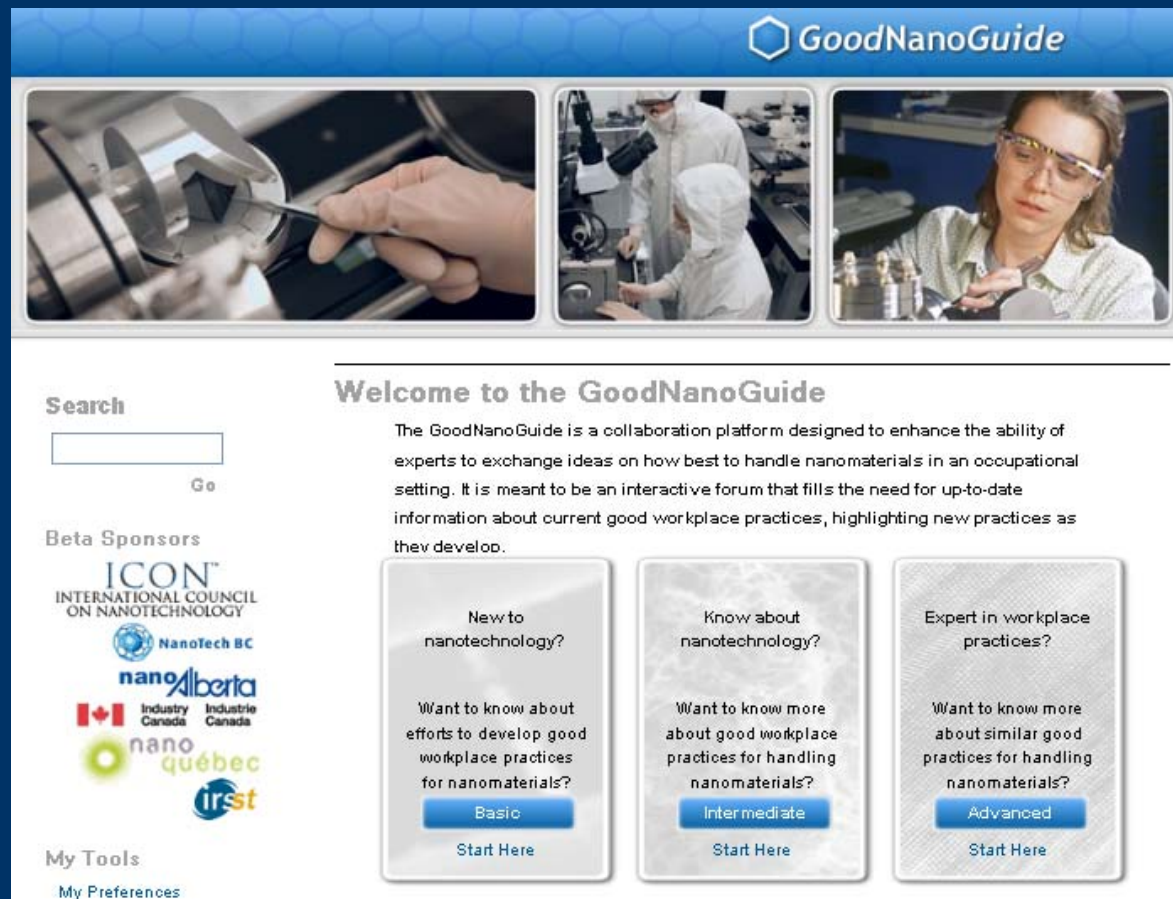


The GoodNanoGuide

An Introduction to a Novel Concept



The screenshot displays the GoodNanoGuide website. At the top, a blue header features the GoodNanoGuide logo and three images: a hand using a pipette, two scientists in a lab, and a scientist wearing safety goggles. Below the header, the page is divided into several sections. On the left, there is a search bar with a 'Go' button and a 'Beta Sponsors' section listing logos for ICON, NanoTech BC, nanoAlberta, Industry Canada, nano québec, and irst. Below the sponsors is a 'My Tools' section with a 'My Preferences' link. The main content area is titled 'Welcome to the GoodNanoGuide' and contains a paragraph of introductory text. Below this text are three vertical panels, each with a question, a level button, and a 'Start Here' link. The first panel asks 'New to nanotechnology?' and offers 'Basic' and 'Start Here' options. The second panel asks 'Know about nanotechnology?' and offers 'Intermediate' and 'Start Here' options. The third panel asks 'Expert in workplace practices?' and offers 'Advanced' and 'Start Here' options.

GoodNanoGuide

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Go

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Welcome to the GoodNanoGuide

The GoodNanoGuide is a collaboration platform designed to enhance the ability of experts to exchange ideas on how best to handle nanomaterials in an occupational setting. It is meant to be an interactive forum that fills the need for up-to-date information about current good workplace practices, highlighting new practices as they develop.

New to nanotechnology?

Know about nanotechnology?

Expert in workplace practices?

Want to know about efforts to develop good workplace practices for nanomaterials?

Want to know more about good workplace practices for handling nanomaterials?

Want to know more about similar good practices for handling nanomaterials?

Basic

Intermediate

Advanced

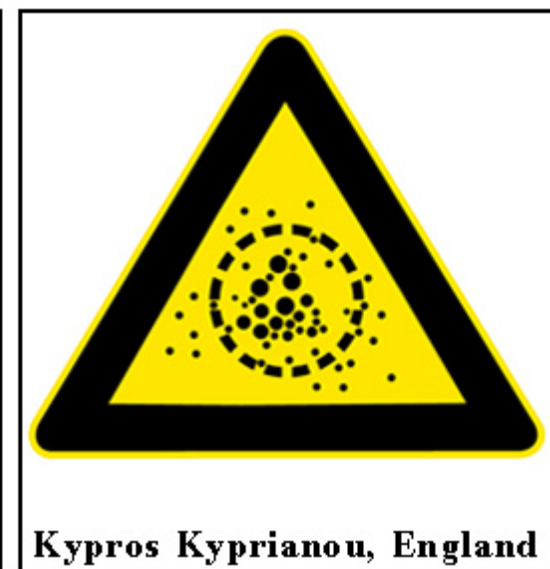
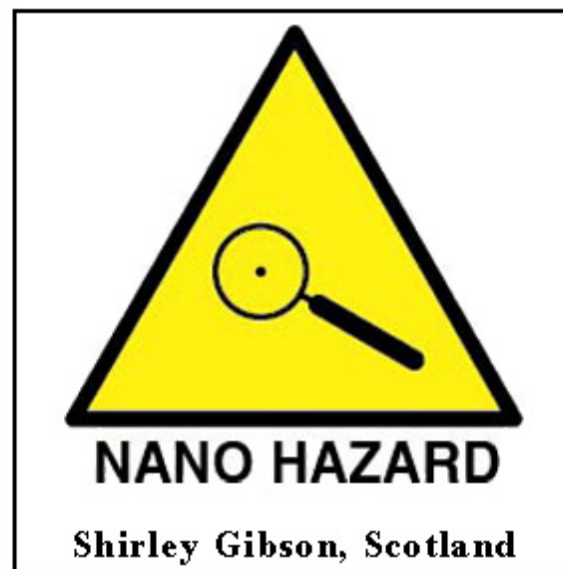
Start Here

Start Here

Start Here

Why a GoodNanoGuide?

Winners of Nano-Hazard Symbol Contest



“The winning designs will be submitted to international standard-setting bodies responsible for hazard characterisation and could be used as a label on product-packaging or workroom walls.”

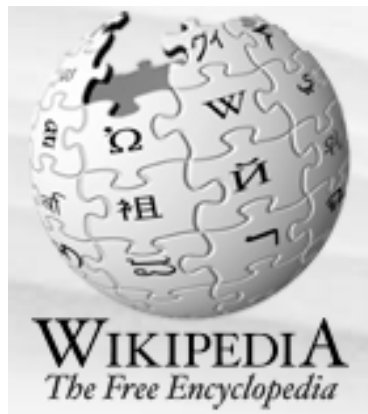
ETC Group, January 24, 2007

Why a Wiki?

A Wiki is central, shared repository of online information

Wikis for Dummies

- Anyone can edit the pages
- Editing is easy and requires no special tools
- Formatting is simple
- Changes are easily tracked



Why a Wiki for Nano Handling Practices?

Features	Policy Document	Research Paper	Wiki Entry
Describes a specific practice	No	Maybe	YES
Written by practitioners	Maybe	Maybe	YES
Written for practitioners	Maybe	No	YES
Short lead time to publication	No	No	YES
Engages global community	No	Maybe	YES
Provides a forum for dialog	No	No	YES
Easily accessed	YES	No	YES

- Policy document = Guidance document usually produced by a government agency, intended to convey principles of safe handling. Publicly available on the Internet.
- Research paper = Peer-reviewed publication on e.g., effectiveness of personal protective equipment, aerosolizability, etc.
- Wiki entry = Page in the Good Practices Wiki that communicates practices that are followed when working with a specific material or process.

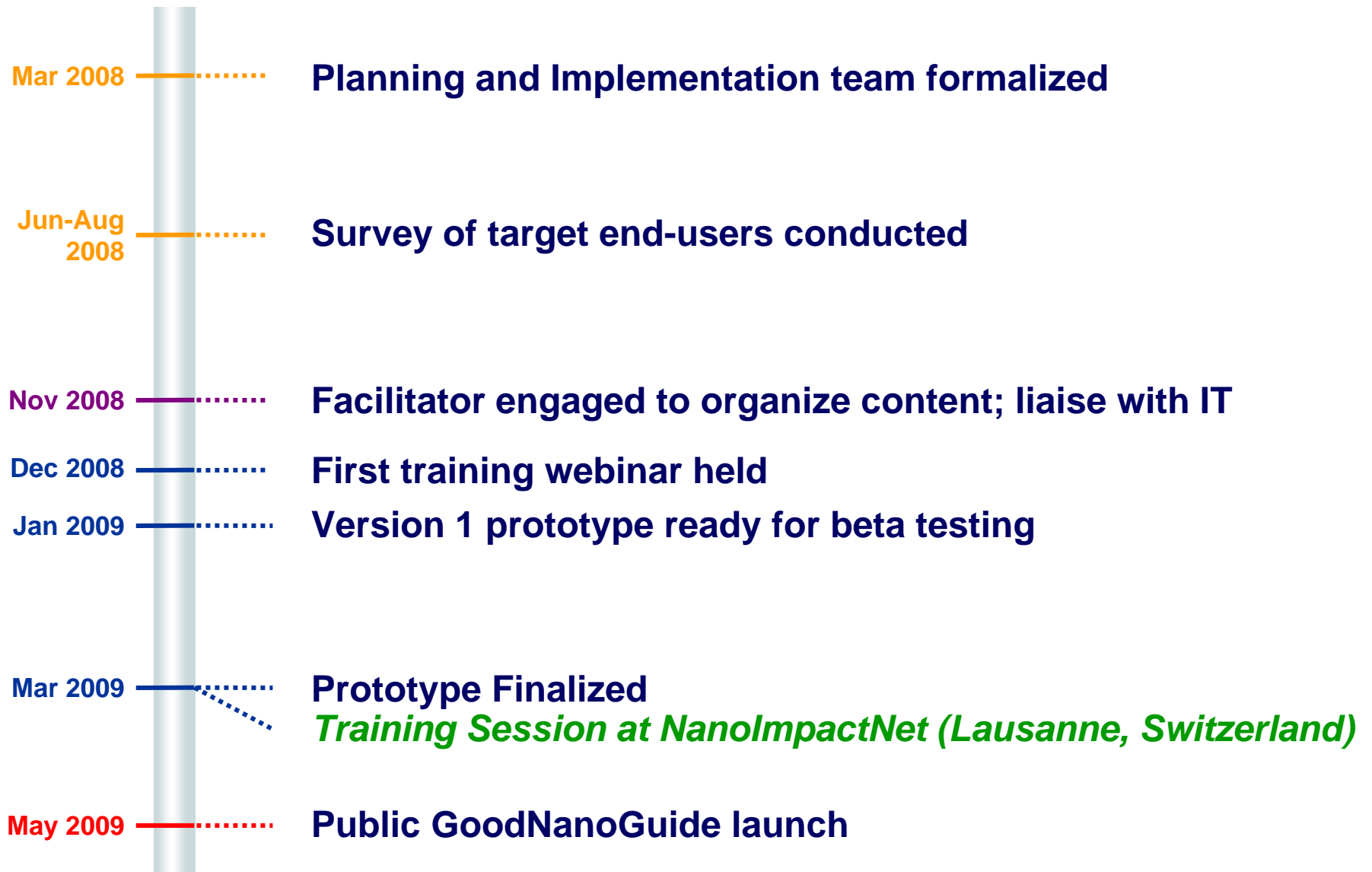
Wiki Generates Global Interest



Australia
Belgium
Brazil
Canada
Denmark
France
Germany
India
New Zealand
South Africa
Switzerland
USA
UK

Global locations of current participants

GoodNanoGuide Timeline



Features of the GoodNanoGuide Wiki

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Welcome to the GoodNanoGuide

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New to nanotechnology?

Want to know about efforts to develop good workplace practices for nanomaterials?

Basic
Start Here

Know about nanotechnology?

Want to know more about good workplace practices for handling nanomaterials?

Intermediate
Start Here

Expert in workplace practices?

Want to know more about similar good practices for handling nanomaterials?

Advanced
Start Here

- Protected Internet site on occupational practices for the safe handling of nanomaterials
- Multiple stakeholders contribute, share and discuss information
- Modern, interactive, up-to-date

http://icon.rice.edu/projects.cfm?doc_id=12207

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Basic



Welcome to the GoodNanoGuide-Just the Basics.

As mentioned, the GoodNanoGuide is designed to be a platform in which experts can exchange ideas on how best to handle nanomaterials in the workplace. In this section, the GoodNanoGuide will address basic questions about the development of nanotechnologies generally and of good practices for handling engineered and other nanomaterials in the workplace. This section is not intended, however, to be a thorough examination of all issues involving nanotechnologies and good workplace practices. Therefore, following a brief explanation of the topic, the GoodNanoGuide will direct you to other resources on the Internet if you want to learn more about a particular subject.

Here is a list of the general questions that the GoodNanoGuide will try to address:

- [What is nanotechnology?](#)
- [What are nanomaterials?](#)
- [What are the potential benefits of different nanomaterials?](#)
- [What are the potential risks of different nanomaterials?](#)
- [What basic steps can be taken to protect workers involved with nanomaterials?](#)
- [What regulations have been adopted or are being considered for nanomaterials?](#)

Finally, if you would like a more comprehensive overview about how to protect workers involved with nanotechnologies, please either proceed directly to the [Intermediate](#) or [Advanced](#) sections of the GoodNanoGuide or download Matthew Hull's "[Nanotechnology Environmental, Health and Safety: A Guide for Small Business](#)," attached here and below.

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Advanced



Welcome to the GoodNanoGuide-OHS Expert Matrix

The GoodNanoGuide is structured along a conceptual framework for occupational risk management designed to control and minimize exposures to engineered nanomaterials in the presence of uncertainty. Each organization should have a [management structure](#) to assess and minimize risk. In this section, the GoodNanoGuide has established a matrix in which the potential handling hazards of nanomaterials are rows labeled by the leftmost column, and the various physical forms of the nanoparticles are in four vertical columns.

Nanoparticles in:	→ Dry Powder	Liquid Dispersion	Solid Polymer Matrix	Nonpolymer Matrix
First Step: Identify	Potential Hazard	Potential Hazard	Potential Hazard	Potential Hazard
Second and Third Steps: Risk Assessment and Management				
Material Unpacking	Exposure Potential	Exposure Potential	Exposure Potential	Exposure Potential
	Controls	Controls	Controls	Controls
Synthesis	Exposure Potential	Exposure Potential		
	Controls	Controls		
Weighing	Exposure Potential	Exposure Potential	Exposure Potential	Exposure Potential
	Controls	Controls		
Dispersing	Exposure Potential	Exposure Potential		
	Controls	Controls		
Mixing	Exposure Potential	Exposure Potential		
	Controls	Controls		
Spraying	Exposure Potential	Exposure Potential		
	Controls	Controls	Controls	Controls
Machining	Exposure Potential	Exposure Potential	Exposure Potential	Exposure Potential
	Controls	Controls	Controls	Controls
Packing	Exposure Potential	Exposure Potential	Exposure Potential	Exposure Potential
	Controls	Controls	Controls	Controls
Process Equipment	Exposure Potential	Exposure Potential	Exposure Potential	Exposure Potential

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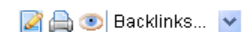
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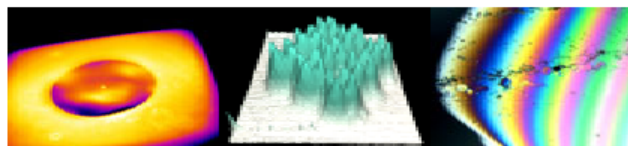
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Protocols



General Protocols

- [Government Guidance Documents](#)
- [Nanotechnology Standards](#)
- [Production Specific](#)
- [Research Specific](#)
- [Organizational Control Systems](#)



Material Specific Protocols

- [Carbon nanomaterials](#)
 - [Fullerenes](#)
 - [Carbon Nanotubes](#)
- [Macromolecules \(e.g., dendrimers\)](#)
- [Metal nanomaterials](#)
- [Oxide nanomaterials](#)
- [Quantum Dots](#)
- [Self-assembled nanomaterials](#)
- [Semiconductor nanomaterials](#)

Operation Specific Protocols

- [Synthesis](#)
- [Powder Handling](#)
- [Dispersion & Handling Dispersed Nanomaterials](#)
- [Dispersion Deposition](#)
 - [Spinning Dispersions](#)

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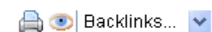
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Photochemistry of CdSe nanoparticles



Nanomaterial hazard analysis

Cadmium selenide nanoparticles are attached as a sub-monolayer on a silicon substrate. This solid material is immersed in water and exposed to light. The material is non-volatile, and the amount of the hazardous material is very small, in sub-microgram quantities.

Nanomaterial exposure assessment

There is potential for skin contact if the sample is mishandled.

Nanomaterial exposure control

Standard laboratory hygiene practices should be adequate here. Use gloves when handling and transferring the material. Good chemical hygiene as spelled out in the [Rice University Chemistry Department's Chemical Hygiene Manual](#) will be maintained. If the immersion solution is accidentally spilled, this should be cleaned up by wet wipe methods.

New students and staff will be trained by experienced staff in the specific procedures of the laboratory after they receive general training from the University EH&S. Waste material is labeled for content, and removed by the University chemical waste disposal service.

Hazard class B, Bound material, short term exposure, control band 1

Changes in procedure may increase/decrease risk of exposure. Such changes will be incorporated into the protocol and training. The University EH&S and/or the Chemistry Department maintains records on employee training and overall safety procedures.

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OHS Reference Manual

The GoodNanoGuide's provides both occupational, health and safety ("OHS") [Protocols](#) and an OHS Reference Manual. The OHS Reference manual outlines the approaches taken by professionals in the filed of OHS using research about nanomaterials and other precedents to develop appropriate protocols and guidelines. The Manual is open for edit and comment and is organized into six sections sequenced to conform with general industrial processes by which risks are investigated and protocols developed:

[Section I - A Well-Defined Description of Work](#) - This is the important description of the specific work and OHS environment.

[Section II - Identify Hazard](#) - This requires use of the main concepts of nanomaterial physico-chemical characteristics, toxicology, ecotoxicology, and hazard classifications and OHS concepts to inform the consideration of the materials and factors that may constitute potential exposure and OHS risk from nanomaterials.

[Section III - Assess Potential Exposures](#) - This analysis of the range of locations, types of person(s) and exposure routes allow the professional to recommend practices for qualitative and quantitative exposure assessment. <o:p>

[Section IV - Develop Risk Management Plan](#) - This deals with the elements of the Plan based on the principles of controlling and managing exposure and how to apply good OHS and control practices.

[Section V - Verify Control Measures](#) - Key to any OHS process is the need for the tools to evaluate the exposures, effectiveness of control measures and verification of procedures.

[Section VI - Periodically Re-Evaluate Good Practices](#) - Outlines the rationale for periodic reviews of the OHS protocols and exposure risks to allow for amendments and quality improvement over time.

I. Begin with a Well-Defined [Description of Work](#)

- [Information Collection - Material](#)
[Information Collection - Applications](#)

Interacting with the GoodNanoGuide



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Symbols




Hyperlink

Insert picture or flash

Use normal editor

Categorize Show Categories

Style

B **I** **U** ABC x_2 x^2   

"Conduct any work that could generate [engineered nanoparticles](#) in an enclosure that operates at a negative pressure differential compared to the worker's breathing zone. Examples of such enclosure include gloveboxes, glove bags, and laboratory bench-top or floor-mounted chemical hoods. In some cases, the air reactivity of precursor materials may make it unsafe to operate in a negative pressure glovebox and a positive pressure box may be used if it has passed a helium leak test. If a process subset of a process) cannot be enclosed, then use other engineered systems to control fugitive emissions of nanomaterials or hazardous precursors that might be released. For example, use a local exhaust system like a "snorkel hood."

- Do not exhaust effluent air reasonably suspected to contain engineered nanoparticles whose hazards are not well understood. Whenever practical, filter it or otherwise clean (scrub) it before release.
- [HEPA](#) filtration appears to effectively remove nanoparticles from air, at least to particles as

Implementation Committee



Dr. Michael Riediker
Institute for Work and Health



Mr. Bruce Stockmeier
Argonne National Lab



Dr. Kristen Kulinowski
Rice University



Dr. Paul-Émile Boileau
IRSST



Ms. Ilise Feitshans
International Labour Organization



Dr. Steve Hankin
SafeNano



Dr. Mark Hoover
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Mr. Matthew Jaffe
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