

NanoES&H Update

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 - ❧ The U.S. Department of Energy
 - ❧ The speaker's wife
- Everything is subject to change



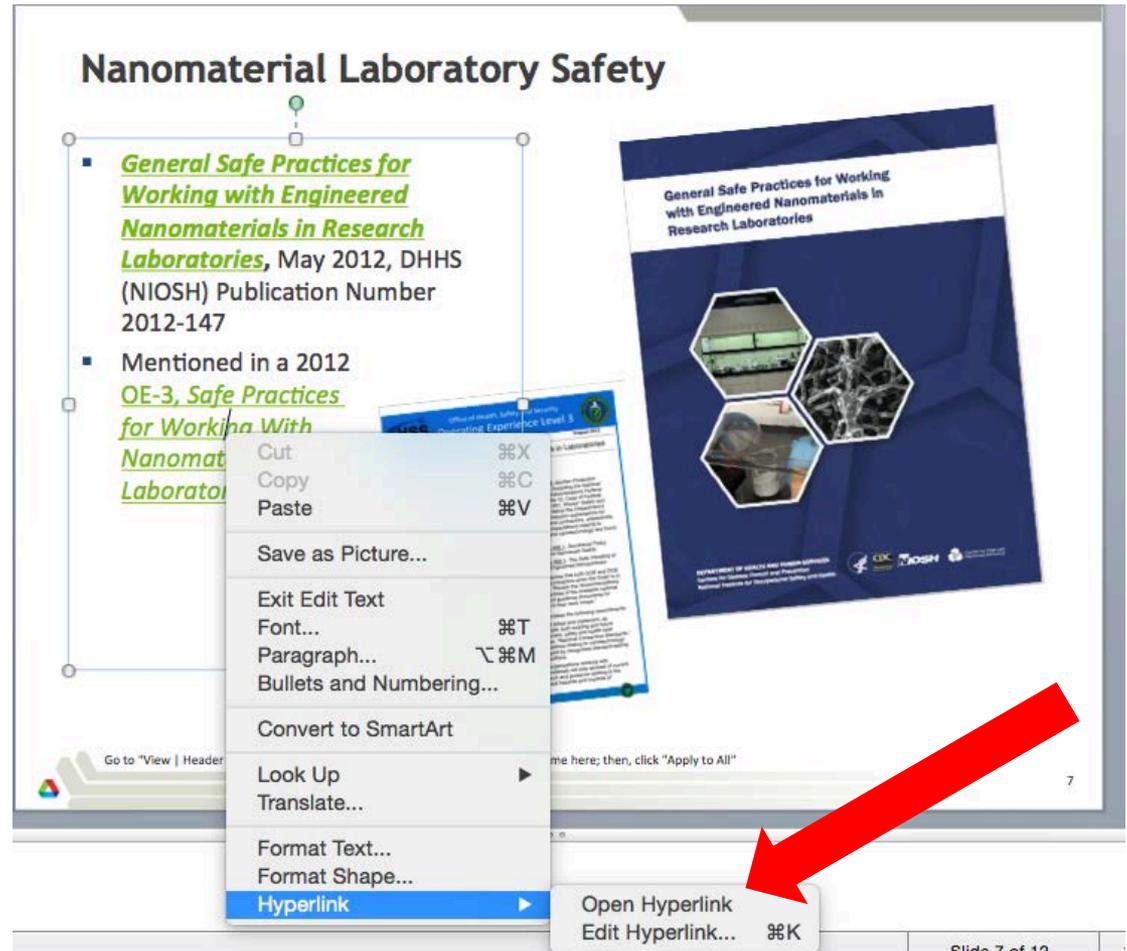
DOE P 456.1 - SECRETARIAL POLICY STATEMENT ON NANOSCALE SAFETY

- Policy excerpts:
 - DOE organizations working with nanomaterials **will stay abreast of current research and guidance relating to the potential hazards and impacts of nanomaterials**, and will ensure that this best current knowledge is reflected in the identification and control of these potential hazards and impacts at their facilities.
 - DOE **will adopt and implement, as appropriate, both existing and future environment, safety and health best practices, “National Consensus Standards,” and guidance** relating to nanotechnology developed by recognized standard-setting organizations. Further, any existing DOE Directives and Standards which contain provisions that are relevant to nanotechnology work must be appropriately applied.

Hyperlinks in These Viewgraphs

Open stubborn hyperlinks by:

1. Positioning the cursor on the link
2. Using either a [CNTL] click or right click to bring up the main menu shown in the screenshot
3. Opening the “Hyperlink” submenu
4. Clicking on the “Open Hyperlink” command



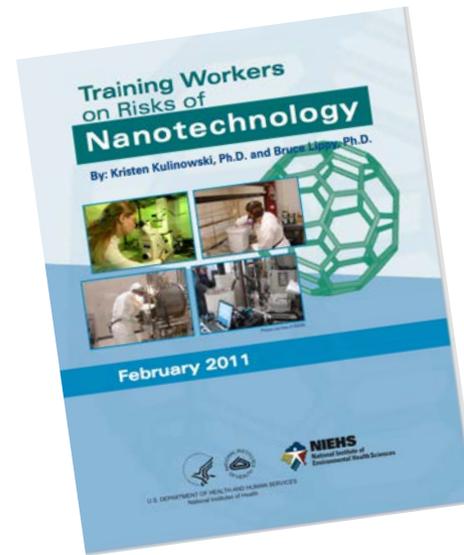
Clearinghouses

- **Nanotechnology Safety & Health Repository**
<http://orise.orau.gov/ihos/tech-topics/nanotechnology-repository.html>
 - Guidelines, Procedures, and Best Practices (approximately 60 items)
 - Training Resources
- **NNI Resources for Nanotechnology Laboratory Safety**
<http://www.nano.gov/LabSafety>
- **National Institute for Occupational Safety and Health (NIOSH), Workplace Safety and Health Topics, Nanotechnology**
<http://www.cdc.gov/niosh/topics/nanotech/default.html>



Training

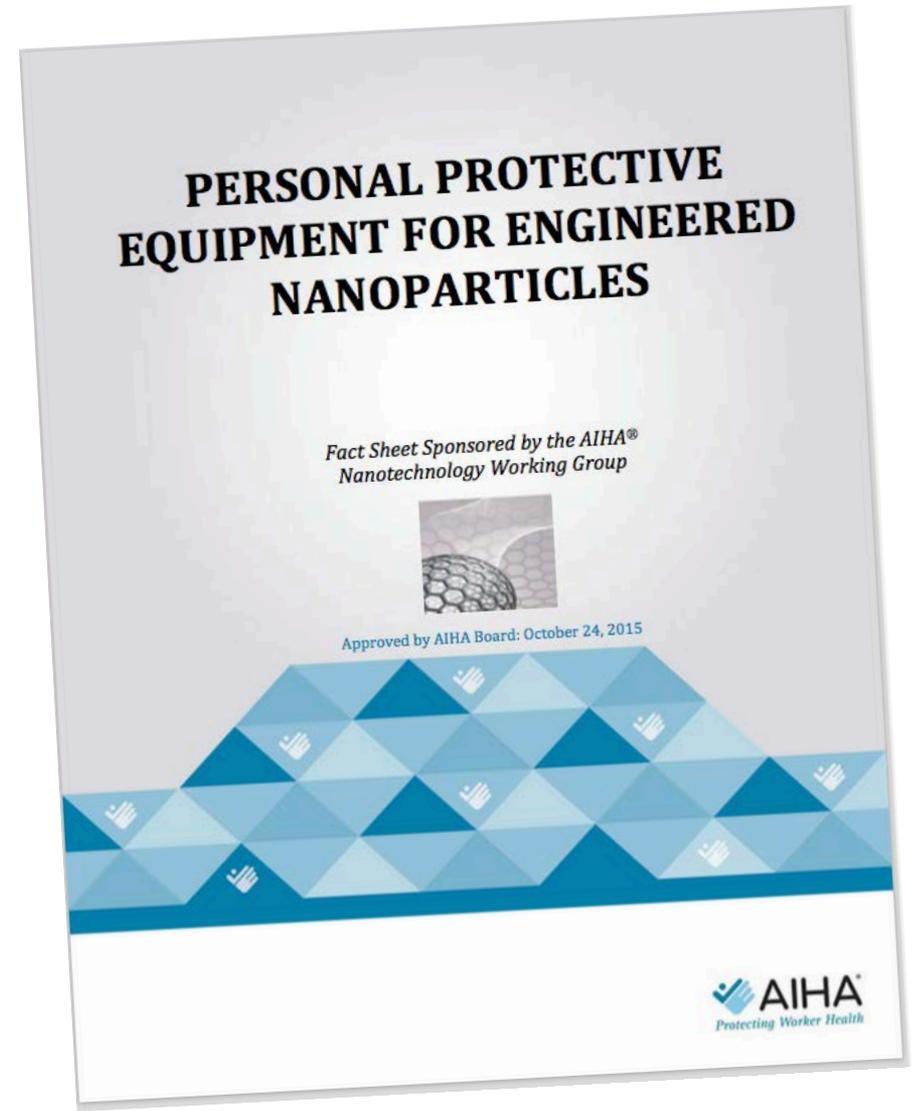
- NIEHS Training Workers on the Risks of Nanotechnology
 - 37 pages of text
 - 90 references, many with hyperlinks
 - Not limited to R&D operations



- NanoValid nanoToGo
 - Safe handling of nanomaterials and other advanced materials at workplaces
 - Field studies
 - General information
 - 7 presentations, each in 2 formats – one of which contains explanatory notes

Personal Protective Equipment

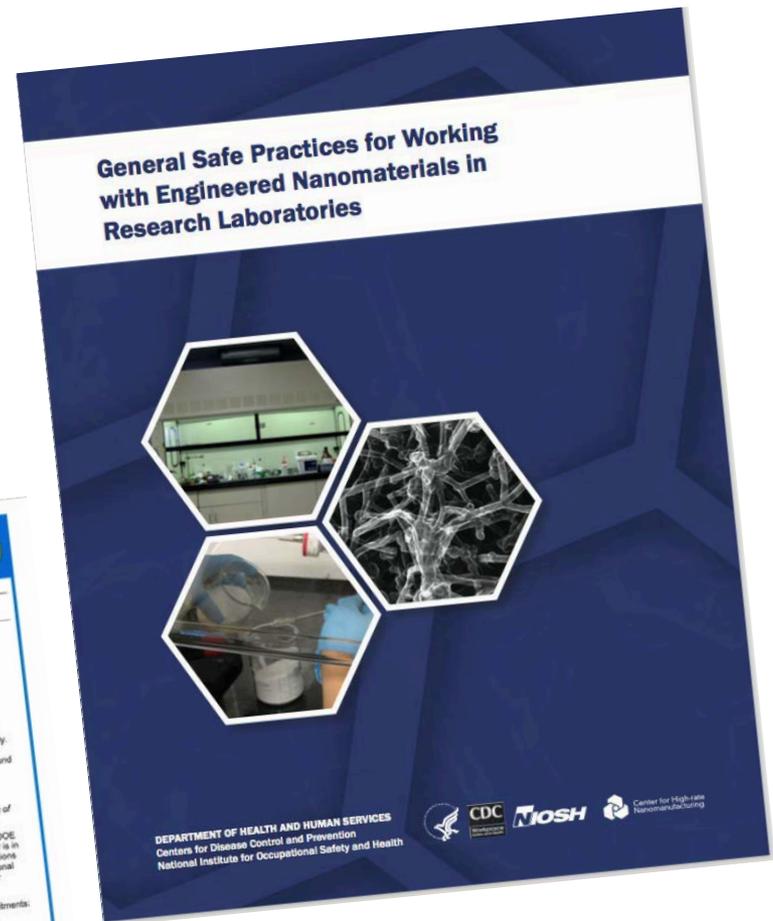
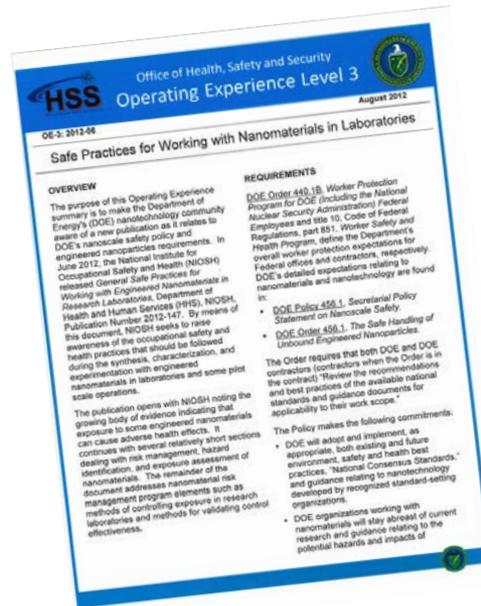
- [AIHA's Personal Protective Equipment for Engineered Nanomaterials](#)
- Broad, short (5-page) fact sheet intended for a “broad audience”
- Industrial hygienists might not finding anything surprising.



Nanomaterial Laboratory Safety

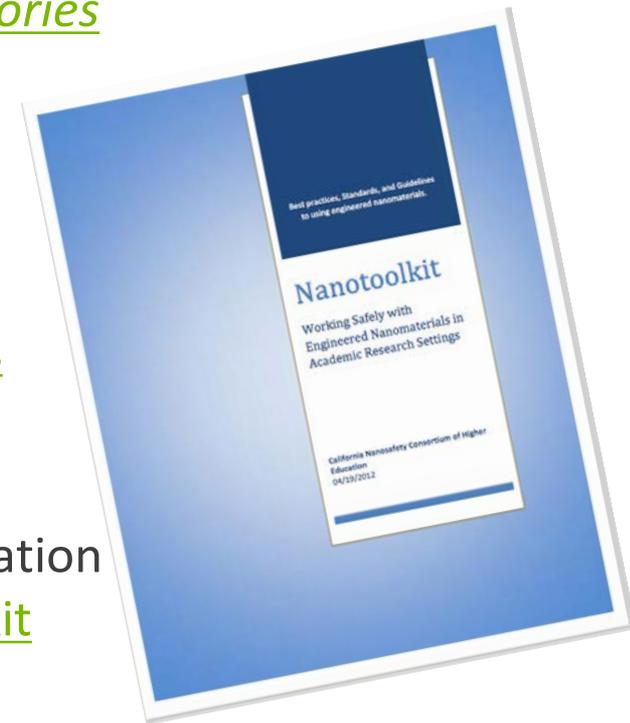
- [General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories](#), May 2012, DHHS (NIOSH) Publication Number 2012-147

- Mentioned in a 2012 [OE-3, Safe Practices for Working With Nanomaterials in Laboratories](#)



Other Sources for Nanomaterial Laboratory Safety

- [Quick Guide: Exposure Risks and Control Measures for Common Laboratory Operations Involving Nanomaterials](#)
Stanford University
- [Nanomaterials Handling Safety Guide for Laboratories](#)
University of Iowa
- [Potential Risks of Nanomaterials and How to Safely Handle Materials of Uncertain Toxicity](#)
Massachusetts Institute of Technology
- [Lab Safety Guidelines for Handling Nanomaterials](#)
Stanford University
- [Nanotoolkit](#)
California Nanosafety Consortium of Higher Education
[Link to 30-minute introductory video on the toolkit](#)
- ..., and what about
[Approach to Nanomaterial ES&H Revision 3a – May 2008](#)
DOE Nanoscale Science Research Centers



Consensus Standards

■ ISO/TC 229 - Nanotechnologies

- Nearly 50 publications – not all relevant to ESH – some are, e.g.:
 - [ISO/TR 12885:2008](#), Nanotechnologies -- Health and safety practices in occupational settings relevant to nanotechnologies
 - [ISO/TS 12901-1:2012](#), Nanotechnologies -- Occupational risk management applied to engineered nanomaterials -- Part 1: Principles and approaches
 - [ISO/TS 12901-2:2014](#), Nanotechnologies -- Occupational risk management applied to engineered nanomaterials -- Part 2: Use of the control banding approach
 - [ISO/TR 13329:2012](#), Nanomaterials -- Preparation of material safety data sheet (MSDS)
 - [ISO/TR 13121:2011](#), Nanotechnologies -- Nanomaterial risk evaluation
- More than 30 more under development

■ ASTM International (E56) - Nanotechnology Standards

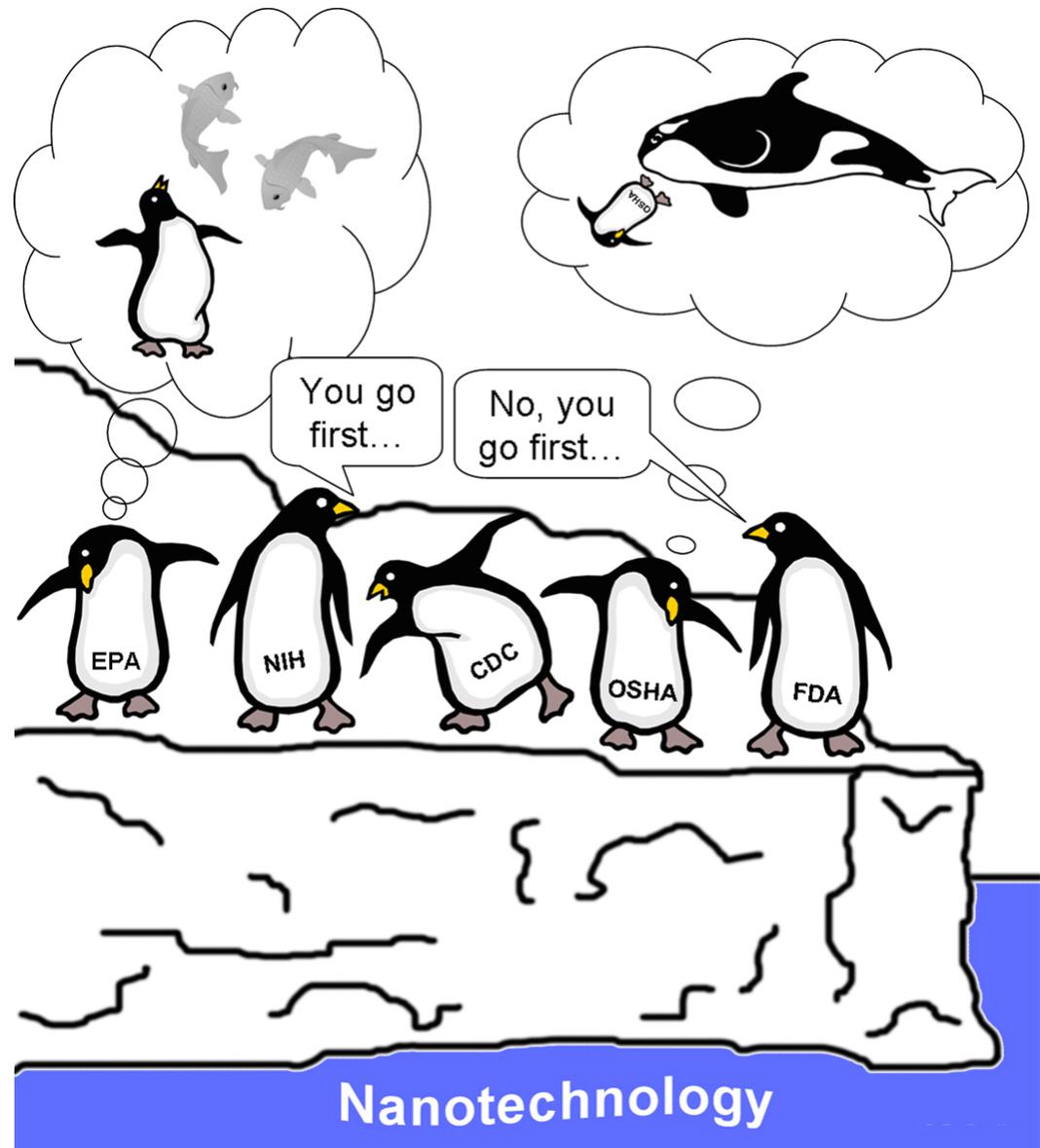
- 4 publications related to *Education and Workforce Development*
- 4 publications related to *Environment, Health, and Safety*, including [E2535 - 07\(2013\), Standard Guide for Handling Unbound Engineered Nanoscale Particles in Occupational Settings](#)
- 8 more on terminology, informatics, and characterization

(Emerging) Developments

- NIOSH Current Intelligence Bulletins
 - [Occupational Exposure to Titanium Dioxide, CIB 63](#)
 - [Occupational Exposure to Carbon Nanotubes and Nanofibers, CIB 65](#)
 - External Review Draft [Health Effects of Occupational Exposure to Silver Nanomaterials](#)
- IARC and carbon nanotubes
 - Carbon nanotubes, multiwalled – high priority
 - “A specific nanotube, **multi-walled carbon nanotube-7** was classified as **possibly carcinogenic (Group 2B)** based on evidence showing that they caused mesotheliomas in male and female rats. All other multi-walled and single-walled carbon nanotubes were categorised as not classifiable as to their carcinogenicity to humans (Group 3) due to insufficient evidence.”
 - Remember many “interesting” nanomaterials, CdS quantum dots, have carcinogenic constituents
- Lancet Oncology
[Carcinogenicity of fluoro-edenite, silicon carbide fibres and whiskers, and carbon nanotubes](#)

Government Regulation and Oversight in 2004

- DOE Secretarial Policy Statement
- DOE Notice and Order
- EPA Regulations..., but why should an industrial hygienist care about an EPA regulation



Another Development..., errrr, Thing to Watch

- Environmental Protection Agency Significant New Use Regulations (SNURs)
 - If a chemical substance is subject to a SNUR and the intended manufacture, processing, or use of the substance is a significant new use, submission of a Significant New Use Notice (SNUN) is required 90 days prior to the manufacture of that substance
 - Regulations at [40 CFR 721](#), especially § 721.63
 - Occupational impacts?
 - Cooperation with Canada and the Organisation for Economic Cooperation and Development (OECD)
 - Operations are probably exempt

§721.10155 Multi-walled carbon nanotubes (generic).

(a) *Chemical substance and significant new uses subject to reporting*—(1) The chemical substance generically as multi-walled carbon nanotubes (PMN P-08-177) is subject to reporting for significant new uses described in paragraph (a)(2) of this section. The requirements of this rule apply to the chemical substance after it has been completely reacted (cured); incorporated or embedded in a permanent solid polymer form that itself has been reacted (cured); or embedded in a permanent solid polymer form that is processed except for mechanical processing.

(2) The significant new uses are:

(i) *Protection in the workplace*. Requirements as specified in §721.63(a)(1), (a)(2) (National Institute for Occupational Safety and Health (NIOSH)-approved air-purifying respirator equipped with N100 filters), (a)(6)(i), and (c).

(ii) *Industrial, commercial, and consumer activities*. Requirements as specified in

(iii) *Release to water*. Requirements as specified in §721.90(a)(1), (b)(1), and (c)(1).

(b) *Specific requirements*. The provisions of subpart A of this part apply to this section.

§ 721.63 Protection in the workplace

(a) Whenever a substance is identified in subpart E of this part as being subject to this section, a significant new use of the substance is any manner or method of manufacturing, importing, or processing associated with any use of the substance without establishing a program whereby:

- (1) Each person who is reasonably likely to be dermally exposed in the work area to the chemical substance through direct handling of the substance or through contact with equipment on which the substance may exist, or because the substance becomes airborne in the form listed in paragraph (a)(6) of this section, and cited in subpart E of this part for the chemical substance, is provided with, and is required to wear, personal protective equipment that provides a barrier to prevent dermal exposure to the substance in the specific work area where it is selected for use. Each such item of personal protective equipment must be selected and used in accordance with 29 CFR 1910.132 and 1910.133.

§ 721.63 Protection in the workplace (continued)

(a)(2) In addition to any other personal protective equipment selected in paragraph (a)(1) of this section, the following items are required:

(i) Gloves.

(ii) Full body chemical protective clothing.

(iii) Chemical goggles or equivalent eye protection.

(iv) Clothing which covers any other exposed areas of the arms, legs, and torso. Clothing provided under this paragraph need not be tested or evaluated under the requirements of paragraph (a)(3) of this section.

(3) The employer is able to demonstrate that each item of chemical protective clothing, including gloves, selected provides an impervious barrier to prevent dermal exposure during normal and expected duration and conditions of exposure within the work area by any one or a combination of the following:

(i) Testing the material used to make the chemical protective clothing and the construction of the clothing to establish that the protective clothing will be impervious for the expected duration and conditions of exposure. The testing must subject the chemical protective clothing to the expected conditions of exposure, including the likely combinations of chemical substances to which the clothing may be exposed in the work area.

(ii) Evaluating the specifications from the manufacturer or supplier of the chemical protective clothing, or of the material used in construction of the clothing, to establish that the chemical protective clothing will be impervious to the chemical substance alone and in likely combination with other chemical substances in the work area.

(4) Each person who is reasonably likely to be exposed to the chemical substance by inhala....

Acknowledgment

The Center for Nanoscale Materials is one of the five DOE Nanoscale Science Research Centers, premier national user facilities for interdisciplinary research at the nanoscale supported by the DOE Office of Science. Together the NSRCs comprise a suite of complementary facilities that provide researchers with state-of-the-art capabilities to fabricate, process, characterize and model nanoscale materials, and constitute the largest infrastructure investment of the National Nanotechnology Initiative. The NSRCs are located at DOE's Argonne, Brookhaven, Lawrence Berkeley, Oak Ridge, Sandia and Los Alamos National Laboratories. For more information about the DOE NSRCs, please visit <http://science.energy.gov/bes/suf/user-facilities/nanoscale-science-rese...>