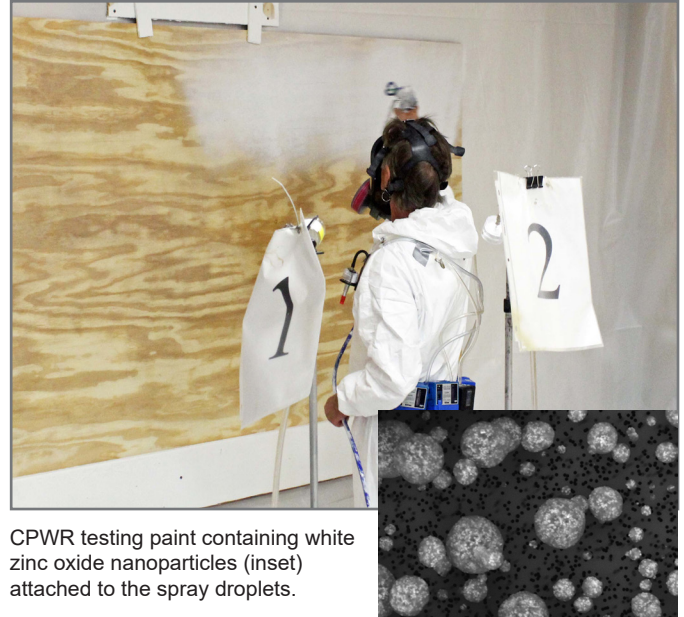


Nanomaterials can improve the performance of paints and coatings—but they may also increase health risks

Advances in technology have allowed humans to engineer and create nanoparticles up to 100,000 times thinner than a human hair. Nanotechnology is the understanding and control of matter at the size of about 1 to 100 nanometers, and a nanometer is one-billionth of a meter. Particles this small can have unusual properties. For example, gold nanoparticles become magnetic, explosive, and even different colors. Adding nanoparticles to a paint can improve its properties or add new properties like the ability to reduce smog.

This document was produced by CPWR – The Center for Construction Research and Training to inform painters and other construction workers about nanomaterial exposure risks.



CPWR testing paint containing white zinc oxide nanoparticles (inset) attached to the spray droplets.

Key Takeaways

- ✓ Nanomaterials include incredibly small, engineered particles that can bring valuable new properties to a wide range of products.
- ✓ Some nanomaterials have been shown to pose health risks, mostly through inhalation.
- ✓ CPWR – The Center for Construction Research and Training has tracked the addition of nanomaterials to construction products for nearly a decade. Paints and coatings make up more than half of the products in their inventory.
- ✓ Risks are still not clear, but some tasks like airless spraying may pose a risk of overexposure.
- ✓ Ventilation, wet methods, and respirators used by painters to control other potentially hazardous materials also protect against nanomaterials.
- ✓ Safety data sheets (SDSs) often fail to provide adequate information about the types of nanomaterials used in construction products and their hazards.
- ✓ Guidance from the National Institute for Occupational Safety and Health (NIOSH) and CPWR is research-based and intended to improve workers' safety and health.

CPWR is the leading source for information about nanomaterials used by painters and allied trades.

CPWR is a nonprofit established by North America's Building Trades Unions (NABTU) that has provided research, training, and service to improve safety and health in the construction industry for 30 years. They offer a variety of resources, including training materials, Hazard Alert Cards, infographics, Toolbox Talks, and more—all free of charge to those with an interest in construction industry safety and health.



IUPAT industrial painter

CPWR has identified nearly 1,000 commercial construction products that are reported to contain nanomaterials, according to claims provided by manufacturers and other sources. **Paints and coatings make up over half of that list.**

Their nanomaterials research team, funded by the National Institute for Occupational Safety & Health (NIOSH), has measured exposures during application of coatings and paints. The team has also conducted awareness sessions for union safety and health trainers.

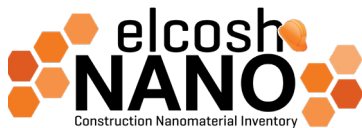
Nanomaterials are improving paints and coatings in the following ways -- and more:

- Anti-corrosive
- Self-cleaning
- Anti-graffiti
- UV protective
- Anti-microbial
- Water-repellant

Learn more from these resources:



Nano-related materials, including tools, research, and guidance: cpwr.com/nano



An inventory of nano-enabled construction products: nano.elcosh.org



NIOSH's nanotechnology website offers useful information on occupational exposures and controls. <https://www.cdc.gov/niosh/nano/about/>

There are no OSHA exposure standards for nanomaterials, but NIOSH has some Recommended Exposure Limits.

Most nanomaterials do not have a Recommended Exposure Limit (REL). NIOSH has some RELs for a few of the nanomaterials found in paints and coatings, including carbon nanotubes, carbon nanofibers, and titanium dioxide and silver nanomaterials. CPWR conducted exposure tests during spraying, sanding, and cutting of products with nanomaterials and found that spraying of nano paints and coatings may exceed the NIOSH RELs, which are designed to reduce the risk of developing occupational diseases over the course of a worker's career. For example, NIOSH determined that nano-sized titanium dioxide is a potential occupational carcinogen (suspected of causing cancer).

Nanomaterial exposures can be controlled like other potential hazards.

CPWR's tests have shown that local exhaust ventilation can reduce exposure to nanomaterials in construction, as it does with larger particles. Wet methods work too. Work practices can make a difference by reducing the risks of bystander exposures, a serious concern for painters.

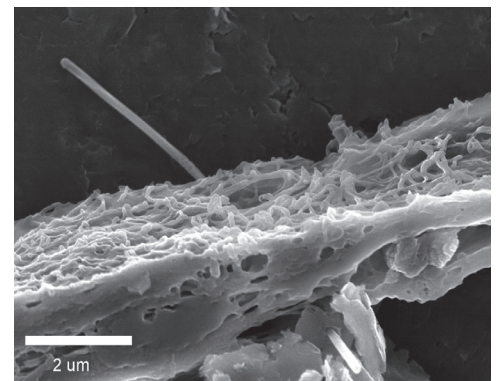
Workers sometimes worry that these small particles will slip through filters or respirator cartridges. That isn't the case if the filters and respirator cartridges are used correctly.



Half-face respirator with P100 particulate filter and organic vapor (OV) cartridges

Human health effects aren't well understood, but there is reason to take precautions to minimize exposures.

Human health studies are limited because engineered nanomaterials are still relatively new. However, research shows that nanoparticles have properties that can make them more hazardous than larger particles. For example, these tiny particles can deposit deeper within the lungs and move to other organs in the body where larger particles cannot. Humans are designing and manufacturing new types of engineered nanoparticles, but nanoparticles are not new. Small and even nano-sized particles found in welding fumes and air pollution have been studied extensively and are known to be harmful to the heart and lungs.



Multi-walled carbon nanotube in lung tissue. The nanotube is the hairlike structure pointing towards the top-left corner of the image.
Courtesy of Robert Mercer, NIOSH

Thousands of studies have been published on the hazards of engineered nanomaterials in cells or laboratory animals. Studies in rats and mice have shown carbon nanotubes can cause inflammation and persistent fibrosis (thickening and scarring of connective tissue) in the lungs, and even effects in cells similar to those caused by asbestos exposure. Workers exposed to carbon nanotubes have shown signs of early effects for fibrosis, inflammation, and cardiovascular stress. Inhalation is the main concern for nanomaterials, although other routes of exposure including the skin or ingestion should not be overlooked.

Safety data sheets for nanomaterials are failing workers.

Research has shown that important safety and health information about nanomaterials has often been missing in safety data sheets. For example, carbon nanotube manufacturers in some cases have listed the OSHA permissible exposure limit (PEL) for graphite, which is 5,000 times higher than the NIOSH recommended exposure limit (REL) for carbon nanotubes. Revisions to OSHA's Hazard Communication standard went into effect on July 19, 2024, and should improve safety data sheets for nanomaterials by requiring manufacturers to disclose information about particle characteristics, such as particle size. CPWR's Nano Safety Data Sheet (SDS) Improvement Tool—<https://nanosds.elcosh.org/>—can help manufacturers evaluate and improve safety data sheets for products that contain nanomaterials.

Learn more about nanomaterials with free resources from CPWR and NIOSH.

The News & Info section of eLCOSH nano has a collection of articles by topic. CPWR.com has a Hazard Alert Card and eleven Toolbox Talks on nano materials. The Toolbox Talks are:

- Aerogel Nanoporous Insulation Products
- Airborne Exposures When Working with Nano-Enabled Concrete
- Controlling Exposures to Ultrafine Particles
- Identifying Nano-Enabled Construction Materials
- Introduction: Nano-Enabled Construction Materials
- Nano-Enabled Cement Materials with Titanium Dioxide
- Nano-Enabled Wood Coatings and Stains
- Right to Know About Chemical Hazards: Nanomaterials
- Spray Painting and Cutting Concrete Block Coated with Nano-Enabled Silver Paint
- Spray Painting and Sanding Nano-Enabled Paint
- Tuckpointing: Nano-Enabled Mortar

All these materials are free and available in English and Spanish.

For more information, contact Gavin West, Director, Health Research – gwest@cpwr.com.

