



Comprehensive Environmental Assessment: Strategically linking Research, Assessment, and Risk Management

Applied to Multiwalled Carbon Nanotubes

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Office of Research and Development**

**US Environmental Protection Agency
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NCI Nano Working Group

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Outline

- A Challenge for Nanomaterial Risk Assessment
 - Our Approach to addressing the challenge
 - Structure (Framework)
 - Linkage, Prioritization, Diversity (Process)

- Applications of our approach
 - Research planning: Multiwalled carbon nanotubes (MWCNTs)
 - Future Assessment & Risk Management

- Summary and Discussion

The views expressed in this presentation are those of the authors and do not necessarily represent the views or policies of the U.S. Environmental Protection Agency.

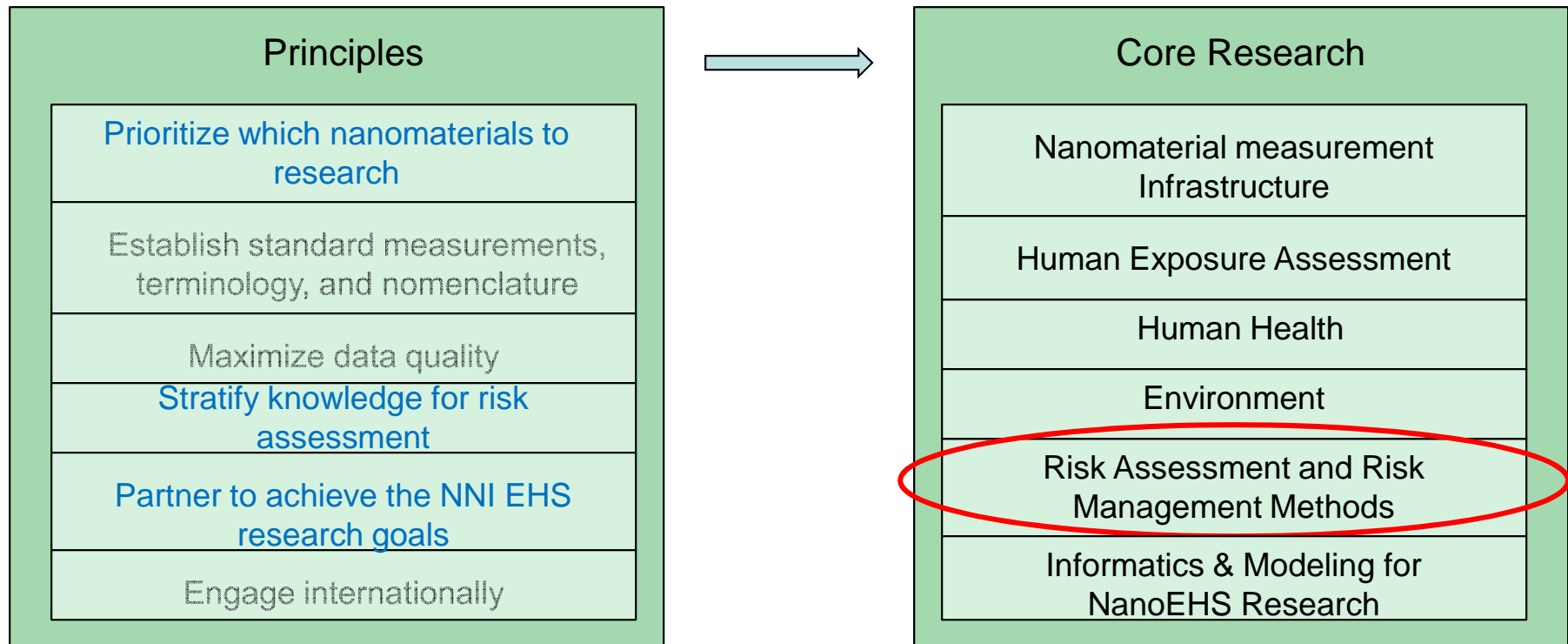


A Challenge: Connecting Research to Understanding Risk

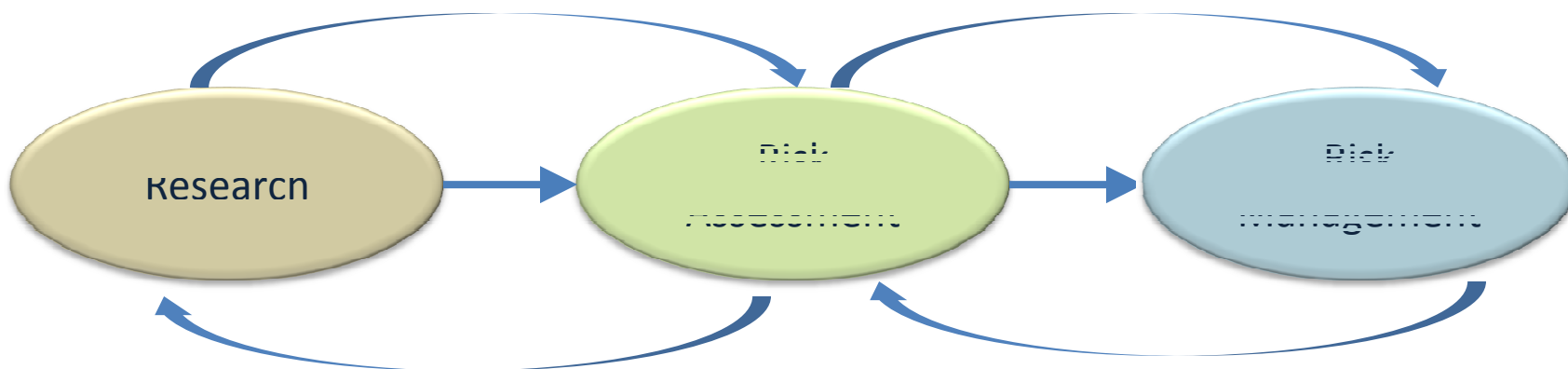
“... disconnect between risk research and its relevance to and use in informed decision making...”

National Research Council (2012), “A Research Strategy for Environmental Health, and Safety Aspects of Engineered Nanomaterials”

Strategic Research for Nanomaterials: 2011 NNI EHS Research Strategy Principles

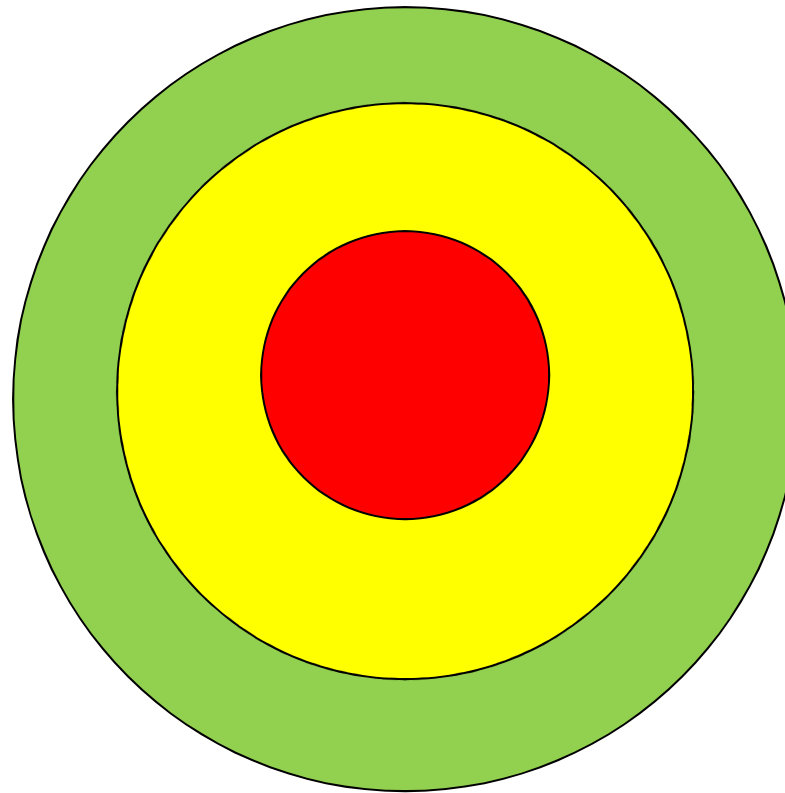


The Comprehensive Environmental Assessment (CEA) Approach



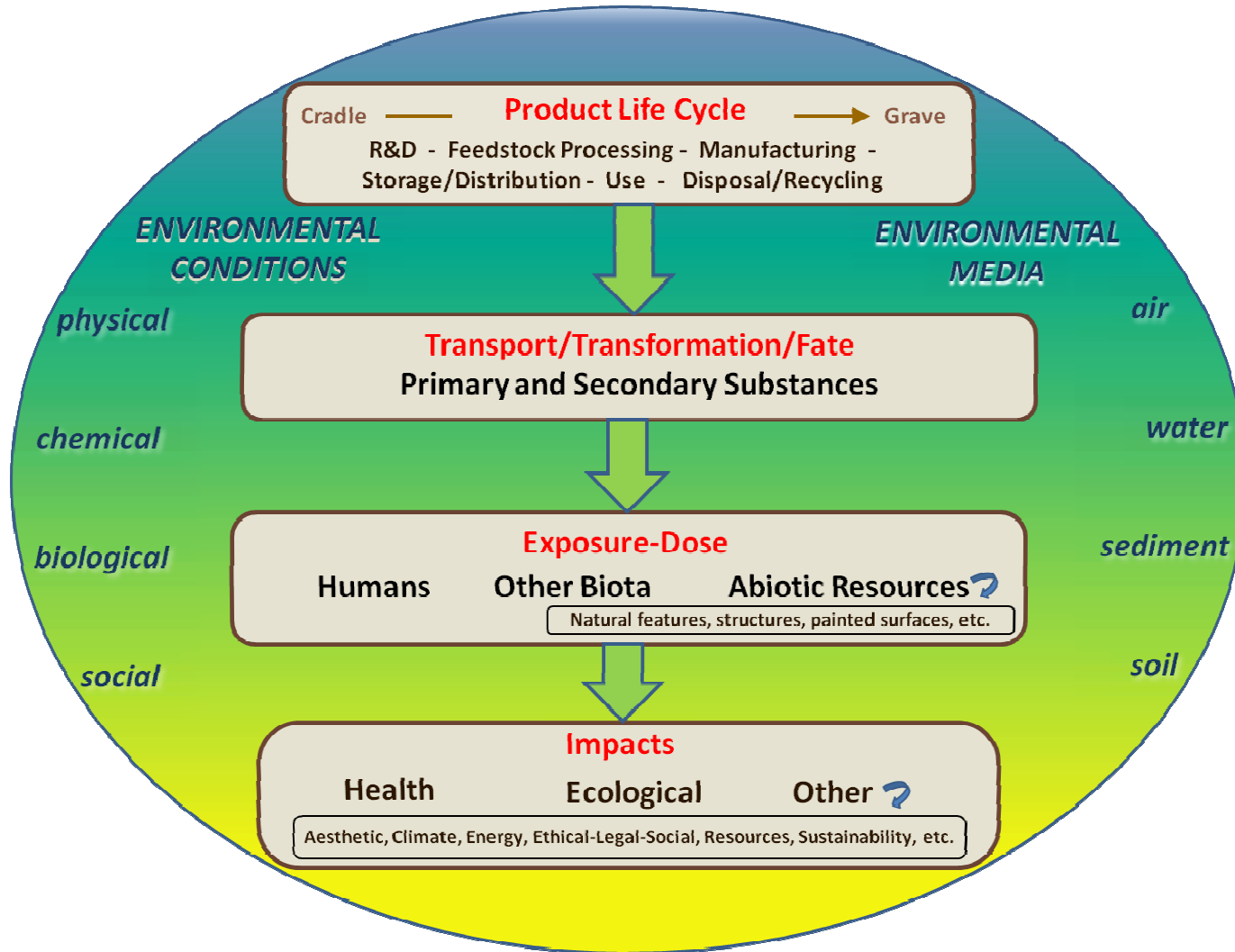
Objective: strategically link research planning, assessment, and risk management efforts

CEA: Informing Research, Assessment, and Risk Management



Red: Research that informs future environmental & human health decision making

CEA Framework: Structuring Information



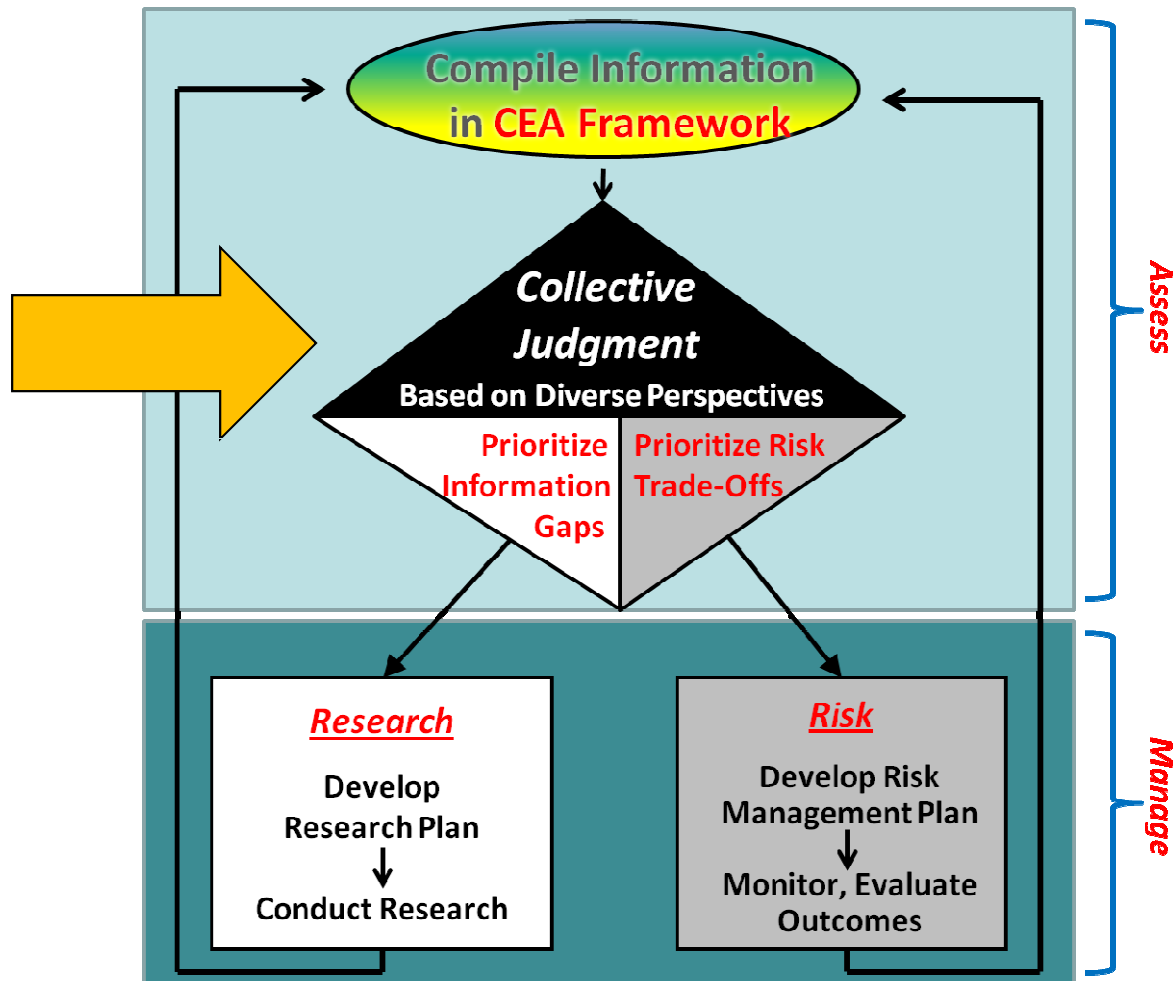
CEA *Process*: Structuring Stakeholder Engagement



→ Structuring information isn't enough

→ Structuring data discussions

CEA Process: Engaging diverse perspectives

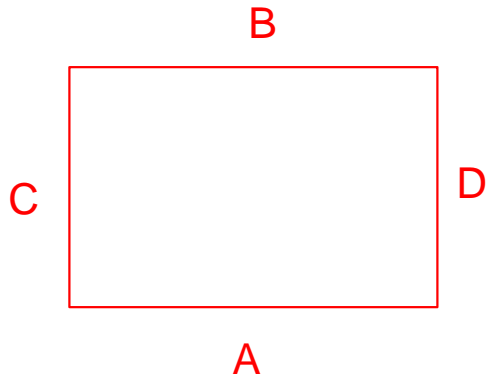




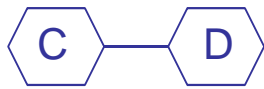
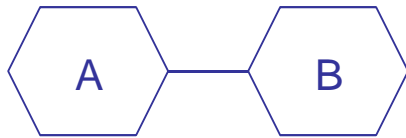
CEA *Process*: Structuring Stakeholder Engagement

A is equal to B,
And C is equal to D

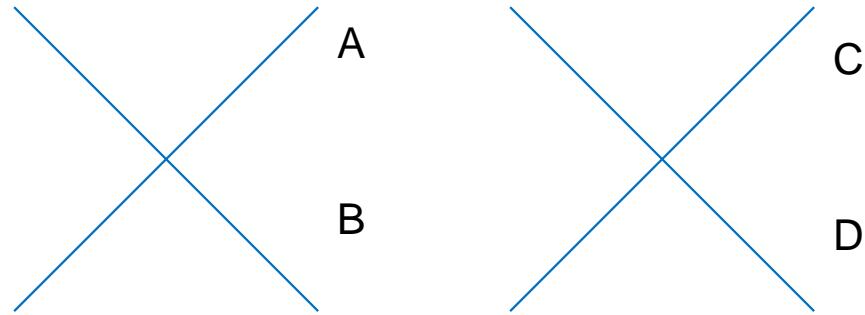
CEA Process: Structuring Stakeholder Engagement



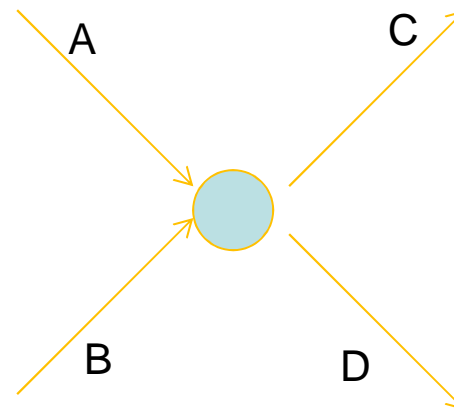
Mathematician



Chemist

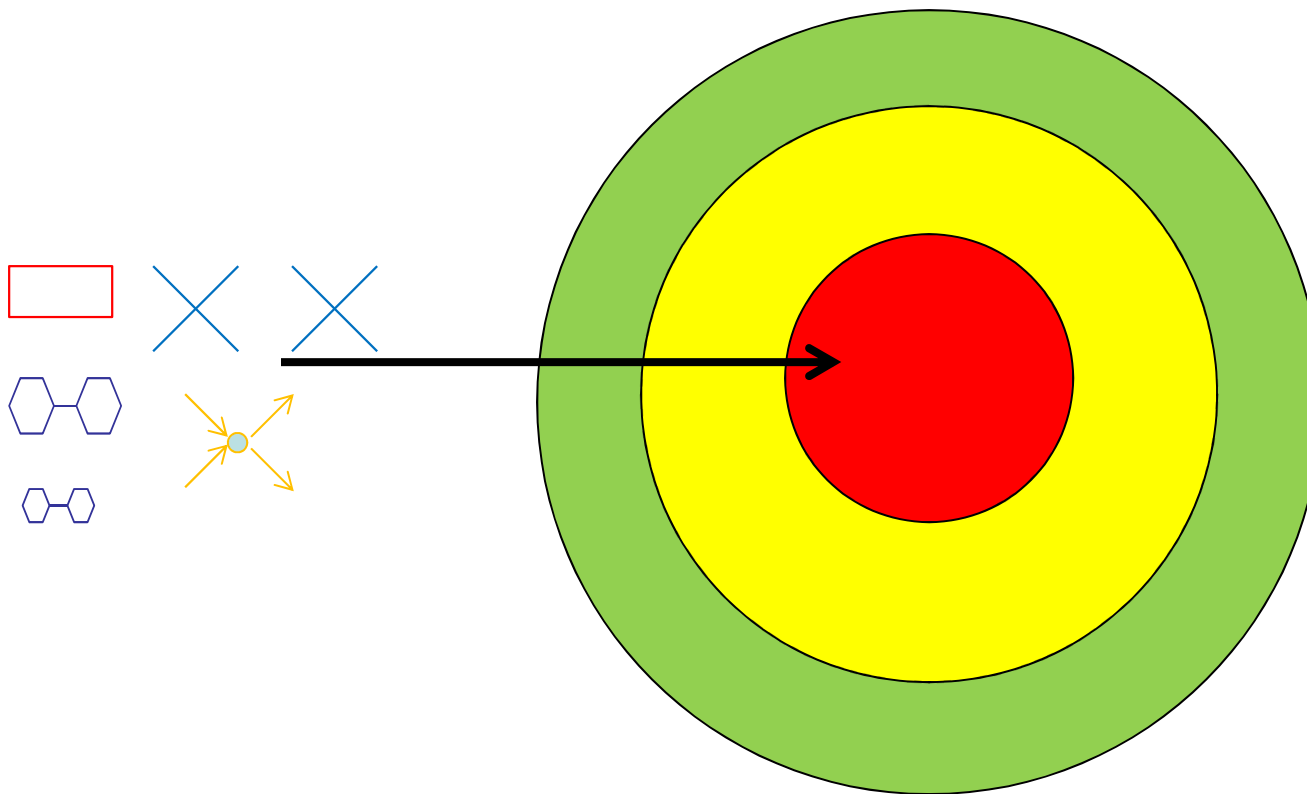


Economist



Physicist

CEA *Process*: Structuring Stakeholder Engagement



*Diverse perspectives =>
Research that informs future environmental & human health decision making*

CEA Applied: Nanomaterial Research Planning for Future Assessment & Risk Management

- Case Studies
 - Nano-TiO₂ Case Studies: Water Treatment and Topical Sunscreen, November 2010
 - Nanoscale Silver Case Study: Disinfectant Spray, August, 2012
 - Multiwalled Carbon Nanotube (MWCNT) Case Study: Flame Retardant Textile Coatings (Draft), July 2012
- Workshops
 - Nano-TiO₂ Workshop: Sept. 29-30, 2009
 - Nano-Silver Workshop: Jan. 4-7, 2011
 - MWCNT Workshop Process: July – October 2012



CEA Applied: Nanoscale Carbon

- *Selection:*
cross-Agency input using web-based tool

→ 13 Representatives

- Program offices, labs, centers, regions

→ Comment & allocate chips

→ Share: Agency colleagues

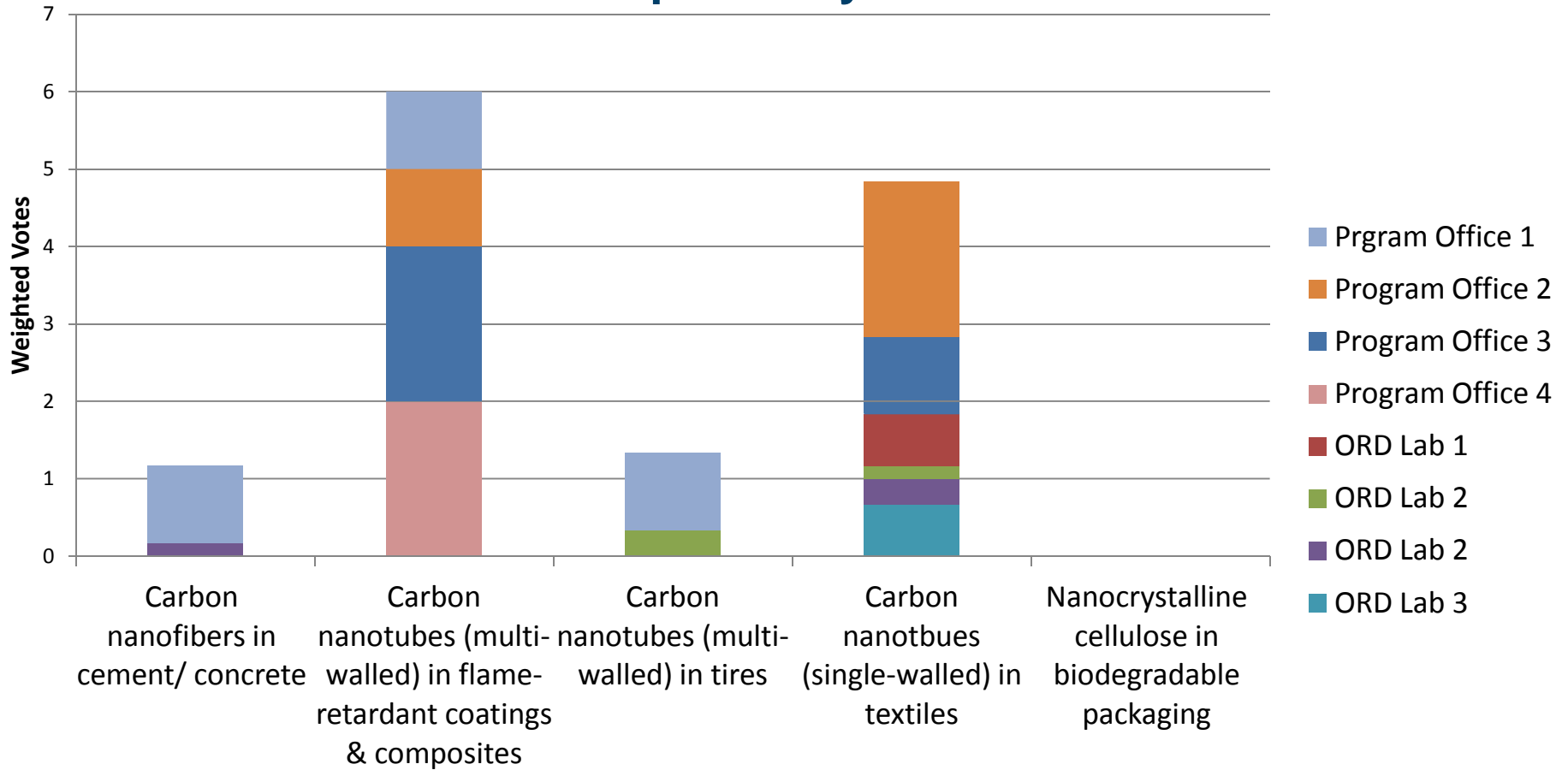
→ Submit vote via email



Recent (5) | Popular (5) | In Review (0) | In Progress (0) | Complete (0)

NANOCARBON CANDIDATES »		Moderate Idea
2 chips	Carbon nanofibers in cement/concrete	
Manage chips	Suitability at a Glance Table with details on CNFs in cement/ concrete: http://ideascale.com/userimages/sub-1/900603/CNF-Cement_Concrete-Suitability-at-a-Glance.pdf ... more »	
	1 comment	Submitted by You 1 month ago
NANOCARBON CANDIDATES »		Moderate Idea
3 chips	CNTs (multi-walled) in flame-retardant coatings & composites	
Manage chips	Suitability at a Glance Table with details on carbon nanotubes (multi-walled) in flame-retardant coatings & composites: http://ideascale.com/userimages/sub-1/900603/CNT-MW-Flame-Retardant-Coatings-Composites-Suitability-at-a-Glance.pdf ... more »	
	1 comment	Submitted by You 1 month ago
NANOCARBON CANDIDATES »		Moderate Idea
4 chips	Carbon nanotubes (multi-walled) in rubber tires	
Manage chips	Suitability at a Glance Table with details on carbon nanotubes (multi-walled) in rubber tires: http://ideascale.com/userimages/sub-1/900603/CNT-MW-Rubber-Tires-Suitability-at-a-Glance.pdf ... more »	
	2 comments	Submitted by You 1 month ago
NANOCARBON CANDIDATES »		Moderate Idea
5 chips	Carbon nanotubes (single-walled) in textiles	
Manage chips	Suitability at a Glance Table with details carbon nanotubes (single-walled) in textiles: http://ideascale.com/userimages/sub-1/900603/CNT-SW-Textiles-Suitability-at-a-Glance.pdf ... more »	
	5 comments	Submitted by You 1 month ago
NANOCARBON CANDIDATES »		Moderate Idea
0 chips	Nanocrystalline Cellulose in biodegradable packaging	
Manage chips	Suitability at a Glance Table with details on nanocrystalline cellulose in biodegradable packaging: http://ideascale.com/userimages/sub-1/900603/NCC-Biodegradable-Packaging-Suitability-at-a-Glance.pdf ... more »	
	Add your comment	Submitted by You 1 month ago

CEA Applied: Multiwalled carbon nanotubes (MWCNNTs) in flame-retardant coatings applied to upholstery textiles

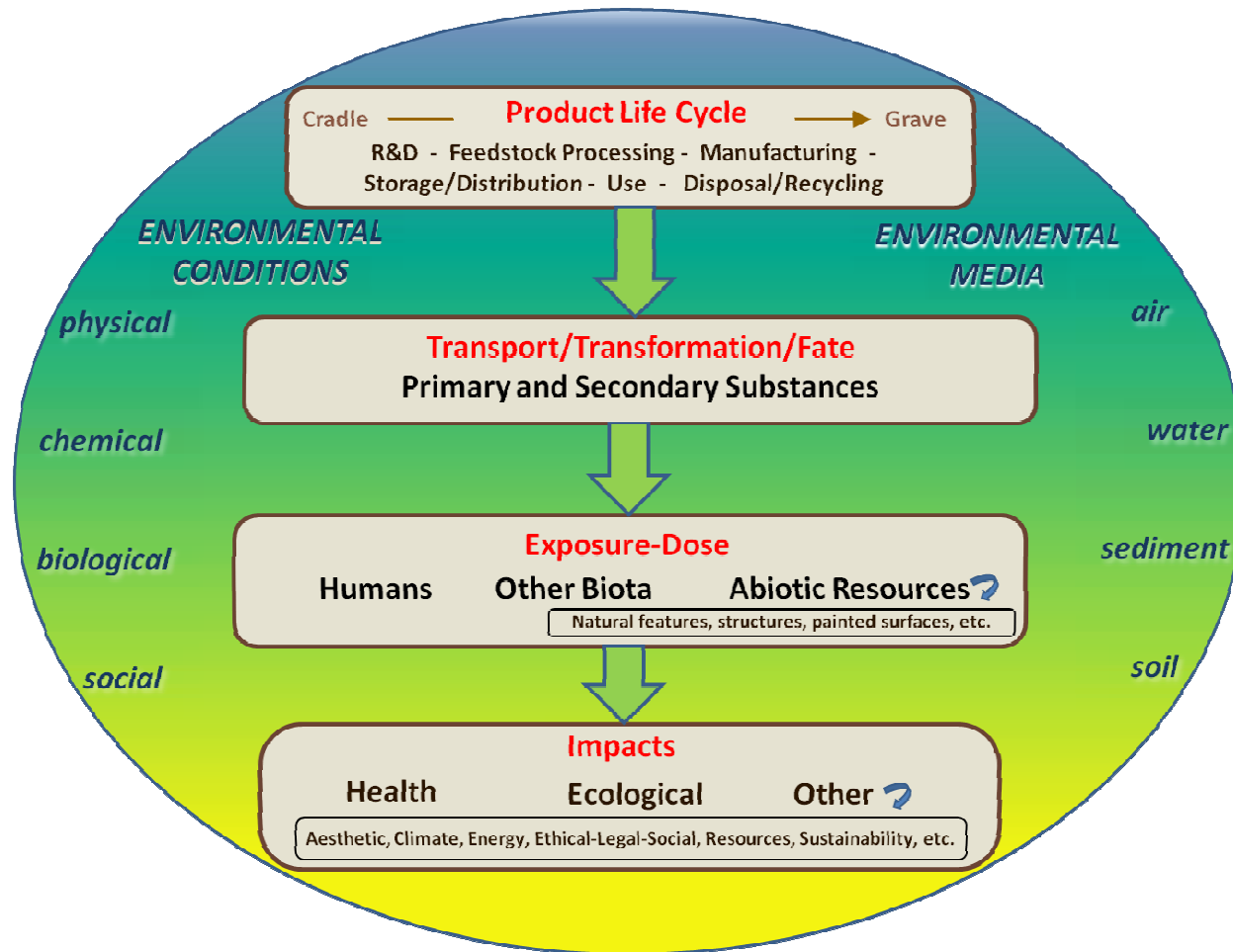


Nanoscale carbon product candidates

→ Top candidates: Single walled carbon nanotubes in textiles

& multi-walled flame-retardant coatings

CEA Applied: “Nanomaterial Case Study: A Comparison of MWCNTs and Decabromodiphenyl Ether Flame-Retardant Coatings Applied to Upholstery Textiles”

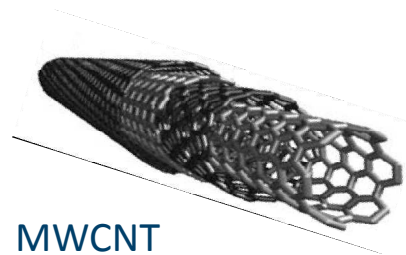
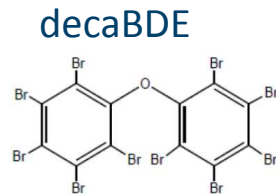


- *Objective: structure information to support collective judgement prioritization for research planning → support research planning → assessments → risk management*

CEA Applied: Case Study on MWCNT in flame-retardant coatings applied to upholstery textiles

- *Building on previous case studies:*

- Comparative approach



- Product focus

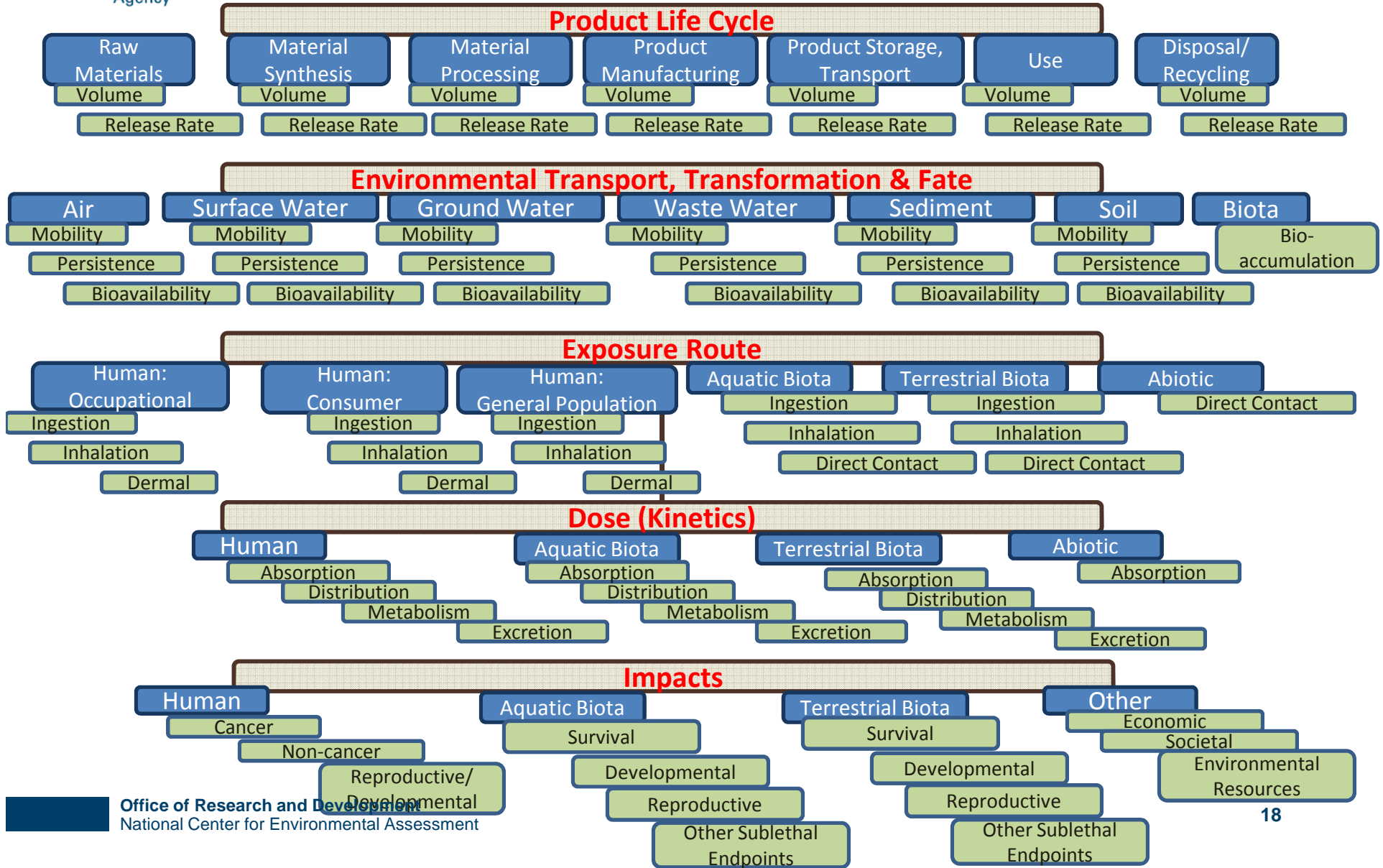
- Broader impacts (e.g., energy use)

- Risk assessment ↔ risk management

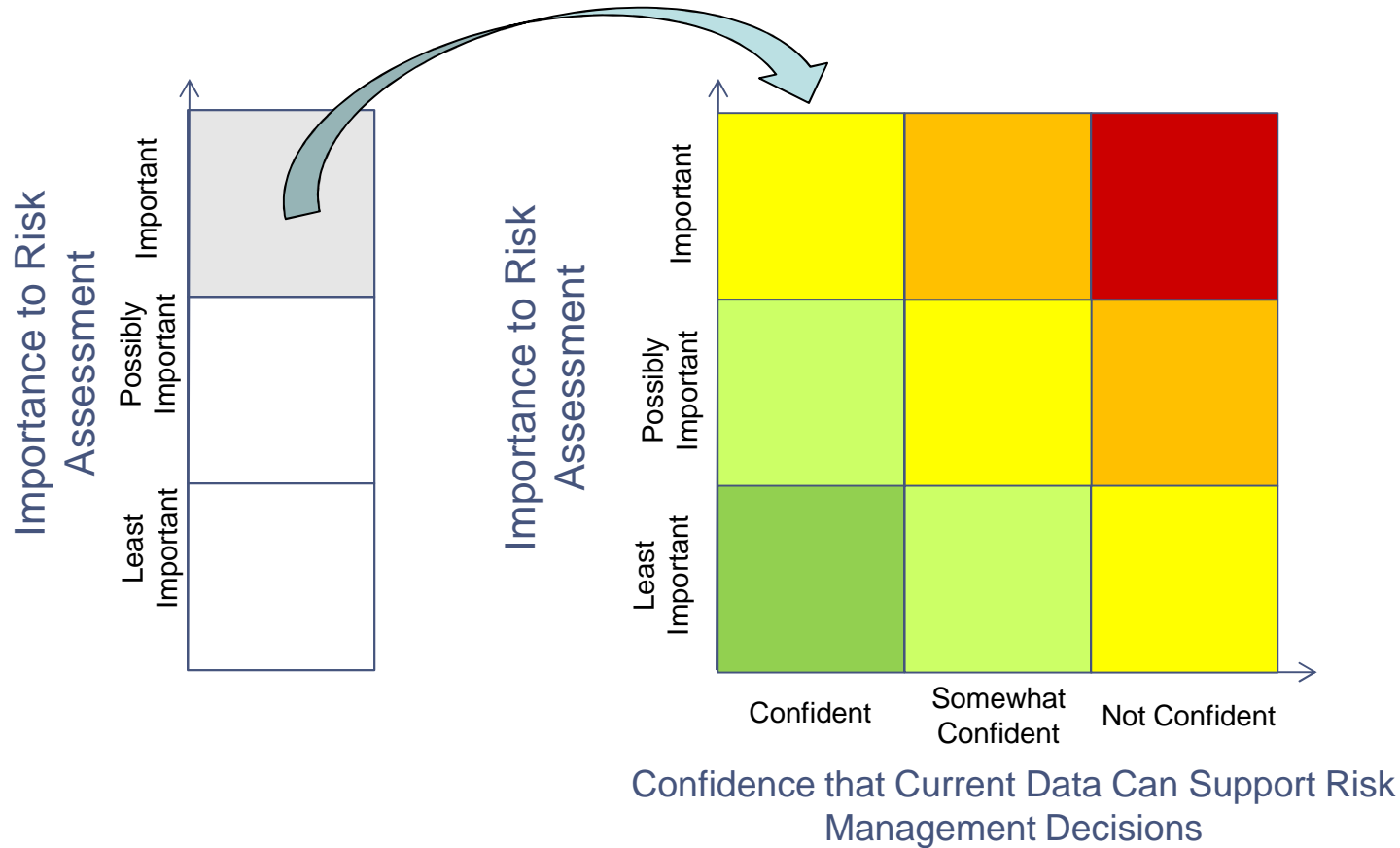
- *Objective: structure information to support collective judgement prioritization for research planning → support research planning → assessments → risk management*



CEA Applied: Engaging Diverse Perspectives on MWCNT in flame-retardant coatings



CEA Applied: Engaging Diverse Perspectives on MWCNT in flame-retardant coatings



*3 Rounds of Structured Rating by diverse participants=>
Research that informs future environmental & human health decision making*

CEA Applied: Face-to-Face Workshop on MWCNTs

Purpose: Derive benefits of diverse perspectives

Structured:

*1) Avoid domination by loudest voice;
all participants contribute equally*

2) Avoid “group think,” remain independent

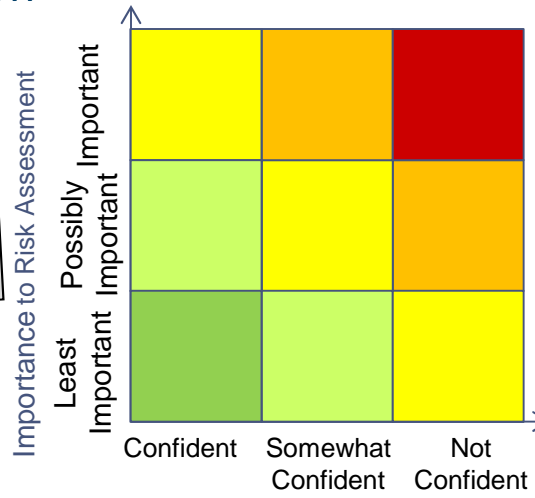


CEA Applied: Face-to-Face Workshop on MWCNTs

*Round 2
Results*



*Structured
Discussion*



3rd Rating Round

Confidence that Current Data Can Support Risk Management Decisions

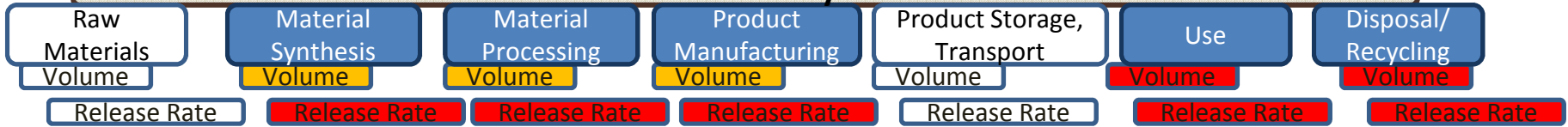
Breakout groups





CEA Applied: Outcomes of Engaging Diverse Perspectives on MWCNTs in flame-retardant coatings

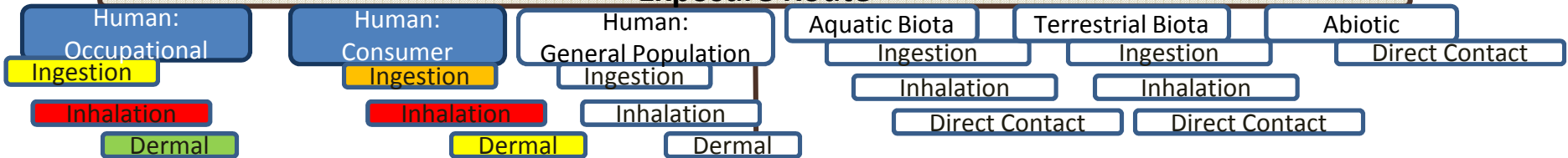
Product Life Cycle



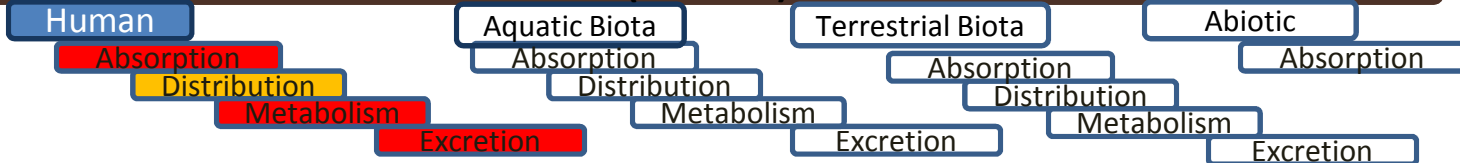
Environmental Transport, Transformation & Fate



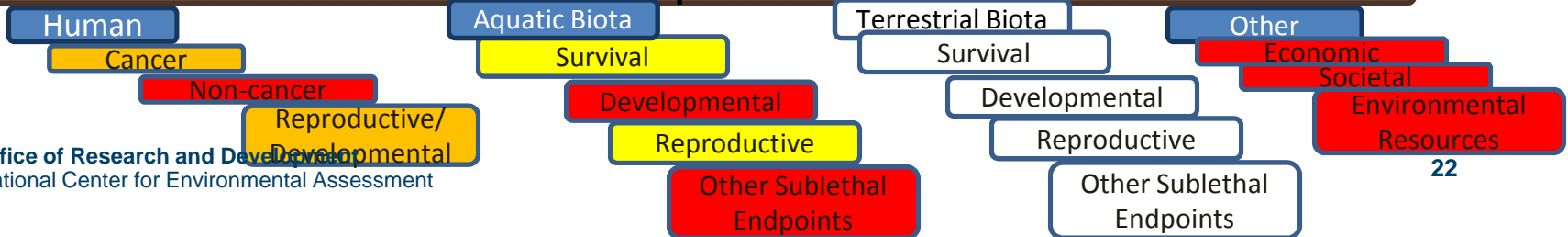
Exposure Route



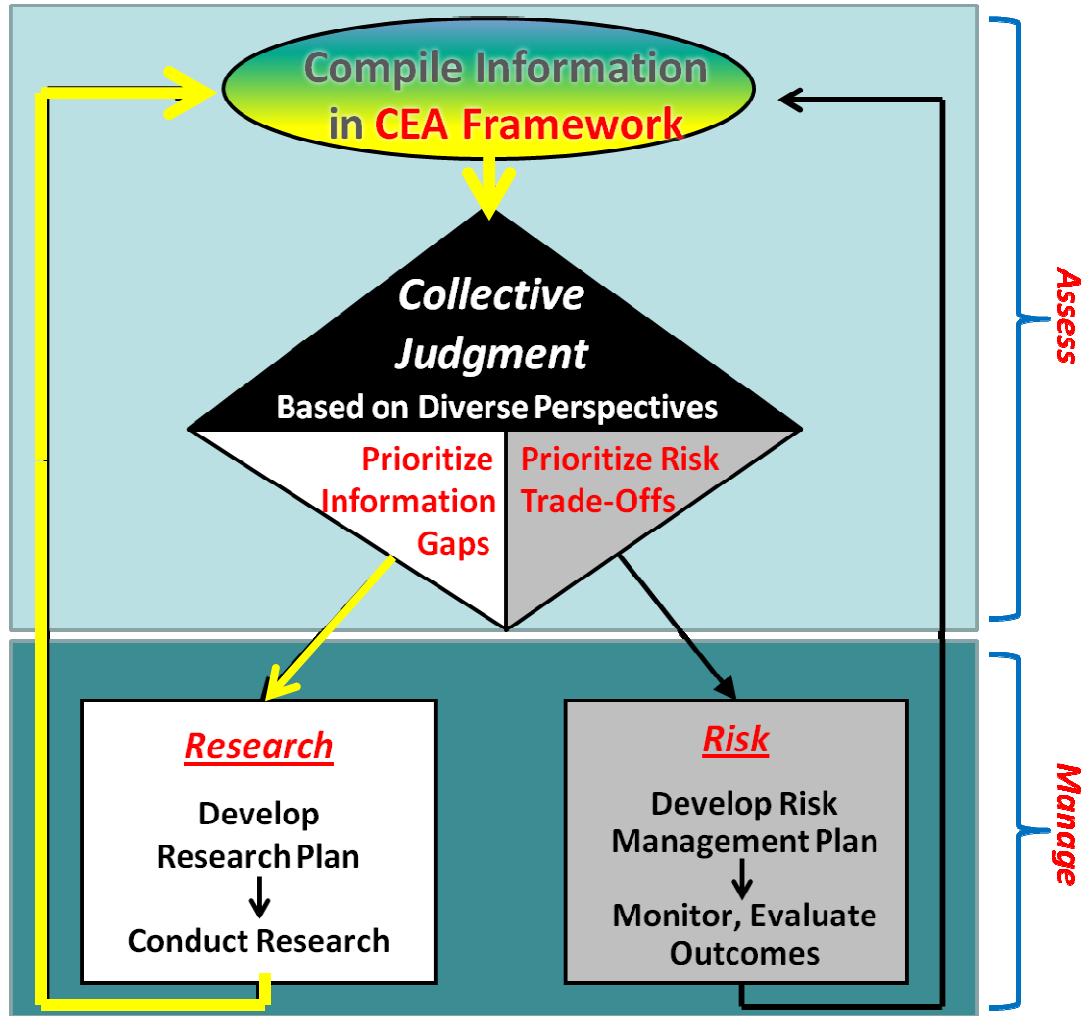
Dose (Kinetics)



Impacts

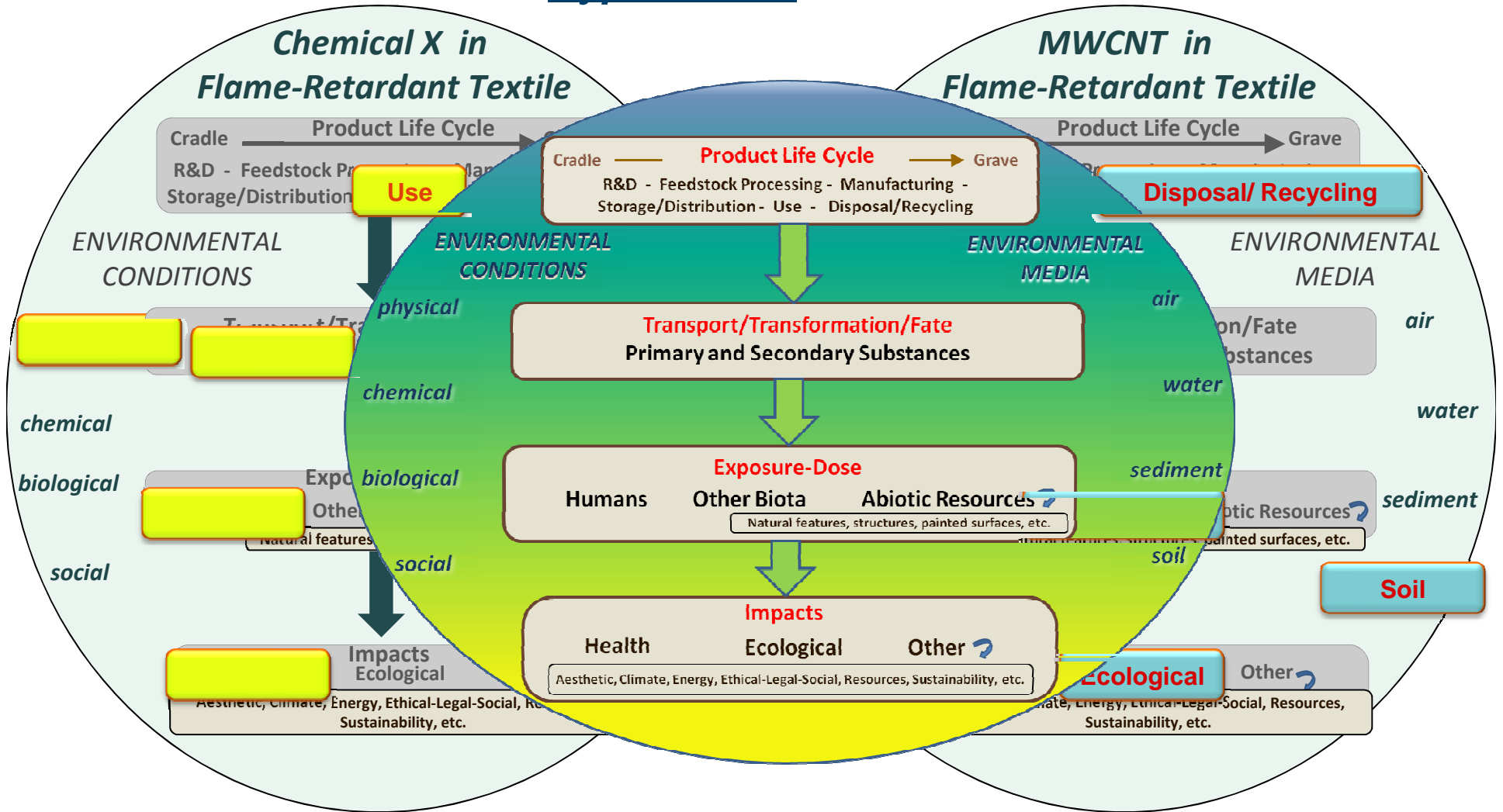


Applying CEA: Future Assessment & Risk Management



Applying CEA: Future Assessment & Risk Management

Hypothetical Trade-Offs



Connecting Research to Understanding Risk: Looking Forward

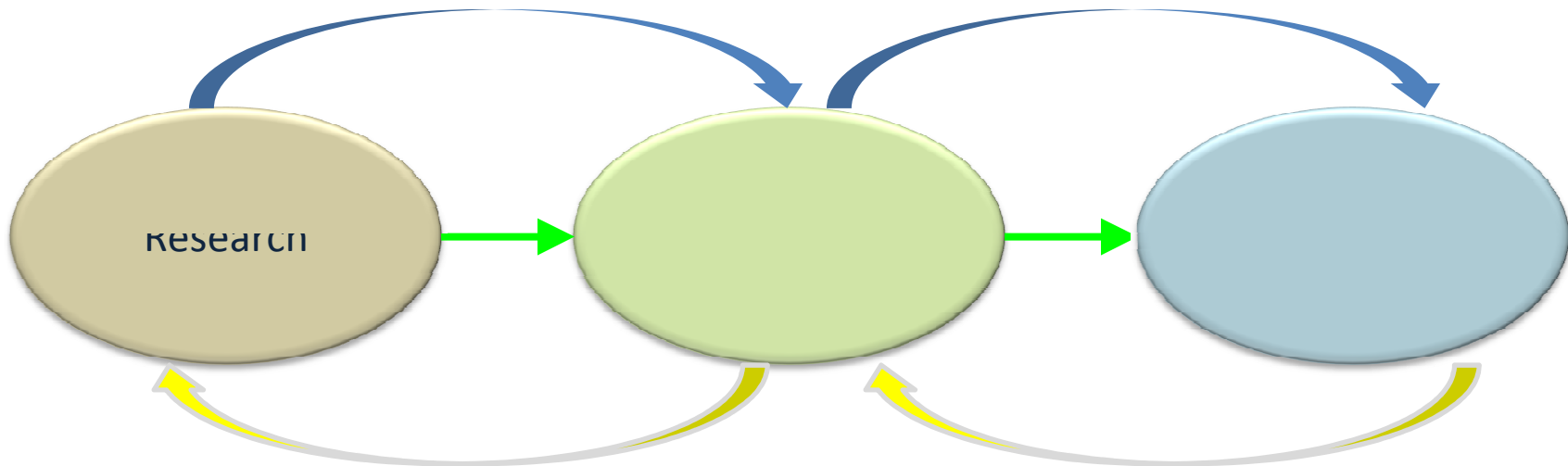
- Opportunities:
 - Implement research priorities

- Tools
 - Web-based interface

- Continued development
 - Screening
 - Inform risk management efforts



A Challenge: Connecting Research to Understanding Risk



*"As individuals we can accomplish only so much. We're limited in our abilities. Our heads contain only so many neurons and axons. **Collectively**, we face no such constraints. We possess incredible capacity to think differently. These differences can provide the seeds of **innovation, progress and understanding.**"*

Page, S.E. (2008)



The CEA Strategy Team

Lyle Burgoon , PhD

Meredith Lassiter, PhD

Geniece Lehmann, PhD

Jeff Gift, PhD

Patricia Gillespie, PhD

Emma McConnell

Kyle Painter

Christy Powers, PhD



Thanks!

Questions and Discussion!

More Information

- U.S. EPA. Nanomaterial Case Study: Nanoscale Silver in Disinfectant Spray (Final Report). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-10/081F, 2012. <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=241665>
- U.S. EPA. Nanomaterial Case Study: A Comparison of Multiwalled Carbon Nanotube and Decabromodiphenyl Ether Flame-Retardant Coatings Applied to Upholstery Textiles (External Review Draft). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-12/043A, 2012. <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=244011>
- U.S. EPA. Nanomaterial Case Studies: Nanoscale Titanium Dioxide in Water Treatment and in Topical Sunscreen (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/057F, 2010. <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=230972>
- Nanomaterial research in the National Center for Environmental Assessment: <http://cfpub.epa.gov/ncea/CFM/nceaQFind.cfm?keyword=Nanomaterials>

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