EPA
United States
Environmental Protection
Agency

An Overview of ORD and It's Computational Toxicology Program

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30 May 2012

Charge Questions

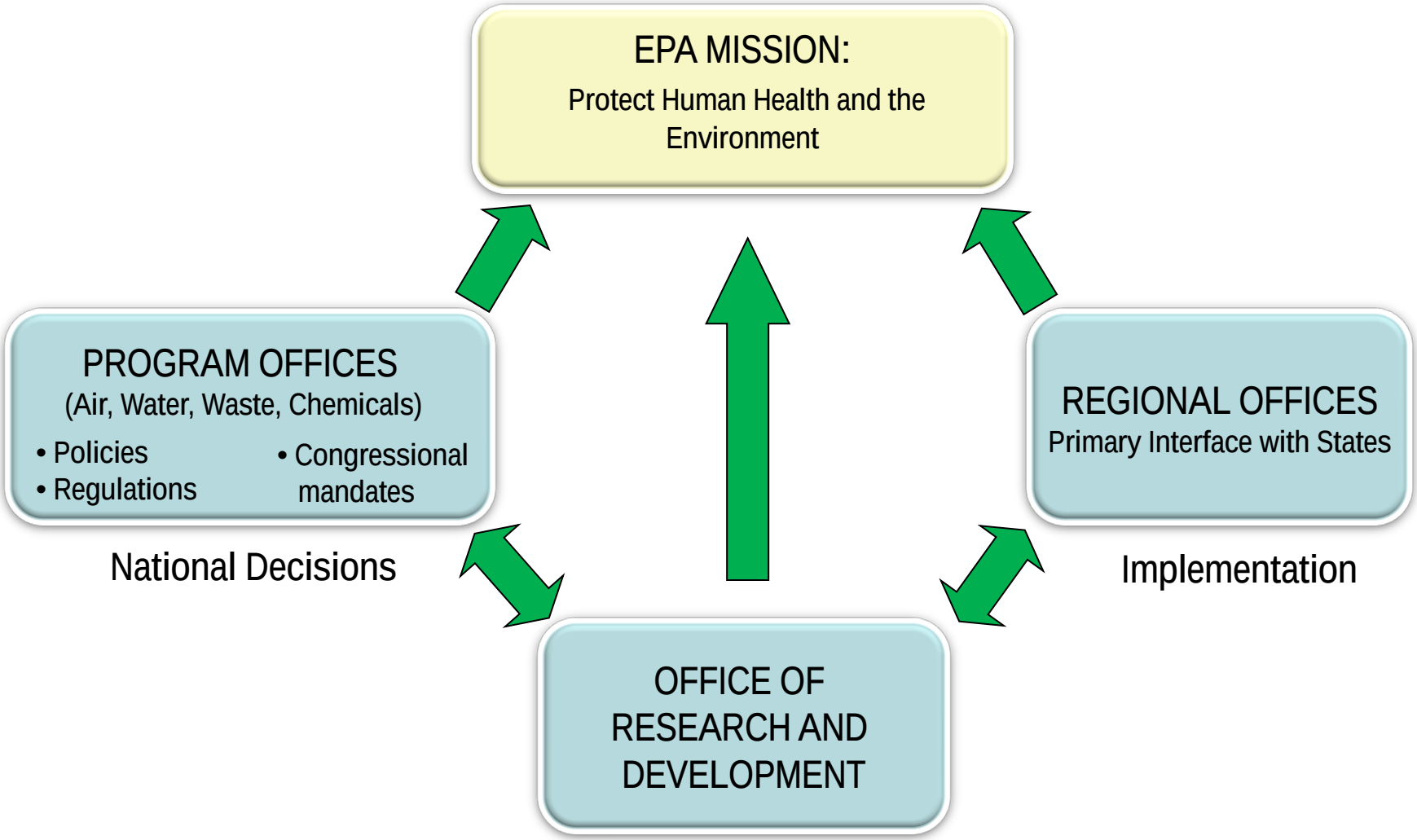
- As EPA prepares for the 21st-century toxicity testing to inform decision making, what specific issues should it consider in areas of identifying sufficient and appropriate data for risk assessment and risk characterization. How would these differ, or be the same, for such EPA applications as chemical screening, prioritization, risk assessment and green chemistry

- What are the barriers that prevent EPA from using outputs of the CompTox program, if any, in support of programmatic needs?
  - How might they be overcome?
  - What are the challenges of acceptance of 21st-century approaches as part of the weight of the evidence in decision making, what might EPA do to address these challenges?

- How well do the outputs of the CompTox program align with EPA's programmatic needs?
  - Are the outputs of the CompTox program currently being used in EPA, If not, why not?

- How should the use of the CompTox program outputs be effectively communicated to stakeholders? What additional research of other steps should be taken to enhance communication?

ORD's Role in Achieving EPA's Mission



Mission of EPA's Office of Research and Development (ORD)

Provide the scientific foundation to support the EPA's mission by:

- **Conducting research and development** to identify, understand, and solve current and future environmental problems
- **Providing responsive technical support** to EPA's Programs and Regions
- **Collaborating with our scientific partners** in academia and other agencies, private-sector organizations, state and tribal governments, and other nations
- **Exercising leadership** in addressing emerging environmental issues and advancing the science and technology of risk assessment and risk management

How ORD Develops its Research Programs

United States Environmental Protection Agency

Decision Inputs

- Programs and Regions (RCTs)
- EPA Strategic Plan
- Administration's priorities
- Congressional mandates
- BOSC Reviews
- SAB, NAS, other external advice
- Stakeholders

ORD Executive Council

Corporate Decisions on

What We Do . . . and . . . *How We Do It*

Planning the Program — *Implementing the Program*

NPDs

Decide What Research Area-Specific Work We Do and When We Do It

L/C Directors

Responsible for Developing ORD's Research Products

L/C Directors

Decide How ORD Produces its Research Products

NPDs

Responsible for Communicating Products to Clients

Evaluation

- Program and Regional Office Feedback
- BOSC Program Evaluations
- SAB, NAS, and other advisory bodies
- OMB Reviews
- Stakeholders

A Systems Approach to Sustainability

United States Environmental Protection Agency

Industry
(products, energy)

Society
(communities, governments)

Products, Services

Labor

Recycle

Reuse

Ecological goods and services

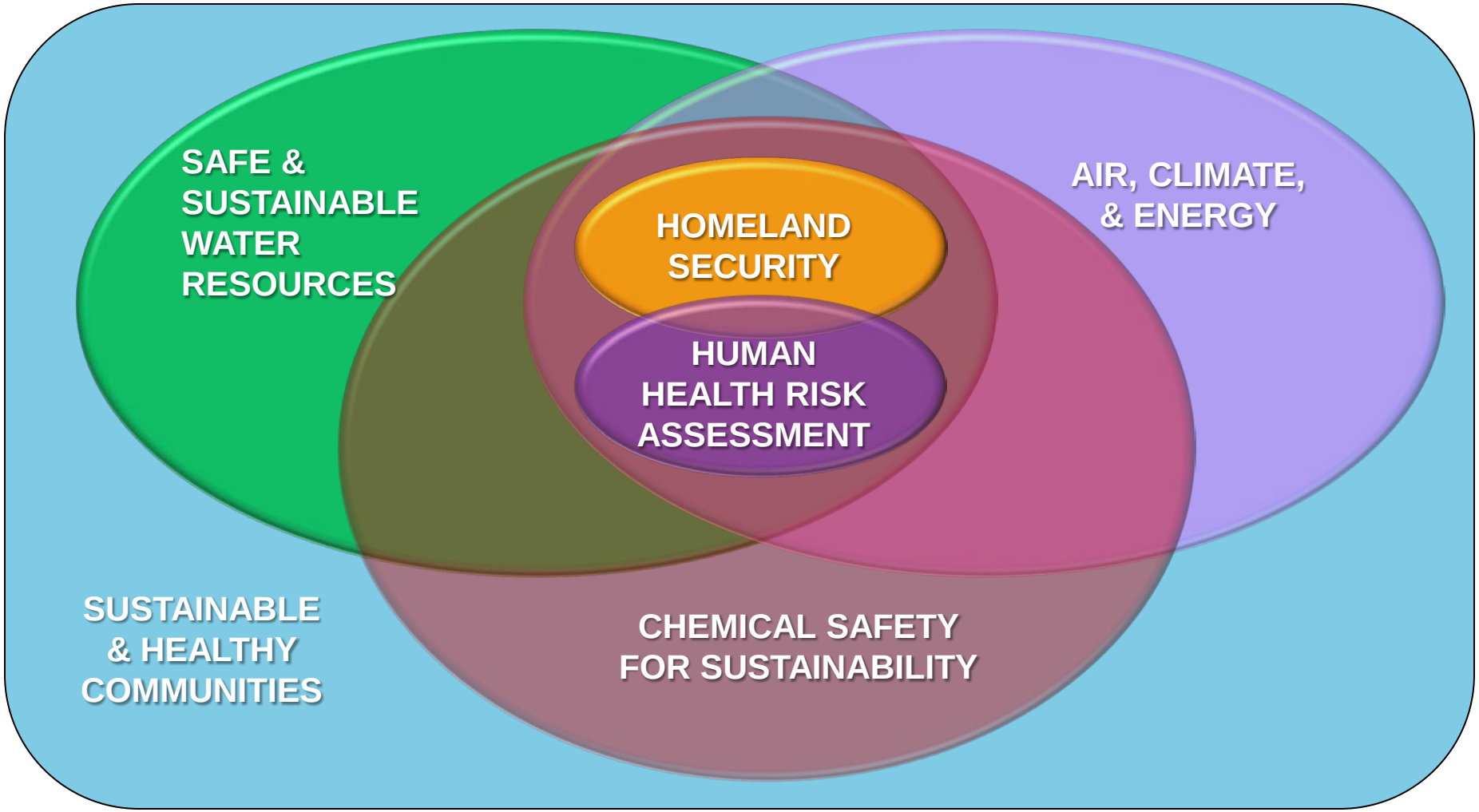
Ecological goods and services

Minimize impact of waste and emissions on the environment and protect our ability to produce ecological goods

Environment (air, water, land, humans & ecosystems)

Adapted from: J. Fiksel, A Framework for Sustainable Materials Management, *Journal of Materials*, August 2006.

Integrated ORD Research Programs



Administrator Jackson's Priorities

- Reducing Greenhouse Gas Emissions
- Improving Air Quality
- Managing Chemical Risks
  - "More that 30 years after Congress enacted the Toxic Substances Control Act, it is clear that we are not doing an adequate job of assessing and managing risks of chemicals in consumer products, the workplace and the environment. It is now time to revise and strengthen EPAs chemicals management and risk assessment programs"
  - "…we must be sensitive to the burdens pollution has placed on vulnerable subpopulations, including children, the elderly, the poor and all others who are at particular risk to threats to health and the environment. We must seek their full partnership in the greater aim of identifying and eliminating the sources of pollution in their neighborhoods, schools and homes."
- Cleaning up Hazardous Waster Sites
- Protecting America's Water

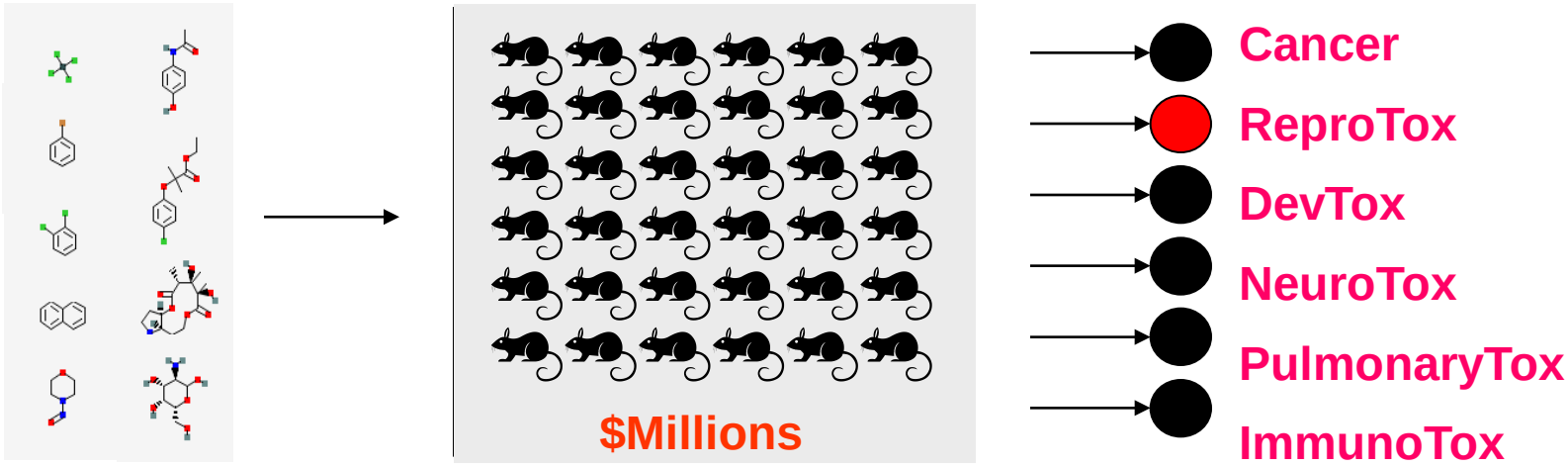
Source: Memo to EPA Employees, January 23, 2009
http://www.epa.gov/administrator/memotoemployees.html

Office of Research and De

Current Approach to Toxicity Testing

United States Environmental Protection Agency

***in vivo* testing**



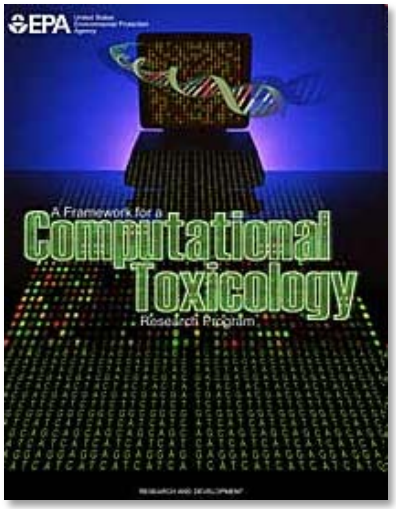
For a food use pesticide: up to $10m in toxicology, $1m to interpret, years to complete

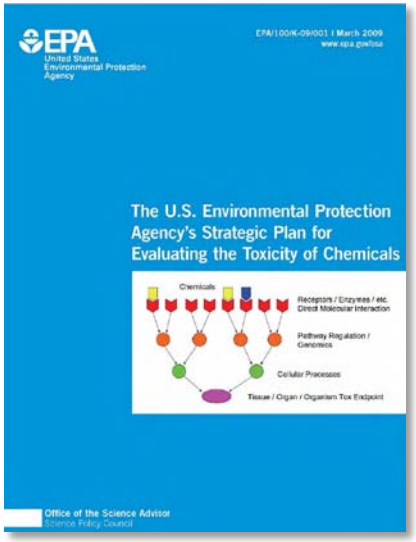
21st Century Chemicals-Related Research Needs

- Understanding environmental **impacts throughout chemical life cycles**—from production, through use, to disposal/recycling
- **Enabling more, and more-timely, chemicals-related decisions** by developing integrated testing strategies and risk prediction approaches that are cheaper, faster, and more reliable, as well as more informative for risk management purposes
- Targeting key complex issues such as **characterizing mixtures of chemicals**, understanding the significance of intermittent chemical exposures, and assessing **individual susceptibilities** to chemical exposures **over life stages**
- Developing **virtual tools** (i.e., liver, embryo) for predicting human health impacts
- Combining recent advances in computational toxicology with **cumulative exposure information** to inform risk assessments
- Identifying opportunities to **apply green chemistry** principles

A Fast Moving Decade

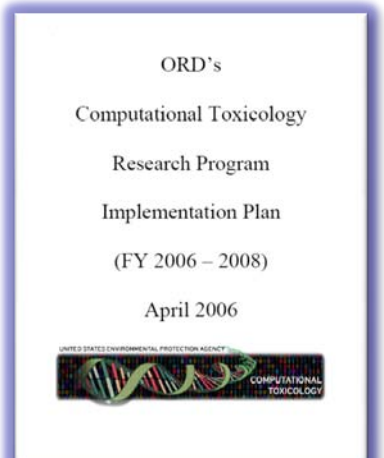
United States Environmental Protection Agency

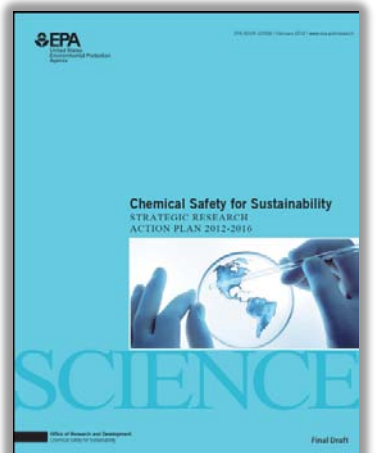




2003 **2005** **2007** **2009** **2011**

2004 **2006** **2008** **2010** **2012**





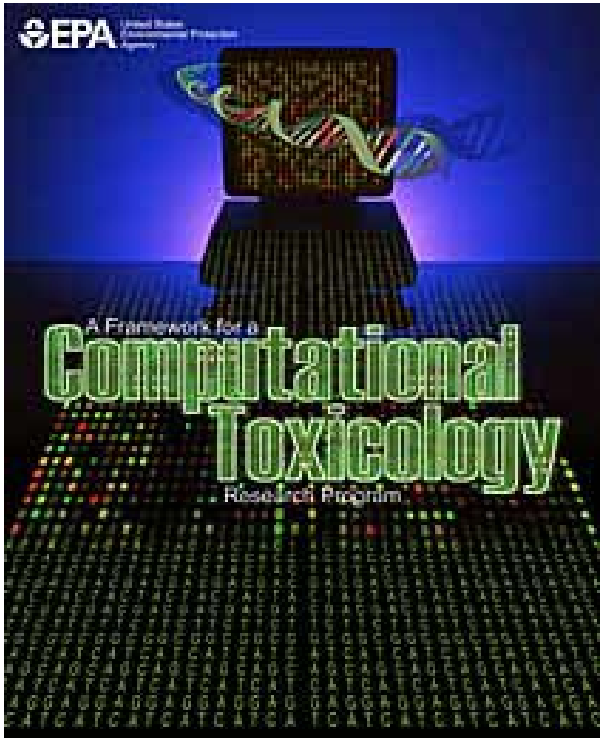
The Framework for a CompTox Program (2003)

Goals:

- Improve Linkages in the Source to Outcome Paradigm
- Provide Predictive Models for Hazard Identification
- Improve Quantitative Risk Assessment (Dose, Species, Chemical)

Success:

- Measured by ability to produce faster and more accurate risk assessments for less cost relative to traditional means and to classify chemicals by their potential to influence molecular and biochemical pathways of concern

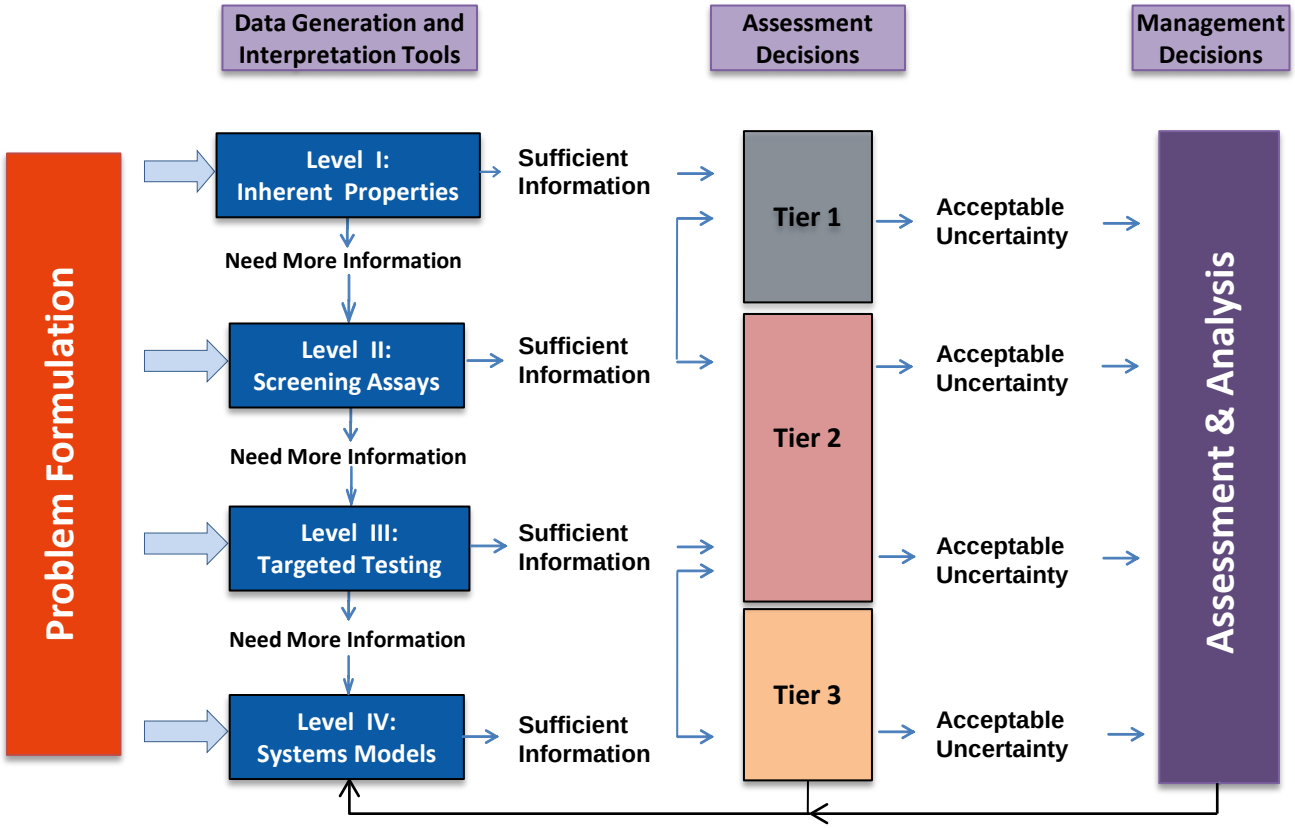


Tox21 Robot Ribbon-Cutting (March 10, 2011)

EPAs Chemical Safety for Sustainability Research Program

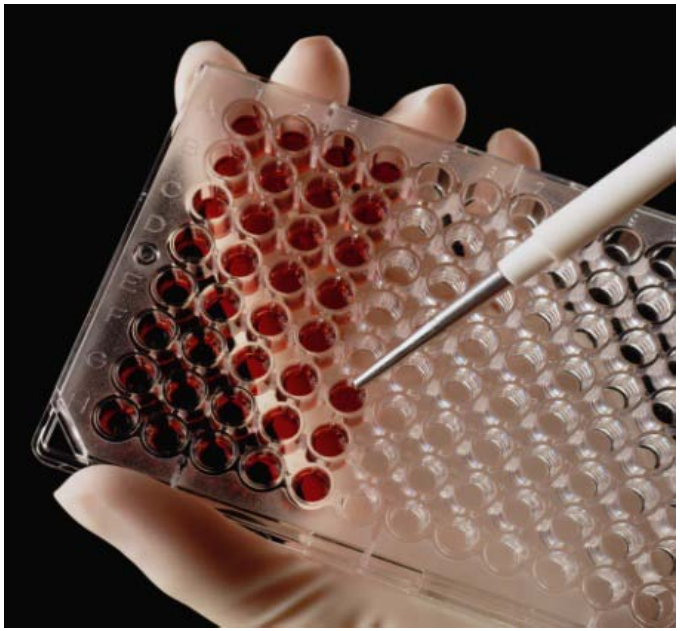
- Improve protection of human health and environment by evaluating chemicals for potential risks
- Assess potential risks of nanomaterials and endocrine disrupting chemicals
- Use advances in computational toxicology research to assess toxicity of chemicals
- Provide tools and guidance for "greener" chemical production to improve environmental sustainability

CSS Conceptual Model

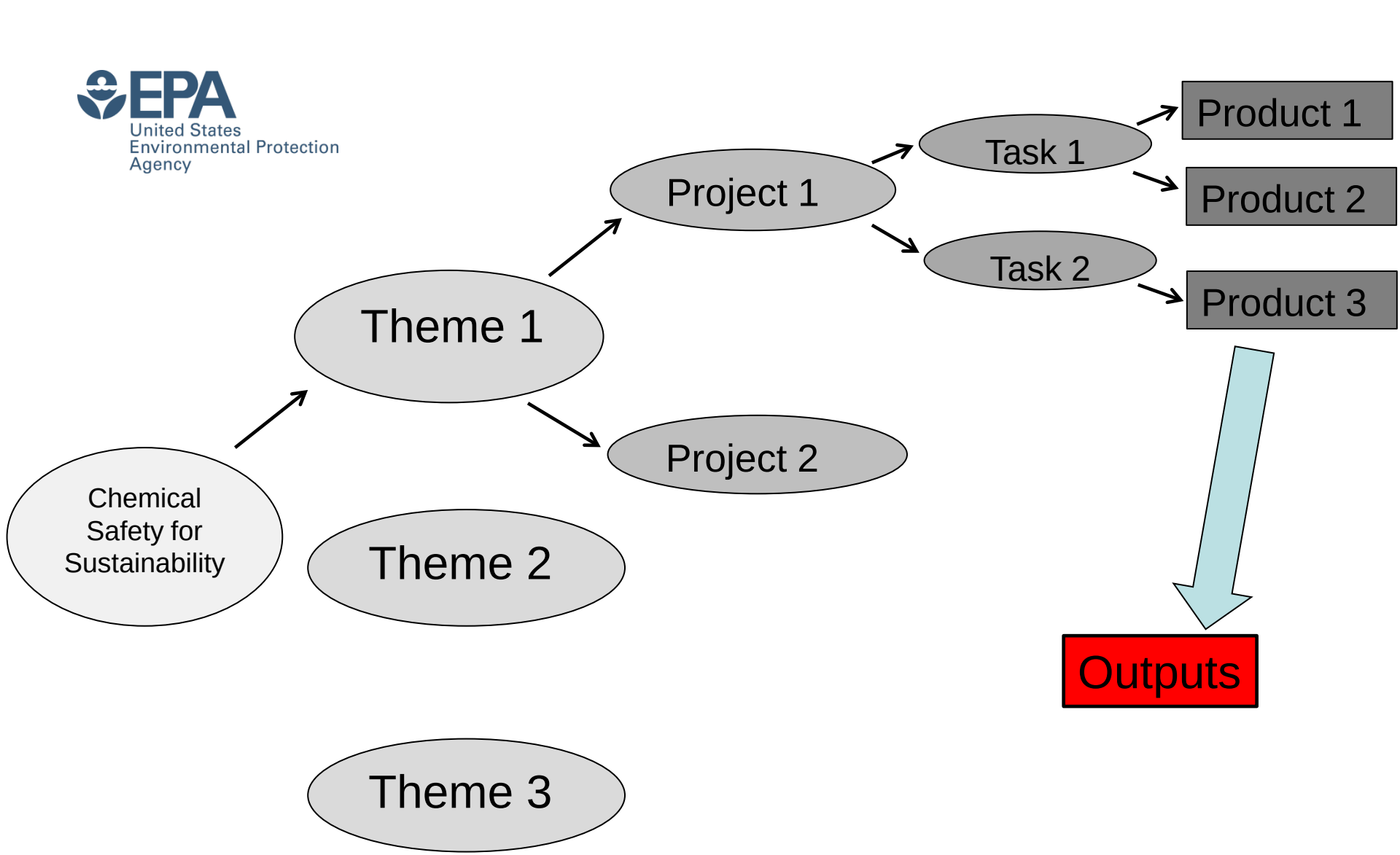


Chemical Safety for Sustainability (CSS) Research Program

8 Research Themes



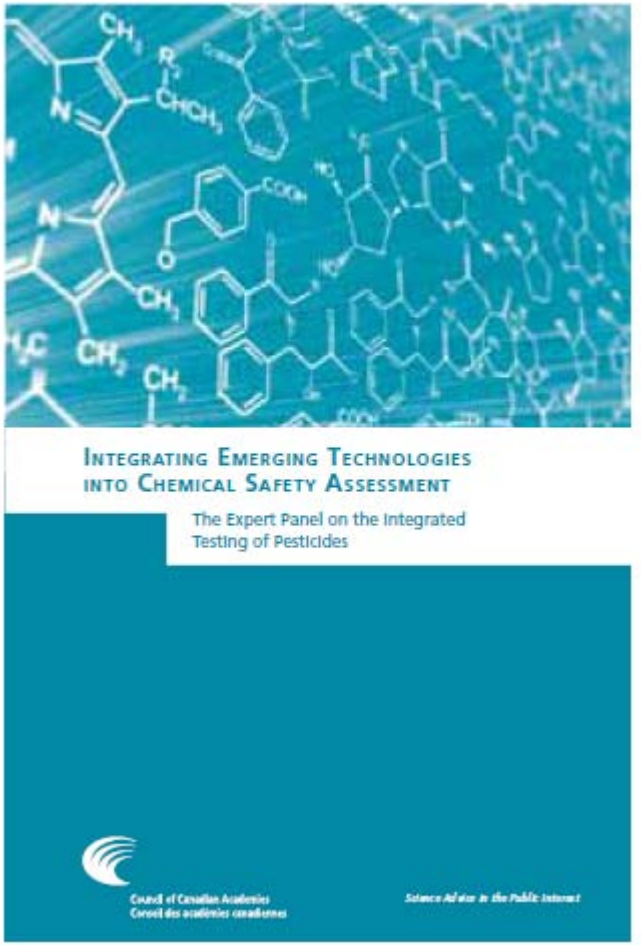
- Chemical Inherency
- Systems Models
- Biomarkers
- Cumulative Risk
- Life Cycle Considerations
- Extrapolation
- Dashboards
- Evaluation


EPA
United States
Environmental Protection
Agency
Chemical
Safety for
Sustainability
Theme 1
Theme 2
Theme 3
Project 1
Project 2
Task 1
Task 2
Product 1
Product 2
Product 3
Outputs

[8] [21] [55] [~320]

"The issues inherent in the current approach to chemical testing are two-fold: to address the lack of toxicity data for the vast majority of industrial chemicals and to recognize that regulatory decisions must be based on the best available science. The Panel believes that these challenges can be best met by adopting an Integrated Approach to Testing and Assessment (IATA)."

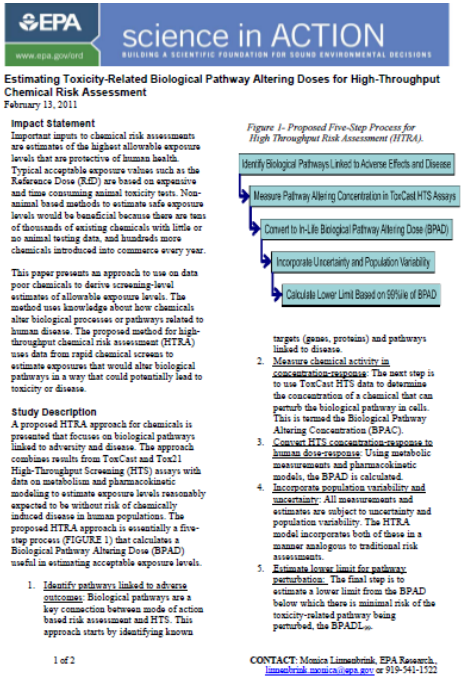
– Leonard Ritter, Chair of the Expert Panel



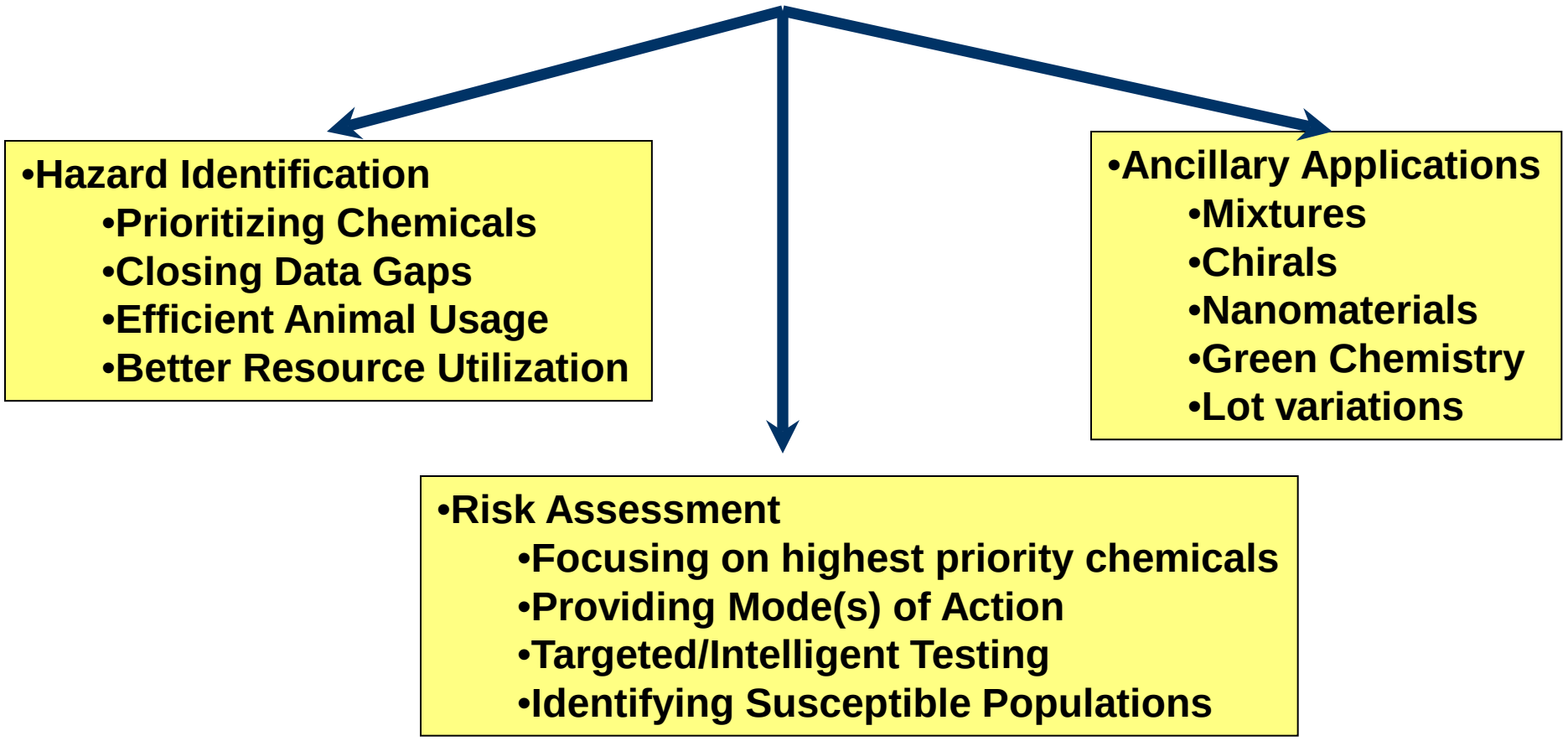
Canadian Council of Academies, 2012

A Few Words on Communication

- Communications Specialist hired in 2009
- Active Website
- Monthly Webinars
  - Community of Practice (external)
  - CSS Theme Presentations (internal)
- Publications Fact Sheets
  - ToxCast Models
  - High Throughput Risk Assessment
- Partner Surveys
- Media events
  - Tox21 Robot dedication
  - Release of the 10k Library
  - L'Oreal CRADA signing



Implications for Success of Computational Toxicology



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"…to integrate modern computing and information technology with molecular biology to improve Agency prioritization of data requirements and risk assessment of chemicals"

Providing Decision Support Tools for
High-Throughput Screening, Risk Assessment and Risk Management

ORD's Organization