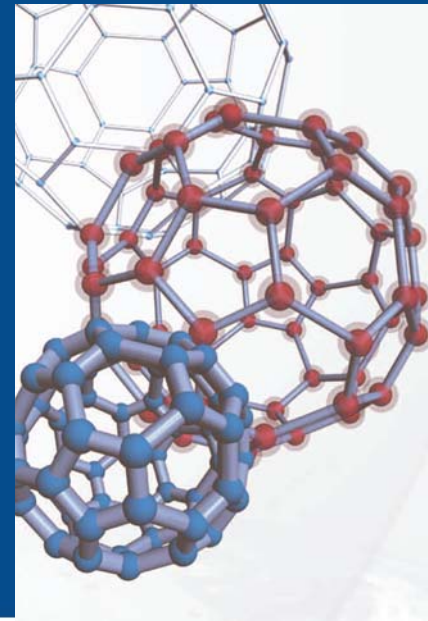


Managing Uncertainties in the Environmental Risk Assessment of Nanomaterials

Richard Owen
Environment Agency (UK), U. Plymouth

Michael Depledge
Peninsular Medical School,
Royal Commission on Environmental Pollution

NATO Workshop, Portugal April 29th



Key Issues For Environmental Risk Assessment of Nanomaterials

1. How: how fit for purpose are risk assessment methodologies?

e.g. EU TGD, SCENIHR opinions, OECD etc



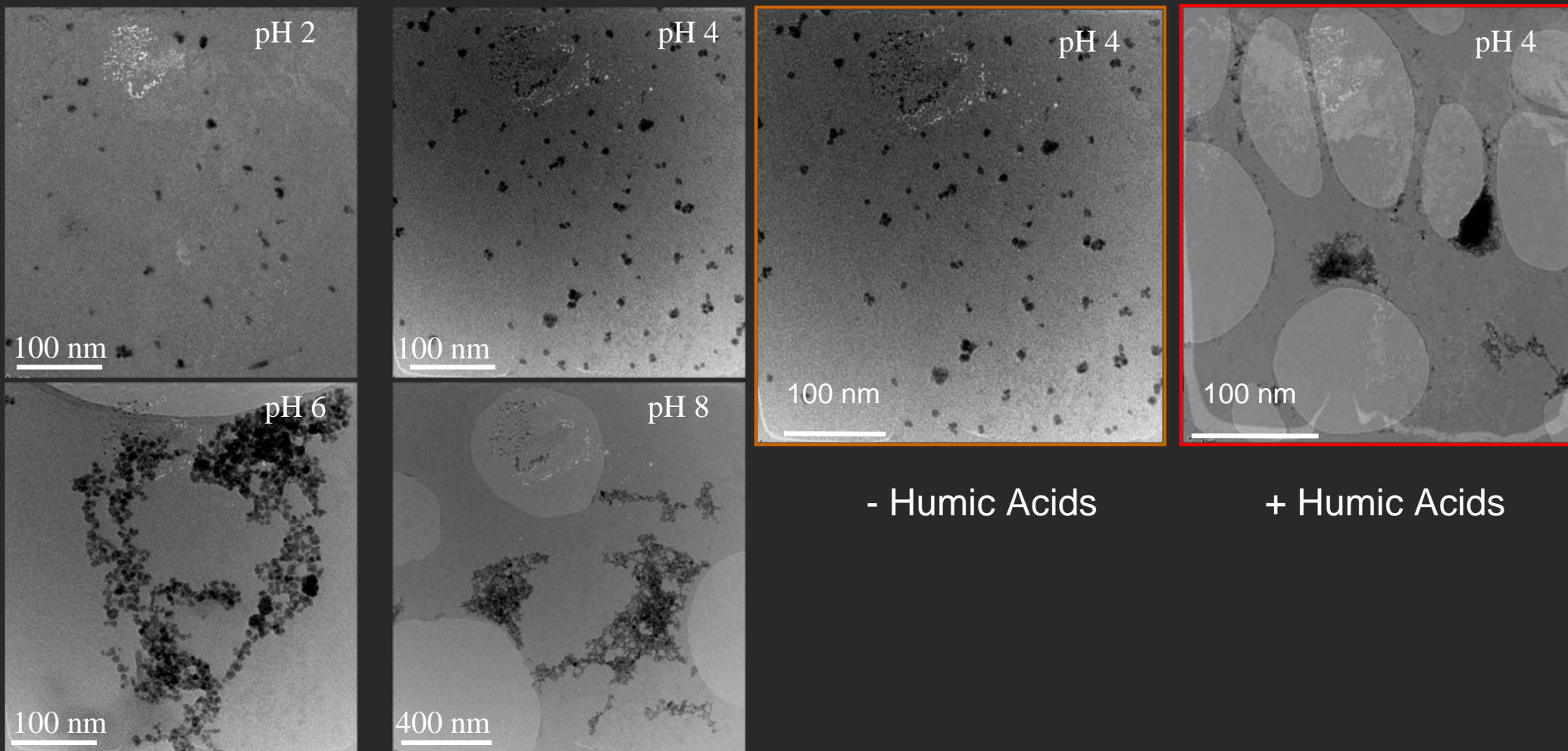
2. When: when to undertake a quantitative risk assessment?

do existing regulations cover nanomaterials
(e.g. REACH, TSCA) , do they need to be amended?



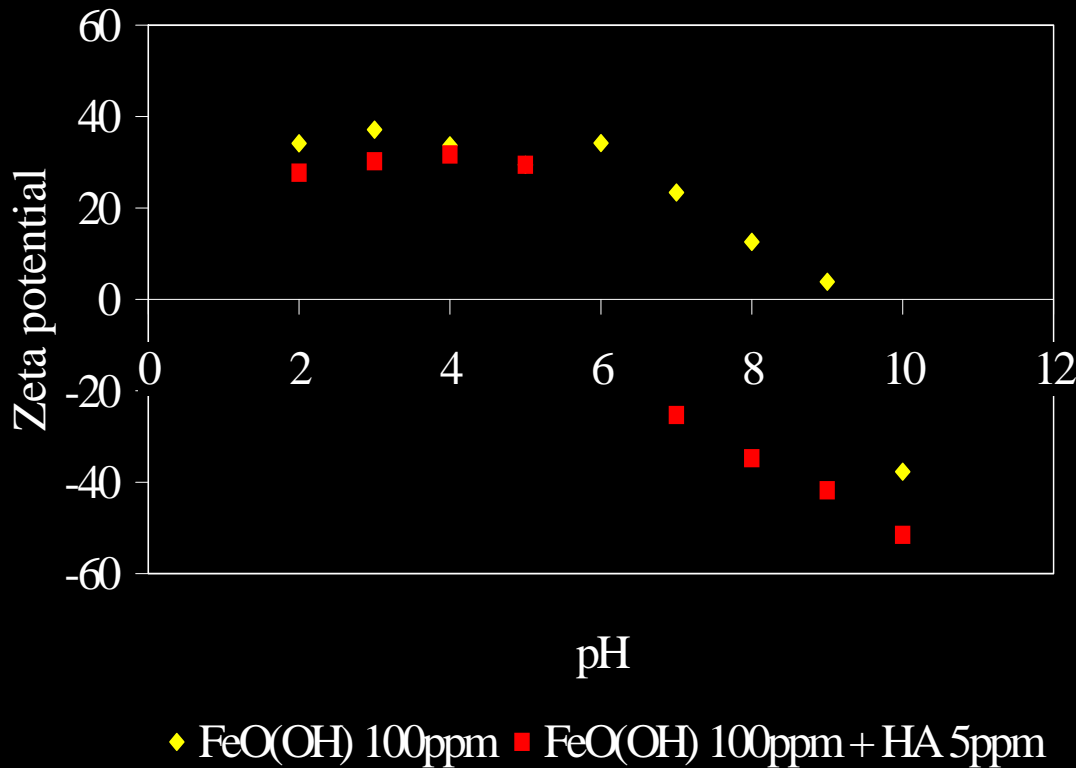
How: Key Issues for Environmental Risk Assessment

1. Complexity of behaviour in natural systems



Agglomeration of Iron oxide nanoparticles

Physico chemical behaviour of nanoparticles in natural systems is influenced by numerous abiotic and biotic factors



Abiotic factors include
pH, ionic strength,
organic matter etc..

Implications:

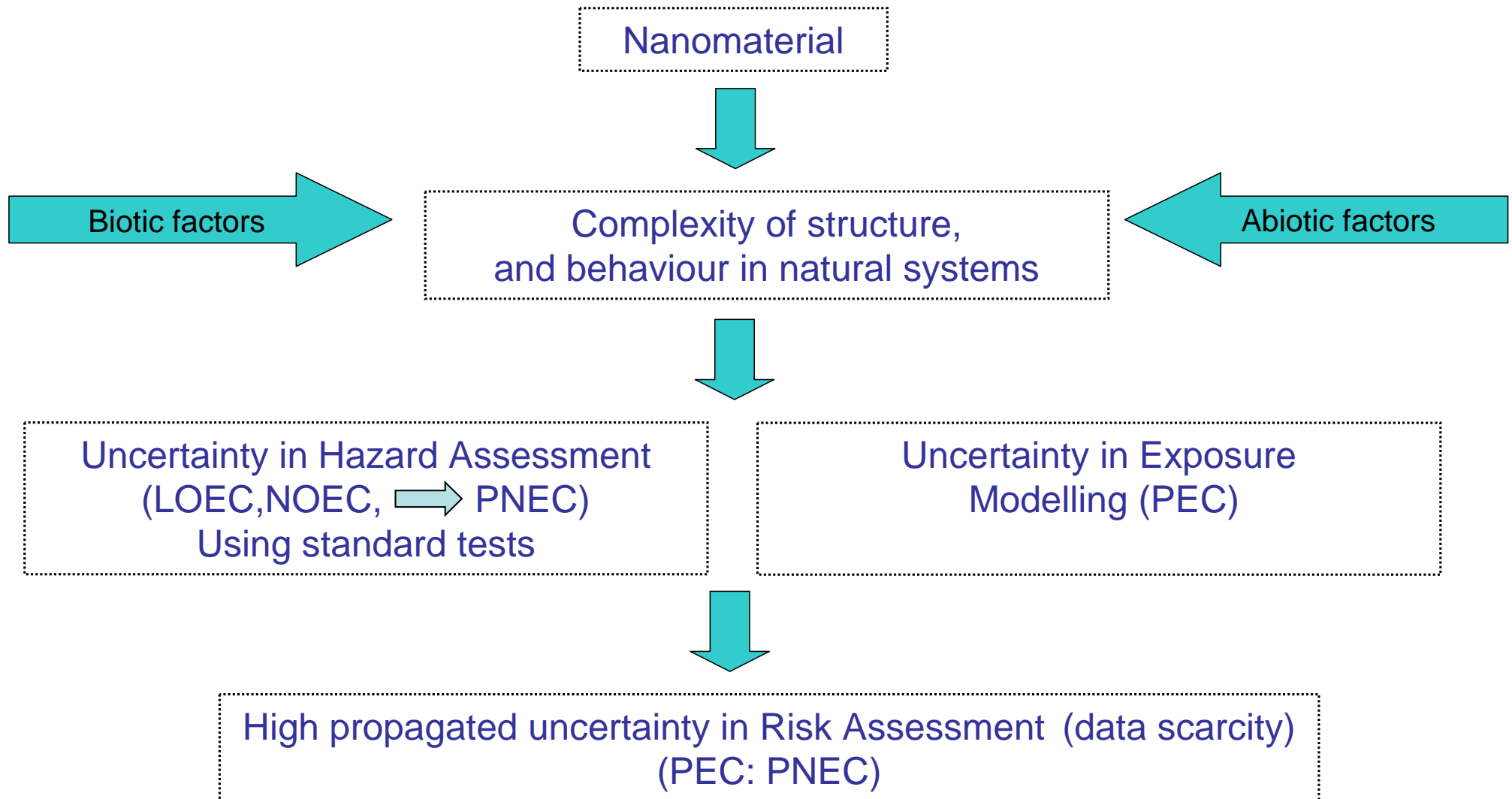
Environmental Exposure: agglomeration, form, surface chemistry

Bioavailability and direct toxicity

Dissolution and indirect toxicity (metal nanoparticles)

Test relevance

2. Complexity and data scarcity leads to risk uncertainty

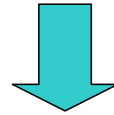


How do we manage high risk uncertainties In a data scarce environment?



(Regulatory) options for managing uncertainty in environmental risk assessment

High propagated uncertainty in Risk Assessment (data scarcity)



Management of risk uncertainty



Application of large uncertainty factors to calculate PNEC



Identify uncertainty sources
Better understanding of
Behaviour, fate, bioavailability
:understand complexity



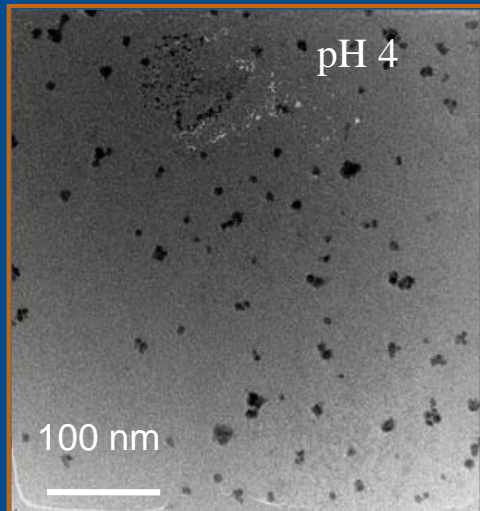
Uncertainty management implications



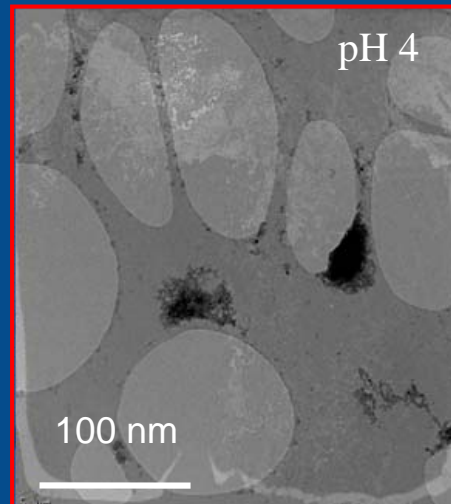
Challenging analytical techniques for dosimetry and monitoring
Over precautionary?

Resourcing implications for gap filling

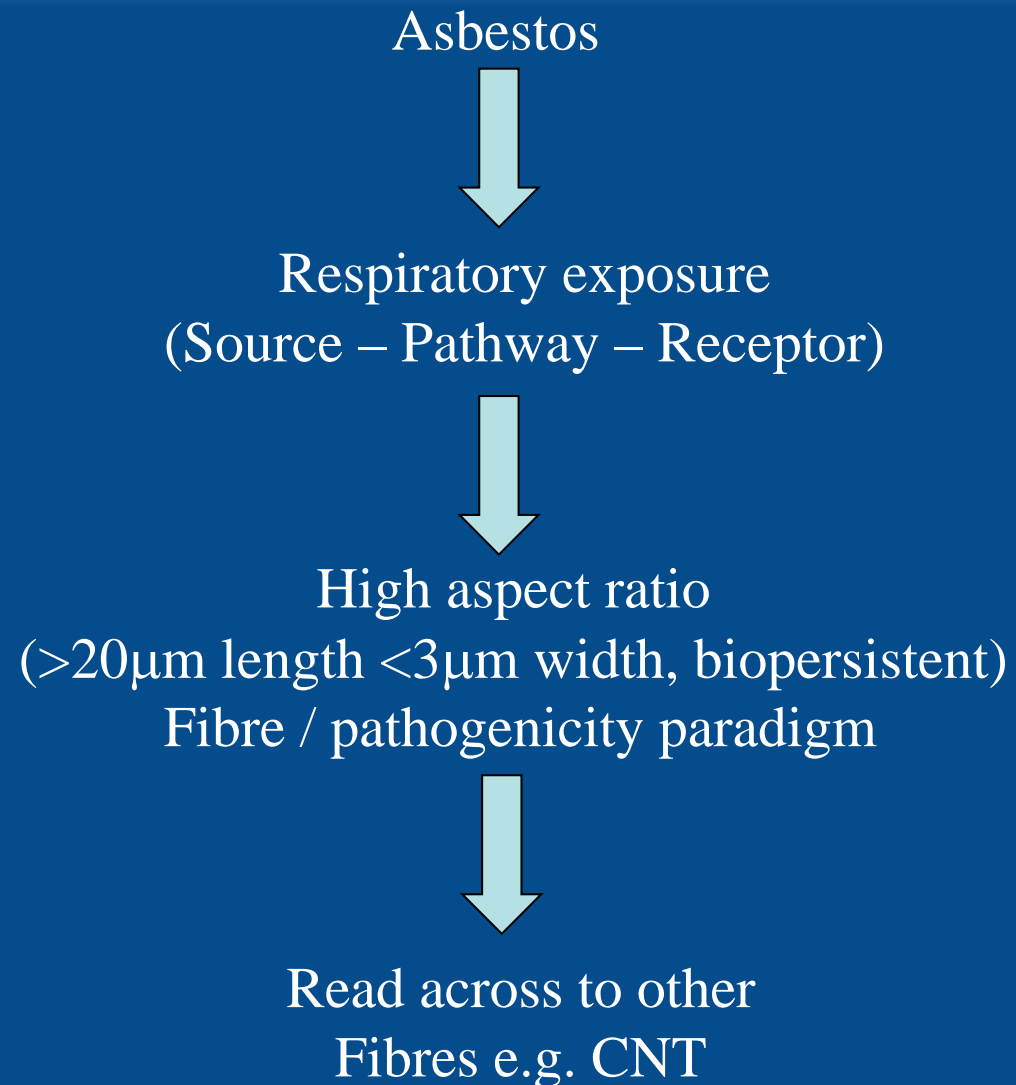
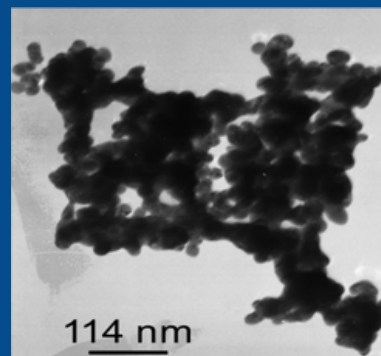
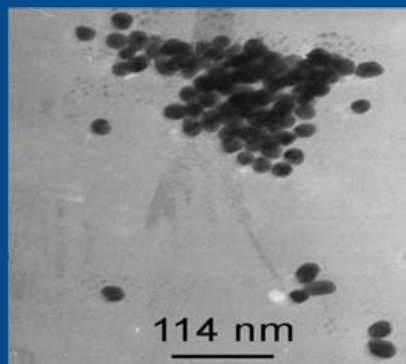
Structure - activity relationships, group read across



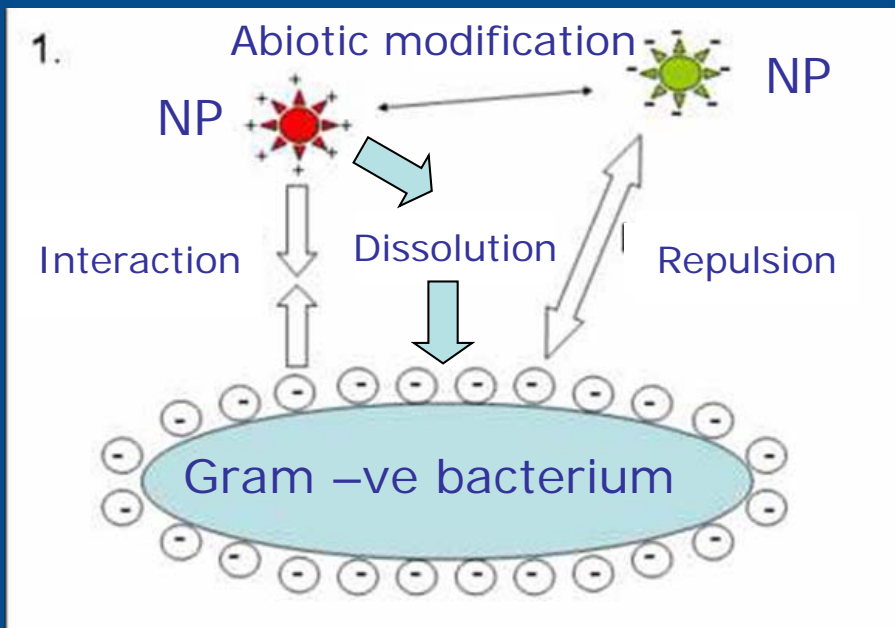
+ Humic Acids



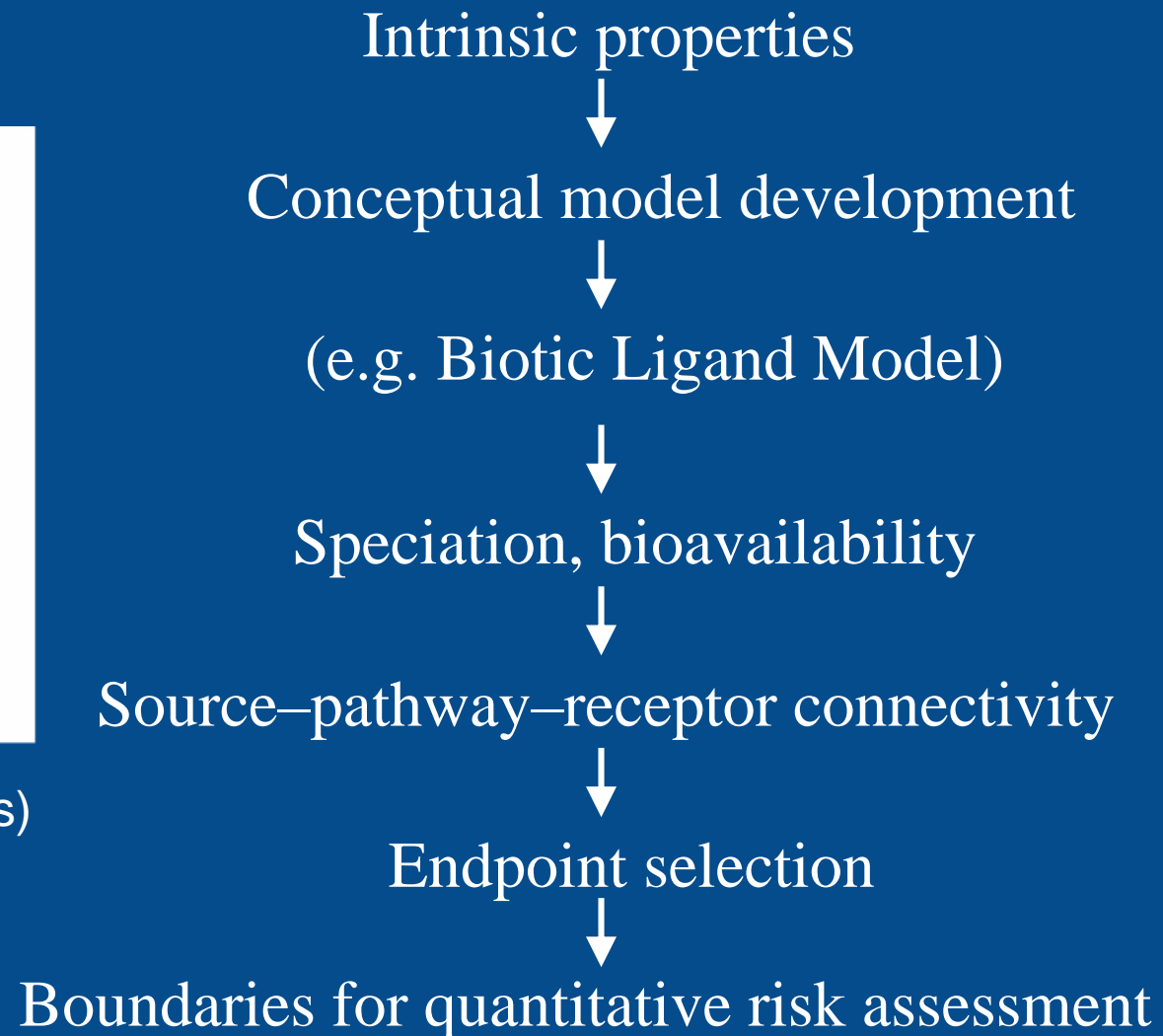
- Humic Acids



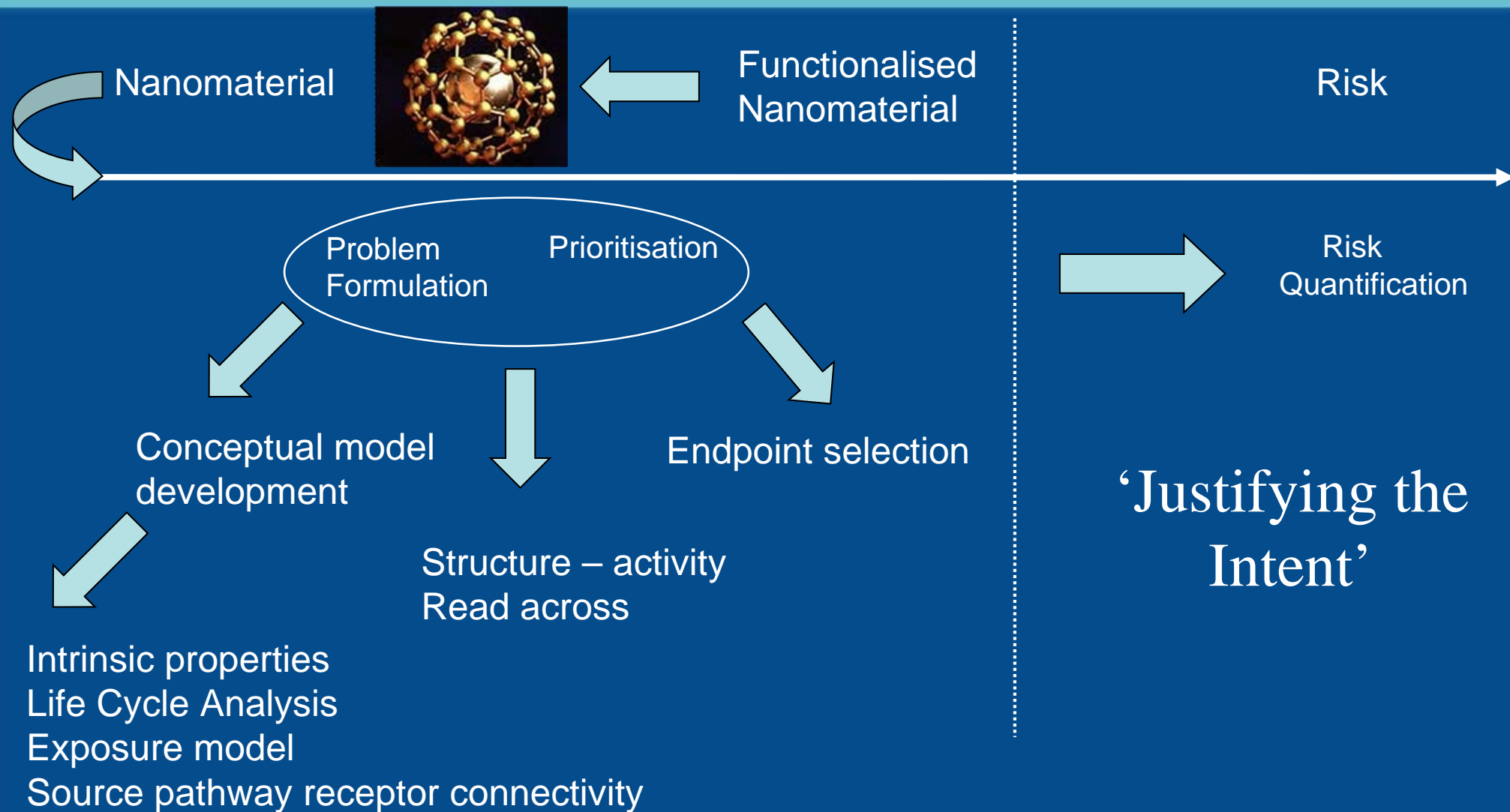
Development of conceptual model of exposure and interaction to drive environmental risk assessment



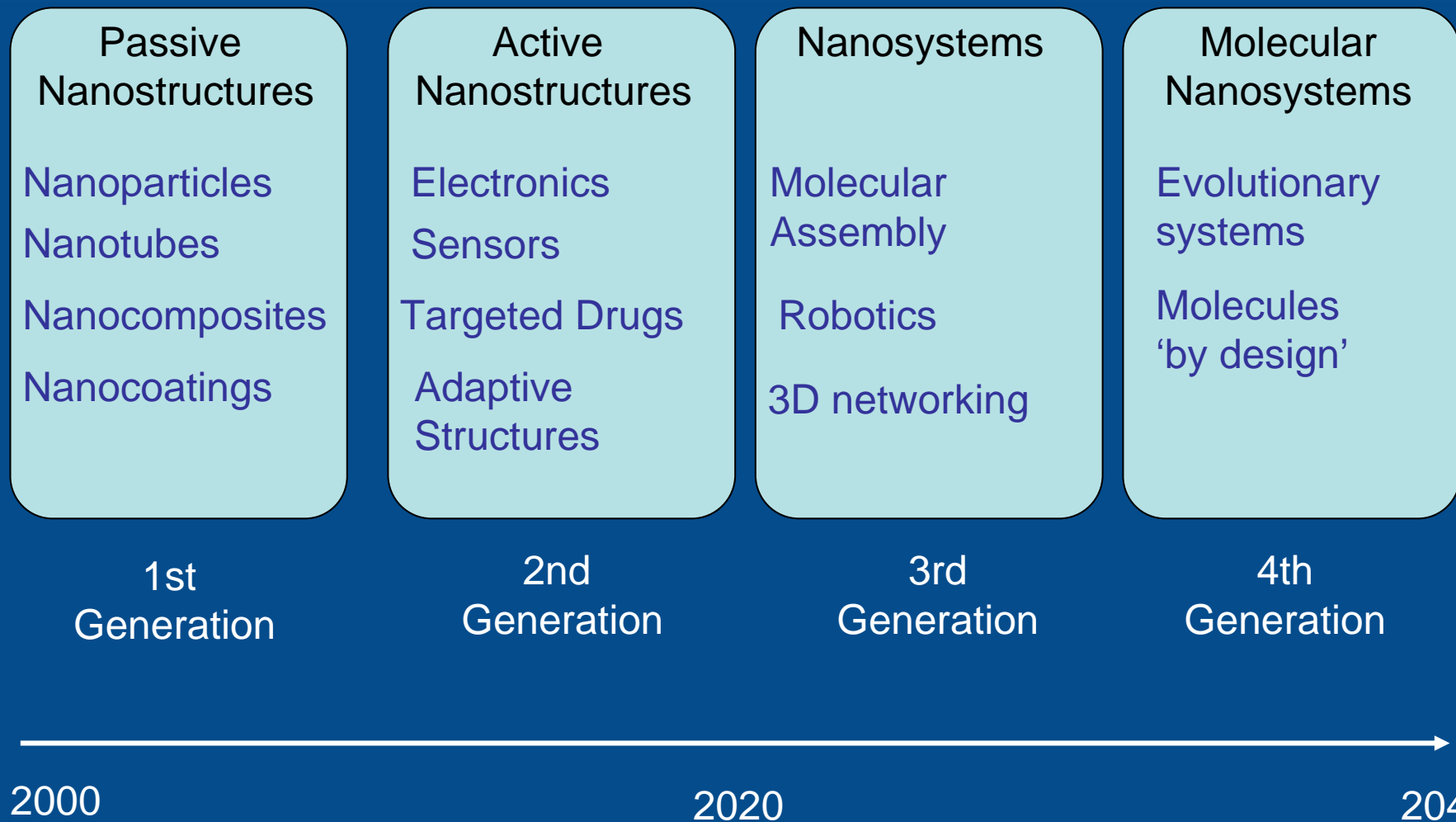
After Neal (2008) Ecotoxicology (in press)



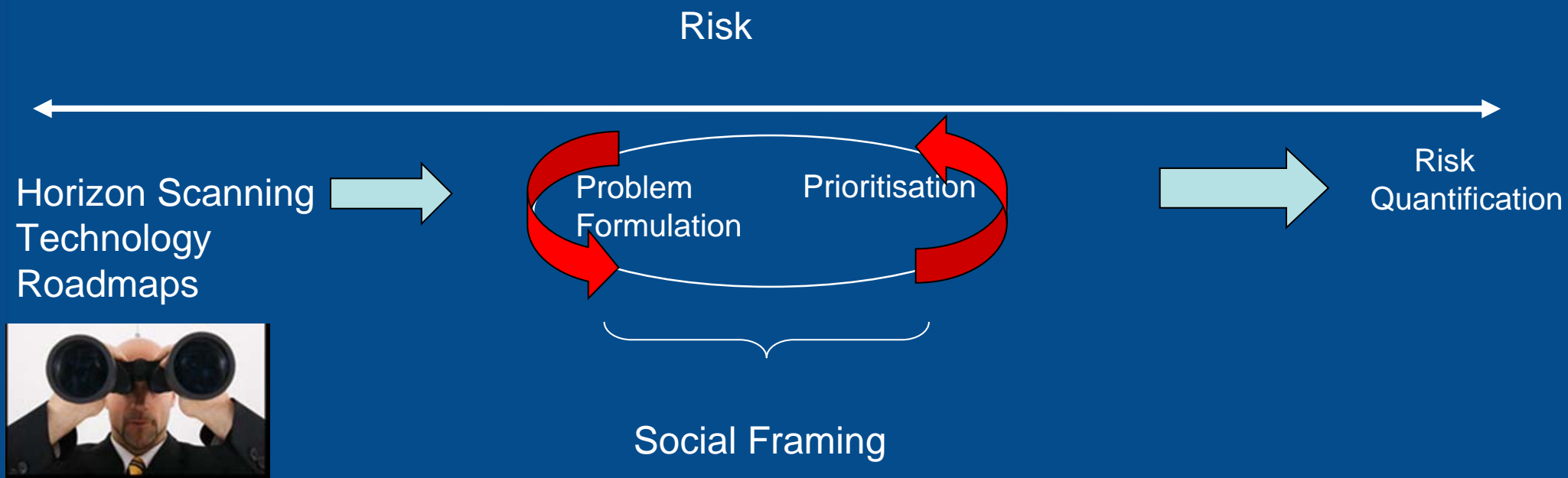
Unpacking problem formulation and prioritisation : the when of risk assessment



Beyond nanoparticles: the evolving landscape of nanotechnology

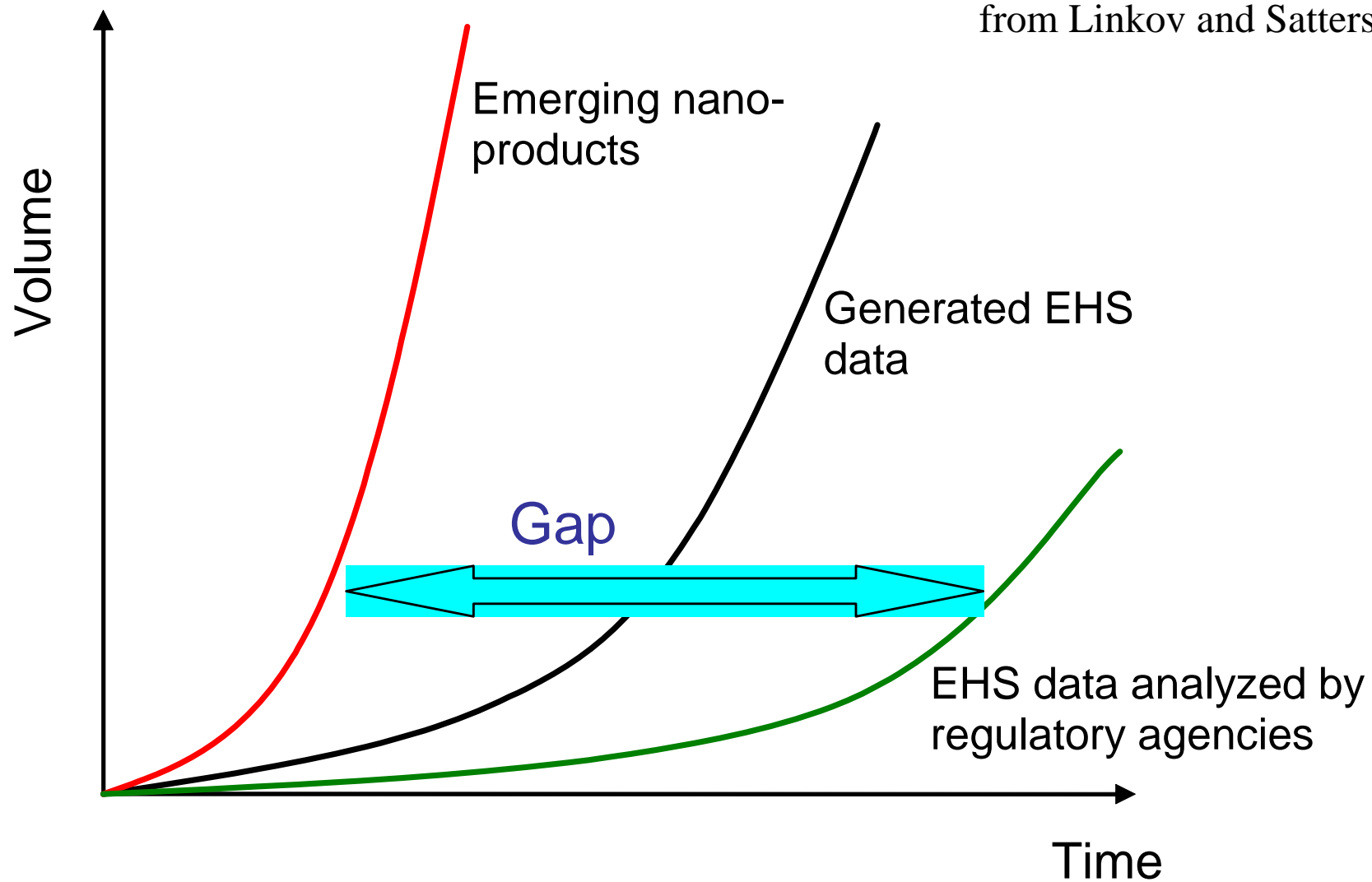


Unpacking problem formulation and prioritisation for emerging technologies



Emergence of Nanotechnology Products in Comparison to Generated EHS data

from Linkov and Satterstrom, 2008



Placing a safety net around prioritised prospective risk assessment

Probably can only do a thorough job for a small group of nanomaterials

It might be scientifically robust, but is it pragmatic, protective?

Need some immediate safety nets to complement the approach.

Direct Toxicity Assessment PPC, Chemicals Sector

- Required for all complex industrial effluent
i.e. (one or more components not identified)
- Holistic measure of toxicity of chemical mixtures
- Accounts for the effects of unknown chemicals
and those of uncertain bioavailability, toxicity
- Provide a degree of ecological relevance



Some Closing Thoughts



- ⌘ Complexity of structure, form and behaviour in natural systems
- ⌘ High Uncertainty in hazard, exposure and risk assessment
- ⌘ Management of uncertainties through better understanding of complexity
- ⌘ Development of conceptual model accounting for complexity- exposure,
Source – pathway - receptor connectivity: driving endpoint selection
Read across (e.g. SAR)
- ⌘ Shift the focus of risk assessment to problem formulation
- ⌘ The need for a safety net around a prioritised risk assessment strategy



Environment
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Small World

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