UNIVERSITY OF CALIFORNIA

UC CEIN Center for Environmental Implications of Nanotechnology

Current Practices and Perceived Risks Related to Health, Safety and Environmental Stewardship in Nanomaterials Industries

Cassandra Engeman, UCSB, Project Coordinator
Barbara Herr Harthorn, UCSB, Principal Investigator
Patricia Holden, UCSB, Co-Principal Investigator
UCSB Research Team: Lynn Baumgartner, Ben Carr, Allison Fish, and John Meyerhofer

University of California-Santa Barbara (UCSB)-based international survey of industry
Sponsored by the U.S. NSF- and EPA-funded UC Center for Environmental Implications of Nanotechnology and the NSF-funded Center for Nanotechnology in Society

A Growing Industry

- Nanotechnology incorporated in more than $50 billion in manufactured goods, 2006
- By 2014, $2.6 trillion in manufactured goods
- 50% of output in electronics and IT will be nano-enabled, 2014
- 16% goods in healthcare and life sciences will incorporate nanotech, 2014

(Lux Report, 2007)

Deficit of knowledge regarding toxicity on NMs in:

1. Life-cycle assessment
2. Persistence and interaction of ENMs in the environment
3. Organismal uptake of ENMs
4. Long-term effects on human health
5. Proper instruments for monitoring & assessment
6. Regulatory uncertainty

(Renn & Roco, 2006; Behra & Krug, 2008)

Prior UCSB International Nanotech Industry Study:

- Data collected Summer 2006
- Sponsored by the International Council on Nanotechnology (ICON)
- Public report available at: http://icon.rice.edu/projects.cfm?doc_id=12201

Findings from 2006 Study:

- Discrepancies between practices and beliefs
- Firms more attentive to general EHS more likely to have nano-specific EHS programs
- Majority of respondents expressed need for more nano-specific EHS information (Conti *et al.*, 2008)

Hierarchical Approach:

1.Elimination or substitution of hazard

2. If substance cannot be eliminated or substituted, ***engineering controls,*** such as isolation and ventilation with HEPA filters and well-designed filter housings should be implemented

3. If first two steps do not remove hazard, use ***administrative controls*** and work practices, such as formal procedures with guidelines of good work policies for management and workers

4. If need further protection, use ***personal protective equipment (PPE)*** and as a last resort, a respiratory protection program

UNIVERSITY OF CALIFORNIA

UC CEIN Center for Environmental Implications of Nanotechnology

Current UCSB Industry Study:

- Data collection Fall 2009-Spring 2010 – *currently in progress*
- Objectives:
  - Update understanding of environmental health and safety practices since 2006
  - Expand knowledge of industry's views on risks posed by nanomaterials
- Endorsed by:
  - The working group on strategic area of nanotechnology, public research institute, AIST
  - Singapore's Institute of Materials Research and Engineering, A*STAR
  - American Industrial Hygiene Association (AIHA) Nanotechnology Working Group
  - International Council on Nanotechnology (ICON)

UCSB

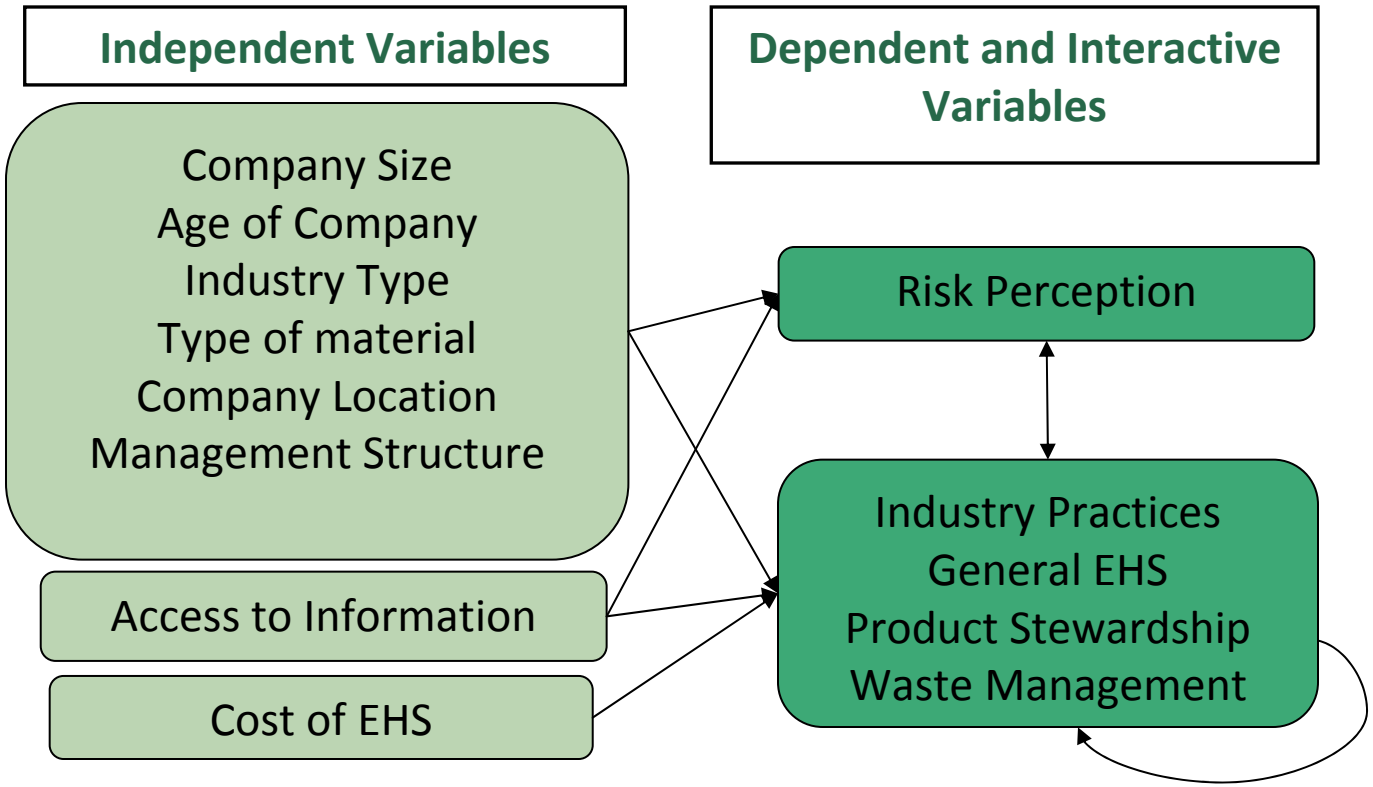
NSF

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Research Questions include:

1. How is industry adapting practices for safe development of NMs? Has this changed since 2006?
2. How do industry EHS practices and views on risk vary by country and region?
3. What are unmet knowledge and guidance needs of industry? How are these changing over time?
4. What determines extent to which NM firms in different sectors and countries follow publically-available guidance documents or respond to toxicity research findings?

Hypothesized relationships:



SURVEY: Main Sections

Company Information

Nanoparticle-specific Information

Employee and Area Exposure Monitoring

Containment and Exposure Controls

Waste Management and Product Stewardship

Views on Risk Assessment and Risk Management

- Structured interviews
- Administered through a 45-minute phone interview
- Available online in English, Japanese and Chinese
- Confidential participation

Project Timeline

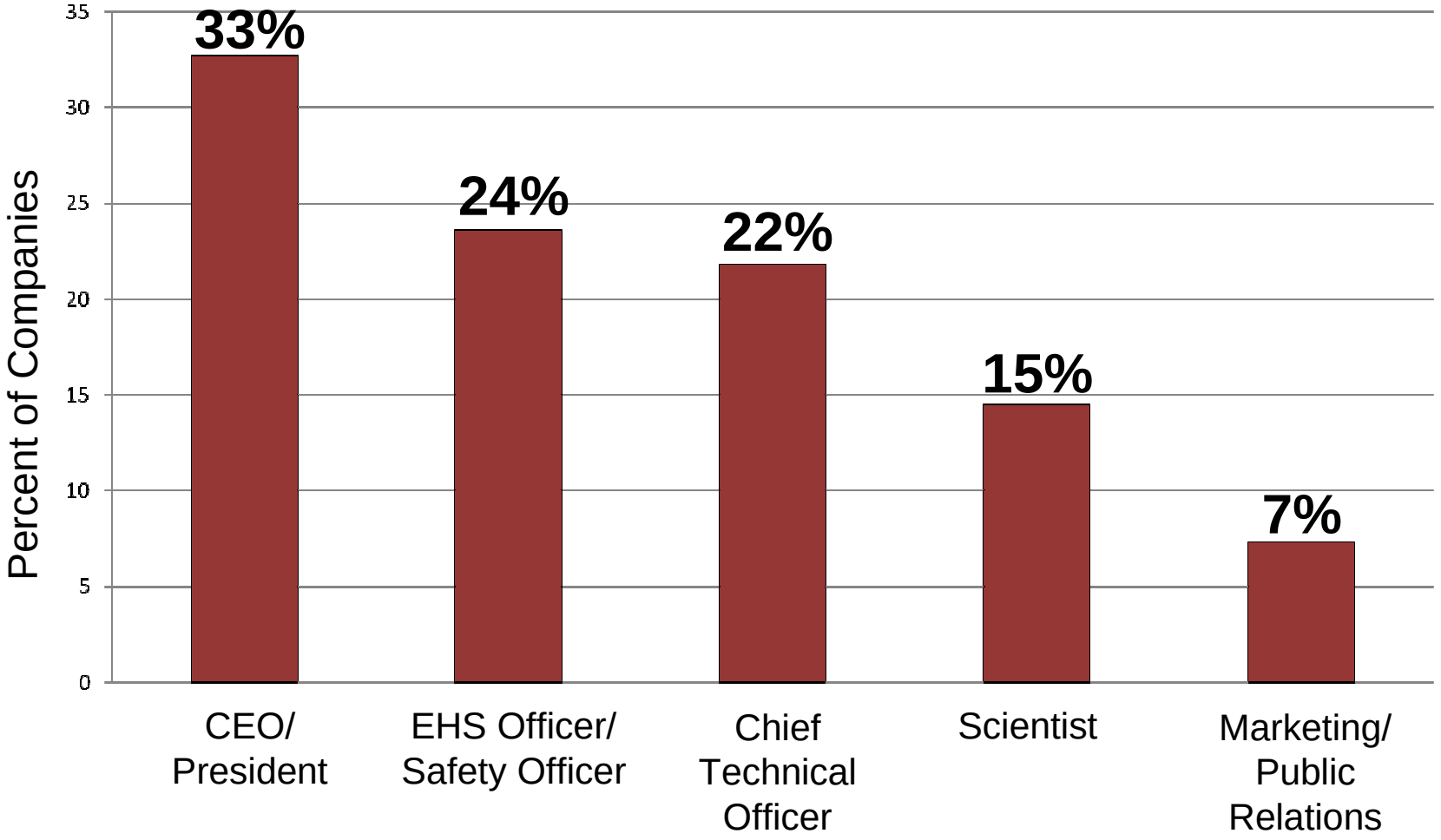
Research Design	•Revise 2006 survey to reflect changes and to include more comprehensive section on perceived risks of NMs •Develop contact database of over 1500 contacts	May – September 2009
Implementation	•Target 500 contacts for participation •Recruit 100 participants for a response rate of 20% •Online survey in Japanese and Chinese	September 2009 – April 2010
Preliminary Analysis	Examine relationship between industry practices and other variables with particular attention to the relationship between perceived risks and industry practices	April – May 2010

THE PARTICIPANTS

	Total Contacts	% of Total Sample	Total Interviews	Response Rate by Region
North America	255	58%	42	16%
Europe	112	25%	9	8%
Asia	68	15%	6	9%
Other	11	12%	0	0%
Overall Response Rate				**12.8%**

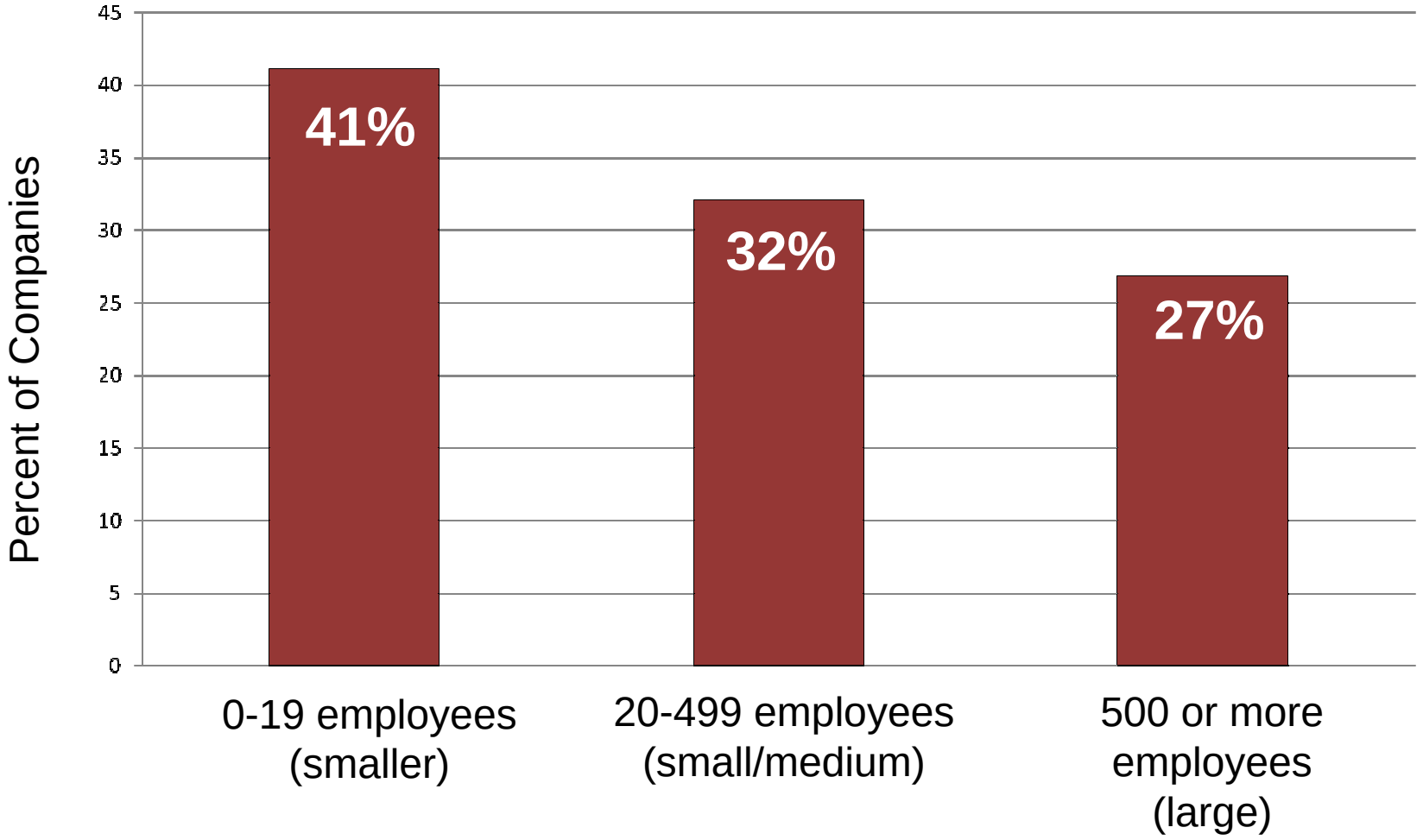
** Data collection is currently in progress.*

Participants' Job Titles



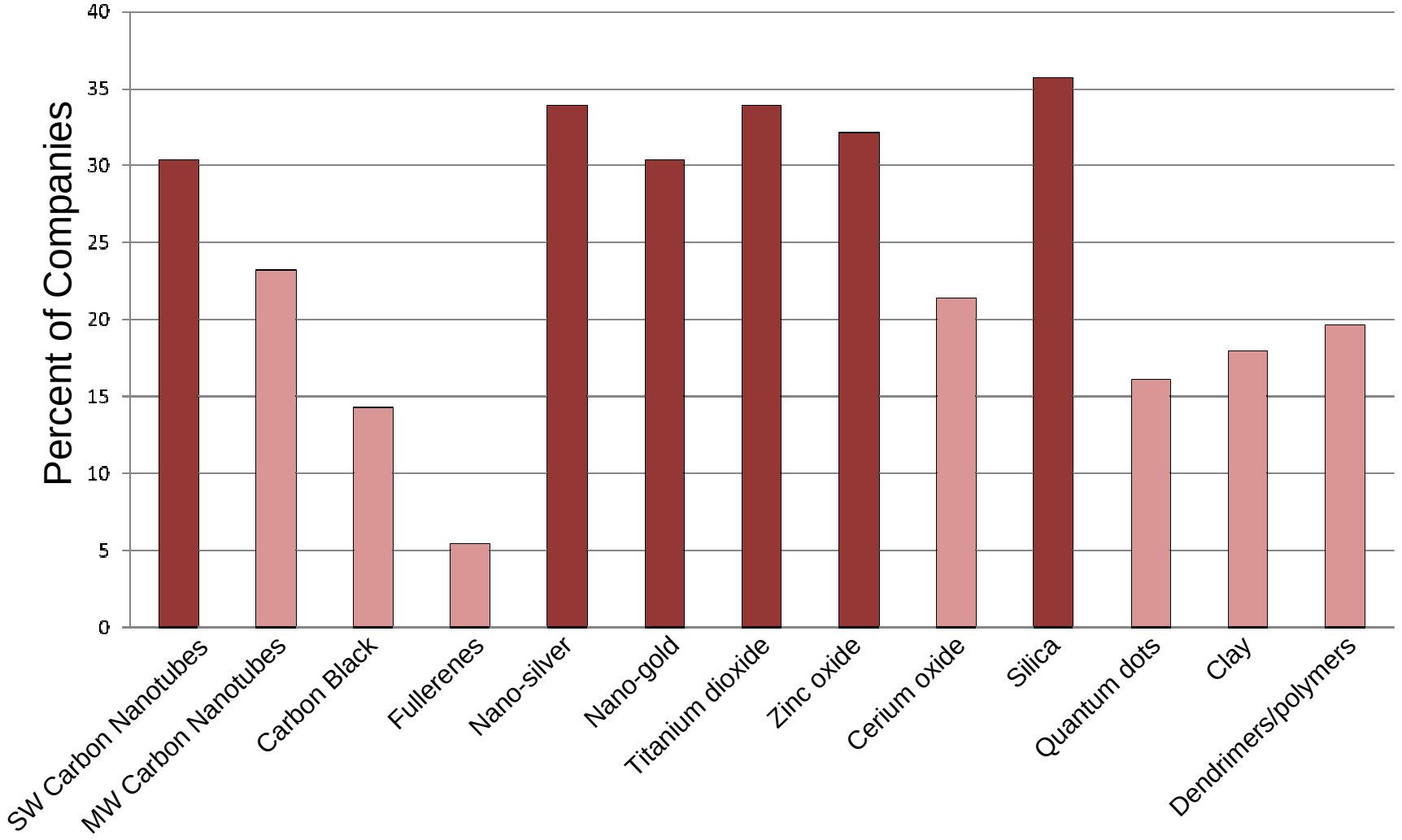
** Data collection is currently in progress.*

Company Size by Number of Employees



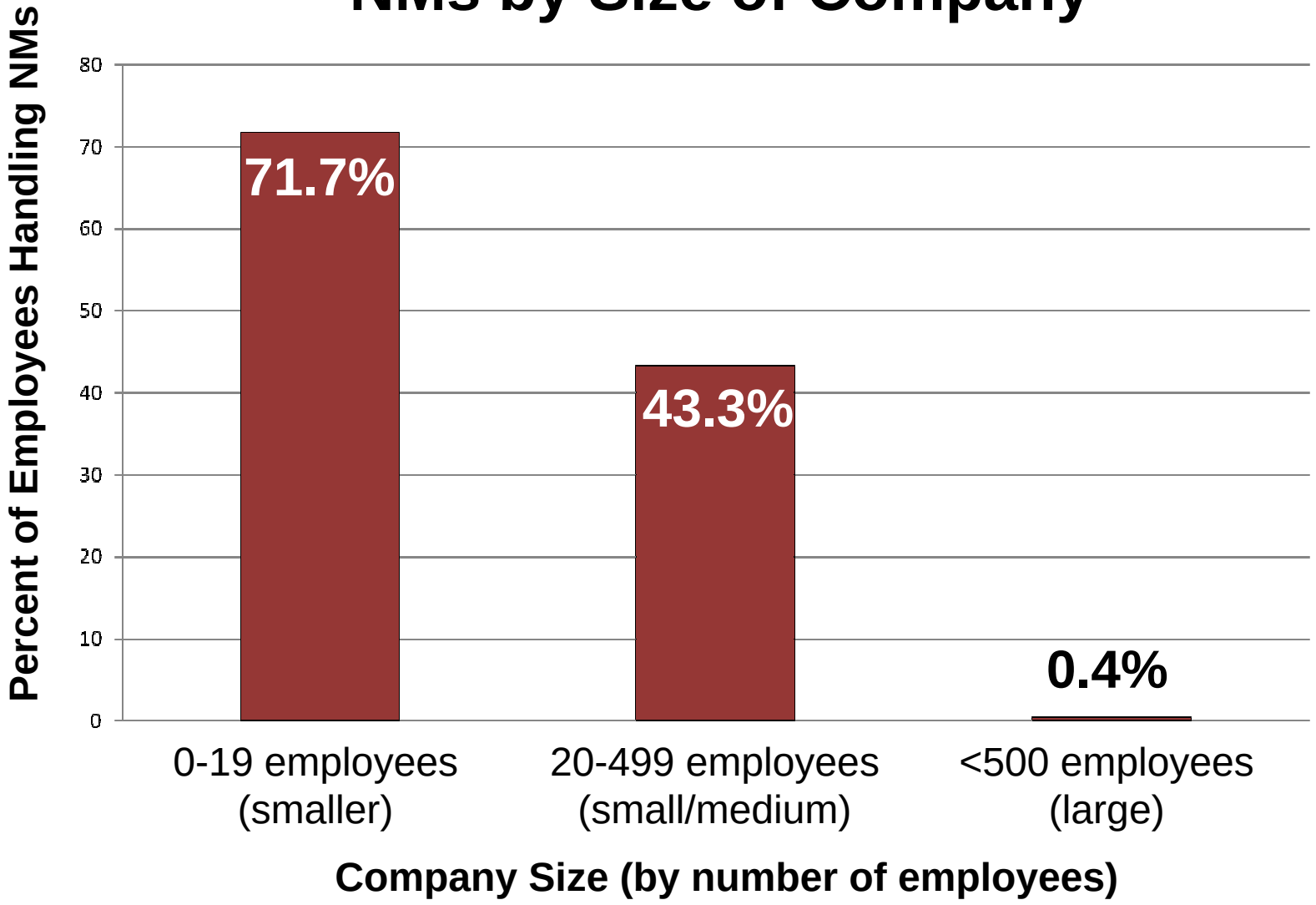
** Data collection is currently in progress.*

Types of Nanoparticles Handled



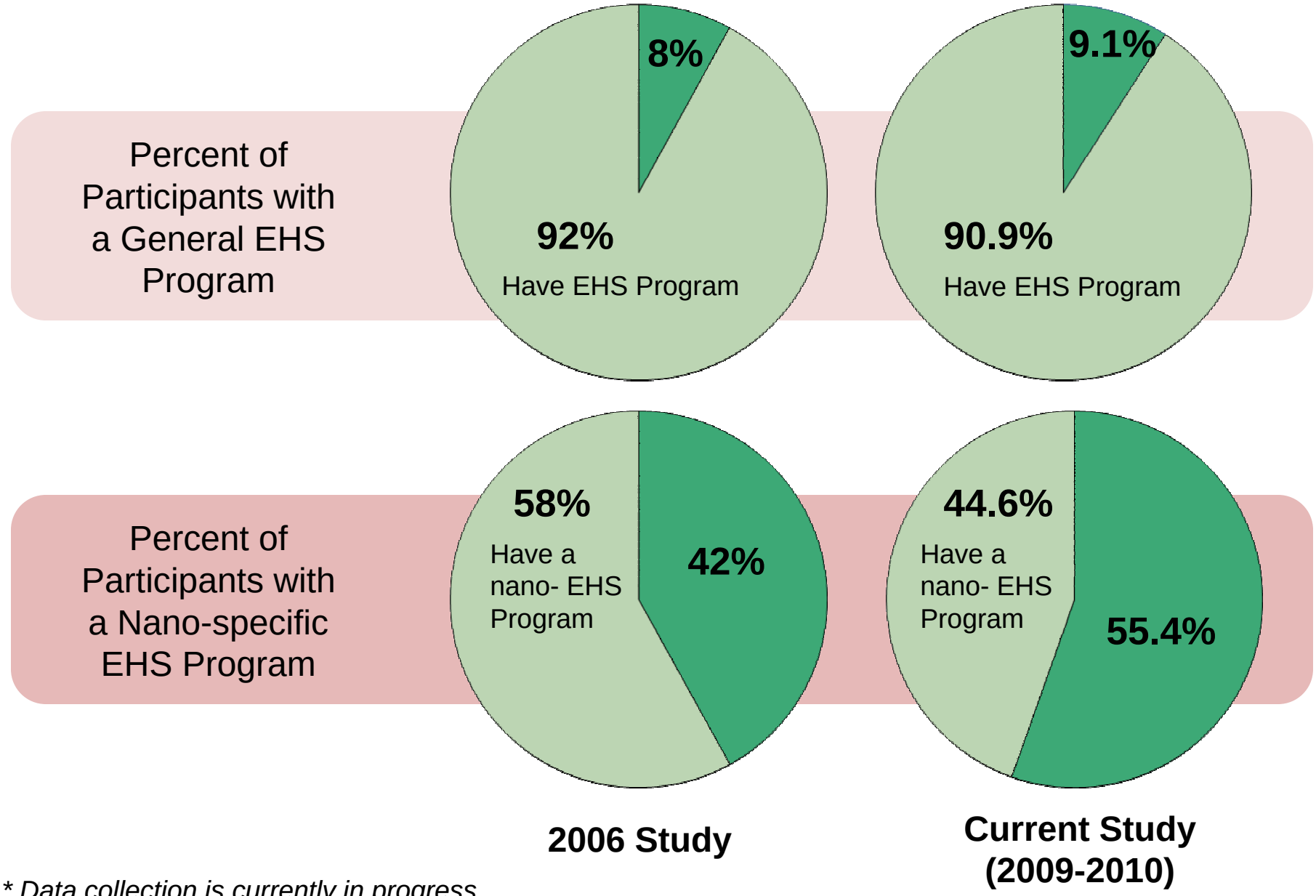
** Data collection is currently in progress.*

Percent of Employees Working with NMs by Size of Company



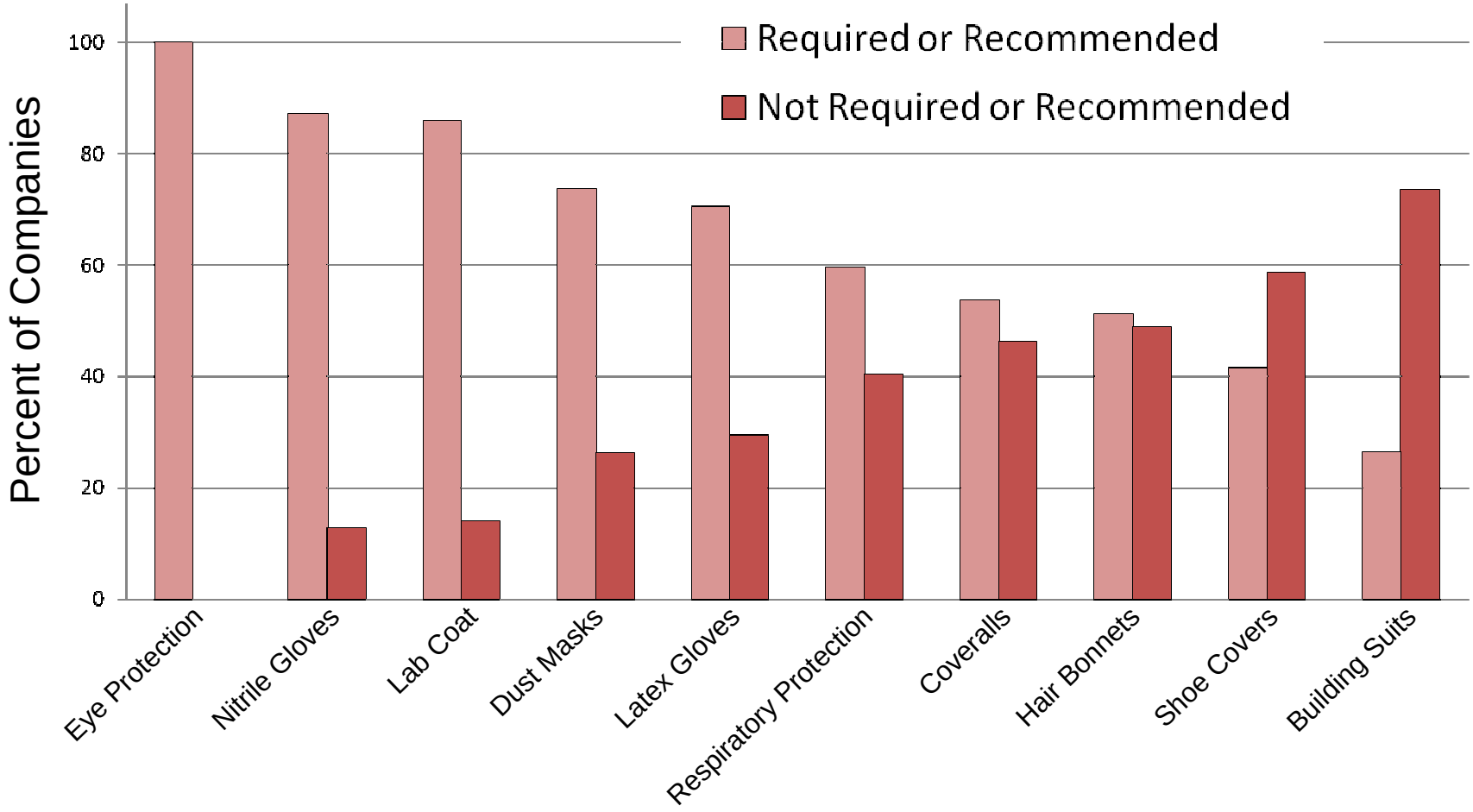
** Data collection is currently in progress.*

General EHS and Nano-specific EHS Programs in 2006 and 2009-2010



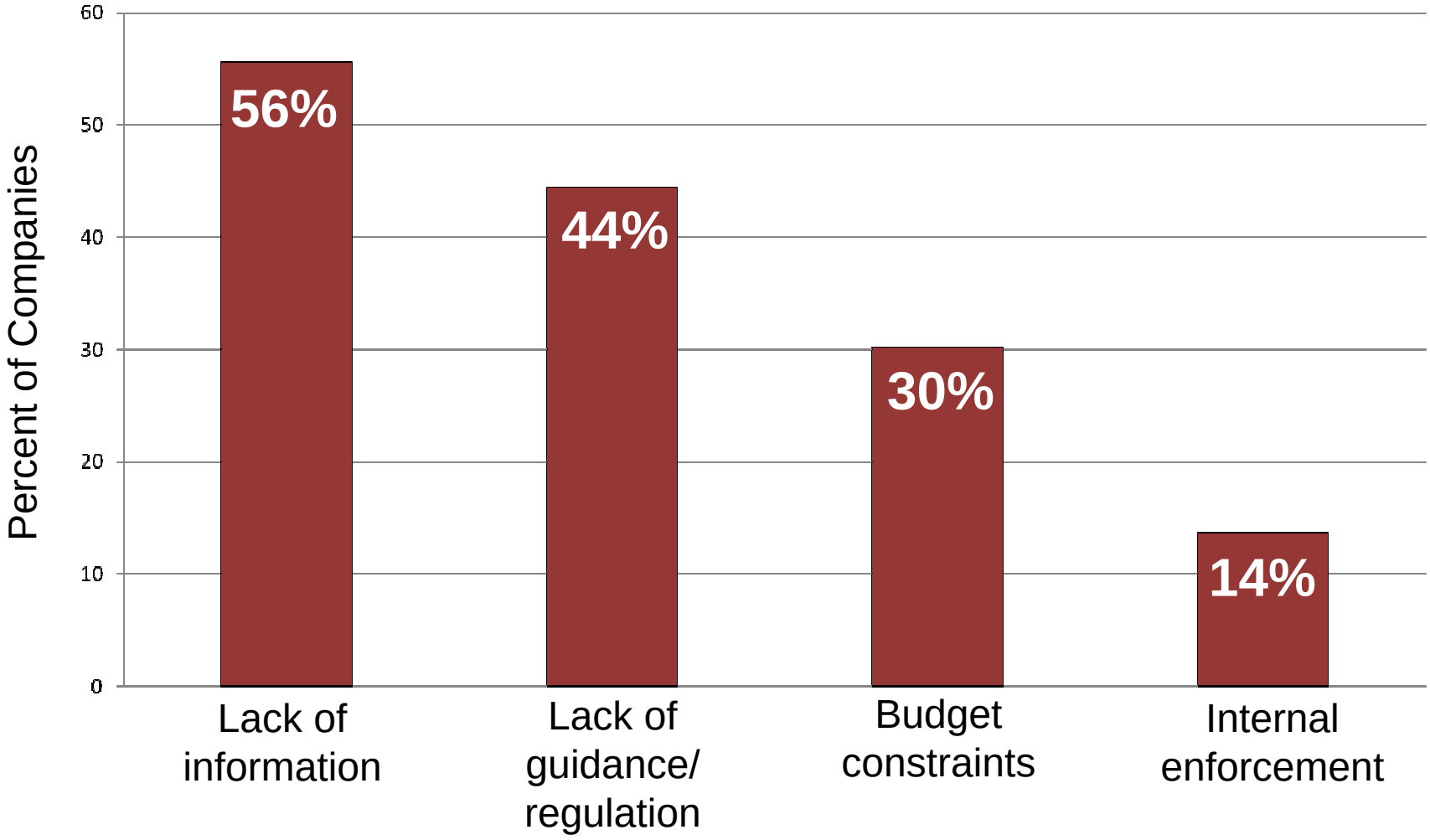
** Data collection is currently in progress.*

Use of Personal Protective Equipment (PPE)



** Data collection is currently in progress.*

Reported Impediments to Implementing Nano-specific EHS Programs:



** Data collection is currently in progress.*

Waste Management

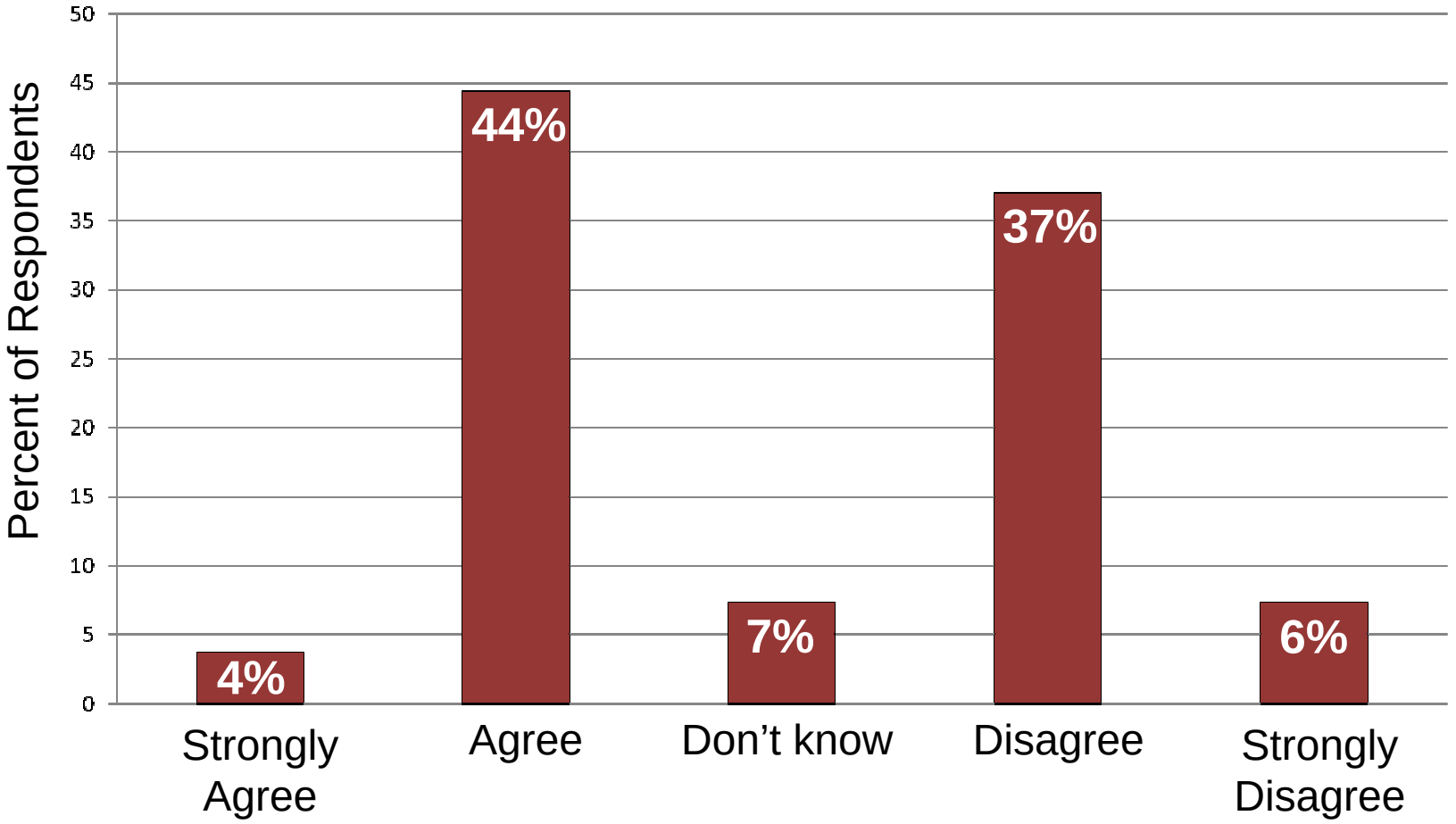
Report having a nano-specific waste program	36%
Report disposing nanomaterials as hazardous waste	66%
Report using separate containers for nanomaterials	42%
Report listing nanomaterials separately in waste manifests	23%

Product Stewardship

- 79% of companies report advertising or disclosing that their products contain nanomaterials
- 81% of companies report providing guidance to their customers regarding safe use

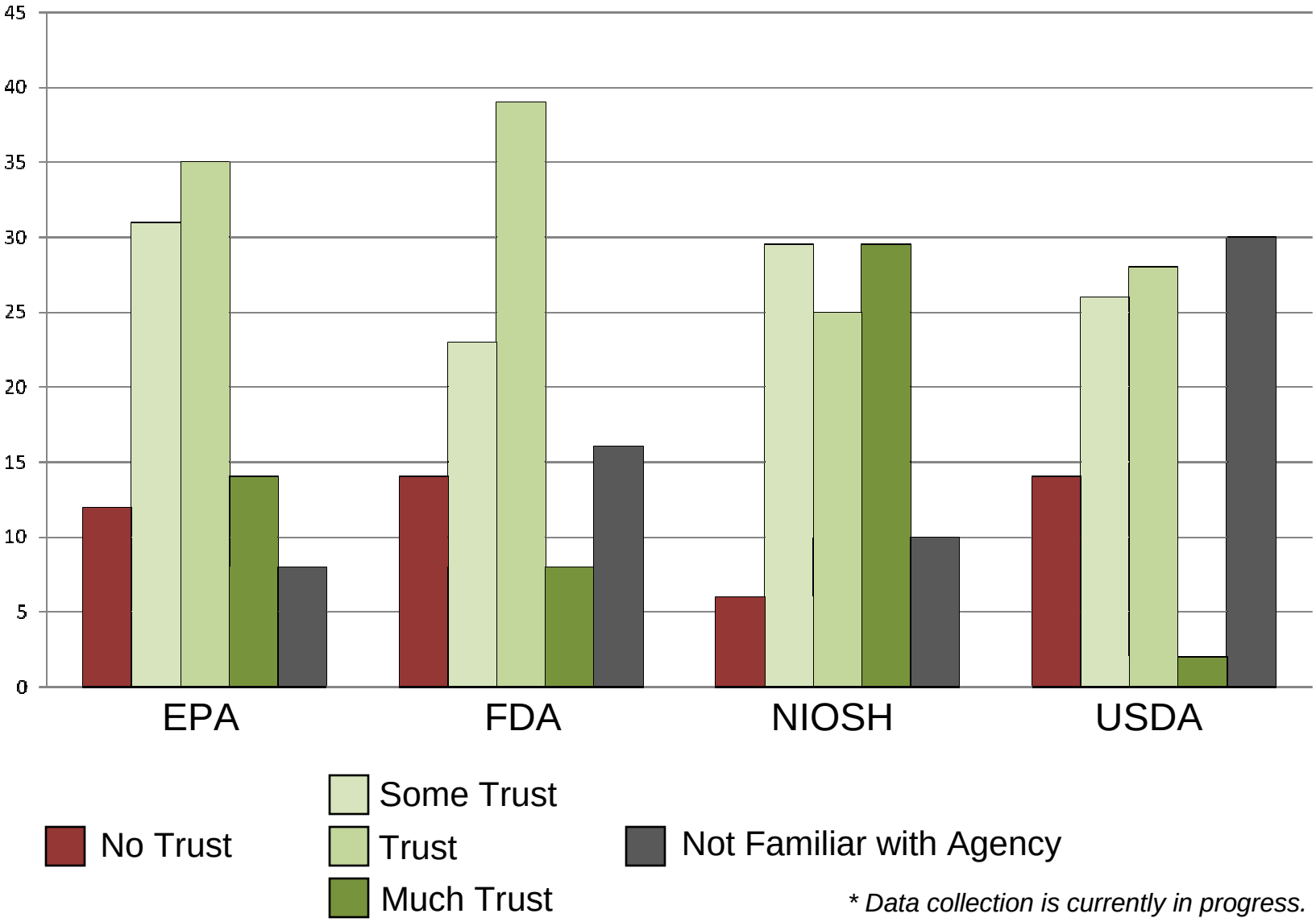
** Data collection is currently in progress.*

Industry Views: “Voluntary reporting approaches for risk management are effective for protecting human health and the environment.”



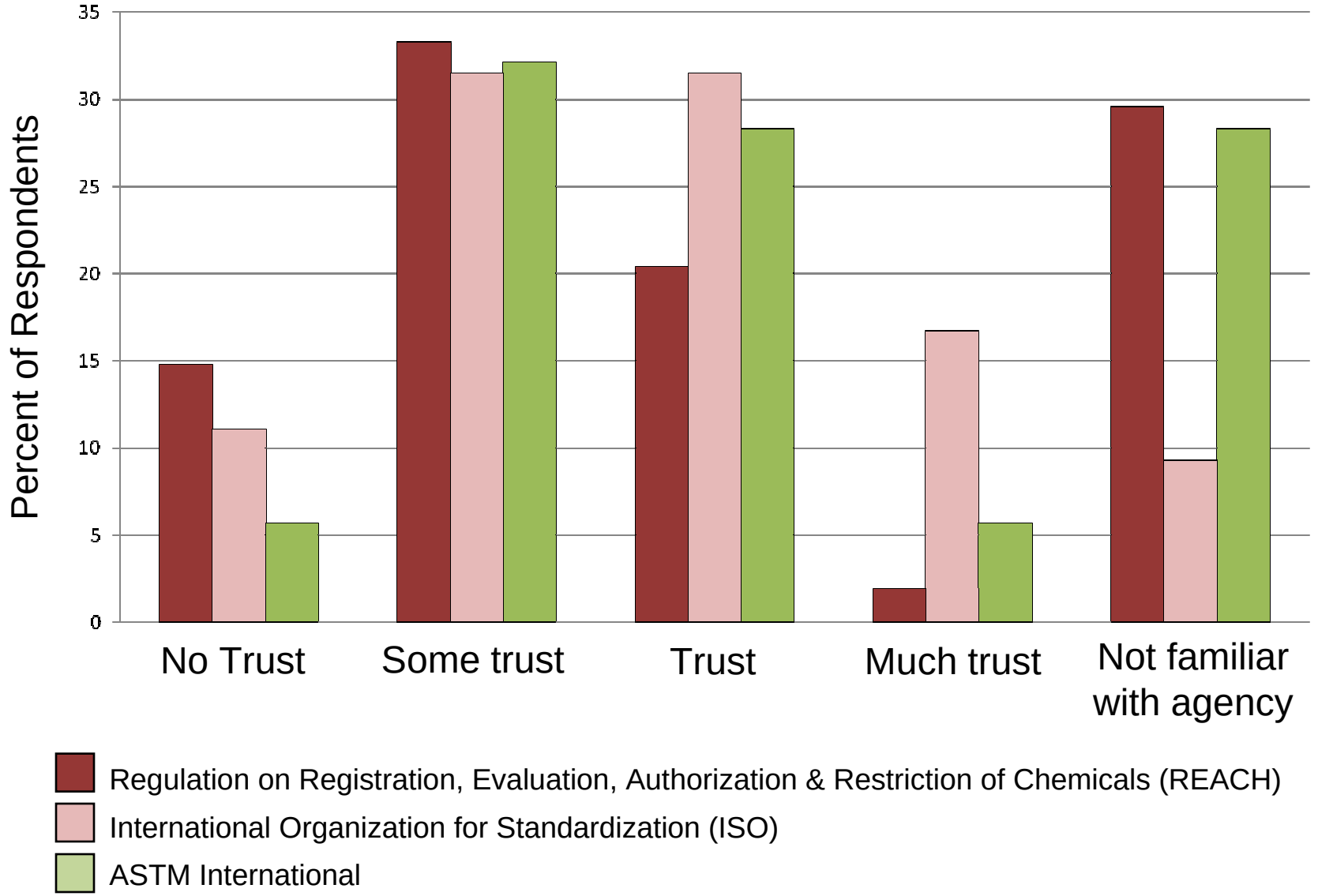
** Data collection is currently in progress.*

Level of trust in US government organizations to effectively assess and manage nano-specific environmental health and safety risks

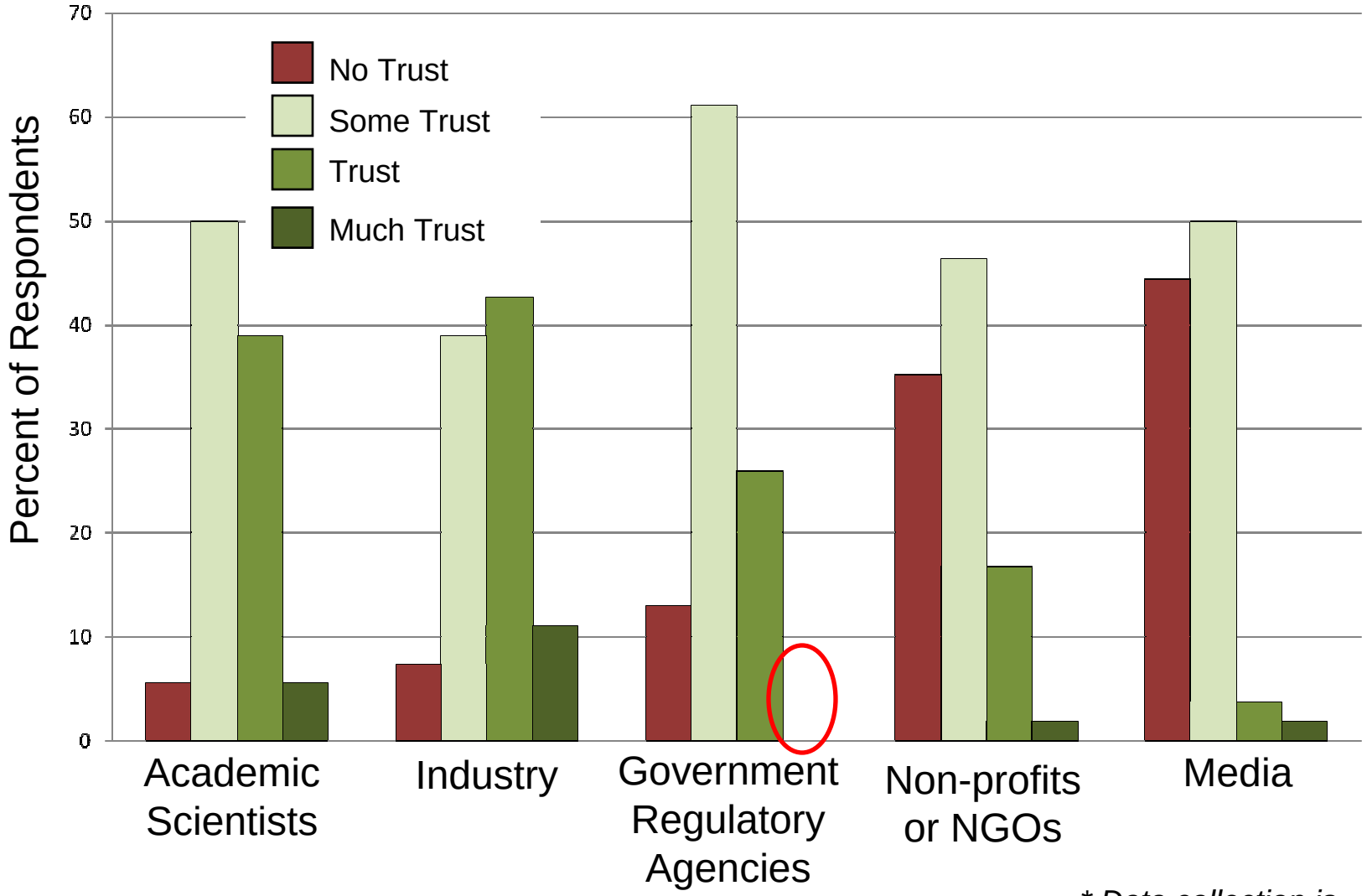


** Data collection is currently in progress.*

Level of trust in international organizations to effectively assess and manage nano-specific environmental health and safety risks



Level of trust in various groups in adequately communicating the ***benefits*** of nanotechnology to the public:



** Data collection is currently in progress.*

Preliminary Analysis

- Compared to larger firms, smaller companies (1 - 19 employees) are:
  - Less likely to consider “budget constraints” an impediment to implementing a nanospecific EHS program
  - Less likely to report “lack of knowledge” as an impediment to implementing a nanospecific EHS program

Preliminary Analysis

- Younger companies (<10 years) are:
  - More likely than older companies to disclose that their products contain nanomaterials
  - More likely than older companies to have nano-specific EHS
- Companies with employees handling smaller amounts of nanomaterials (less than kg at a time) are more likely to dispose of the nanomaterials as hazardous waste

Some Limitations:

Identifying nanomaterials firms

Self-reported practices

Self-selected participation

Further Analysis:

- Cross-national comparisons of practices and views on risks
- Analysis of comparative strength of relationships between views on risks and industry practices, firm characteristics, and other variables

UNIVERSITY OF CALIFORNIA

UC CEIN Center for Environmental Implications of Nanotechnology

Thank You!

Thanks especially to Applied Nanotechnology, Inc. for inviting us to present!

We would also like to thank Joe Conti, Magali Delmas, Sarah Anderson, Charles Geraci, Fred Klaessig, Matthew Hull, Kristen Kulinowski, and Yasuyuki Motoyama for their time, insights, and knowledge.

This material is based upon work supported by the National Science Foundation and the Environmental Protection Agency under Cooperative Agreement No. EF 0830117 to the UC CEIN with additional support from the NSF in Cooperative Agreement No. SES 0531184 to the Center for Nanotechnology in Society at UCSB. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation or the Environmental Protection Agency. This work has not been subjected to EPA review and no official endorsement should be inferred.

UCSB

NSF

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY