

Summary of Nanomaterials Survey Findings

The Massachusetts Office of Technical Assistance's (OTA) online nanomaterial survey has been open since December 2017. The Project on Emerging Nanotechnologies of the Woodrow Wilson International Institute for Scholars has identified Massachusetts among the top 4 states in the US for nanomaterial / nanotechnology commercialization and research & development, with Boston and Middlesex – Essex counties in Massachusetts listed as two of the top 6 nano-metros. Despite the high nanomaterial national visibility, as of March 2018 the survey has been opened 165 times with 13 Massachusetts manufacturers responding. Only 10 of those 13 companies currently use nanomaterials. An additional 41 companies from out-of-state responded. Many companies skipped survey questions.

Outreach Methods

Direct email outreach was conducted through a variety of sources. Those include: UMass Lowell's and OTA's known contacts, OTA's database, email lists from previous Massachusetts nanomaterials conferences and meetings, TURI's nanomaterials webinar email lists, and online searches for MA based nanotechnology companies. MassMEP and the New England Biosafety Association shared the nanomaterials survey in their newsletters. Staff and interns joined nanomaterials LinkedIn groups to post the survey and searched nanomaterials company listings through [NanoWerk and Nano Science and Technology Institute's](#) database. OTA posted the nanomaterial survey link on LinkedIn, Twitter and through OTA's newsletter. OTA staff and interns also boards of health to share the survey with known facilities and networks within their jurisdiction. And lastly, the American Chemistry Council and the Massachusetts Chemistry & Technology Alliance shared the nanomaterial survey with their nanomaterial panel and general membership, respectively.

OTA interns attempted to reach contacts by phone to encourage businesses to take the online survey. No companies were willing to conduct the survey over the phone (35 phone calls).

Findings:

Of the 13 Massachusetts companies, two did not manufacture or use nanomaterials and one coatings manufacturer responded that they may utilize nanomaterials in future products and had no health and safety concerns.

Four Companies Manufacture Nanomaterials:

One pharmaceutical company manufactures lipid nanoparticles. They manufacture biomedical nanomaterials which are disposed of as hazardous / biomedical waste and they are unsure of any nanomaterial risk management program at their facility.

One company that identified as 'Defense' responded that they manufacture nanotubes for electrical and classified applications but did not answer any other survey questions.

One company responded that they are currently in the Military/Defense sector due to the sources of their 'funding, after scale-up nanomaterial textiles'. They manufacture scanning electron microscopy (SEM/TEM) to determine physical structure of nanomaterials plus energy-dispersive X-ray spectroscopy (EDS) to determine atomic composition and check for impurities; Raman Spectroscopy for determining purity and chirality of individual nanotubes; and nuclear magnetic resonance (NMR) spectroscopy for precursors used in CVD process. The facility has a nanomaterials risk management program and responded that they have no health and safety concerns. Nanomaterials at this facility are managed in the following ways:

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- Carbon nanotubes: 10 kg/yr used; 10 kg/yr incorporated into products; 10 kg/yr manufactured; 10 kg/yr; 10 kg/yr disposed of as solid waste
- Carbon black: 1 kg/yr used; 1 kg/yr disposed of as solid waste; 1 kg/yr air (stack) discharge
- Metal oxides: 5 kg/yr used; 5 kg/yr incorporated into products; 5 kg/yr disposed of as solid waste

One company is the Industrial Research and Development field. The business incorporates carbon nanotubes, nanosilver, and quantum dots into products and disposes of them as hazardous / biomedical waste. The facility has a nanomaterials risk management program and responded that they have no health and safety concerns.

Four Companies Use Nanomaterials:

One company claimed to be a user of nanomaterials but did not fill anything else out on the survey. Another company solely identified as being in the field of performing research and development, using nanomaterials.

One pharmaceutical company self-described it's end-product as 'unknown'. The company uses biomedical nanomaterials and disposes of them as solid waste. The facility has a nanomaterials risk management program in place and indicated health or safety concerns about handling/using these materials but neglected to state what those health and safety concerns might be.

One semiconductor manufacturing company described its product as nano bio sensors and gas sensors. The facility has a nanomaterials risk management program in place. Under health and safety concerns, the facility wrote 'Using caution to introduce new materials to manufacturing'. Nanomaterials at this facility are managed in the following ways:

- Carbon nanotubes: 1 kg/yr used and disposed of as hazardous / biomedical waste
- Biomedical nanomaterials: 1 kg/yr used and disposed of as hazardous / biomedical waste
- Titanium dioxide: 1 kg/yr incorporated into products and disposed of as hazardous / biomedical waste
- Metal oxides: 1 kg/yr incorporated into products and disposed of as hazardous / biomedical waste

Two Companies Manufacture and Use Nanomaterials:

One company identified its field as carbon black manufacturing, research and development and produces paints and coatings. The facility has a nanomaterials risk management program at their facility and responded that they have no safety concerns. Nanomaterials at this facility are managed in the following ways:

- Carbon nanotubes: 12 kg/yr used; 12 kg/yr incorporated into products; 12 kg/yr manufactured; 12 kg/yr disposed of as hazardous / biomedical waste
- Carbon black: 1 kg/yr used; 1 kg/yr incorporated into products; 1 kg/yr manufactured; 1 kg/yr disposed of as hazardous / biomedical waste
- Titanium dioxide: 1 kg/yr used; 1 kg/yr incorporated into products; 1 kg/yr manufactured; 1 kg/yr disposed of as hazardous / biomedical waste
- Metal oxides: 1 kg/yr used; 1 kg/yr incorporated into products; 1 kg/yr manufactured; 1 kg/yr disposed of as hazardous / biomedical waste

One respondent that identified as 'academic' claims that their materials can be used in several different industries. The facility has a nanomaterials risk management program in place and indicated, but did not state specific, health or safety concerns about handling/using these materials. The facility did not list amounts, but nanomaterials are managed in the following ways:

- Carbon nanotubes: used; incorporated into products; manufactured; disposed of as hazardous / biomedical waste
- Nanosilver: used; incorporated into products; manufactured; disposed of as hazardous / biomedical waste
- Carbon black: used; incorporated into products; manufactured; disposed of as hazardous / biomedical waste
- Titanium dioxide: used; incorporated into products; manufactured; disposed of as hazardous / biomedical waste
- Metal oxides: used; incorporated into products; manufactured; disposed of as hazardous / biomedical waste
- Biomedical nanomaterials: used; incorporated into products; manufactured; disposed of as hazardous / biomedical waste

Items to consider:

- The Toxic Substances Control Act (TSCA) solely regulates new & existing chemicals introduced in commerce. However, TSCA does not capture nanomaterial data when a company moves from using a micrometer-sized material to nanometer-sized material. For existing chemicals, EPA under TSCA issued a one-time reporting rule that went into effect on August 17, 2017, requiring reporting in August 2018. As of October 2018, there were only 67 responses from across the country. No Massachusetts companies have reported under the new TSCA rule. EPA staff believes that the low reporting may be the result of companies not yet having products in commerce due to being at the research and development stage.
- NIOSH guidelines are merely recommendations rather than regulations or law. NIOSH nanomaterial guidelines are different according to nanoparticle shape, size and chemical because these factors mean that the materials behave differently and present different risks.
- When companies choose certain nanomaterials, they are thinking of function, properties and cost rather than chemical composition.
- Companies and manufacturers may be unaware of their own use of nanomaterials due to lengthy supply chains and lack of particle size disclosure on Safety Data Sheets (SDS).
- There are currently no self-identified nanomaterial best management practice role models from which to adopt handling, environmental or worker health and safety methods.