# Construction Workers and Nanomaterials: Perspective of Vulnerable and Unique Stakeholders

## Session D: Emerging Techologies and Advanced Materials

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THE CENTER FOR CONSTRUCTION RESEARCH AND TRAINING

# Here are the questions I'd like to tackle:

1. Why are construction workers particularly vulnerable stakeholders?
2. What can we say about construction workers' exposure to engineered nanomaterials?
3. What are we doing to understand the hazard posed by construction nanomaterials?
4. How are we doing communicating risk to construction workers?

# Why are construction workers particularly vulnerable stakeholders?

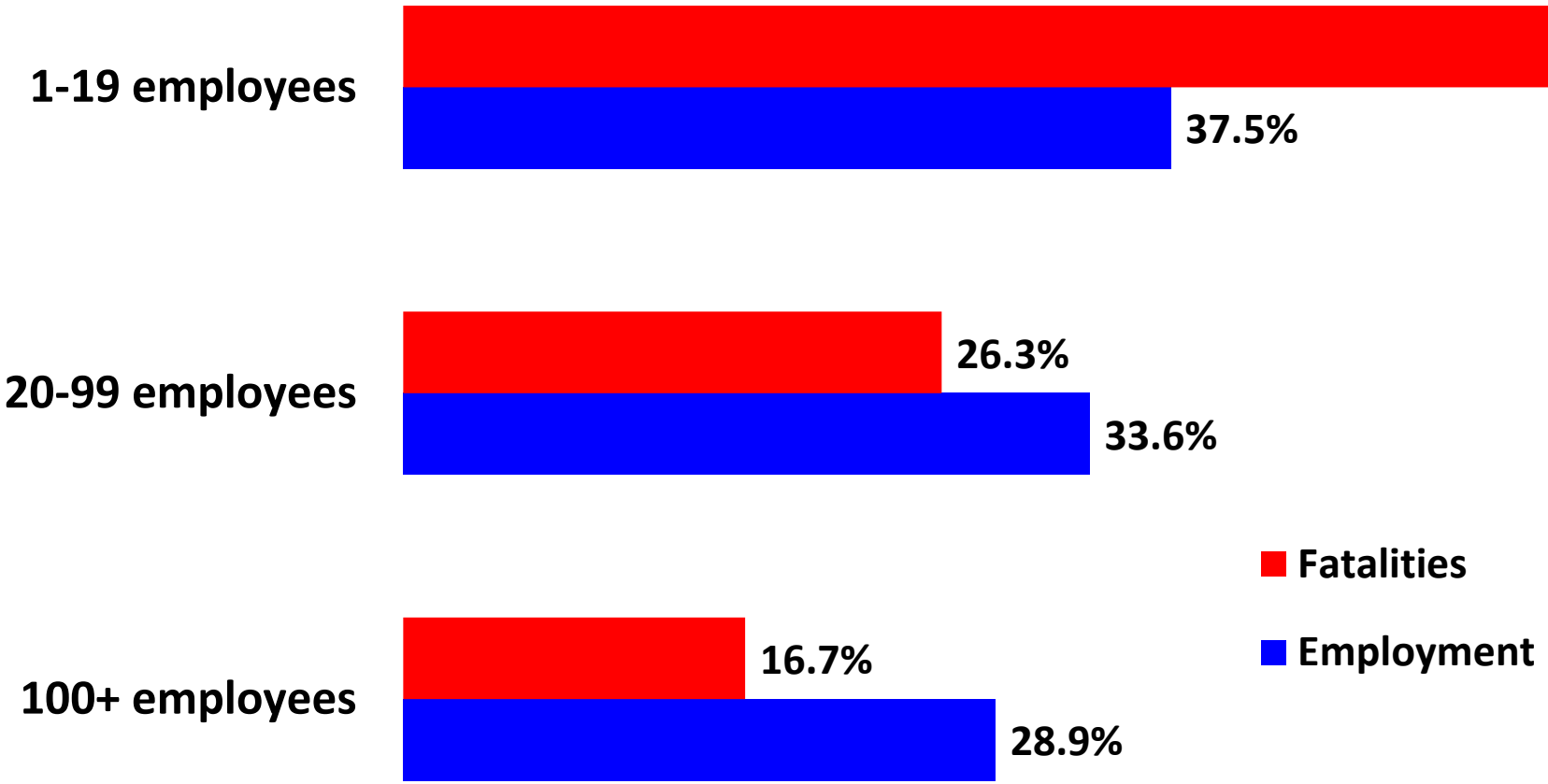
## Question 1

# Construction is dominated by small employers and a diverse workforce

- 90% have <20 employees
- About 80% have <10 employees
- 30% of workers are Hispanic
- 14% are employed by temp agencies

Sources: U.S Census Bureau; CPWR Construction Chart Book 5th Edition; CPWR 2nd Quarter 2015 Quarterly Data Report

# Small firms represent a disproportionate percentage of construction fatalities (2015)




CPWR The Construction Chart Book 2018

**In 2010, more than half of U.S. construction workers reported exposure to vapors, gas, dust or fumes twice a week or more**

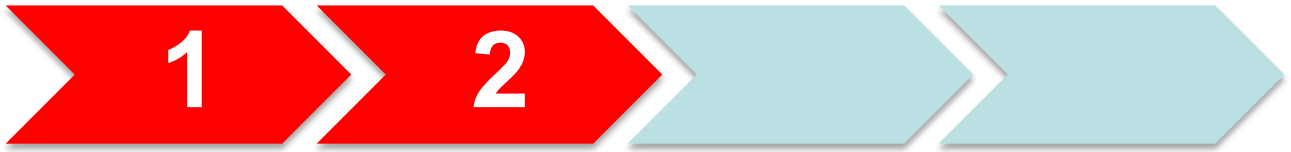

Liss GM, Petsonk EL, Linch KD [2010, Nov]. The construction industry. In: Occupational and Environmental Lung Diseases

# Bystander exposures can be significant in construction

*Photo courtesy of the NJ Department of Health and Senior Services' NIOSH-funded Silicosis Surveillance Project*

# What can we say about construction workers' exposure to engineered nanomaterials?

## Question 2

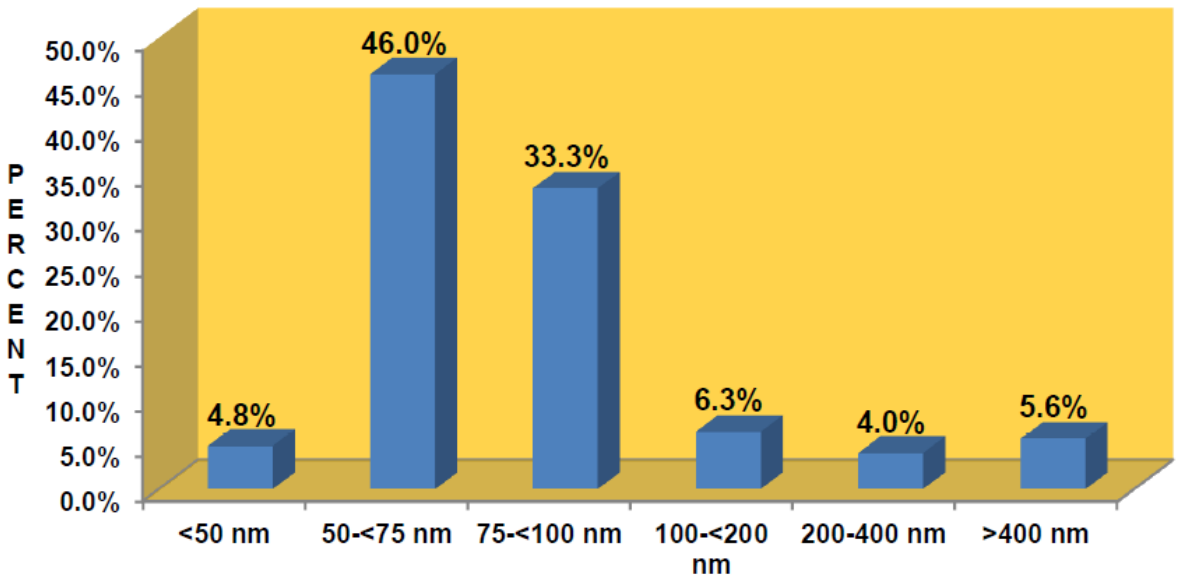


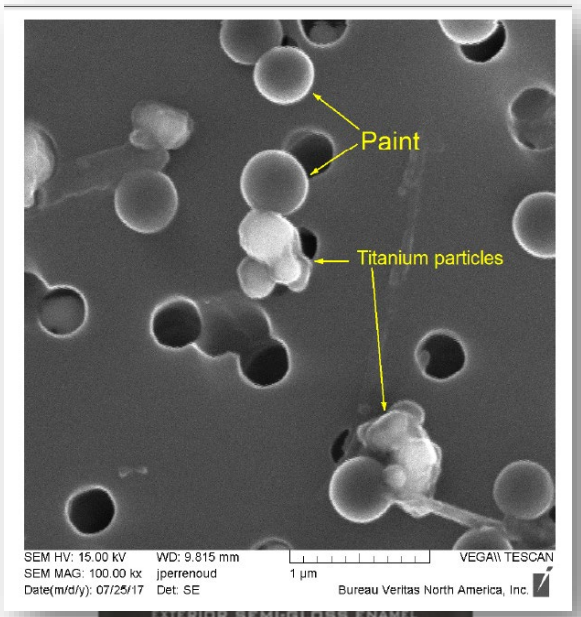
# Multiple studies have evaluated release of ENPs from coatings during sanding

**(Dylla and Hassan, 2012; Vaquero, Gelarza and Ipina, 2015; West et al. 2016)**

**"Results are mostly encouraging with regard to worker health."**

# April 2017, we sampled exposures during spraying paint containing nano titanium dioxide, with subsequent sanding




# We used the same 3-pronged sampling approach


Photo courtesy Earl Dotter

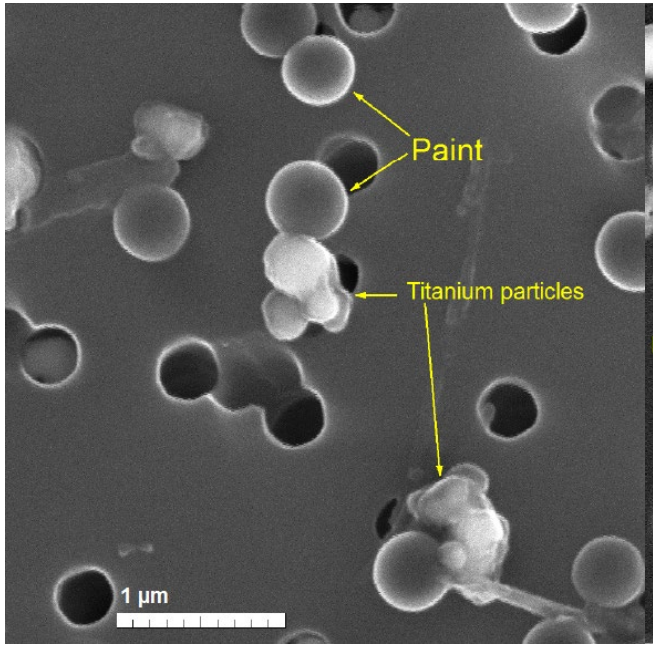
## Prong 1: Real-time instruments

**TSI Scanning Mobility Particle Sizer and Optical Particle Sizer**

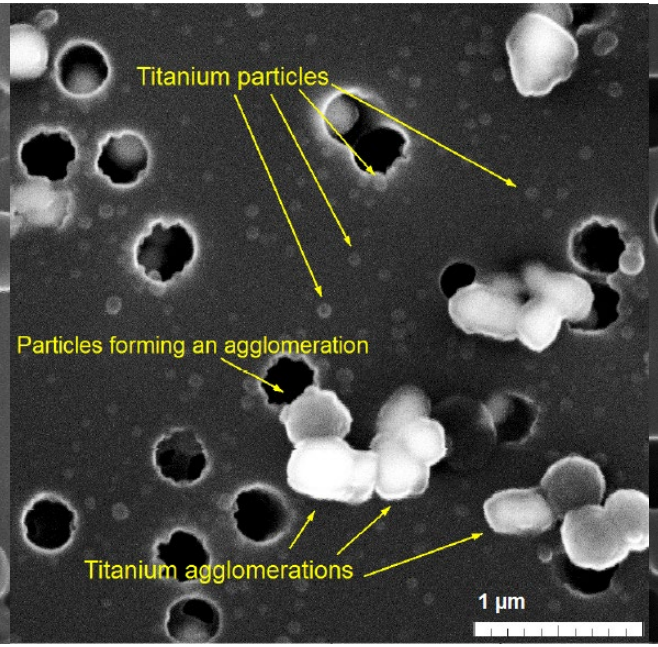
# Prong 2: standard industrial hygiene sampling for dust and metals


Photos courtesy Earl Dotter

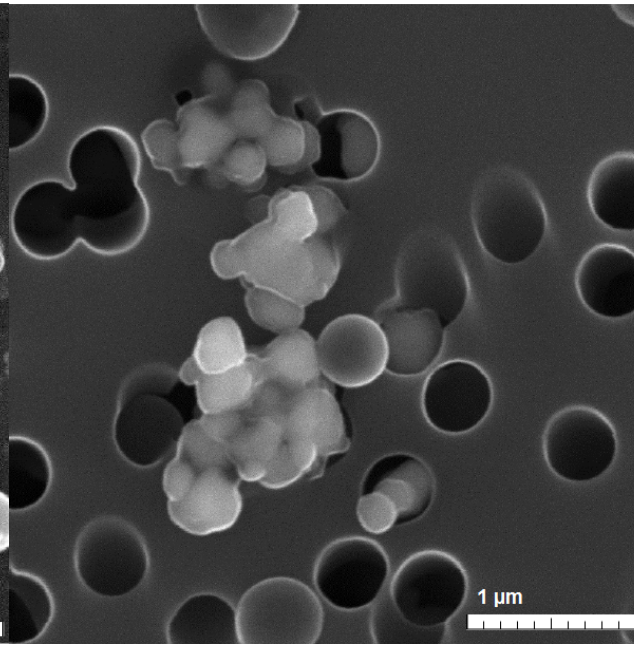
# Prong 3: electron microscopy of bulk and airborne particles




Sonicated in water



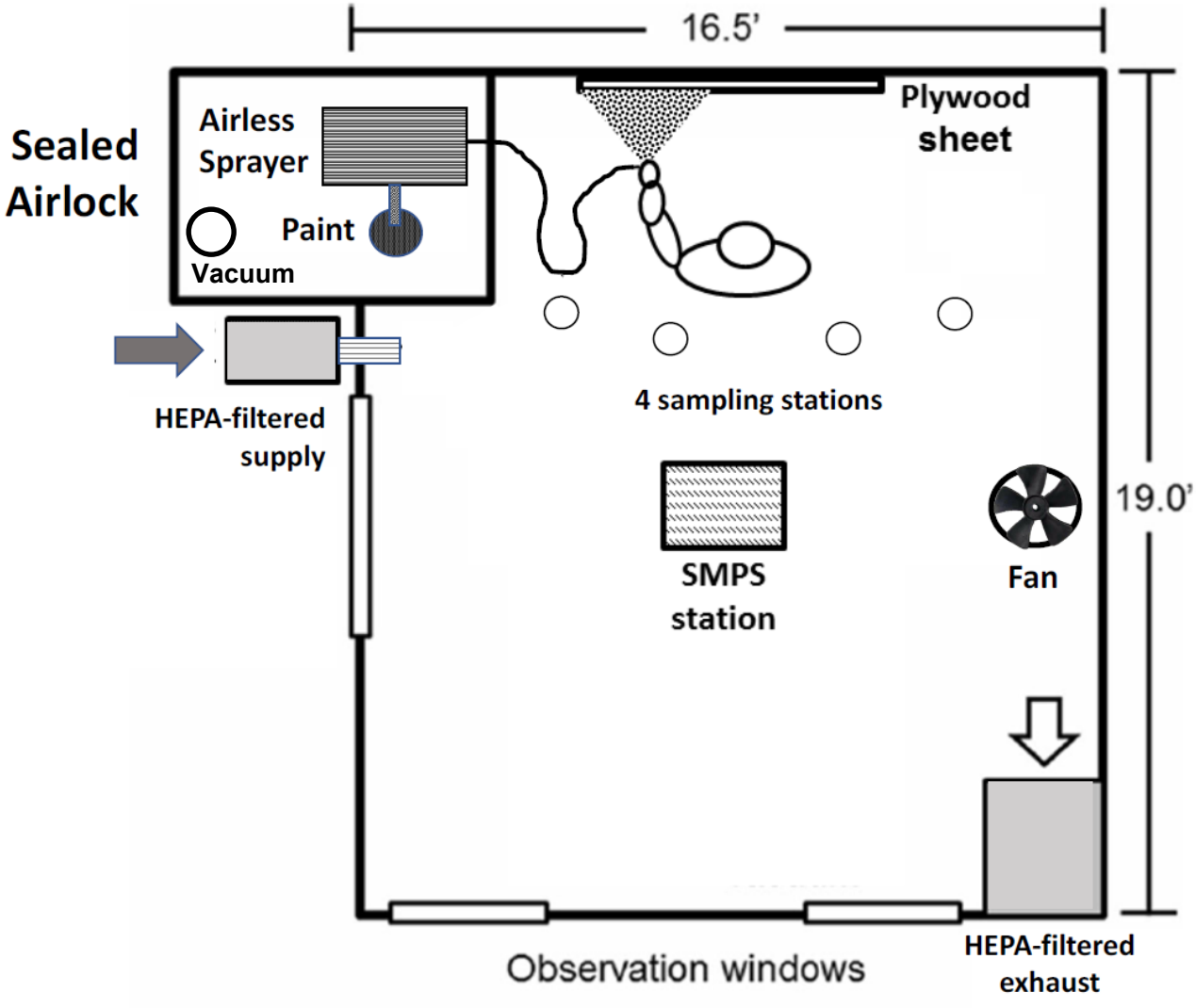

Sonicated in acetone




Conventional paint in acetone

## SEM bulk characterization of paint

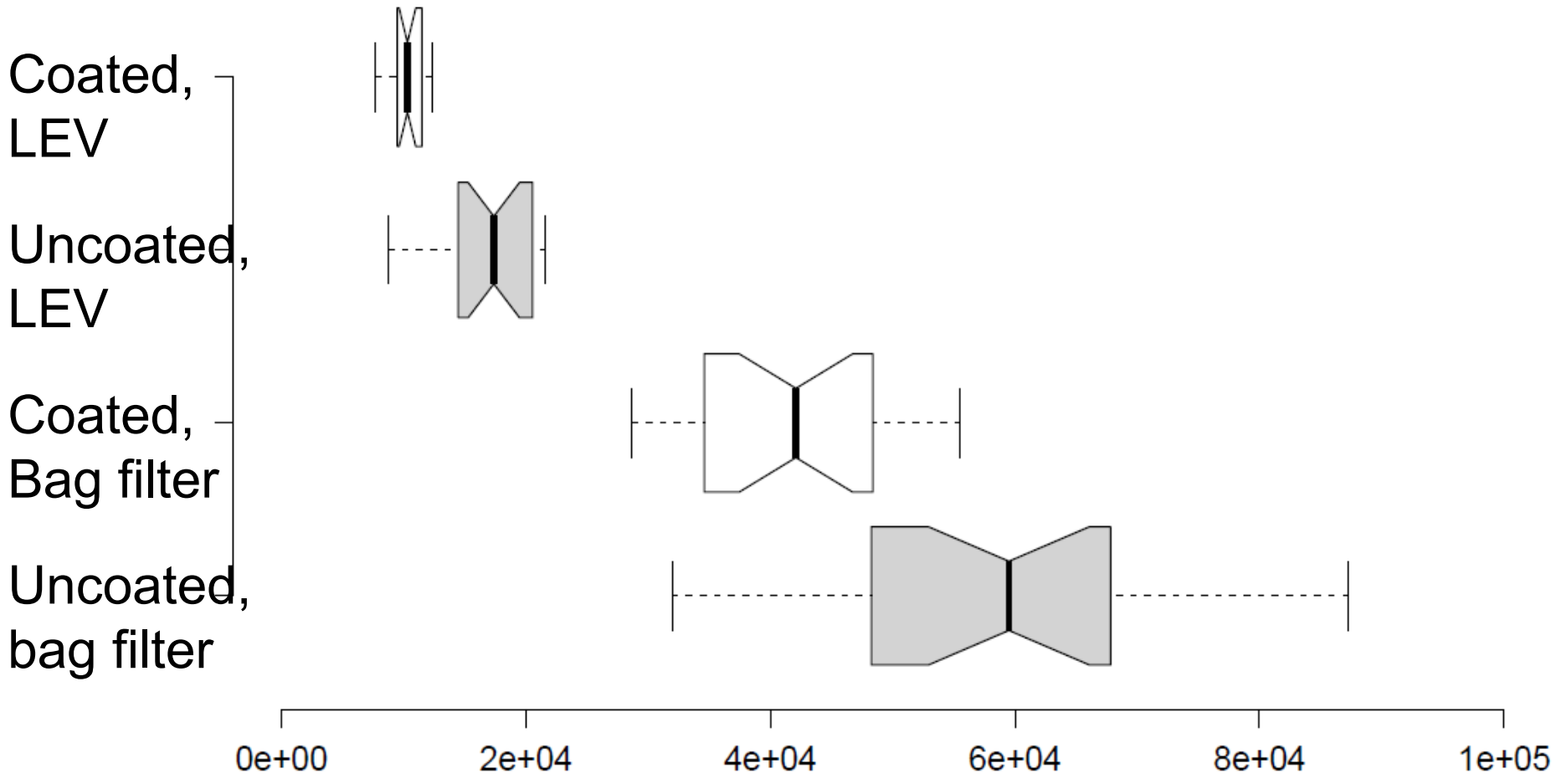
# We used an environmental chamber with HEPA-filtered air



# We sprayed and then sanded plywood sheets

LEV

# We again demonstrated local exhaust can significantly reduce nanoparticle release



**"This study may be the first to provide evidence suggesting potential for overexposure to nano-TiO2 during routine construction activity in reference to the NIOSH REL for ultrafine TiO2 (0.3 mg/m3 as a 10-hour TWA)"**

**West et al., draft manuscript**

# What are we doing to understand the hazard posed by construction nanomaterials?

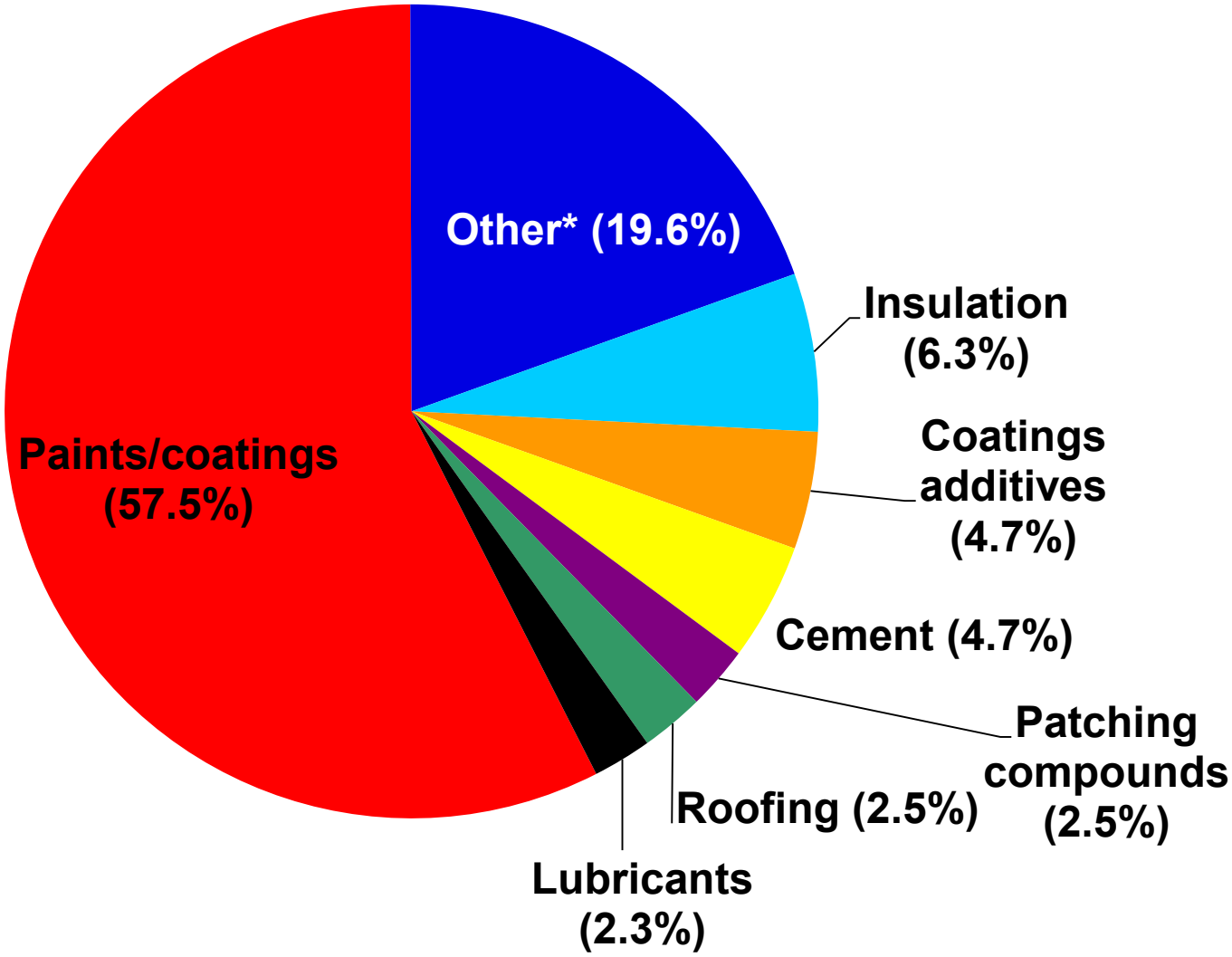
## Question 3

1 2 3

**Our site currently features 583 *commercial* construction products reported to be nano-enabled and 265 articles**


**www.nano.elcosh.org**

# Paints and coatings still dominate




Draft Chart Book graphic (2a)

# NIOSH collected aerosol samples of nano ZnO coating (June 2015)


In 2017, Dr. Jenny Roberts from NIOSH again collected dust from TiO2 painting and sanding

# How are we doing communicating risk to construction workers?

## Question 4

1 2 3 4

# Safe Work Australia found SDSs lacking (2010)

- **Evaluated 50 SDSs**
- **18% (9/50) "were assessed as providing reliable information to appropriately inform an occupational risk assessment"**


Safe Work Australia (SWA). 2010. *An Evaluation of MSDS and Labels associated with the use of Engineered Nanomaterials*. Commonwealth of Australia.

# CPWR surveyed 79 worker-trainers from 22 trades with an average of 30 years in the trade

**(2013-2014)**

| Survey Respondent Characteristics | N | Mean | SD | Range |
|---|---|---|---|---|
| Years in trade | 78 | 30.5 | 9.4 | 9-55 |
| Years as a trainer | 79 | 13.3 | 7.8 | 1-34 |

# Nearly half were not aware that nano had been applied to construction materials

| | Yes | No |
|---|---|---|
| Aware that nanotechnology has been applied to construction materials? | 41 (52%) | 38 (48%) |
| Aware that construction products containing nanomaterials are commercially available in the USA? | 38 (48%) | 41 (52%) |

# CPWR funded a Small Study focused on nanotechnology awareness

Laura Boatman and Debra Chapman, State Building and Construction Trades Council of CA

**Explore awareness among CA construction unions and employers about nano**

- Used questions from CPWR nano survey
- Received 253 written surveys from Survey Monkey

**"Comprehensive nanotechnology training is virtually non-existent."**

**2% of respondents had received training**

**(Boatman and Chapman, 2018)**

# Technology Safety Data Sheets may have value for advanced manufacturing

- **Conceived in 1994 as a tool for informing users of DOE remediation technologies about hazards**
- **Presented at International Environmental Nanotechnology Conference, Chicago October 7, 2008**

*MSDSs Fail to Communicate the Hazards of Nanotechnology to Workers*

# The AIHA Nanotechnology Working Group is a valuable resource

# Thanks! Questions?

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