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## Delivering Science to Front Lines of a Disaster: How U.S. Environmental Protection Agency Researchers Assist With Environmental Emergency Response

**Editor's Note:** The National Environmental Health Association (NEHA) strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, NEHA has partnered with the Office of Research and Development (ORD) within the U.S. Environmental Protection Agency (U.S. EPA) to publish two columns a year in the *Journal*. ORD is the scientific research arm of U.S. EPA. ORD conducts the research for U.S. EPA that provides the foundation for credible decision making to safeguard human health and ecosystems from environmental pollutants.

In these columns, authors from ORD will share insights and information about the research being conducted on pressing environmental health issues. The conclusions in these columns are those of the author(s) and do not necessarily represent the official position of U.S. EPA.

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Each year, communities across the U.S. experience emergencies such as oil spills, accidental and intentional releases of hazardous substances, natural disasters including floods and wildland fires, and homeland security incidents. Almost any emergency has an environmental component to be considered, each with unanticipated challenges that impact the health of communities. With other federal partners, the U.S. Environmental Protection Agency (U.S. EPA) plays a critical but often behind-the-scenes role in implementing the federal response to emergencies at all scales, providing on the ground emergency assistance and technical support to state and community first respond-

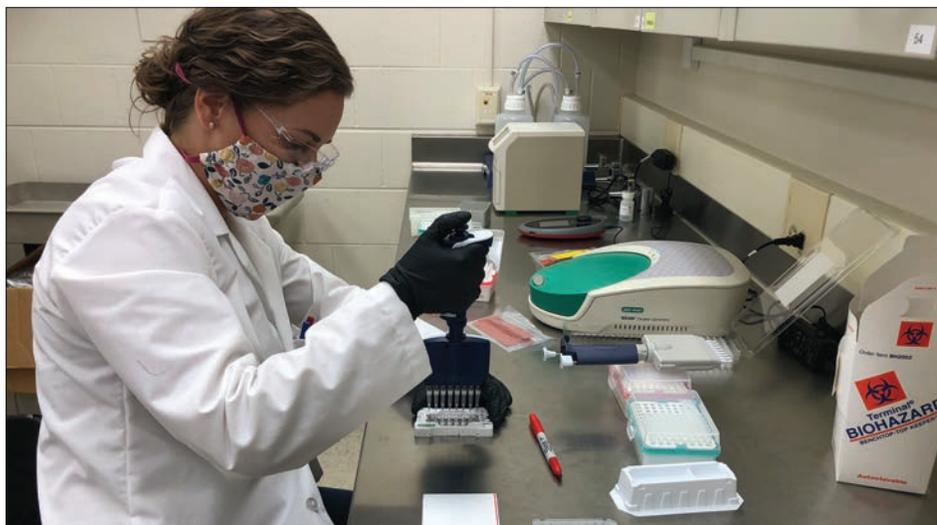
ers. This role operationalizes several of the 10 Essential Public Health Services (Centers for Disease Control and Prevention, 2021).

The role of U.S. EPA in emergency response initially focused on oil spills and hazardous substances releases, and U.S. EPA continues to lead federal coordination on these actions under the National Response Framework (Federal Emergency Management Agency, 2016). This role expanded to address additional threats like chemical, radiological, and biological attacks, particularly after the September 11, 2001, terrorist attacks and anthrax contamination of the U.S. Capitol. Today, U.S. EPA's emergency responsibilities include protecting the nation's drinking

water supply and responding to the cleanup of both localized and wide-area incidents and natural disasters.

The Office of Research and Development (ORD) within U.S. EPA provides the scientific foundation necessary to support U.S. EPA in its emergency response activities to tackle a variety of environmental health challenges and increase U.S. capabilities to prepare for and respond to emergencies. ORD researchers work closely with federal, state, tribal, and local partners during emergency responses, conduct research to support long-term recovery efforts after disasters, and identify ways to increase preparedness and resilience in the future. In the last decade, ORD researchers have contributed to real-time solutions needed to address the environmental aftermaths of the Deepwater Horizon oil contamination in the Gulf of Mexico; the Gold King Mine release of heavy metals that contaminated the Animas and San Juan Rivers; Hurricanes Harvey, Irma, and Maria in 2017; ricin toxin and fentanyl cleanups across the country; decontamination efforts following anthrax attacks; and environmental impacts of the avian influenza outbreak in poultry across the U.S. Midwest in 2015.

Often the disasters for which ORD researchers provide support are unique, unanticipated circumstances where emergency responders have limited familiarity and practice, and there is little existing scientific information available. In these novel situations, ORD provides rapid scientific input to emergency responders by triaging requests for emergency assistance, identifying the right team of scientific experts, coordinating closely with frontline responders to the emergency (e.g., federal on-scene



Measuring SARS-CoV-2 mRNA in a wastewater sample at the U.S. Environmental Protection Agency (U.S. EPA) Office of Research and Development laboratory in Cincinnati, Ohio. Photo courtesy of U.S. EPA.

coordinators, public health departments, water utilities), and applying current scientific research or conducting new studies to inform response. Recent examples include assistance in addressing the Ebola crisis in the U.S. in 2014 and the SARS-CoV-2 virus pandemic that began in 2020.

Although the U.S. was spared a large Ebola outbreak in 2014, the horrifying outbreak in West Africa and the arrival of the first confirmed Ebola case in the U.S. highlighted the nation's lack of Ebola-specific environmental response protocols, particularly regarding the management of vast amounts of Ebola-contaminated medical waste and facility decontamination procedures. Working with the Ebola virus requires a level 4 biological safety laboratory, a capability that is uncommon and costly; thus, environmental response studies had not been conducted with the Ebola virus.

ORD researchers were called upon by U.S. EPA emergency responders and state and local agencies to provide advice on: how best to clean up ambulances, aircraft, and residences of infected patients; decontamination of personal protective equipment; management of Ebola-contaminated waste; and the fate of the virus in wastewater treatment. Although lacking in Ebola-specific data, researchers did have deep expertise in conducting studies on these topics using other viruses and bacteria. ORD researchers utilized this experience and extrapolated scientific results from these

related studies to provide scientifically sound and timely advice during the outbreak. For example, researchers advised U.S. EPA's Office of Emergency Management in the development, training, and deployment of guidance for U.S. EPA responders on how best to support an Ebola-related situation. ORD also contributed to the development of national guidance on how to manage Ebola-laden and similar wastes by adapting and communicating prior research results from a U.S. National Security Council work group of federal, state, and private sector stakeholders (U.S. Department of Transportation, 2019).

The environmental response to the current COVID-19 pandemic caused by the SARS-CoV-2 virus has likewise required ORD researchers to extrapolate research results, as well as to conduct new focused, real-time studies. Early in the pandemic, U.S. EPA responders, state and local agencies, and the private sector sought advice from ORD researchers in addressing the environmental challenges of this novel virus. Several of these questions included:

- Do disinfectants and other antimicrobial products work well when applied to real-world surfaces common in public spaces, such as handrails, carpets, upholstery?
- Can personal protective equipment be disinfected and reused by healthcare workers?
- Can virus laden aerosols in public spaces, such as schools and mass transit vehicles, be treated effectively by commercially available devices?

- Can municipal sewage be monitored for the virus to reflect the community's rate of infection?
- Are masks protective if they are out of date or reused?

While providing technical advice as needed, ORD researchers also quickly started short-term, applied research studies to address these (and other) questions (U.S. Environmental Protection Agency, 2021). These studies have engaged community partners as part of the research process to best tailor support. Research teams include ORD principal investigators and the end users including transit agencies, U.S. EPA policy makers and responders, government agencies including the Centers for Disease Control and Prevention, state health and environment agencies, the private sector, and others. For example, ORD researchers are working closely with the New York City Transit Authority and the Los Angeles County Metropolitan Transportation Authority to assess options to reduce potential exposure of riders to the virus on their trains and buses. The local agencies have helped prioritize the disinfection studies that ORD researchers have conducted, and they have used the results of the testing to inform their decisions that affect millions of riders.

In another example, ORD researchers quickly developed applied methods to measure SARS-CoV-2 mRNA markers in wastewater (see photo above) and to support the development of Ohio's statewide sewage monitoring effort (Ohio Department of Health, 2021), thereby giving state public health officials another measure of severity of infection at the local level. ORD researchers continue to share this newly gained expertise with other states and institutions that are establishing their own sewage monitoring programs.

In the years ahead, the U.S. will be challenged by environmental emergencies that cannot be anticipated and have not been faced before; however, U.S. EPA and its researchers will continue to respond and provide emergency support. U.S. EPA's successful response to these disasters depends on ORD's foundational scientific depth, the nimble ability of its researchers to rapidly apply existing science and conduct new studies, and its continued engagement with emergency responders, decision makers, and the environmental and public health communities, including the local environmental health practitioner community. These relationships will continue to

be critical to protect public health during emergencies by getting the right scientific expertise to the people who need it. 🐼

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