NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

NTRC | NANOTECHNOLOGY RESEARCH CENTER

Occupational Exposure Science

What Have We Learned Since QEEN I ?

QEEN II: 2nd Quantifying Exposure to Engineered Nanomaterials from Manufactured Products Workshop

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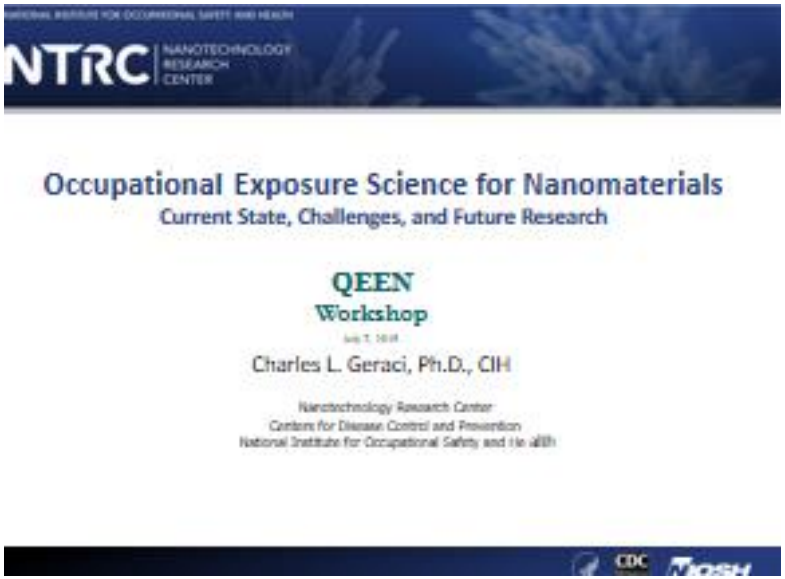
State of the Science in 2015?

"This literature review (2000-2015) provides evidence that for ENMs, as found for other materials, the likelihood of the exposure depends largely on the physical form of the substance as well as the applied process and operational conditions. These results can be used to provide first indications of the likelihood of exposure and guidance for exposure controls in workplaces. However, there is a clear lack of high-quality exposure data, in particular for downstream use and end-of-life scenarios and in low- and medium-income countries."

Basinas et al. Anals of Work Exposure and Health. 2018

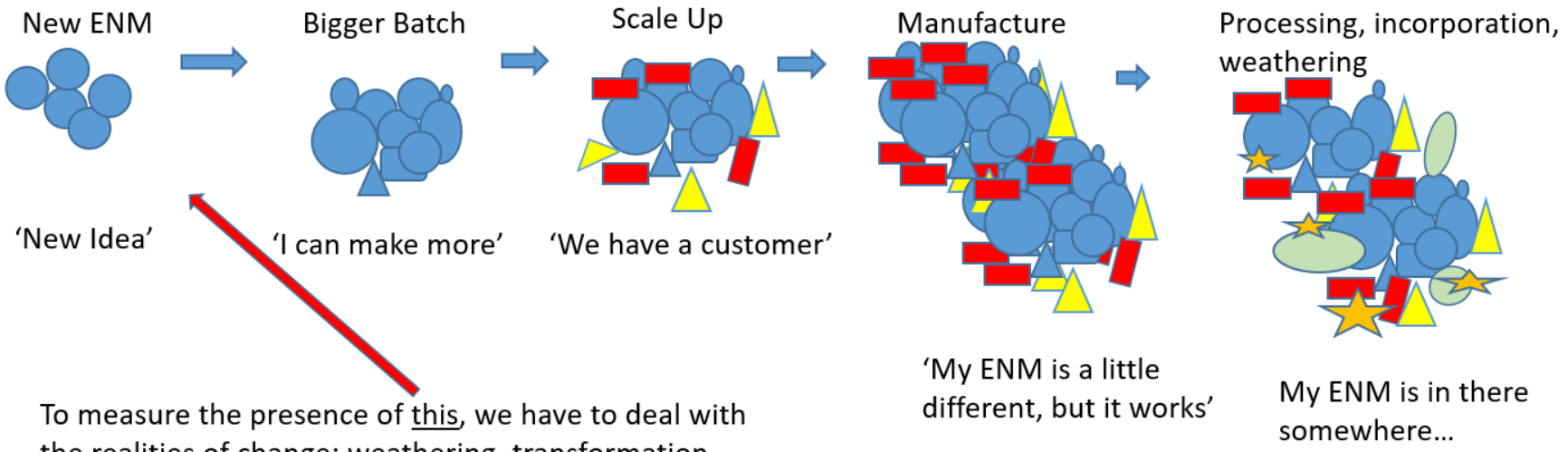
At QEEN I in 2015 we said the state of ENM exposure science was:



- Complex
- Focused on ‘pristine’ materials
- Lacked realism
- Needed consistency
- Needed more life cycle
- Mass still a primary metric
- Exploring other metrics needed
- Confirmatory analyses needed
- Challenging to define ‘nano…”

Remember this from 2015?

Simple View of a Complex Life Cycle Reality



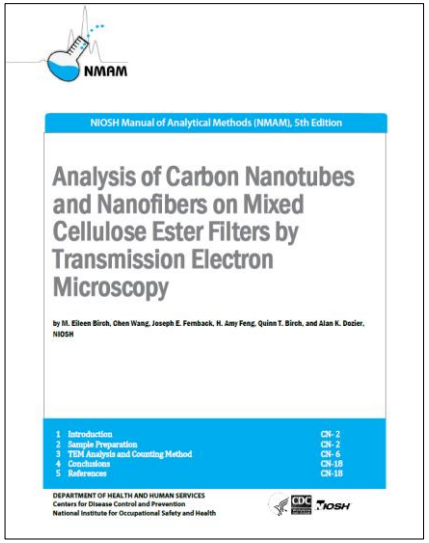
Basic Questions and Research Challenges

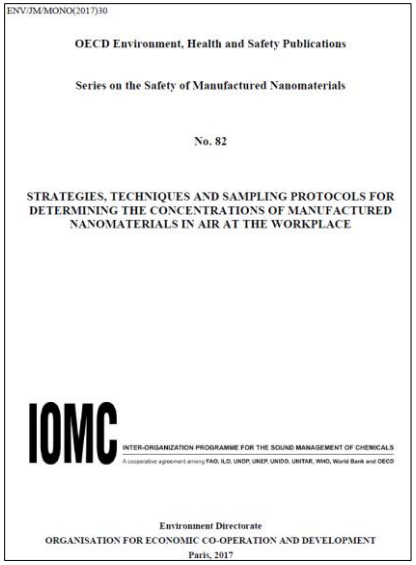
- Detection
- Measurement
- Relevant measurement
- Consistency
- Reproducibility
- Real-world encounters (Value Chain)

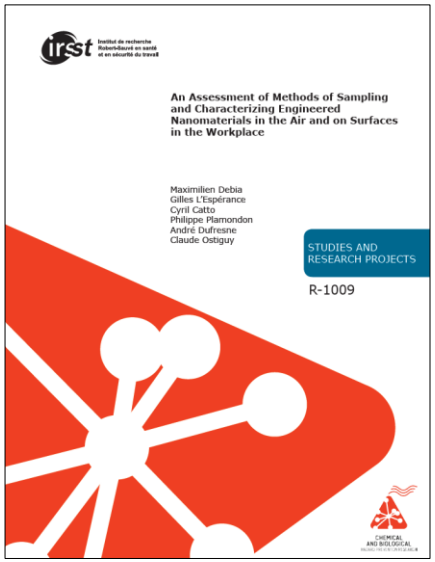
Good information on all of these topics will be shared in our breakout sessions.

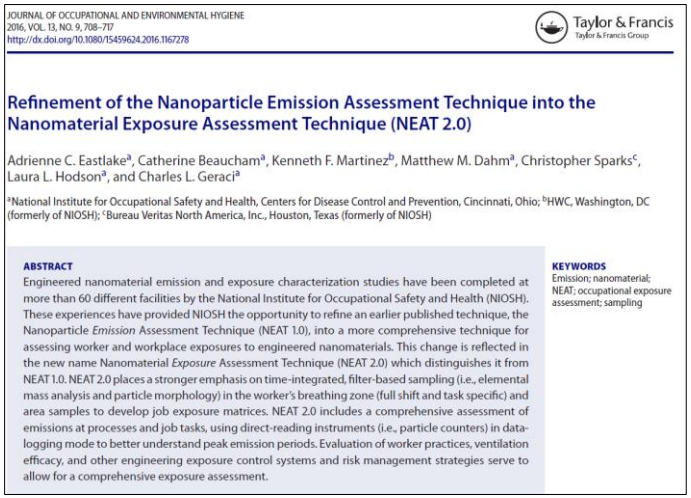
Progress

- Consistency in approach - examples
  - OECD Tiered Approach
  - NIOSH NEAT 2.0
  - OECD Strategy
  - ISO TC 229 Technical Guidance
- Improved sampling and analytical techniques
- Advanced or improved field instruments







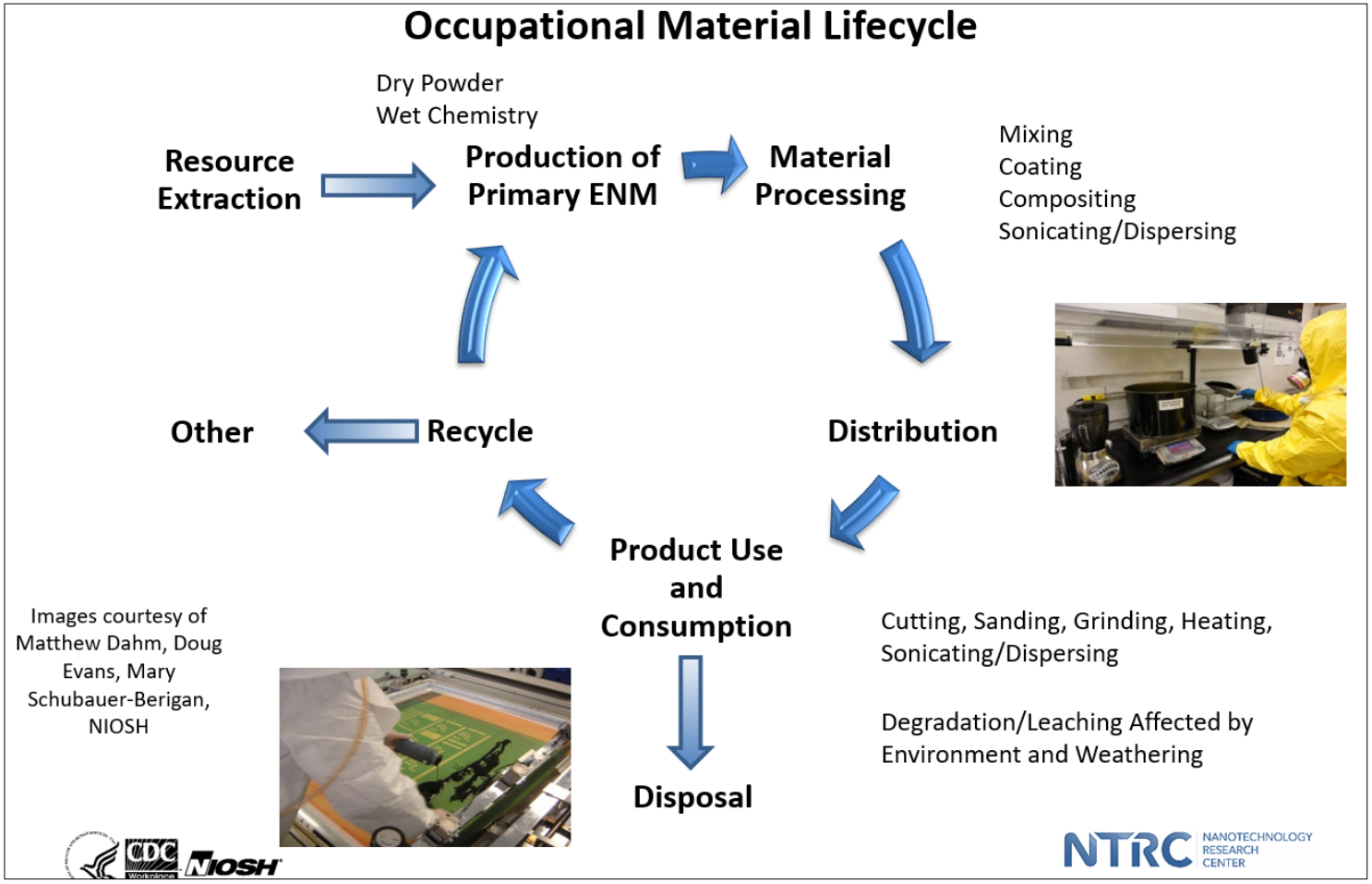


Recommended Reading

All show a similar, tiered approach

- DRI
- Microscopy
- Elemental analysis
  - Direct analysis for metals
  - 'Indicator' analysis for CNT/CNF
- Guidance for CNT 'counting'
- Updating the initial approach

A Life-Cycle Approach (Go to Session 1C)



Ultra-Fine Particulate

An opportunity to go….

Ambient air particulate matter (PM), including ultrafine (Nano sized) particulate matter (UFP) provided a foundation to study Engineered Nanomaterials (ENM). Extensive ENM knowledge can now be applied to better inform PM and UFP health risk research and vice versa.

Paraphrased from Stone et al. Environmental Health Perspectives. 2017

New Knowledge?

- More ENMs are making it into commerce
- Lines between Nano and Advanced Materials are blurred
- Measurement and characterization methods are improving
- Life cycle/value chain approach
- Introduction into Advanced Manufacturing
- Renewed focus on Ultrafine Particulate (in addition to Engineered Nano Particulate)

Take Home Message?

- Progress is being made on several fronts to detect and measure ENM.
- We accept that ENMs are one of many components in a complex industrial environment
- Basic measurements can identify opportunities for exposure mitigation
- Control procedures work
- Joining our experience with UFP and ENM will be important