



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

Applied to Multiwalled Carbon Nanotubes

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EU-US Bridging NanoEHS Efforts

October 26, 2012

Outline

- A Challenge
 - The Comprehensive Environmental Assessment Approach:
Connecting research, assessment, risk management
 - Structure (Framework)
 - Linkage, Prioritization, Diversity (Process)
- Applications
 - 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...”

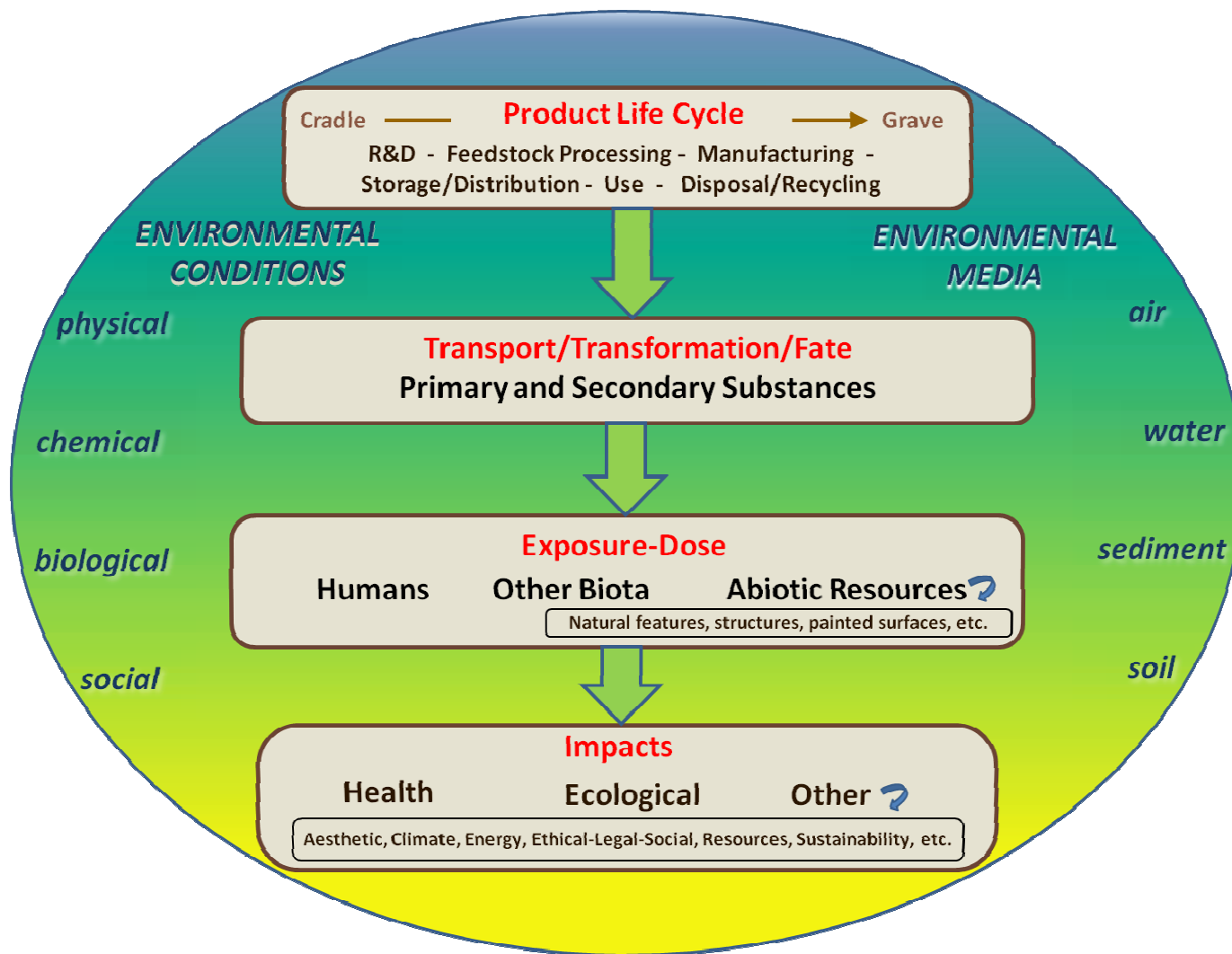
National Research Council (2012), “A Research Strategy for Environmental Health, and Safety Aspects of Engineered Nanomaterials”

The Comprehensive Environmental Assessment (CEA) Approach

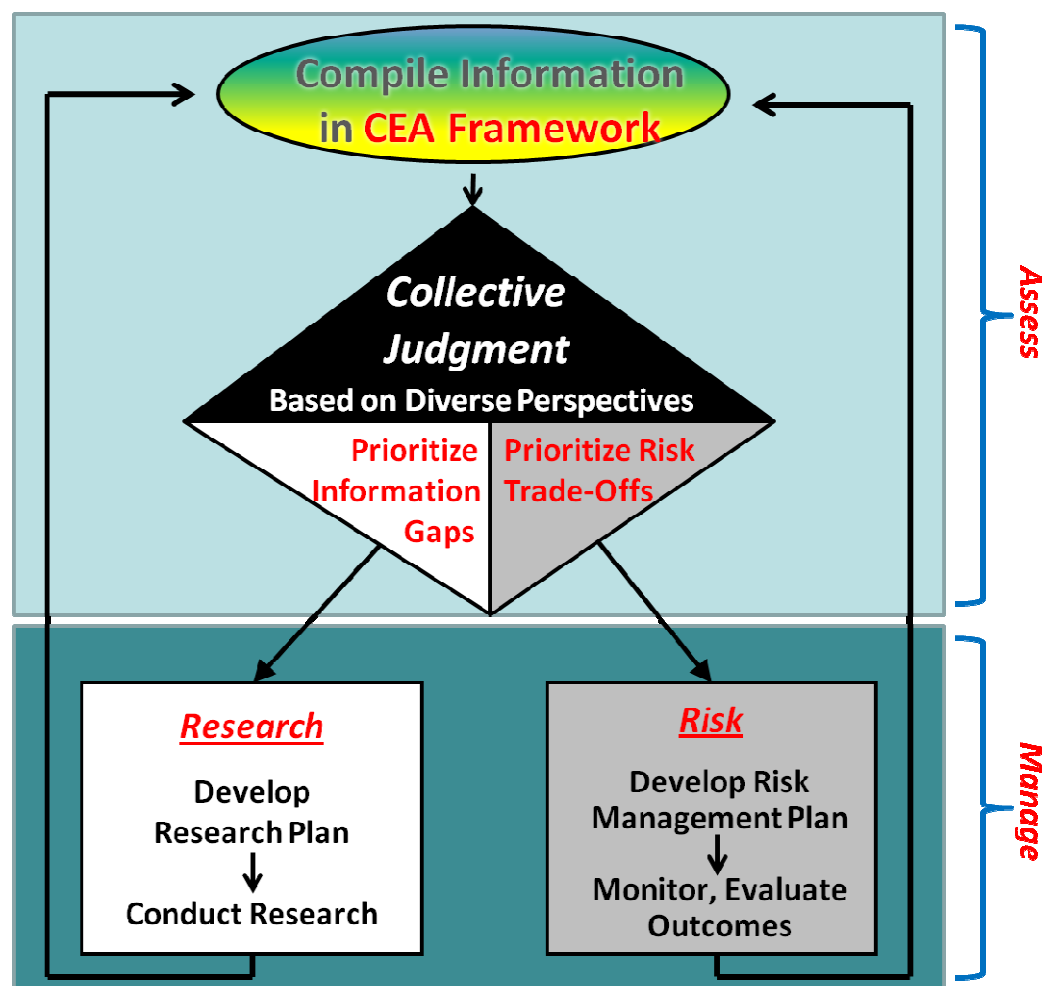


Objective: strategically link research planning, assessment, and risk management efforts

CEA Framework: Structuring Information



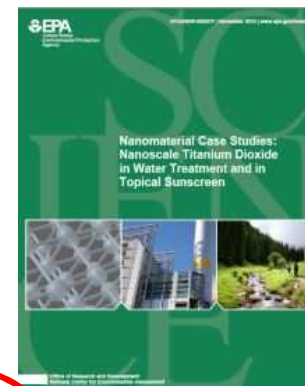
CEA Process: Engaging diverse perspectives



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

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

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3
chips

CNTs (multi-walled) in flame-retardant coatings & composites

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 »

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chips

Carbon nanotubes (multi-walled) in rubber tires

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 »

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5
chips

Carbon nanotubes (single-walled) in textiles

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

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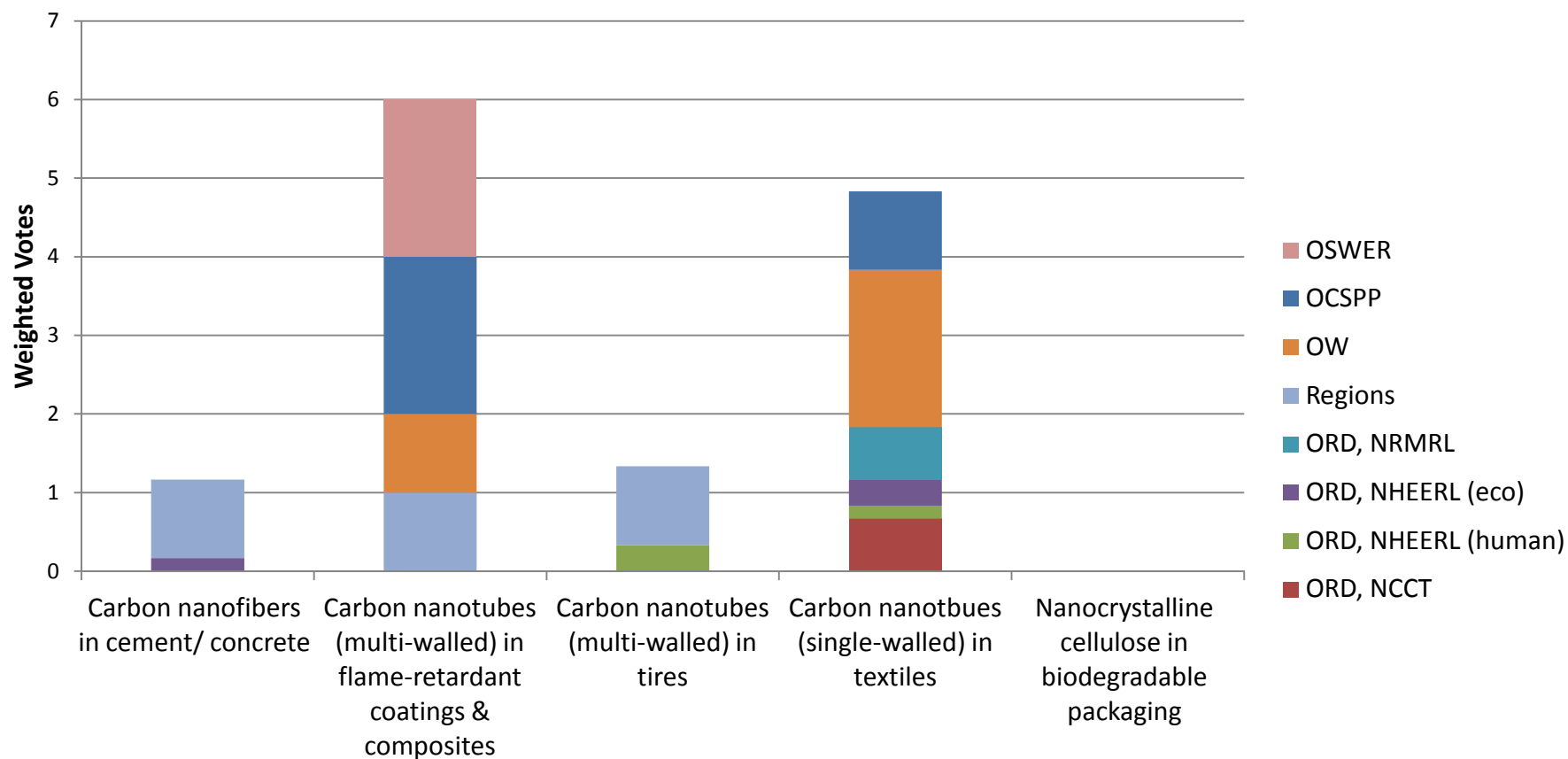
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Nanocrystalline Cellulose in biodegradable packaging

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 »

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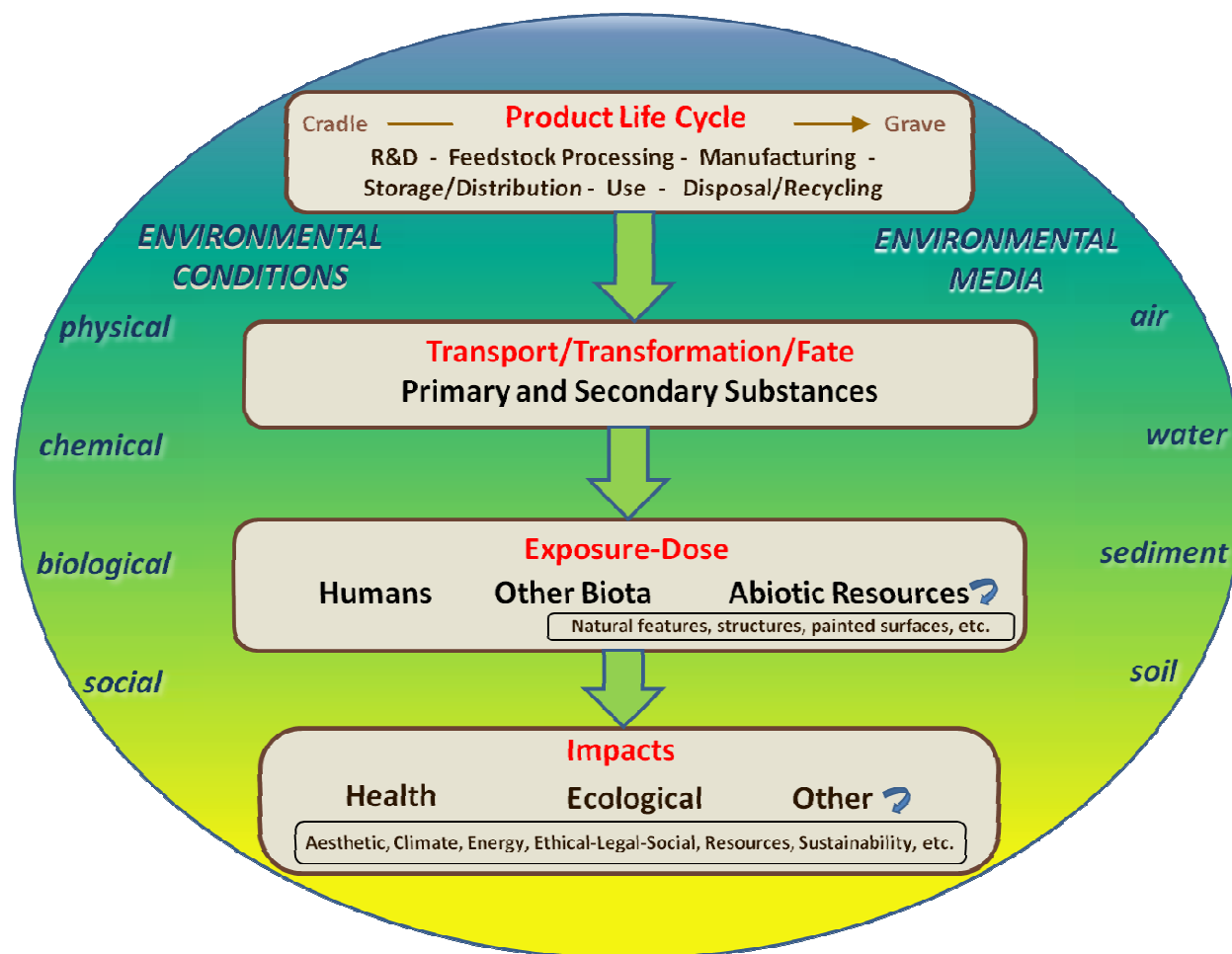
CEA Applied: Multiwalled carbon nanotubes (MWCNNTs) in flame-retardant coatings applied to upholstery textiles



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”

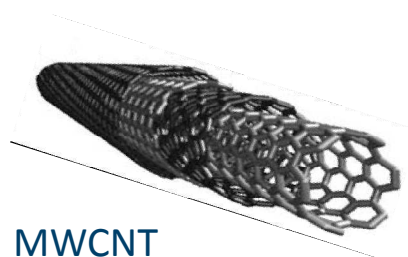
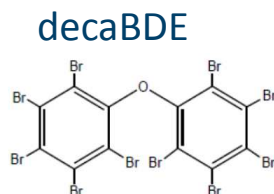


- *Objective: structure information to support collective judgement prioritization for research planning → support research planning → assessments → risk management*

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*

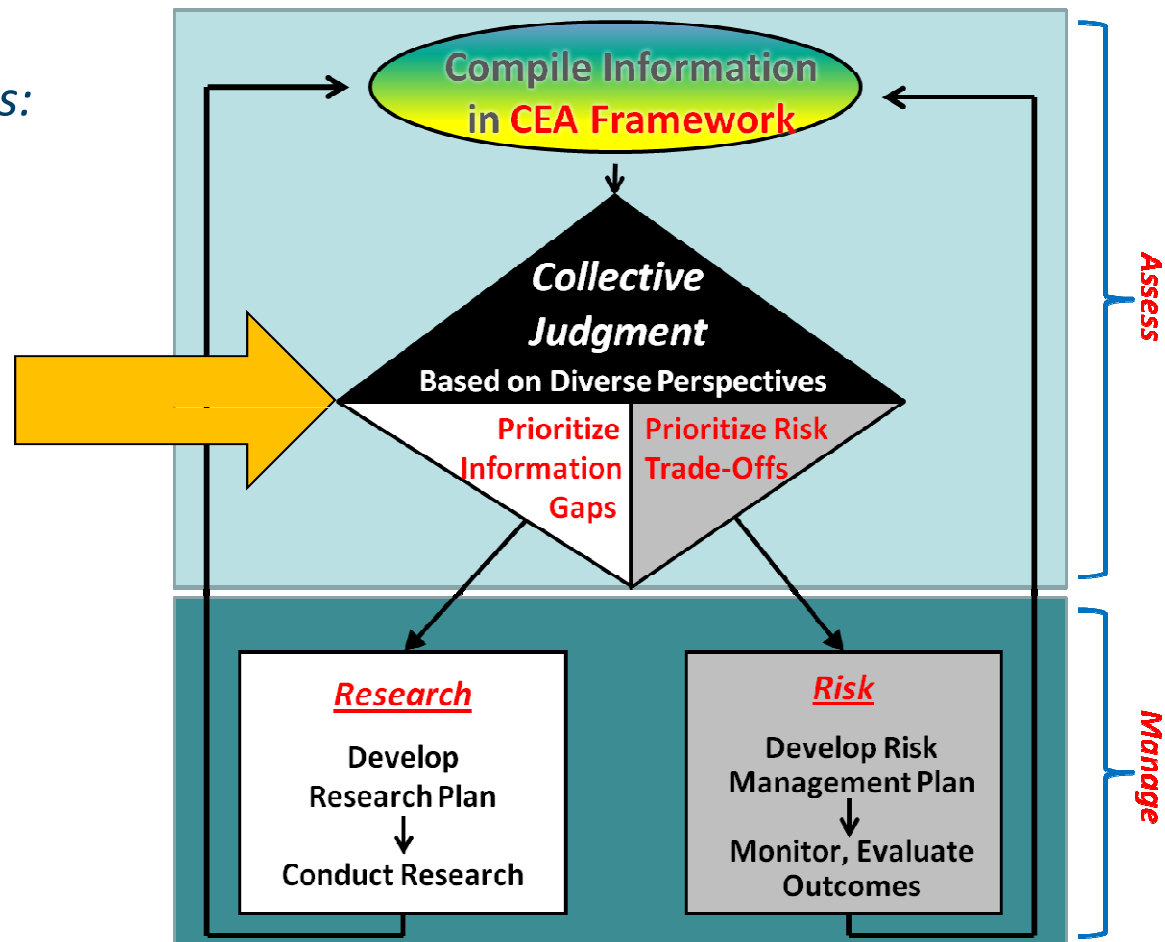
CEA Applied: Engaging Diverse Perspectives on MWCNT in flame-retardant coatings

- *Building on previous workshops:*

- *Three prioritization rounds*

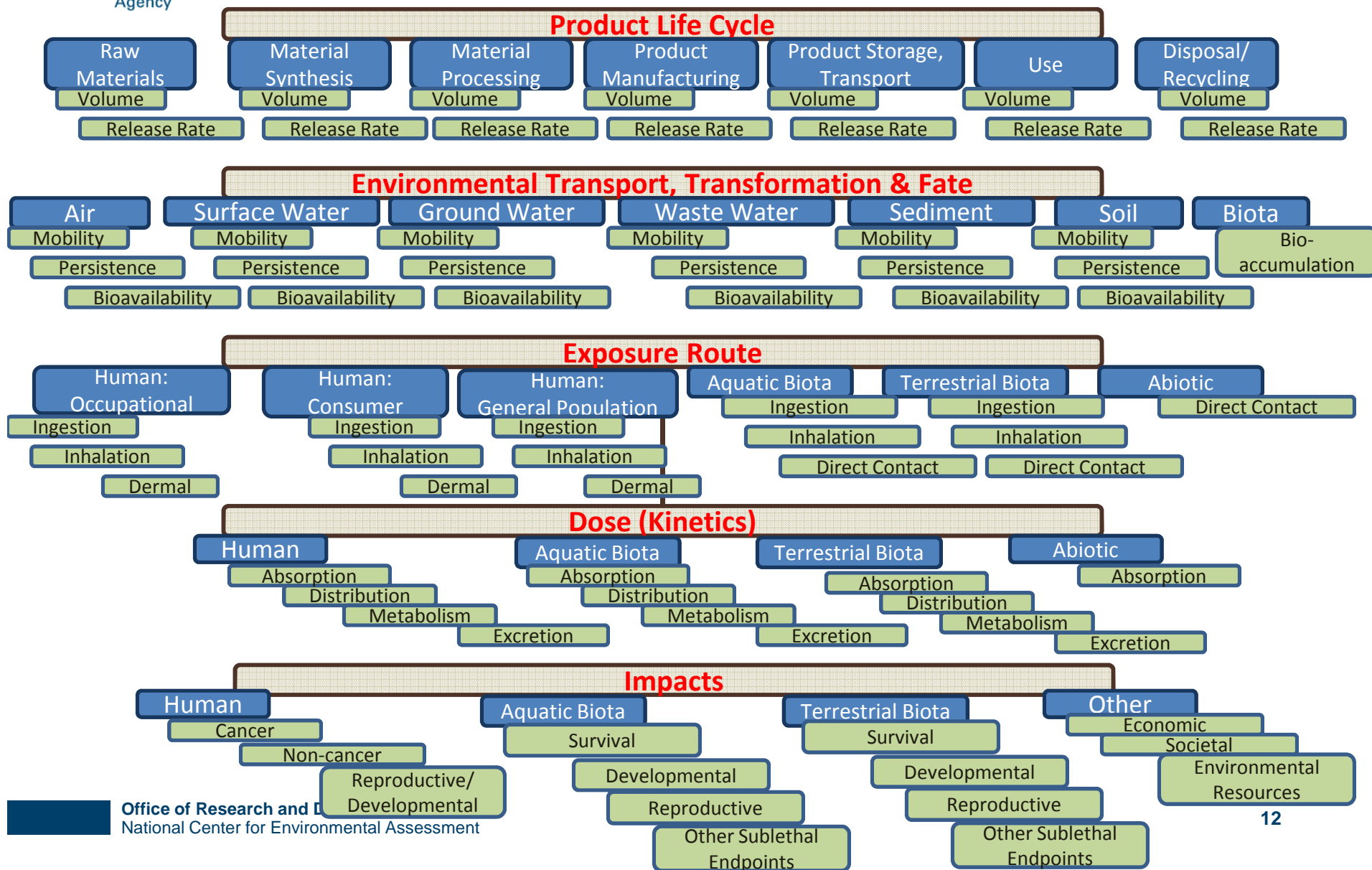
- *Prioritization based on*

- *Outcome*

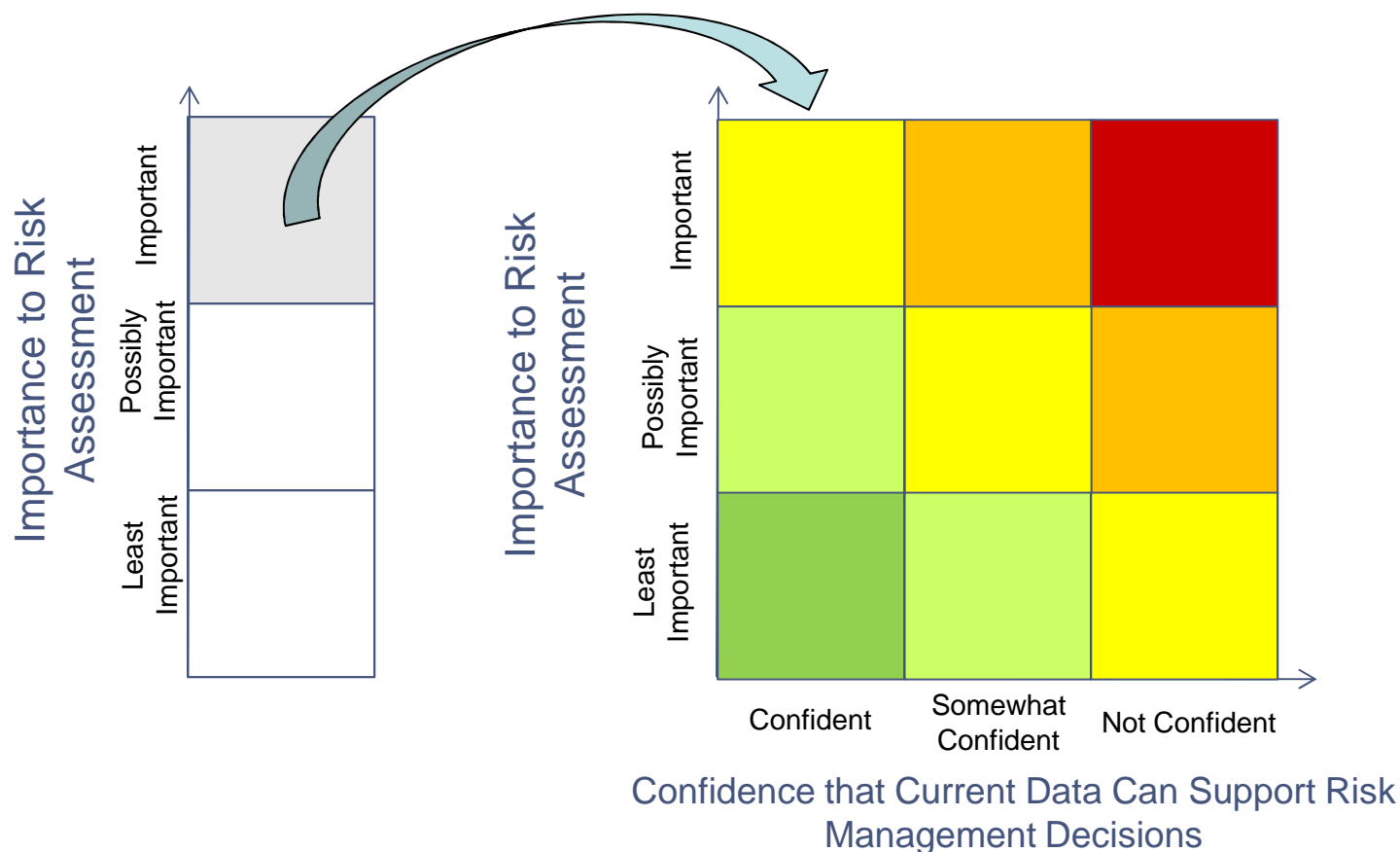


<http://www.epa.gov/nanoscience/files/CEAPrecis.pdf>

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



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



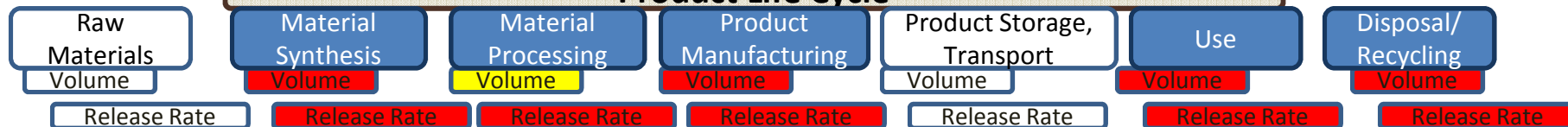
Rating by diverse participants=>

Research that informs future environmental & human health decision making



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

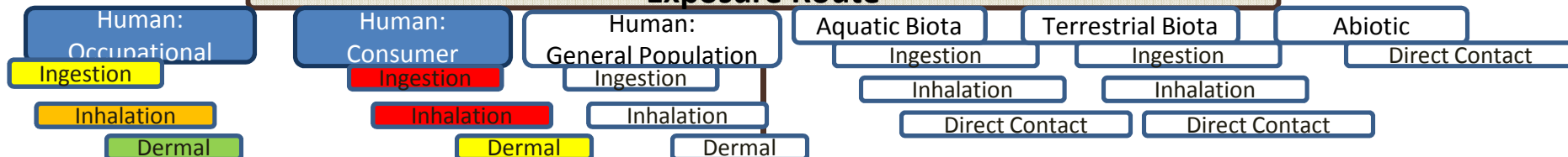
Product Life Cycle



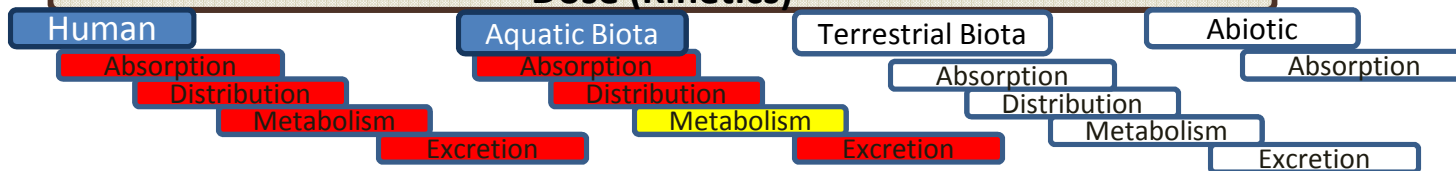
Environmental Transport, Transformation & Fate



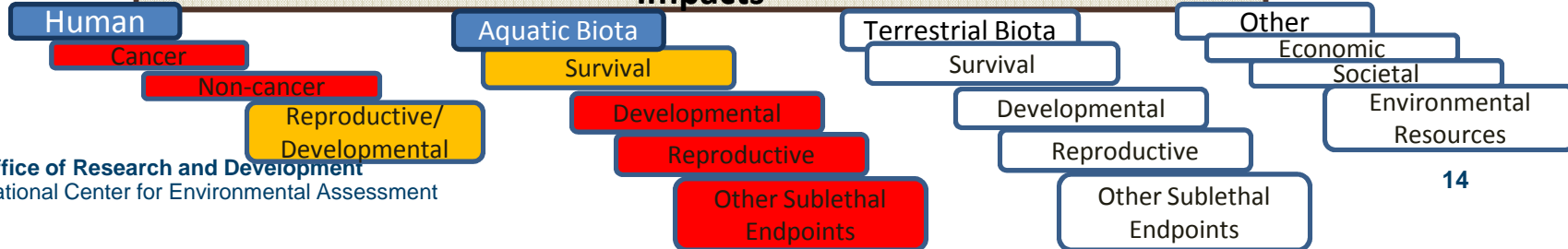
Exposure Route



Dose (Kinetics)



Impacts



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*

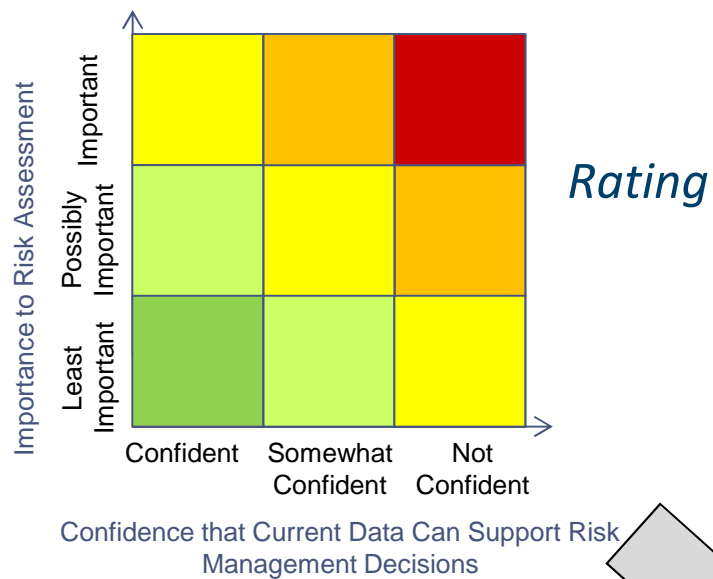
2) *Avoid “group think,” remain independent*



CEA Applied: Face-to-Face Workshop on MWCNTs



















*Structured
Discussion*



Breakout groups



Applying CEA: Future Assessment & Risk Management

Raw Materials	 Full Text	Complete
Material Synthesis	 Full Text	In Progress
Material Processing	 Full Text	In Progress
Product Manufacturing	 Full Text	Incomplete
Product Storage, Transport	 Full Text	Incomplete
Use	 Full Text	Incomplete
Disposal/Recycling	 Full Text	Complete
Environmental Transport, Transformation & Fate		Status
Air	 Full Text	Complete
Surface Water	 Full Text	Incomplete
Groundwater	 Full Text	In Progress
Wastewater	 Full Text	Incomplete
Sediment	 Full Text	Incomplete
Soil	 Full Text	Incomplete
Biota	 Full Text	Incomplete
Exposure Route		Status
Human: Occupational	 Full Text	Incomplete
Human: Consumer	 Full Text	Incomplete

Nanocarbon

CEA Level: Exposure Route

Human: Occupational

Status: Not Completed

Rating

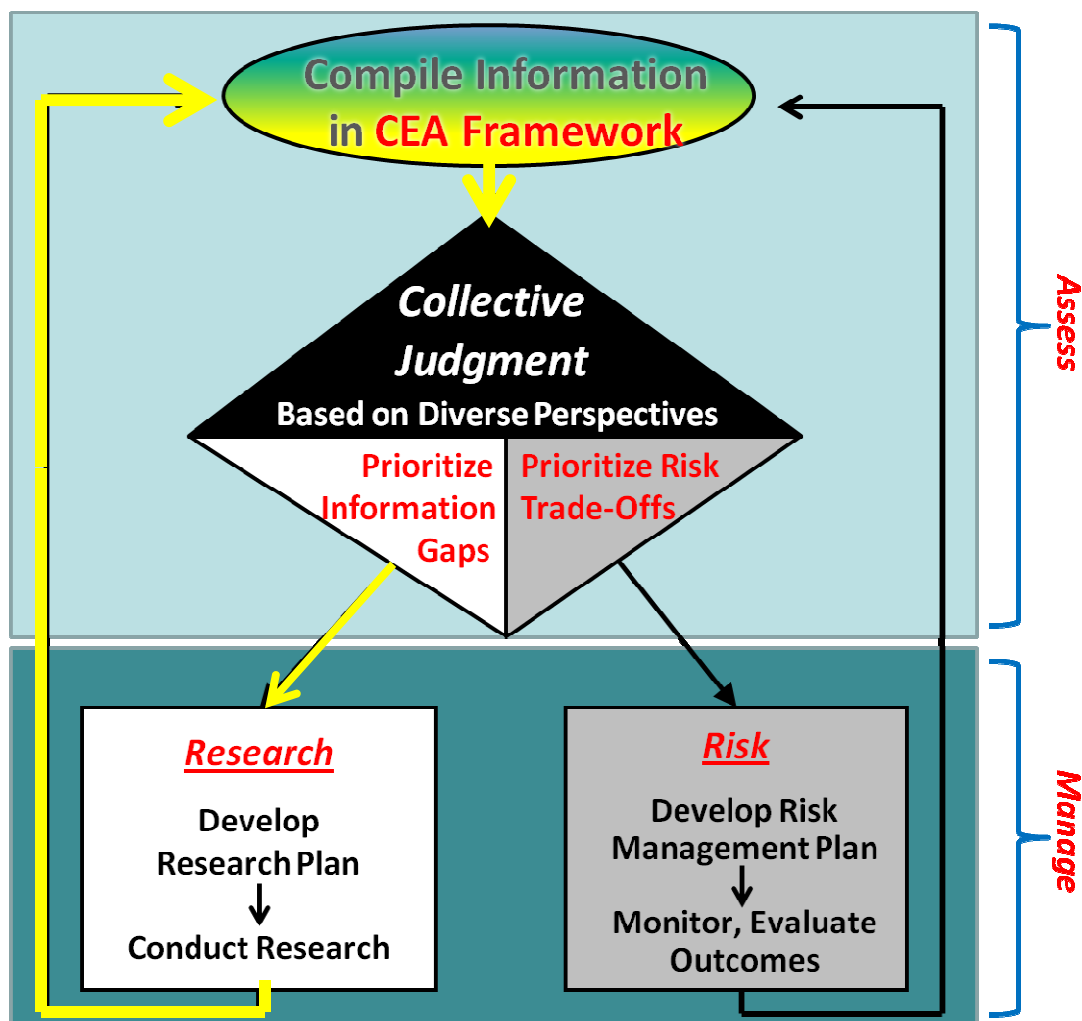
- ☐ Important
☐ Possibly Important
☐ Least Important

Save and Go to Human: Consumer

Save and Go to Navigation

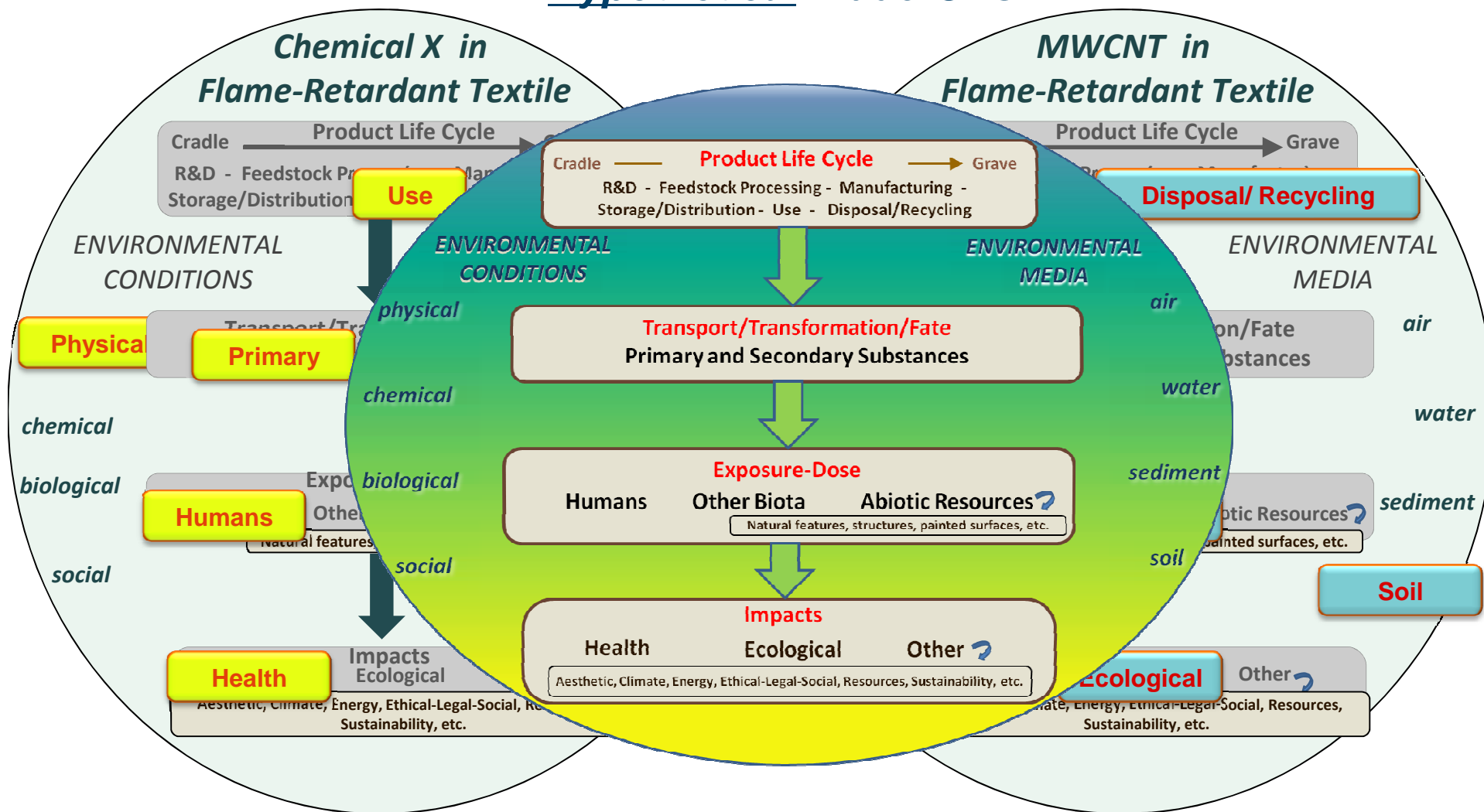
- Facilitates external stakeholder engagement in prioritization of research gaps
- Pilot underway for research planning

Applying CEA: Future Assessment & Risk Management



Applying CEA: Future Assessment & Risk Management

Hypothetical Trade-Offs



A Challenge: Connecting Research to Understanding Risk



➤ *CEA objectives*

➤ *Applications*

- *Opportunities*
- *Tools*

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

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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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