RESPONSE TO CASE STUDY

TRANSPORT AND FATE PERSPECTIVE

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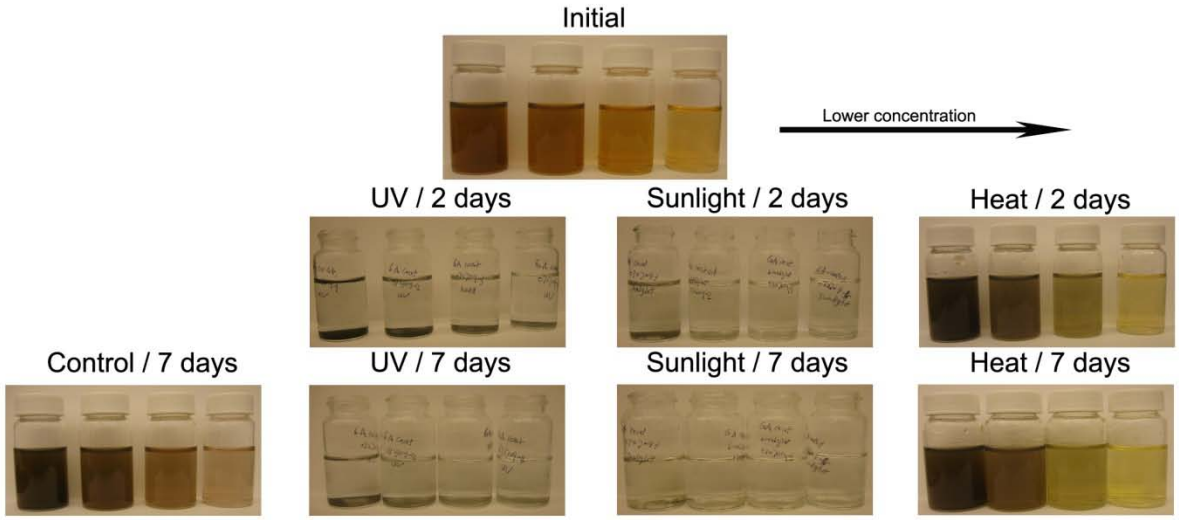
Of course… for transport and fate, characterizing transformations is critical

Changes to nanoparticles

- Aggregation
- Chemical transformations (e.g. photo-induced)
- Bio-transformations
- Dissolution
- Depositio

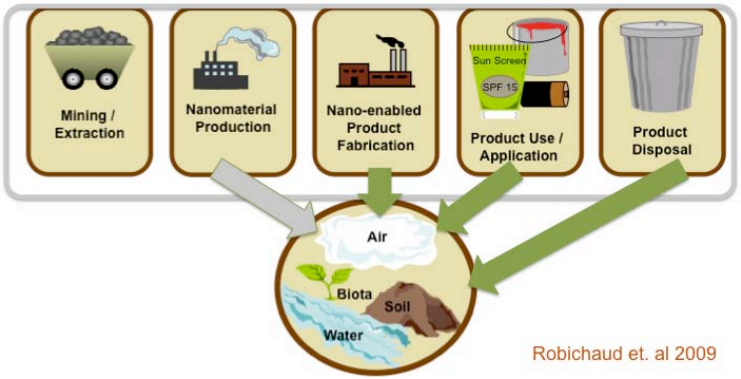
NP-mediated changes to environment

- Reactions with non-nano components
- Adsorption/facilitated transport
- Oxidation/ reduction



To dissect the transport and fate issues associated with this problem, start with a life cycle perspective

- What is produced and how much?
- Who uses these materials and how?
- What are end-of useful life issues associated with “downstream” products?
- What are the potential receptors associated with each product use and disposal and what if any effects have been observed?



Robichaud et. al 2009

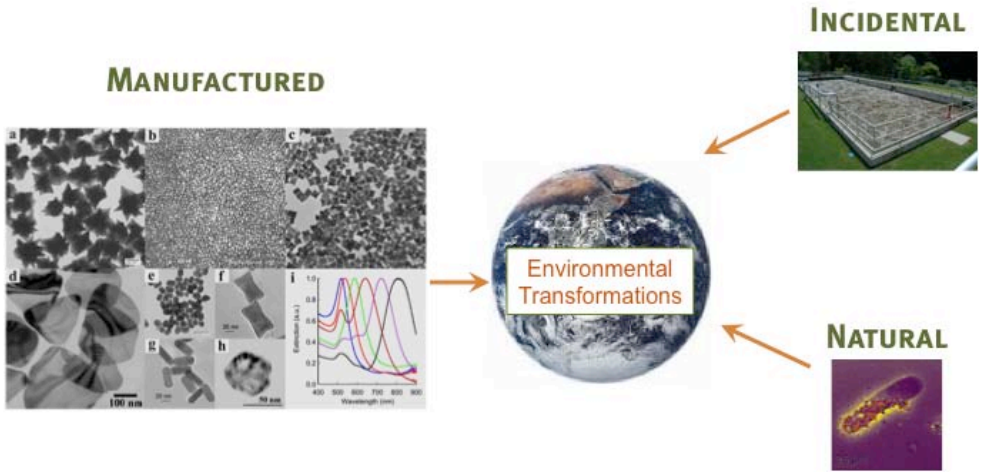
- Are any similar effects observed in areas associated with exposure pathways for specific materials?
- How do material properties change based on products they are used in?
- What are long-term (10yr +) transformations of nanomaterials?
- What are the procedures for dealing with non-nano wastes and feedstocks?

TO IDENTIFY CAUSATIVE AGENT, CONSIDER CAUSE(S) OF DEATH AND CONSIDER ORGANISMS AS LONG-TERM ACCUMULATORS

- Around the manufacturing site,
  - Is death of birds, fish and shrubs indicative of known causes e.g., metal poisoning? Mutagenic/genoxic?
  - Are there measurable quantities of “indicator” elements or compounds associated with nanomaterials, wastes, or feedstocks that may have bioconcentrated?
- Along the value chain
  - What are observations of those using nano-feedstocks or in contact with nano-enabled products?
- In the world
  - What are the other possible manufactured, incidental, and natural sources of a suspected material?

THE IMMEDIATE CHALLENGE ≠ FIND THE MANUFACTURED NANOPARTICLES

- Identify cause
- Differentiate sources
- Scrutinize discharges
  - Are there nanoparticles in any identifiable discharges or wastes?
  - Are there contaminants associated with nanomaterials? (think THF fiasco!)
- Measure what you can (key gap!)



WHAT COULD HAVE BEEN DONE TO PREVENT THIS CATASTROPHE?

- What means are available to start-up companies to test new materials?
- What information is available to companies to aid them in identifying treatment and disposal technologies for managing associated feedstocks and wastes?
- What guidelines are available for selecting most-needed measurements in workplace, wastes, etc. (may included non-regulated material- bottom line considerations)
- Identify the novel properties of the nanomaterials that make them attractive as replacements for older materials or that enable new products and consider possible environmental impacts associated with these properties.
- How might novel properties affect transport and potential for transformation?

KEY INFORMATION TO HAVE ON NEW NANOMATERIALS

- Novel properties
- How they are made (energy, feedstocks and wastes)
- Likely persistence
- Mobility
- Preferred phases
- Reactivity with key environmental components
  - Ability to accept/ donate electrons
  - Sorptive reactivity
  - Protein/ gene reactivity
    - Conformational changes
    - Gene expression
- Cellular interactions
- Organismal interactions
- Ecoystem-level impacts