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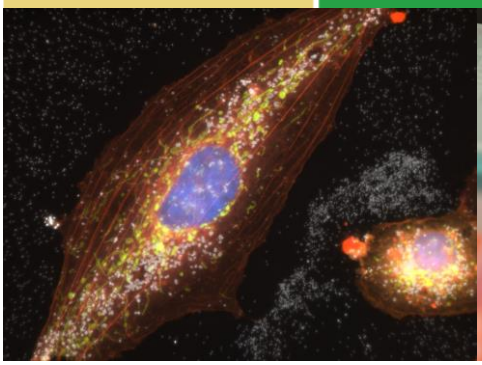
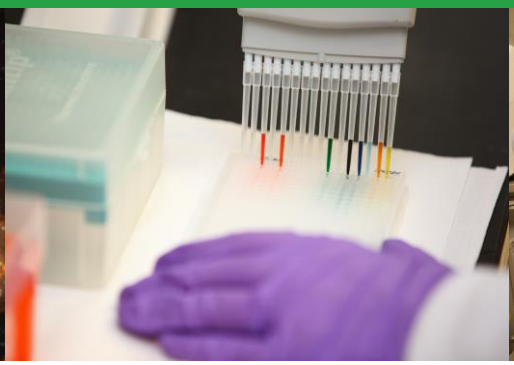
science in ACTION

INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE





CHEMICAL SAFETY FOR SUSTAINABILITY RESEARCH

Background
Chemicals are a key element of innovation in the American economy, and moving toward sustainable innovation requires designing, producing and using chemicals in safer ways. Since many chemicals have not been thoroughly evaluated for potential risks to human health and the environment, innovative research is needed to make better-informed, timelier decisions. To address this need, the US Environmental Protection Agency's (EPA) chemical safety research is determining how to better evaluate chemicals for potential risks.

EPA's chemical safety research:

- Uses **complex system science** to understand the relationship between chemical exposures and ecological and human health outcomes.
- Develops efficient and effective methods to **accelerate chemical safety evaluation**.
- **Evaluates high priority chemicals and emerging materials** to help better protect human health and the environment, with a focus on vulnerable population groups like children and endangered species.
- **Assesses the impacts of high priority chemicals and materials.**
- Provides **accessible data and interactive web applications** to support scientific discovery and chemical safety decisions.
- **Engages stakeholders** to facilitate the translation of research to improve chemical safety policy and regulatory decisions.

Complex Systems Science
EPA is developing computer models that simulate biological and chemical interactions in complex biological systems. These complex systems models map existing chemical research to dynamic computer simulations of biological tissues. These models virtually show how chemicals interact with important human tissues which helps reveal how those interactions are relevant to adverse outcome pathways. An adverse outcome pathway (AOP) shows the linkages between chemical interactions with biological processes and how the linkages could lead to adverse human health and environmental effects.

An example of these computer simulations are Virtual Embryo (v-Embryo) models that help predict what chemical-biological interactions might lead to developmental toxicity and birth defects.

Accelerating Chemical Evaluation
EPA's researchers are using rapid, automated (high-throughput) chemical screening technology to evaluate thousands of high priority chemicals for potential toxicity. The innovative screening technology evaluates chemicals for different types of toxicity, such as cancer and reproductive and developmental effects. EPA is also developing innovative exposure science models to make rapid, automated exposure predictions to create a more complete picture of potential chemical risk. Having rapid, automated predictions for toxicity and exposure helps EPA to better predict chemical risks to human health and the environment.

High Priority Chemicals & Emerging Materials
As part of research collaborations worldwide, EPA researchers are supporting safe, sustainable design and use of chemicals and materials needed to better protect human and environmental health. This research helps EPA evaluate the impacts of existing and new chemicals to better protect all populations including those who are most vulnerable.

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As part of this research, EPA studies high profile chemicals that are used in products to help address an immediate environmental or human health concern. Most of these chemicals are methodologically challenging and require an in depth analysis of the production, use and disposal of the chemicals. This analysis helps determine how these chemicals interact with humans and the environment, as well as ways to reduce risk.

For example, in response to concerns about Polychlorinated biphenyls (PCBs) in schools, EPA researchers identified and evaluated potential sources of PCBs in educational facilities to better understand exposures to children, teachers, and other school workers. EPA also investigated methods to reduce or eliminate PCB emissions in a school setting. These results were shared with the New York school board to help inform their construction and remodeling of schools.

As part of a large US and international research collaboration, EPA is also leading research to understand the unique and novel properties of nanomaterials, and determining if they are safe for humans and the environment. EPA researchers have developed a method for rapidly estimating how a variety of nanomaterials are exposed to the environment and how they move in soils and sediments.

Accessible Data & Interactive Web Applications

The results of evaluating thousands of chemicals are massive amounts of data and many predictive models. As part of EPA's commitment to share research in open and transparent ways, all of this data is publicly available for anyone to access and use to inform decisions on chemicals.

Chemical safety research data is available on EPA's web pages and includes data and studies from:

- Rapid, automated (or *in vitro* high-throughput) chemical screening data
- Aggregated public sources of chemical toxicity data.
- Animal toxicity studies.
- Chemical exposure data and prediction models.
- High quality chemical structures and annotations.

In the long-term, all of the predictive tools will be available through user-friendly online applications called Chemical Safety for Sustainability Dashboards, or iCSS for short. The vision is for iCSS to be the portal into accessing all EPA chemical safety models and tools. Currently, iCSS provides a portal for users to search and query available high-throughput screening data. iCSS is using advances in technology to integrate these diverse sources of chemical information to help inform decisions.

Engaging Stakeholders

Chemical safety research is constantly evolving and it is important for EPA to engage stakeholders who have an interest in using this research to inform decisions. Stakeholders are encouraged to provide EPA researchers input about research priorities and ideas for improving access to existing data. EPA uses workshops, webinars, web pages, fact sheets and other communication materials to solicit stakeholder feedback.

Collaboration Opportunities

EPA partners and collaborates with EPA program offices and regions, industry, academia, trade associations, state and local government agencies, other federal agencies and non-governmental organizations who have interests in advancing current approaches to evaluate chemicals for potential risks. EPA collaborations are formalized through various agreements that facilitate research and data sharing. EPA also funds innovative chemical safety research through its Science to Achieve Results grant program.

More information:
www.epa.gov/research/chemicalscience

Chemical Safety for Sustainability Research Program

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