

How Industrial Hygiene Can Improve Your Bottom Line

Health and Safety Improvements to Developments in Advanced Materials, Advanced and Additive Manufacturing and Nanotechnology

The materials and methods used in manufacturing are changing rapidly and dramatically. So are the business management and product delivery models that have been part of the global manufacturing economy for decades. One of the most notable changes is that the products are being manufactured closer to where they will be purchased or used. The current push in manufacturing is to have items made “just in time” and “just to order”. New manufacturing techniques—most notably, additive manufacturing and 3-D printing—are driving much of this change. Advanced robotics, synthetic biology, digital manufacturing interfaces, and rapid process simulation and prototyping are also accelerating the development of new ways to make things.

The materials, process, and product life cycle for nanotechnology can be defined by basic research, proof of concept, scale-up, early production and commercialization. New materials and processes being driven by economic and technological competition factors can also generate unwanted health and safety concerns for workers, the public, the environment, and negatively impact company public relations.

Examples of possible hazards for additive manufacturing include:

- *Energy* – very high and focused energy from lasers, E-beams and heat
- *Advanced Materials* – fine powders or solid strands from metals, polymers, biopolymers, nanomaterials, ceramics, carbon fibers
- *Volatiles* – off-gassing alcohols, aldehydes, BTEX (benzene, toluene, ethylbenzene, and xylene), or styrene

Examples of possible hazards from product development using advanced manufacturing include:

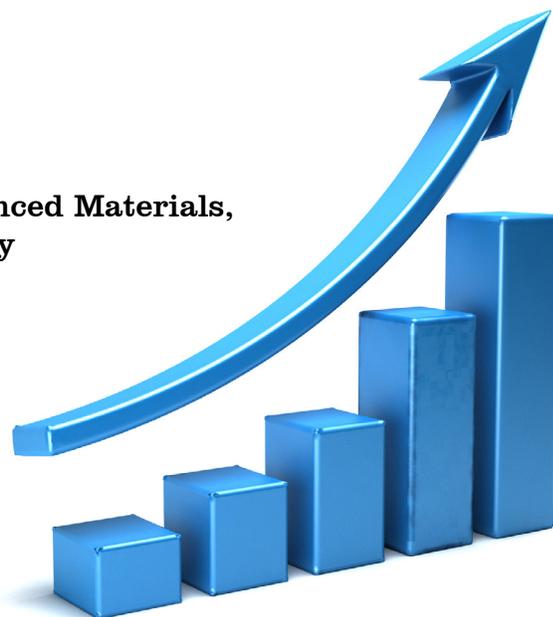
- *Robotics* – ergonomics, material compatibility and skin irritation
- *Chemistry* – potential differences in toxicology effects for nano-sized materials

Health and Safety Concerns

Health and safety considerations should be addressed at every stage of product life cycle especially during concept design and research and development. Health and safety concerns range from materials and processes being used and developed by researchers to handling of product during disposal at product end-of-life. Negative company public relations can occur at any stage of product development, manufacture and use due to manufacturing mishap or unforeseen failure of product performance during commercial use. The cradle to grave management of products may be called “product stewardship”.

Product Stewardship

Product stewardship is defined by the Product Stewardship Society as “responsibly managing the health, safety, and environmental aspects of raw materials, intermediate, and consumer products throughout their life cycle and across the value chain in order to prevent or minimize negative impacts and maximize value.”



Support from Industrial Hygiene

Industrial Hygiene is a science and art devoted to the anticipation, recognition, evaluation, prevention, and control of those environmental factors or stresses arising in or from the workplace which may cause sickness, impaired health and wellbeing, or significant discomfort among workers or among citizens of the community. (source: American Industrial Hygiene Association: <https://www.aiha.org/about-ih/Pages/default.aspx>)

A powerful resource for health and safety considerations in technology developments is practiced by Industrial Hygienists or “IHS”. The American Industrial Hygiene Association defines an industrial hygienist as a scientist or engineer committed to protecting the health and safety of people in the workplace and the community. Industrial hygienists are experts in assessing and managing physical, chemical, and biological exposures thru exposure risk science. Industrial hygienists use education, professional training and experience to assess potential risks and hazards using the steps of anticipation, recognition, evaluation, control, and confirmation (ARECC).

Health and safety considerations should be addressed at every stage of product life cycle especially during concept design and research and development (R&D).

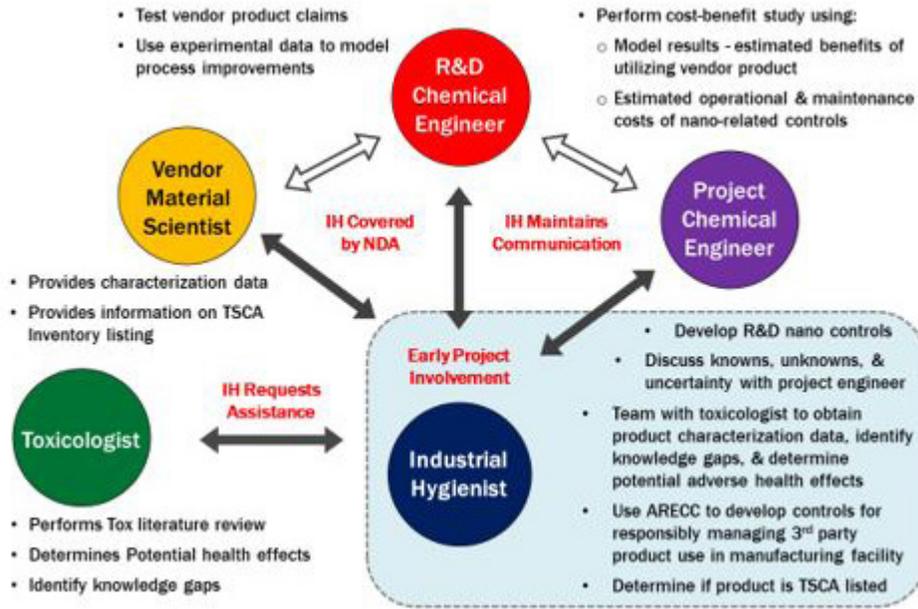
Typical roles of the industrial hygienist include:

- Investigating and examining the workplace for hazards and potential dangers
- Making recommendations on improving the safety of workers and the surrounding community
- Conducting scientific research to provide data on possible harmful conditions in the workplace
- Developing techniques to anticipate and control potentially dangerous situations in the workplace and the community including design and testing of engineering controls and personal protective equipment
- Training and educating the community about job-related risks
- Advising management, government officials and participating in the development of company SOPs and guidelines as well as regulations to ensure the health and safety of workers and their families
- Ensuring that workers are properly following health and safety procedures



Industrial hygienists provide expertise and team participation to support product development.

Figure shows Areas IHs Add Value to Nano Particle Development.



Adapted and used with permission of the American Industrial Hygiene Association

Industrial hygienists work with issues that concern us all

- IHs deal with the health and safety challenges facing people everywhere including:
- Indoor air quality (sick building syndrome, second-hand tobacco smoke)
- Evaluating and controlling environmental lead exposure
- Emergency response planning and community right-to-know
- Occupational disease (AIDS in the workplace, tuberculosis, silicosis)
- Potentially hazardous agents such as asbestos, pesticides, and radon gas
- Cumulative Trauma Disorders (repetitive stress injuries, carpal tunnel syndrome)
- Radiation (electromagnetic fields, microwaves)
- Reproductive health hazards in the workplace
- Setting limits on exposure to chemical and physical agents
- Detection and control of potential occupational hazards such as noise, radiation, and illumination
- Hazardous waste management

References

- Nanomaterial Stewardship, Guidance Sponsored by the AIHA® Nanotechnology Working Group, Approved by AIHA Board: March 15, 2017. <https://www.aiha.org/government-affairs/PositionStatements/Nanomaterial%20Stewardship%20Guidance.pdf>
- Engineered Nanomaterials in the Workplace, Fact Sheet Sponsored by the AIHA® Nanotechnology Working Group, Approved by AIHA Board: July 9, 2015. https://www.aiha.org/government-affairs/PositionStatements/Engineered%20Nanomaterials%20in%20the%20Workplace_Final.pdf
- Personal Protective Equipment for Engineered Nanoparticles, Fact Sheet Sponsored by the AIHA® Nanotechnology Working Group, Approved by AIHA Board: October 24, 2015. https://www.aiha.org/government-affairs/PositionStatements/PPE%20for%20ENP_FINAL.pdf
- From "Just in Time" to "Just Next Door", 21st-century Manufacturing Challenges and Opportunities for Industrial Hygienists. Article by Charles Geraci and Laura Hodson. American Industrial Hygiene Association. *The Synergist*, January 2018. <http://synergist.aiha.org/201801-21st-century-manufacturing>
- Figure, Areas IHs Add Value to Nano Particle Development. Copied and adapted from original PowerPoint slide located at the AIHA® Nanotechnology Working Group Website, downloaded Wednesday 31 January 2018. <https://www.aiha.org/Communities/NanotechnologyWorkingGroup/Shared%20Documents/Forms/AllItems.aspx?RootFolder=%2FCommunities%2FNanotechnologyWorkingGroup%2FShared%20Documents%2FPresentations%2C%20Articles%2C%20and%20The%20Like&olderCTID=0x0120000289CDB0FCCD124F9B64DA086A92BAFE&View={903F5E01-D064-48C7-9B74-0245337C3121}>

General Information

- National Institute for Occupational Safety and Health (NIOSH), Centers for Nanotechnology Website. <https://www.cdc.gov/niosh/topics/nanotech/default.html>

American Industrial Hygiene Association

3141 Fairview Park Drive, Suite 777 | Falls Church, VA 22042 | www.aiha.org
 Brochure developed by the AIHA Nanotechnology Working Group

- IH/IHs – Industrial Hygiene / Industrial Hygienists
- TSCA – Toxic Substances Control Act
- NDA – Non-Disclosure Agreement
- ARECC – Anticipate, Recognize, Evaluate, Control, and Confirm

