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# Nanomaterials: Research to Support Environmental Decisions

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# Key Issues

- How, if at all, are nano-scale particles different as environmental contaminants?
- If different, how to assess risk?
- If risky, how to mitigate?

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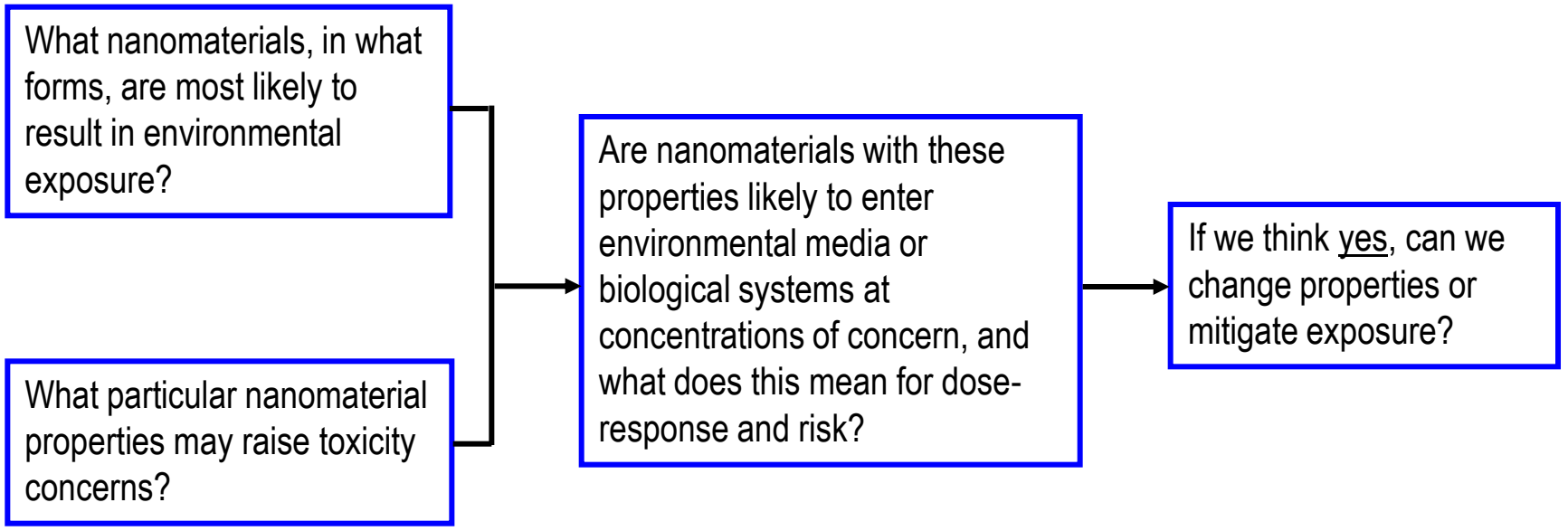
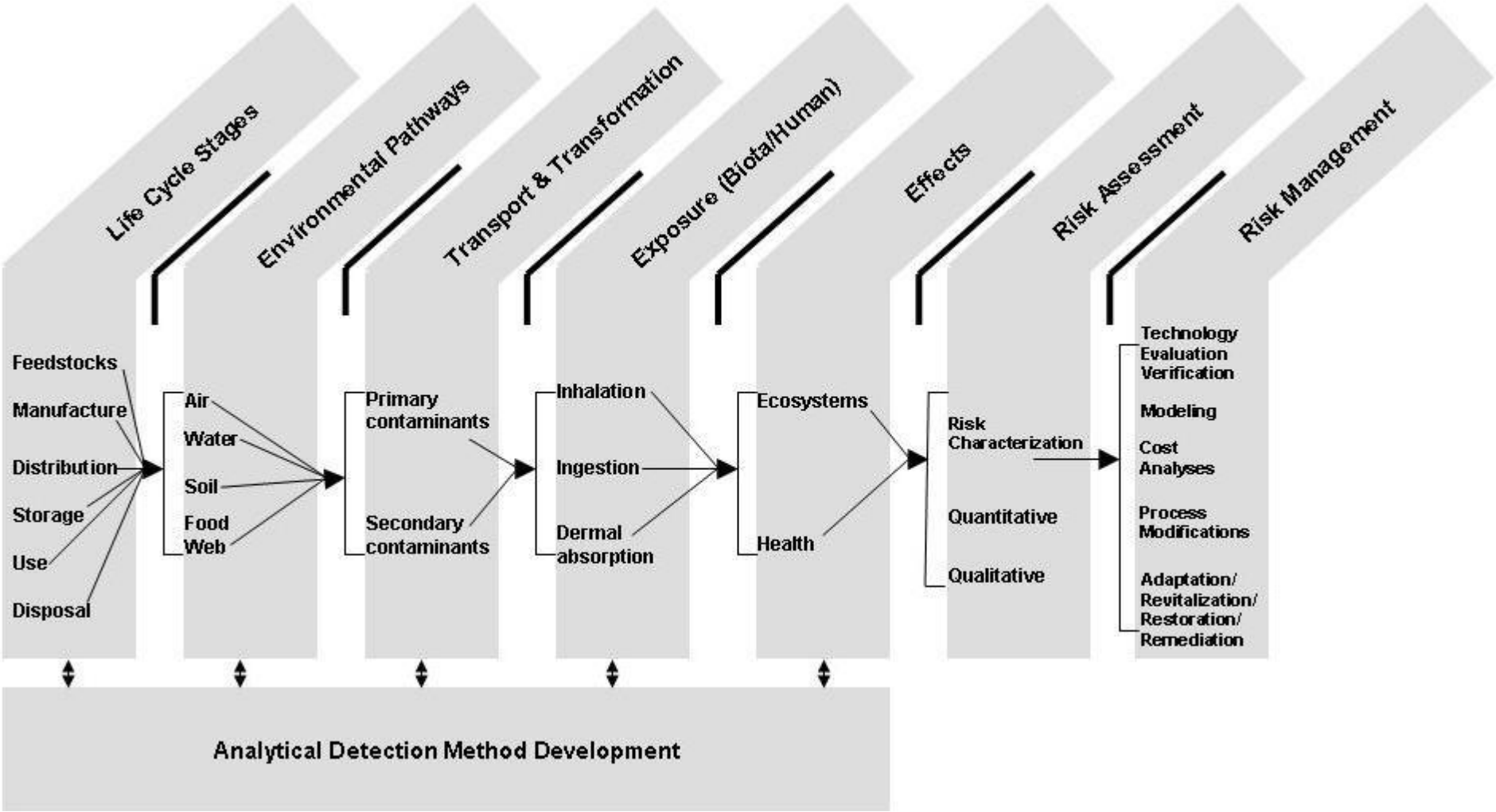
# Nanomaterials and Environmental Decision Making: A Few "Simple" Questions



# Comprehensive Environmental Assessment






Based on Comprehensive Environmental Assessment (Davis and Thomas, 2006)

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# *Information Needs: Physicochemical Characterization*

What are the unique chemical and physical characteristics of nanomaterials?

- How do these properties affect toxicity?
- How will manufacturing processes, formulations, incorporations in end-use products, and alterations in the environment affect these characteristics?
- Are there adequate methods to characterize nanomaterials?

➢ Risk Management Implication: If we identify properties of concern, can we "engineer-out" the hazard of those properties without compromising material functionality?

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# *Information Needs*: Fate, *Transport, Transformation, and Exposure*

- What technologies exist, can be modified, or must be developed to detect and quantify manufactured nanomaterials in environmental media and biological systems?
- What are the major processes and/or properties that govern the environmental fate, transport, and transformation of manufactured nanomaterials, and how are these related to the physical and chemical properties of those materials?
- What are the exposures that will result from releases of manufactured nanomaterials?

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# *Information Needs: Human Health and Ecological Effects*

- Are current testing schemes and methods (e.g., organisms, endpoints, exposure regimes, dose metrics, analytical methods) applicable to testing nanomaterials?
- What are the effects (local, systemic, acute, and chronic) of exposure to nanomaterials or their byproducts?
- What are the absorption, distribution, metabolism, and elimination parameters for various nanomaterials?
- How do variations in manufacturing, processing, and surface modifications affect toxicity of various nanomaterials?

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# Information Needs: Assessing and Managing Risks

- Which manufactured nanomaterials have a high potential for release from a life-cycle perspective and what practices can be applied to minimize the risks of nanomaterials throughout their life cycle?
- Are new decision-making approaches needed for nanomaterials risk management?
  - Implication: For emerging technologies such as nanotechnology, how should we think about risk management? Specifically, can we avoid potential risks at the beginning, by focusing on key properties and use scenarios, and taking appropriate measures to minimize hazard and exposure?

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## Key Points

- Decision makers need information grounded in reality, and nanotechnology EHS researchers should understand decision makers' needs.
- A life-cycle perspective is important.
- Avoiding risk is better than managing risk. What information can researchers provide to decision makers that can prevent hazards and unintentional exposures?