Nanomaterial Exposure: Critical Exposure Metrics for Detection, Identification of Routes, and Assessment of Risk

Case Study: Many pathways of exposure can be hypothesized for nanomaterials releases from the company's facility.

Steve Diamond
Research Biologist
United States Environmental Protection Agency
National Health and Environmental Effects Research Laboratory
Mid-Continent Ecology Division
Duluth, Minnesota

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Exposure pathways:

- air
- direct deposition
- water
- sediment
- food chain

Methods are generally well developed for chemicals
These are applicable to nanomaterials
Models for chemicals provide a framework for nanomaterial studies

The critical unknown re nanomaterials is detections and metrology

Exposure pathways:

Water exposure:

- uptake rate/kinetics
- organic carbon/biota lipid factors
  - Kow
  - carbon-normalized/lipid normalized concentrations
  - ambient water correction factors (ionic balance)

Sediment

- organic carbon/biota lipid factors
- BAF, BSAF
- assimilation efficiency

Biota

All of the above

These models cannot (generally) be evaluated for nanomaterials until detection, characterization, and quantification methods for complex media have been developed.

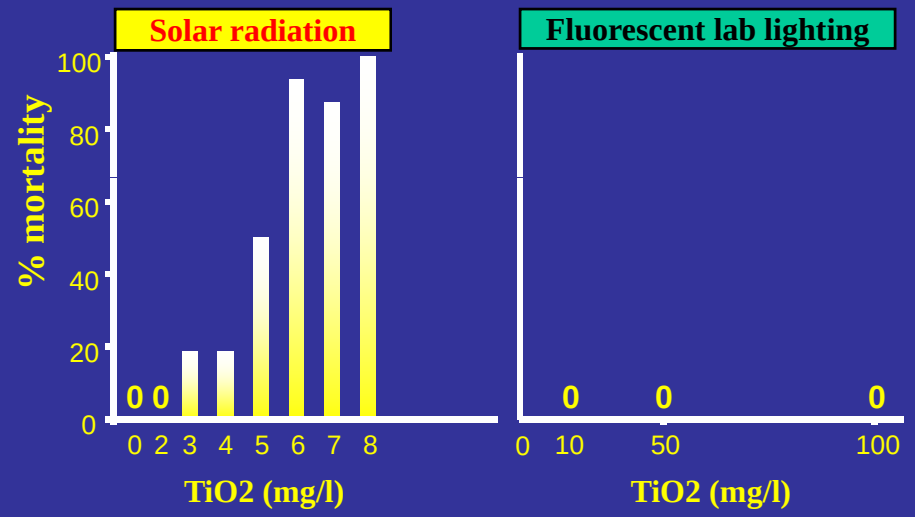
Key Exposure Metrics

- concentration
- particle size/distribution
- agglomeration state
- surface area
- crystal structure
- dimensionality
- functionalization

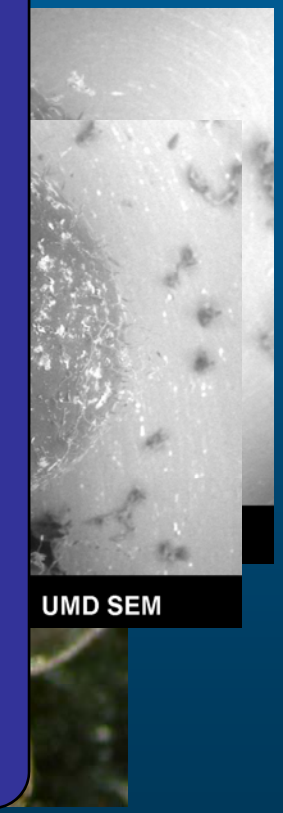
- other characteristics of potential importance relative to toxicity and level of exposure

These metrics will be critical for understanding pathway processes (fate and transport)

Exposure pathways: Nanomaterial-specific considerations



Simulated solar radiation effect on TiO2 toxicity in larval medaka.
(Diamond et al., unpublished data)



Implications for Case Study:

- **Various pathways for exposure can be hypothesized.**
- **Nanomaterials present unique issues (and challenges)**
- **Detecting, much less quantifying, exposure via these hypothesized pathways is currently not possible**
- **More proximate exposure metrics will be harder to obtain**