Field Studies', Journal of Occupational and Environmental Hygiene, 7: 3, 163 —176

		– Methner, M., Beaucham, C., Crawford, C., Hodson, L., Geraci, C. (2011) 'Field application of the Nanoparticle Emission Assessment Technique (NEAT): Task-based air monitoring during the processing of engineered nanomaterials (ENMs) at four facilities', Journal of Occupational and nvironmental Hygiene, accepted for publication in May, 2011. – Ramachandran, G., Ostraat, M., Evans, D., Methner, M.M., O'Shaughnessy, P., D'Arcy, J.B., Geraci, C.L., Stevenson, E.K., Maynard, A., Rickabaugh, K. 'A Strategy for assessing workplace exposures to nanomaterials', submitted to the Journal of Occupational & Environmental Hygiene on 04-27-2011.
	Mobile direct-reading sampling of carbon nanofibers	Evans-DE; Ku-BK; Birch-ME; Dunn-KH. Aerosol monitoring during carbon nanofiber production: mobile direct-reading sampling. Ann Occup Hyg 2010 Jul; 54(5):514-531.
	Exposure, Fate Assessment Screening Tool (E-FAST)	http://www.epa.gov/opptintr/exposure/pubs/efast.htm
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	http://www.epa.gov/oppt/exposure/pubs/nanomaterial.pdf
	Guidance document "Approaches for Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials"	n/a
	CHEMSTEER MODEL	http://www.epa.gov/opptintr/exposure/pubs/chemsteer.htm
	Emission Scenario Documents	Released Scenario Documents can be accessed on the OECD web site - http://www.oecd.org/chemicalsafety/risk-assessment/emissionscenariodocuments.htm
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy	--

9. Other relevant information

COUNTRY	METHOD OR MODEL USED	OTHER RELEVANT INFORMATION
AUSTRALIA	(a)OECD WPMN Emission Assessment for Identification of Sources and Release of Airborne Manufactured Nanomaterials in The Workplace: Compilation of Existing Guidance (b)NIOSH Method 5040	--
	Stable Isotope Tracing	Requires a high level of expertise. Can be expensive. Provides internal "tagging" of the nanomaterial without altering properties that might influence the nanomaterials' interactions with surrounding materials. May need to control for potential dissolution of the metal from the nanomaterial.
AUSTRIA	Exposure measurement of nanoparticle (particle size distribution)	--
	Acoustic Dust Tester (ADT)	--
BELGIUM	Precautionary Matrix for Synthetic Nanomaterials	--
CANADA	(New Research Project) Techniques for distinguishing background “ambient” nanoparticles (NPs) from process-related NPs in the workplace.	Note: this is a Health Canada Research Project launched in May 2011.
DENMARK	NanoSafer	The model has been published in danish and can be found at http://nanosafer.i-bar.dk/
FINLAND	Direct NP concentration measurement method	--
	Stoffenmanager Nano	--
GERMANY	Scanning Mobility Particle Sizer (SMPS Fa. GRIMM)	-
	Condensations Particle Sizer 3007 (CPC 3007 Fa. TSI)	--

	Thermophoretic personal sampler	--
	Nanometer Aerosol Sampler (NAS)	--
IRELAND	Protein (biomoleucle) corona determination around Nanomaterials (NM) – influence on NM fate & behavior	– Being considered for development as a standard by ISO. Currently adding protein corona to ISO nanodefinitions: TC229 Nanotechnologies on terminology and nomenclature for nanoscience and nanotechnology. – The current definition for a protein corona that's floating around: proteins hydrodynamically associated with a surface in a biological medium – NOTE: The thickness of the corona is typically in the nanoscale.
ITALY	Evaluation of nanoparticles exposure by CPC-DMA and low pressure cascade impactor	based on ISO TR12885/2008
JAPAN	XPONA	Schematic of XPONA is as follow. This works on a project with National Institute of Advanced Industrial Science and Technology and some Japanese companies. 
NETHERLANDS	(risk assessment and risk management model)	--

	(Nanotracer)	--
	Setting NRVs	--
NORWAY	Survey	--
SLOVENIA	Detection of nanoparticles	--
SPAIN	In vitro assessment of oral absorption	--
	Nanofilters for sample collection in air and water compartments	--
	Release evaluation during accelerated aging/weathering processes	--
	Control banding Nanotool	--
	Drilling chamber	Graphical representations of the chamber are available.
	Crash chamber	Graphical representations of the chamber are available.
SWITZERLAND	Near-field-far-field and Bayesian	--
US	Nanoparticle Emission Assessment Technique for Identification of Sources and Releases of Engineered Nanomaterials	--
	Mobile direct-reading sampling of carbon nanofibers	--
	Exposure, Fate Assessment Screening Tool (E-FAST)	The models and methods contained in E-FAST have been evaluated for applicability to nano materials as described in the Interim Guidance…..
	Guidance document "Interim Technical Guidance for Assessing Screening Level Environmental Fate and Transport of, and General Population, Consumer, and Environmental Exposure to Nanomaterials (17 June 2010)"	The document provides more details for specific topic areas and summarizes current information on some issues related to environmental fate and transport and consumer, general public, and environmental exposure assessments for nanomaterials.
	Guidance document "Approaches for	The Appendices at the end of the document provide more details for specific topic areas and

	Assessing and Controlling Workplace Releases and Exposures to New and Existing Nanomaterials”	summarize current information on some issues related to workplace release and exposure assessments for nanomaterials, including special considerations for nanomaterials, toxicity, routes of exposure, exposure metrics, and factors affecting exposure.
	CHEMSTEER MODEL	The models and methods contained in ChemSTEER have not been evaluated for applicability to nano materials.
	Emission Scenario Documents	Detailed information on the CEB's standard exposure models used in the ESDs are included as appendices of the Scenario documents
Environmental Group	INESE: Impact of nanoparticles environmental sustainability and ecotoxicity supported by the Italian Institute of Technology (SEED Project, 2010-2013) Italy	--

10. Other responses (non survey)

TYPE OF DOCUMENT	TITLE
Final Report	Aitken, R.J., "Specific Advice on Exposure Assessment and Hazard/Risk Characterisation for Nanomaterials under REACH (RIP-oN 3), Final Report on Task B2: Operational Conditions And Risk Management Measures - Harvesting Results From On-Going Activities", RNC/RIP-oN3/B3/2/v3, 10 December 2010
Final Report	Aitken, R.J., "Specific Advice on Exposure Assessment and Hazard/Risk Characterisation for Nanomaterials under REACH (RIP-oN 3), Final Report on Task B2: Operational Conditions And Risk Management Measures - Harvesting Results From On-Going Activities", RNC/RIP-oN3/B3/2/v3, 10 December 2010
Abstract	Rose, Jérôme et al., "Environmental Impact of Engineered Nanoparticles and Nanomaterials Through Their Life Cycle" CEREGE UMR 6635- CNRS, Aix-Marseille Université, 13545 Aix-en-Provence FRANCE iCEINT: international Consortium for the Environmental Implications of Nanotechnology, CNRS-CEA, www.i-ceint.org;
Abstract	Rose, Jérôme et al.," Aging and Toxicity of Real NM in Aquatic Environment" CEREGE UMR 6635- CNRS, Aix-Marseille Université, 13545 Aix-en-Provence FRANCE iCEINT: international Consortium for the Environmental Implications of Nanotechnology, CNRS-CEA, www.i-ceint.org; Note: Experiments were supported by the French national programs NANOALTER (INSU/EC2CO/CYTRIX), AGING NANO & TROPH (ANR-08-CESA-001) and the FP7 NEPHH project (CP-FP 228536-2).
Article	Kuhlbusch,T.A.J , Asbach, C., Fissan, H., Göhler, D., Stintz, M., "Nanoparticle Exposure at Nanotechnology Workplaces: a Review", *Particle and Fibre Toxicology*,8-22, 2011.