FUNDING RESEARCH RECOMMENDATIONS

Invest in Research and Training for Critical Science on Understanding Chemical Exposures and Influences on Health to Ensure Science-Based and Health-Protective Policies

RECOMMENDATION

EPA must invest in research and workforce training to ensure it has the right and best science for decision-making and that its workforce keeps pace with current scientific advances in order to ensure that its regulatory decision-making is evidence-based.

ISSUE SUMMARY

The Environmental Protection Agency and its associated programs are the core of the nation's environmental protections of air, water, hazardous waste, climate, industrial chemicals, and environmental justice. In the face of EPA's mounting responsibilities to fulfill its mission to protect human health and the environment, its research budget has shrunk.

The Agency's ability to meet its mandate to be a driver of innovation and change in environmental health has been severely hampered by a systemic under-resourcing of the Agency's research stretching back as far as 1980. While new challenges are presented at every turn, with many addressed by scientists and authoritative bodies for the past decade, EPA and its staff have been financially and academically hindered from both investing in science that will allow the Agency to answer critical questions related to environmental contaminants and health, and from keeping pace with current scientific methods and best practices. This has resulted in Agency actions which utilize outdated science methodology and subsequently regulations which fail to comprehensively address public and environmental health challenges.

EPA must invest in research, keep abreast of the science and be better equipped to meet its statutory requirements. The Agency can only do that if it is adequately investing in research to help itself answer pressing questions on environmental exposures and human health. Below are some recommendations for research investments to fill critical research gaps and ensure that its research, staff, and thus regulations are in step with most up-to-date science.

PROPOSED ACTIONS

We recommend EPA invest in the below research-related areas:

1. **Next-generation methods for understanding and characterizing environmental stressors — including biomonitoring, exposure methods and human epidemiologic studies to identify and measure a broad range of chemical and social exposures** found in the population, and to identify the major exposure sources (industry, consumer products, food, etc.) of chemicals, to evaluate how they can exacerbate disparities in health outcomes, and increase the load of cumulative effects of multiple chemical exposures, social stressors, such as poverty, food insecurity and racism, on health.

2. **Basic laboratory science to rapidly identify which and how chemicals and pollutants harm health.** EPA must upgrade their approach to rapid in vitro tests to identify chemicals that may adversely affect development and human health along the lifespan to ensure it is responsive to population health needs and is anchored in whole animal testing.

3. **The Children's Environmental Health and Disease Prevention Research Centers** (Children's Centers). The Children's Centers study the impact of environmental factors, including air pollution and chemicals, on health conditions like asthma, birth outcomes, cancer, immune function, neurodevelopment, autism, obesity, and reproductive development. These risks are significant and worth investigating — a 2017 impact report from the EPA found that environmentally related diseases in U.S. children cost $76.6 billion every year.

4. **EPA Office of Research and Development (ORD) should require ongoing training to Agency risk assessors,** as a part of the workforce analyses recommended by EPA Office of Inspector General (OIG).

5. **Translation, communication and promotion of evidence-based real-world solutions** to reduce and prevent harmful chemical exposures and deliver measurable health improvements.

SUPPORTING EVIDENCE

Next-generation methods for understanding and characterizing environmental stressors — including biomonitoring, exposure methods and human epidemiologic studies to identify and measure a broad range of chemical and social exposures found in the population, and to identify the major exposure sources (industry, consumer products, food, etc.) of chemicals, to evaluate how they can exacerbate disparities in health outcomes, and increase the load of cumulative effects of multiple chemical exposures, social stressors, such as poverty, food insecurity and racism, on health.

EPA should fund more, and make better use of existing, human epidemiologic data and novel methods, which facilitate analysis of chemical and nonchemical exposures and their potential additive or multiplicative effects.[1] The Agency should invest in mapping the top 5% for multiple chemicals and see whether the same groups are in that top 5% for multiple compounds. Such investment should include a nationwide mapping tool similar to CalEnviroScreen that can visually represent (for widespread consumption) environmental exposures, as well as a steady and accessible funding stream to support advancements in civic science and associated technologies (i.e., low-cost, widely available) to ensure these tools and technologies can advance community enforcement efforts and help reduce harmful exposures. EPA should also increase its funding streams for projects related to community-based participatory research/environmental justice programs and focus more on R2A funding.

Additionally, EPA must fund research to develop better methods to incorporate these exposures and vulnerabilities into probabilistic models and produce data-driven models. EPA should use established methods (e.g., probabilistic assessment) to quantify health risks from exposures and develop the necessary data to support quantifying all risks and better benefits calculations. EPA should use these risk calculations to quantify benefits under TSCA and other relevant regulatory and science programs, and better identify policy options for different exposure scenarios.[2] This will allow the Agency to make better and more informed decisions that address the full population.

Basic laboratory science to rapidly identify which and how chemicals and pollutants harm health. EPA must upgrade their approach to rapid in vitro tests to identify chemicals that may adversely affect development and human health along the lifespan to ensure it is responsive to population health needs and is anchored in whole animal testing.

EPA must expand funding and research to address the undefined predictive ability of in vitro and in silico models for predicting toxicity in humans, to develop improved representative models (e.g., tissue/organ bioengineered models) of human development, and to develop sophisticated statistical and mathematical approaches to model these data.[3] The key areas that are a problem and that need to be addressed immediately include chronic doses, low doses, cumulative exposures and model systems that do not account for sensitive tissues as well as ages. Further in vitro systems need to be improved to fully capture human variability, and data need to be anchored in whole-animal and human results. Finally, the data and results need to be made accessible and informed by community input.

The Children's Environmental Health and Disease Prevention Research Centers (Children's Centers). The Children's Centers study the impact of environmental factors, including air pollution and chemicals, on health conditions like asthma, birth outcomes, cancer, immune function, neurodevelopment, autism, obesity, and reproductive development. These risks are significant and worth investigating — a 2017 impact report from the EPA found that environmentally related diseases in U.S. children cost $76.6 billion every year.

The NIEHS and EPA Science to Achieve Results (STAR) grant program funded the Children's Centers jointly. These centers have been funded since 1998, and have been performing invaluable work in identifying and mitigating how these environmental factors can pose a health risk to children. This work has led to improved policies that help to reduce health risks and improve the quality of life for children and the public. The importance of this work cannot be overstated, and it is deeply concerning that EPA currently is not providing funds through the National Center for Environmental Research (NCER) Science to Achieve Results (STAR) grant program to continue investing in this effort. EPA must once again invest in this area of health.

EPA Office of Research and Development (ORD) should require ongoing training to Agency risk assessors as a part of the workforce analyses recommended by EPA Office of Inspector General (OIG).

EPA risk assessors are not currently providing any ongoing training to ensure that they keep up with the state of the science, which is rapidly changing. As a result, many of

the regulatory assessments the Agency conducts may not incorporate the most current science. Having an EPA workforce that stays current will improve the efficiency and the accuracy of risk assessments. This should include ongoing trainings to Agency risk assessors on key multilevel and mixture modeling approaches (e.g., Quantile-based G-comp, Monte Carlo, Markov, Bayesian, and Random Forrest), as a part of the workforce analysis recommended by EPA's Office of the Inspector General. Further, new methods in risk assessment, including probabilistic approaches to quantify health risks from exposures, better account for human variability, vulnerability, as well as baseline exposures and stressors, and thus better protect public health.

In a recent audit, EPA's OIG made specific recommendations for EPA to conduct a workforce analysis to assess capabilities to implement the newly amended Toxic Substances Control Act (TSCA), and as an outcome, specify what skill gaps must be filled to meet the TSCA requirements. EPA should also conduct a consistent and transparent review at regular intervals to identify new data from the health literature and ensure that assessors are using the best available science.

Translation, communication and promotion of evidence-based real-world solutions to reduce and prevent harmful chemical exposures and deliver measurable health improvements.

EPA must invest in a series of projects that will identify and communicate who is most vulnerable and at risk from environmental exposures to better inform prevention efforts; improve tools to measure the benefits of preventing harmful chemical exposure; and develop evidence-based recommendations and policies to prevent toxic chemical exposures. EPA must also support training programs to train scientists, clinicians and community leaders in how to effectively promote science-based policy. EPA should also invest in community based participatory research that is responsive to community needs and can inform EPA science and policies.

REFERENCES

1 National Research Council, N. R. (2012). Exposure Science in the 21st Century: A Vision and a Strategy. Washington, DC, The National Academies Press.
2 Mcgartland, A., Revesz, R., Axelrad, D. A., Dockins, C., Sutton, P., & Woodruff, T. J. (2017). Estimating the health benefits of environmental regulations. Science, 357(6350), 457-458. doi:10.1126/science.aam8204.
3 Knudsen TB, Keller DA, Sander M, Carney EW, Doerrer NG, Eaton DL, et al. FutureTox II: In vitro Data and In Silico Models for Predictive Toxicology. Toxicol Sci. 2015;143:256–67.