2021 Environmental Health Summit

Disaster Research Response and Public Health Emergencies: Creating an Environment for Resilience in North Carolina

November 3-4, 2021
Virtual

Introduction

Disasters threaten the health of multitudes of people, damage the stability of an area's infrastructure, and demand a variety of resources for recovery. They also recur, and have over time increased in frequency and impact. Disasters are the results of human societies' vulnerabilities being exposed by hazards including severe weather events, infectious disease outbreaks, and "man-made" events. Due to its geography, meteorology, and demographics, North Carolina is regularly faced with myriad public health emergencies and disasters. These events often come with little forewarning and demand comprehensive and expeditious response to mitigate damage to the population and stabilize infrastructure.

Despite the continued occurrence of disasters, improvement on disaster response and understanding of the exposures which occur during disasters (as well as their potential health effects) has been hampered by exclusion of disaster related research during and immediately following disaster response. Due to this exclusion, there are demonstrated gaps in our capacity to conduct

environmental health research, including data and sample collection, during and in the immediate aftermath of disasters. In light of the increased frequency and severity of disasters, it behooves us to leverage the capacities offered by disaster-related research in order to improve our responses and minimize damage to human health. These capacities and concerns must be taken with the concerns and capacities of other stakeholders including policy makers, elected officials, community partners, the public, and industry. This summit was conceived of in part to create networks between stakeholders to enable more effective and inclusive planning, response, and recovery supported by research and prior experience.

This summit, entitled "Disaster Research Response and Public Health Emergencies: Creating an Environment for Resilience in North Carolina," is the 13th summit organized by the Research Triangle Environmental Health Collaborative (RTEHC) since the first in 2008. This summit was held virtually to allow participants to attend safely in light of the COVID-19 pandemic; it also had the added benefit

of allowing those not in the nearby geographic area to attend. This summit was a collaboration between RTEHS and the National Institute of Environmental Health Sciences (NIEHS). This 2-day summit included both presentations of various lengths and discussion groups. Many of the presentation slides are available on the summit website and recordings of the summits are available online as well.

The objectives of the summit were to: a) foster increased understanding of the importance of rapid data collection and research in response to disasters by a wide audience of stakeholders; b) identify strategies and platforms to facilitate relationships and knowledge sharing between stakeholders; c) explore research tools, protocols, and processes that help support timely research in response to disasters; d) assess community concerns related to disaster-related environmental exposures, research, and response; e) determine state and local disaster research capabilities; f) determine state and local ability to prioritize/integrate research needs; g) identify mechanisms to mobilize and support rapid response from the North Carolina scientific and technical community; and h) explore funding and partnership opportunities.

The overall themes which presented themselves during the summit include the centrality of prior preparation, integration of many stakeholders into formal planning, the necessity for mindful community engagement, and focus on helping at-risk/historically marginalized/under resourced populations/black, indigenous, and persons of color (BIPOC) communities. ✂

Summit Overview

The summit was preceded by pre-summit workshops focusing on essential topics such as the NIEHS Disaster Research Response (DR2) Program and the National Response Framework. Following these trainings were introductions to RTEHC and its historical dedication to supporting human health research as pertains to environmental exposure. Also introduced were NIEHS and its continued commitment to disaster related research and applying a health equity lens while doing so. Plenary sessions focused on where community and research meet, with the first discussing NC's preparedness and response organization and second discussing public safety during disasters. Afterward, panels allowed a platform for stakeholders from a diverse array of backgrounds to present their experiences. Guided discussion groups brought mixed perspectives from attendees and presenters together to discuss opportunities and challenges to disaster related research. The first day closed with short "lightning" talks. Day 2 included case studies of NC disasters and their chemical exposures as well as practical challenges between researchers and data collection. Day 2 closed with a breakout session focused on recommending next steps necessary to facilitate disaster related research. ✂

Summit Event Summaries

THE NIEHS DISASTER RESEARCH RESPONSE (DR2) PROGRAM
Aubrey Miller (NIEHS)

Miller provided an introduction to the NIEHS Disaster Research Response (DR2) Program. He brought to attention the increased frequency and severity of disasters, and so too do the questions surrounding the safety of families, communities, schools, and homes. These questions center on complex and unknown exposures, risks of those exposures, the efficacy of public health measures, and the disproportionate harm suffered by at-risk populations such as those with disabilities and those in under-resourced communities. He also discussed reasons why such questions had not been consistently answered; the time between the disaster and data collection is often too long, and disaster research is not formally supported by disaster-response cycle frameworks.

The DR2 program was formulated specifically to integrate research into the disaster response cycle by aiding identification of data gaps and research priorities. It also facilitates disaster related research by supporting timely data collection and management, providing access to data collection instruments. It engages agencies, academia, workers, and communities in training workshops as well. It is creating a community of practice and information sharing by being a vector of resources, networking, and training.

The DR2 website (https://www.niehs.nih.gov/research/programs/disaster/index.cfm) connects users to the Resources Portal, a searchable collection of over 500 publicly available research resources. Resources are added to the collection as they are created. These resources include items such as survey instruments featuring common data elements (CDEs) which allow for information to be collected with the same set of questions. Using CDEs allows for comparison of results across research projects, thus use of the provided survey instruments allows for more easy comparison across projects and harmonization between them. Prior to these instruments being available, researchers would frequently create new tools as needed and comparison between results was often not feasible. With data harmonization, decision makers are better informed, as shown by use of this platform by NIH for the COVID-19 response and the community's subsequent use of over 125 COVID-19 related resources.

To support human subject research during and immediately after disasters, DR2 also provides guidance for how to expedite necessary reviews of research protocols. The Rapid Acquisition of Pre- and Post-Incident Disaster Data (RAPIDD) protocol includes standardized documents such as surveys and checklists and may be adapted to the needs of specific institutions. It allows for pre-approval of protocols prior to a disaster event, thus shortening the timeline between the event in questions and collection of essential data.

Additionally, accessible through the website is the Climate Change and Human Health Literature Portal which includes articles from 2009 onward and includes over 14,000 publications. It also links publications to materials which are not typically published, including data collection protocols and survey instruments, as would be uploaded to the Resources Portal.

The DR2 program also provides trainings. Beginning in 2014 with Los Angeles, California, these trainings bring together stakeholder groups including hospitals, industry, academia, and agencies to address realistic scenarios tailored to the hazards of the area. These trainings are specifically designed to explore local capacity for research, find opportunities for community engagement, and identify challenges

to research. They also facilitate information sharing, establishment of research priorities, and collection of baseline and longitudinal data collection. These trainings have aided real-world responses to good effect in Texas during Hurricane Harvey and in Arizona when developing COVID-19 protocols.

In order to strengthen the disaster research community and increase the nation's overall capacity for disaster research, DR2 maintains a network of centers in the US, each with their own focus related to disaster research (e.g. mental health, chemical exposure, tribal community specific work). This network facilitates collaboration and information sharing, allowing projects to draw upon the strengths of many centers. Currently, the DR2 program is guiding Japan and Canada in developing their disaster research programs, supporting the growth of an international community of disaster research and a stronger culture of disaster research. ⚜

THE NATIONAL RESPONSE FRAMEWORK
Katie Webster (NC Emergency Management)

Webster presented an overview of the National Response Framework (NRF) and showed its potential for adaption in the state response framework in NC. The NRF is a guide for responding to disasters that provides organization which is scalable to any size disaster and can be adapted to specific event types or jurisdictions. The NRF groups resources and capacities into necessary functional areas, termed Emergency Support Functions (ESFs) (see Figure 1). It also describes support annexes which are detailed structures of private sector, non-governmental organizations, and federal support.

The priorities of an emergency operations plan are guided by another construct, the Federal Emergency Management Agency (FEMA) Community Lifelines. It guides an objectives-based response and prioritizes rapid community re-stabilization following an event. These are elements of infrastructure deemed essential for human health and economic security and which support continuous critical government and business operation. The Community Lifelines are: safety and security; food, water and shelter; health and medical; energy; communications; transportation; and hazardous materials. The Community Lifelines construct requires pre-incident planning to identify stabilization targets, and an iterative post-incident cycle of assessment,

priority establishment around unstable lifelines, response, and reassessment until stabilization is achieved. After stabilization is achieved, the construct requires that the lifelines be made more resilient to destabilization prior to the next event. This construct is not limited to evaluating the stabilization of a lifeline only in the context of the event itself, but taken in the overall historical context of an area (e.g. resources already strained by the COVID-19 pandemic further taxed by Tropical Storm Fred push a lifeline toward destabilization).

The Incident Command System (ICS), a part of the NRF, gives clear terminology, roles, and responsibilities for personnel acting as part of an emergency operations center (see Figure 2). It provides a common language for clearly identified and hierarchical roles, allowing those familiar with the organizational structure to function in a variety of situations. The hierarchy gives a clear chain of accountability and communication, facilitating efficiency in a response. This structure can also be adapted to situations as necessary, as discussed below.

NC Emergency Management (NCEM) is responsible to state level emergency management and takes part in each phase of disaster response: planning responses and establishing partnerships;

FEMA Emergency Support Function (ESF)	NC Emergency Support Function (NCESF)
ESF #1 – Transportation	NCESF #1 – Transportation NCESF #1A – Air Operations/State and Regional Disaster Lift
ESF #2 – Communications	NCESF #2 – Communications
ESF #3 – Public Works and Engineering	NCESF #3 – Public Works and Engineering
ESF #4 – Firefighting	NCESF #4 – Firefighting
ESF #5 – Emergency Management	NCESF #5A – Worker Safety and Health Support NCESF #5B – Situation and Documentation NCESF #5C – Weather Support NCESF#5D – Reconnaissance and Damage Assessment NCESF #5E – Risk Management Section
ESF #6 – Mass Care, Housing, Emergency Assistance & Human Services	NCESF #6 – Mass Care and Human Services
ESF #7 – Logistics Management and Resource Support	NCESF #7 – Resource Support NCESF #7A – Volunteer and Donations Management NCESF #7B – Military Support
ESF #8 – Public Health and Medical Services	NCESF #8 – Disaster Health & Medical Services
ESF #9 – Search and Rescue	NCESF #9 – Search and Rescue
ESF #10 – Oil and Hazardous Materials Response	NCESF #10 – Hazardous Materials
ESF #11 – Agriculture and Natural Resources	NCESF #11 – Agriculture and Natural Resources
ESF #12 – Energy	NCESF #12 – Energy
ESF #13 – Public Safety and Security	NCESF #13 – Law Enforcement
ESF #14 – Cross-Sector Business and Infrastructure	NCESF #14 – Community Recovery and Mitigation
ESF #15 – External Affairs	NCESF #15 – Public Information

Figure 1: Table of Federal ESF vs NC ESF

increasing public awareness and providing timely information; training state and local emergency managers, nonprofits, non-profits, and other stakeholders; response activities such as search and rescue and commodity provision; and recovery after a disaster.

NCEM includes up to 229 employees during non-response times and maintains 7 facilities including the emergency operations center (EOC), warehouses, branch offices, and a data center. NCEM divides the state into 3 branches (Western, Central, and Eastern) and further into 15 areas managed by area coordinators. This enables NCEM to communicate with all counties at once, gathering information about their needs. When a county's resources are exhausted, it requests aid from the state, which may then request aid from the federal government if its resources are insufficient to appropriately respond to a disaster. Webster illustrated how the NRF is adaptable by comparing the general NRF to the state response framework in NC as carried out by NCEM.

The NC state response framework includes additional sub-EFSs, organizing it by both national ESF and hazard specific considerations. This organization is reflected in the state Emergency Operations Center (EOC) during a response; individuals from NC Emergency Management and their partners (e.g. Salvation Army) gather into groups including ESF groups and these groups are given separate spaces in which to work. Webster also illustrated how the ICS has been adapted by NC, with additional roles added (see Figure 2, teal boxes). ⬡
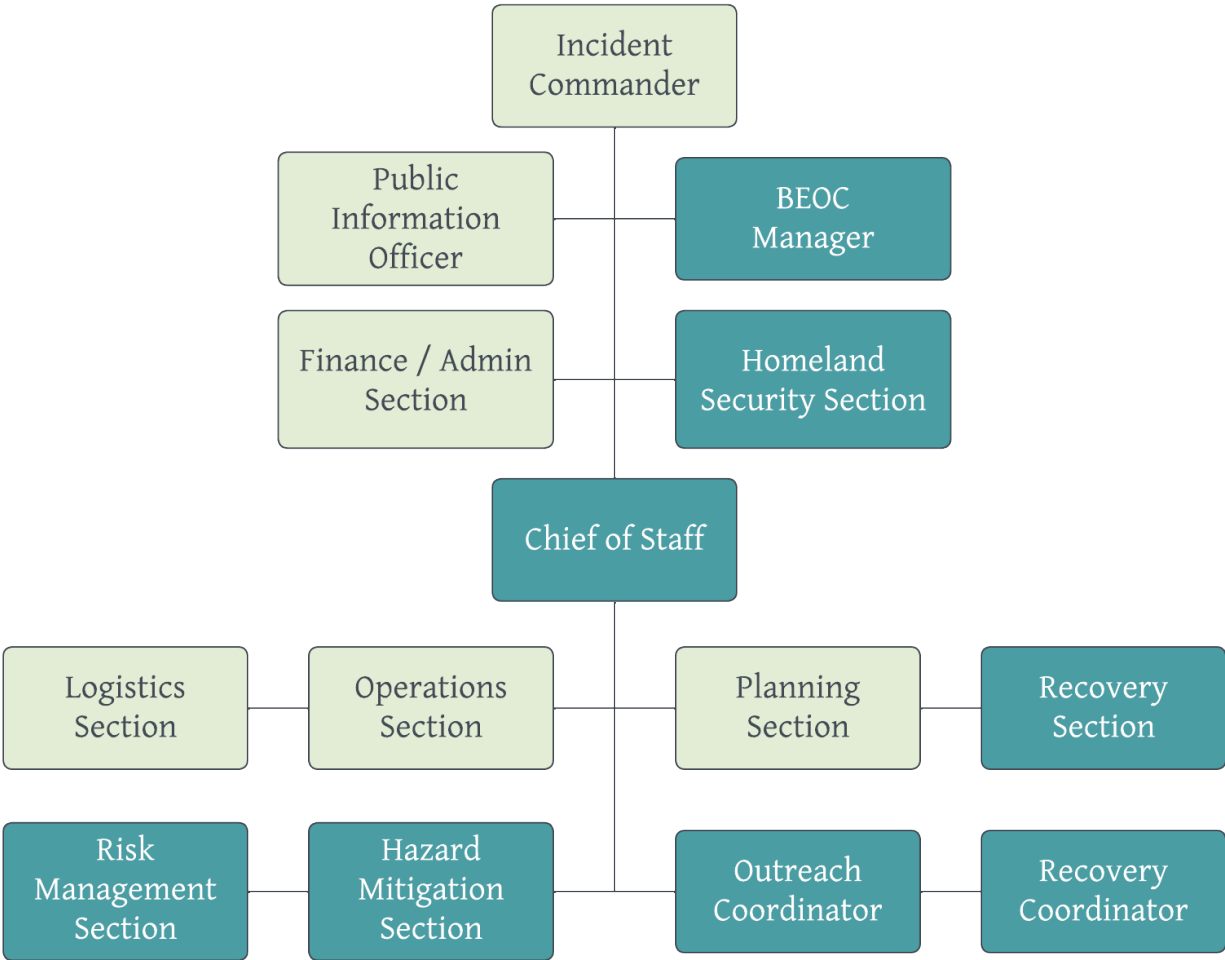

Figure 2: IC structure with NC addenda in teal

ENGAGING WITH COMMUNITIES AND RESPONSE NETWORK IN A TIME OF DISASTER
Jil Christensen (Day One Relief)

Christensen related the mission and story of Day One Relief, which began in the days immediately preceding Hurricane Florence. It strives to reach the BIPOC communities most impacted by disasters and often overlooked during relief effort. It strives to build capacity in community partners by providing resources according to their priorities which they can then distribute in their communities. The central tenants of Day One Relief are rapid and equitable relief while also building resilience in communities with long-term solutions. It is through information sharing and community partner capacity building that Day One Relief hopes to make itself obsolete.

To date, Day One Relief has responded to Hurricanes Florence, Michael, Dorian, and Isaias as well as the COVID-19 pandemic. Immediately prior to Hurricane Florence, Day One Relief began airlifting basic supplies to areas likely to be impacted and coordinating resource transportation between airports and communities. In 3 days, the organization grew to include 2000 volunteers aiding in 500 flights of resources to communities. Day One Relief has since built its responses on prior preparation and resource staging, community driven priorities, and above all mutual trust with their community partners. Day One Relief, through its efforts of community engagement, integrated itself into a long-standing networks of trust which already existed between community partners. Because of these partnerships, Day One Relief is able to in effect provide resources to community members most in need via community partners.

In order to allow for effective water supply staging prior to an event, Day One Relief partnered with IBM to predict sites which are likely to suffer severe damage. This artificial intelligence (AI) process takes into account static and dynamic data sources (including weather information) to generate one measure of water vulnerability. The ability to precisely place critical water supplies where they will be needed saves valuable time after the event and saves lives in the process.

Day One Relief also has harnessed big data and created a state dashboard to make the data available to communities. This dashboard is a map with layers to show the locations of animal feed operations, community partners, emergency shelters, dams, watersheds. It utilizes data made available by IBM to track storms and identifies the counties most at risk of severe damage.

Day One Relief's response to COVID-19 relies less on big data but nonetheless effectively provides resources to community partners. In line with its previous responses, it engages community partners (including churches, barbershops, daycares, funeral homes, etc.) and enables them to help their communities by providing the resources they determine they need. Day One Relief therefore plans with community partners and does not unilaterally prescribe action. Doing this consistently has strengthened the trust that community members place in it, allowing Day One Relief to function effectively in resource dissemination. The organization has provided over 4.7 million masks to medical staff and federal prisons as well as about 500 community organizations. It also has coordinated vaccination clinics and vaccine sign-up phone banks designed with equity in mind. ⬚

INTEGRATING EQUITY: CONSIDERATIONS TO MITIGATE PUBLIC HEALTH CRISES IN NC
Courtney Peragallo (UNC Chapel Hill)

Peragallo took this opportunity to remind participants that equity is fundamental to all public health endeavors including disaster response and to discuss different considerations when designing inclusive public health action. Part of designing public health action requires a working concept of how public health is influenced by different factors; Peragallo points specifically to the social-ecological model. This model highlights the need for targeted care and approaches for different populations in light of their history and current resource availability. In practice, because inequities are historically rooted and contribute to communities' higher risk for experiencing negative health outcomes, researchers should approach a community to establish mutual respect.

One challenge that researchers can face when researching a community is that of participation; if a community does not trust a researcher, fewer community members will participate. Researchers must first establish mutual respect with the community by allowing the community to be engaged with the research and communicate their boundaries and needs. One way to help foster respect between a community and researchers is to engage trusted individuals within the community, of which community health workers are excellent examples. Community health workers build trust and interpersonal relationships within the community as part of their jobs. Engaging trusted community members is especially effective when approaching non-English speaking populations who may otherwise be reticent to engage.

Peragallo gives an illustrative example of these considerations when focusing on NC farmworkers. Farmworkers comprise a substantial portion of the NC population, especially during peak harvest season (which coincides with Atlantic Coast hurricane season). Many of these individuals are Spanish speaking and by very nature of their work physically isolated, perhaps to the point of being technologically isolated as well (e.g., sparse cell service), from the rest of society while living in very close proximity to one another. Counties with higher proportions of Spanish speaking farmworkers are concentrated in the southeastern part of the state, an area which suffers from the highest number of disaster declarations in the state. Considering these factors is critical in reaching such individuals, and cultural considerations are critical to ensure that a public health message is understood. To this end, Peragallo called for communication through a community's preferred medium and with mindful messages.

Mindful communication through a community's preferred medium has been very important during the COVID-19 pandemic; while in-person communication had been preferred in Peragallo's work with rural populations, the pandemic necessitated usage of communication platforms. Platforms such as Facebook, Zoom, and WhatsApp were not preferred, but were effective especially when used in a way that included a trusted community member. Written communication must be developed with audience language and health literacy capabilities in mind, with special attention to common terminology and accessible presentation.

Peragallo called for increased commitment to cultural sensitivity on the part of the research community. This requires increased engagement with priority populations, increased collaborations with trusted community organizations, mindful written communication, and the time and space to allow for mutual trust to grow. Allowing mutual trust to grow means not only engaging trusted community members, but also giving community members safe spaces for communication, paying attention to cultural cues, and showing humility. Peragallo's presentation includes a list of helpful resources to aid in our journey towards cultural sensitivity.

NORTH CAROLINA'S PUBLIC HEALTH PREPAREDNESS AND RESPONSE SYSTEM'S ORGANIZATION, DOCTRINE, AND ENGAGEMENT OPPORTUNITIES
Brian Combs (NC Department of Health and Human Services)

Combs described the overall organization of and resources available to NC public health during disaster responses. The NC public health response organization is composed of the Epidemiology Section, the State Laboratory of Public Health, the Chief Medical Examiner, the Environmental Health Section, and 86 local health department epidemiology teams. Each of these components contributes to the state's disaster response capacity and they all work together on responses.

The Epidemiology Section is divided into the Communicable Disease Branch, the Occupational and Environmental Epidemiology Branch, and Public Health Preparedness and Response Branch. The Communicable Disease Branch focuses on investigating and halting disease outbreaks as well as building local health department capacities through trainings for disease surveillance, data quality, outbreak investigation, and outbreak control. It is concerned with human public health as well as veterinary public health issues. The Occupational and Environmental Epidemiology Branch investigates environmental and occupational exposures which may be hazardous to human health, performing medical evaluation and surveilling for subsequent health problems. It also quantifies exposures and performs risk assessments, giving guidance on levels of exposures. Because of its diverse functions, the Occupational and Environmental Epidemiology Branch includes toxicologists, physicians/nurses, industrial hygienists, and epidemiologists. Public Health Preparedness and Response Branch is charged with protecting public health during disasters and it does so by and promoting disaster preparedness in public health and healthcare systems. This branch includes an industrial hygiene coordinator, a training and exercise coordinator, a Centers for Disease Control (CDC) career epidemiology officer, and pharmacist

coordinators for the Strategic National Stockpile and stockpiles of nerve agent antidotes. The Public Health Preparedness and Response Branch breaks the state into 4 regions, each with professionals to support local health departments and aid communication with the state branch.

The State Laboratory of Public Health provides both medical and environmental lab services. It does so through sample testing, consultations, and trainings for both public and private health provider organizations. The state laboratory has a Bioterrorism and Emerging Pathogens Unit (BTEP), which includes a public health scientist, laboratory specialists, and medical laboratory technologists. It is a BSL 3 laboratory and investigates clinical and biological samples for pathogens (such as anthrax and viral hemorrhagic fever) and toxins (such as ricin). The Chemical Terrorism and Threat Unit (CTAT) includes 4 chemists who have been trained in and closely follow CDC guidelines. It investigates biological and environmental samples for substances of interest including cyanide, nerve agents, and toxic metals in blood.

The Office of the Chief Medical Examiner ensures that deaths in NC which are due to injury or suspicious, unusual, or are unattended are investigated. It draws on a network of medical examiners across the state in order to do this.

Local health department epidemiology teams, of which there are 86, include health directors, preparedness coordinators, environmental disease specialists, communicable disease specialists, and immunization specialists. These teams are essential to statewide epidemic surveillance.

Combs highlighted how the above capacities work together with community partners during a disaster response, allowing for information sharing, mass care, public health surveillance, volunteer management, and medical countermeasures. These partners include schools, fire departments, hospitals, social services, non-profit organizations, and community based organizations. Partnerships are created prior to the event to allow for effective coordination.

Combs suggests that the CDC Center for Preparedness and Response Applied Research Plan may be a source of funding for disaster research. The Public Health Preparedness and Response Branch also offers training opportunities encompassing current perceived threats, most recently the COVID-19 pandemic. ⬡

PUBLIC SAFETY IN DISASTERS
Katie Webster (NC Emergency Management)

Webster further expanded upon her pre-summit training, discussing NCEM functions in more depth and the challenges that it faces in fulfilling those functions. These challenges are not limited to limited resources for distribution and occur prior to, during, and after an event. NCEM strives to coordinate emergency planning, increase public preparedness, provide specialized training, support emergency response, and administer programs for mitigation and recovery. It utilizes a modified ICS discussed previously.

Challenges for NCEM prior to a disaster include communicating uncertainty in information, as is the case with weather forecasts or when specific shelters will be operational. It must do this while also addressing response hesitancy in potentially affected communities so that as many individuals as possible are protected. Response hesitancy is not yet well understood despite its great importance as a challenge in a disaster response. It also must predict where the most affected communities will be to allow for effective staging of necessary resources. Such "hot spots" may be areas that typically become inaccessible during certain events.

During a disaster, many of NCEM's challenges involve a tighter timeline and more immediate needs. These challenges include life-saving operations and questions of sheltering affected individuals in congregate vs non-congregate areas. Ongoing challenges involve communicating essential information both internally and to community partners as well as the public. This communication must be accurate and timely while also being clear about any uncertainties that still exist. Webster points out that the NC

Flood Inundation Mapping and Alert Network (FIMAN) allows users to monitor river gauges and predicted flood potential in NC.

After a disaster, NCEM must focus on long-term recovery plans and mitigation while navigating any reticence that a community might have when engaging with government. This reticence may lead community members to miss out on available assistance if they do not provide necessary personal information. Part of this stage is also communicating what assistance is available. After a disaster, NCEM employs additional reservists and temporary workers specifically to aid community members in their recovery.

Webster concluded with things to consider during the disaster response cycle. Primary among them is prior planning; plan well before a disaster is impending so that there's little time pressure. Researchers should present a project to emergency managers well before a disaster is impending and should be as clear as possible with their timelines and future goals. These goals should be easily identifiable as mutually beneficial, as would be the case with identifying gaps in service or response. This presentation should be a succinct and should be outside of any primary disaster seasons to allow the emergency manager to process the proposed project. Researchers should use the organizational structure of emergency management to their benefit; the structure is designed for information flow and it is helpful to get buy-in from personnel higher in the command chain for introductions to those who can help researchers get information. ✂

MY FIVE GREATEST CHALLENGES AS MAYOR
Rett Newton (Mayor of Beaufort, NC)

Mayor Newton spoke from the perspective of a disaster responder during his presentation. In this, position as mayor Newton has faced important community challenges including crumbling infrastructure, degraded water quality, effects of climate change, and the expanding wealth gap. He focused specifically on the critical role of leadership in disaster response and how his community specifically has been affected by recent hurricanes and the COVID-19 pandemic.

Netwon's activities as a leader are centered around being in the public eye. Leaders must be visible and must bring information concerning risks and recommendations to the family level. He has learned through Beaufort's experiences that mandatory evacuations are not actually mandatory, so it is essential to get accurate information to families and empower them to make their decisions. To this end, it's important to make communication infrastructure as far-reaching into the community and as resilient to damage as possible. This means utilizing diverse platforms and communicating through more than one interface (e.g. going door-to-door and using social media platforms). When communicating, it is important to communicate exactly the hazards that are known. Part of Newton's presentation focused on hazard classification, pointing out that hurricane categories refer solely on wind speed (i.e. they do not include hazards such as potential storm surge).

The resource gap has been a particularly striking challenge in Newton's community. As he says, it has always been there, but "[Hurricane] Florence exposed it, [Hurricane] Dorian widened it, and COVID-19 deepened it." He touches on the cyclical nature of disasters and the effects they have on those with fewer resources, pushing them deeper into the wealth gap. Empowering families to make their own decisions is critical because not all families have the resources for all family members to leave the area for the duration of a storm. Additionally, the resource gap affects which families are able to recover after a disaster, with mold being a particularly large problem in Newton's community.

Newton's experiences give unique perspective to identify potential research topics. Newton urges researchers to investigate how to better aid those most vulnerable in communities who have fewer resources available to them for evacuation and recovery. Additional areas of potential research include identifying key metrics of storm surge to enable more effective hazard communication and the effects of increased development and the subsequent contribution to stormwater on water quality. ❇

COMMUNITY MOBILIZATION AND ENGAGEMENT TRAINING
M. Chris Herring (NC Central University/Sandhills Community College)

Herring gave a description of uptake of training concerning community mobilization and engagement, MGT 405, provided by the federal government and notes related to instructing trainees. This training has reached over 100 communities and 3,000 participants in states across the country which are exposed to a wide variety of hazards.

This training provides a framework for strengthening faith-based community organizations and public sector collaboration, especially as pertains to developing emergency plans. It fills gaps of awareness concerning the roles and capabilities of emergency management as well as the roles and capabilities of community partners. Many faith-based communities were not aware that they could and were needed to play roles in disaster planning and response. The training also brings together as many stakeholders as possible in order to foster trust and stress the necessity of inclusive planning. In many cases, this training serves as the first time stakeholders had come together for disaster planning.

Herring described some of the challenges faced while instructing participants. Herring stressed that each community's culture and characteristics determines the challenges they face. In some cases, low literacy levels or language barriers necessitated slight changes to the curriculum schedule and provision of translators. Additionally, a lack of trust between community members and government agencies poses challenges in potential outright conflict between participants.

This training provides opportunities to strengthen the resilience of under-resourced and historically marginalized communities. It also provides the opportunity to access communities through faith-based communities, even historically difficult to reach communities composed largely of those who do not primarily speak English. The faith community can serve as support for emergency management and public health in areas where resources are not easily accessed.

DISASTER SERVICES FOR IMMIGRANT AND FARMWORKER COMMUNITIES
Lariza Garzón (Episcopal Farmworker Ministry)

Garzón provided an overview of the Episcopal Farmworker Ministry (EFWM) including their initiatives in direct service, community education, leadership development, and advocacy. They work primarily with workers and their families, primarily seasonal and guest workers in NC as well as undocumented workers who may or may not work in agriculture.

Direct services that EFWM provides include home repair for those who do not qualify for federal assistance, provision or food/water, appliance replacement, and a text alert system which reaches over 2,000 individuals. Their direct services reached about 4,000 individuals in 2018 when the ministry had only 2 staff people. Additionally, EFWM engages the community with trainings in Spanish through online platforms as well as door-to-door education, working with community partners to expand their range.

The challenges that EFWM faces include that their target population of seasonal or undocumented workers is primarily Spanish speaking and may not be able access resources that are only disseminated in English. Additionally, individuals often are fearful to access resources. Another barrier to accessing resources is that many individuals do not possess federally recognize forms of identification, thereby excluding them from the possibility of federally provided disaster relief. Additionally, seasonal workers often are living in extremely isolated camps and may not be aware of their geographic location. This means that if they receive word that NC may experience a hurricane, they may not even know the information is relevant to them.

Garzón related lessons that EFWM has learned, stressing that long term relationships with communities are imperative for effective operation. Garzón also stressed that when providing information and donations it must be done in a culturally appropriate way, ensuring that everyone is able to benefit. Garzón called for systematic change to the disaster relief system for more inclusion of vulnerable populations. Ways that the state can improve its services for these communities include providing more information in Spanish, providing Spanish text alerts, and moving law enforcement officers from in front of shelter facilities to provide a more welcoming atmosphere.

As an outreach partner, EFWM can provide presentations and information to Spanish speakers, as all staff speak Spanish. EFWM also has an emergency fund for agricultural workers affected by COVID-19. Garzón encourages widespread use of the free online resources that the organization has developed concerning disaster safety for agricultural workers. ✄

WATER QUALITY DISASTER RESEARCH RESPONSE: HURRICANE FLORENCE IN NORTH CAROLINA
Lee Ferguson (Duke)

Ferguson, a researcher at Duke, described his research concerning water quality following Hurricane Florence. One of the major issues with Florence was how slow the storm was as well as the storm surge, making it the "wettest" hurricane on record in the Carolinas. Some areas, including farms and residential areas, in the southeastern part of the state were completely isolated by water or inundated for over 2 weeks. This situation posed challenges to Ferguson's team while they collected samples, as river crossings were impassable for some time. Additionally, closed off areas sometimes necessitated that team members wade through flood waters to take samples, which was sometimes not feasible in light of nearby flooded industrial sites. The samples the team was able to collect showed that sewage spillage impacted drinking water.

From this project, Ferguson imparts wisdom concerning post disaster data collection. It is important to be prepared and plan ahead, ordering supplies well before an event occurs, as well as flexible in the moment to ensure the safety of the team. Planning enables fast data collection, which is necessary for stakeholders to assess the present conditions and make appropriate decisions. Ferguson also stresses that compassion for affected community members is central; some individuals may need help that team members are not prepared to provide, but it is important to ensure that these individuals are in contact with resources, such as emergency responders, that can provide this help. �

LESSONS FROM THE UNITED STEELWORKERS
Ashlee Fitch (The Tony Mazzochi Center)

Fitch described the role of the Tony Mazzochi Center and its collaboration with NIEHS to train workers after disasters. The Tony Mazzochi Center is the safety training arm of the US Steel Workers trade union which represents steelworkers as well as a variety of others including paper workers, rubber workers, and glass workers. The Tony Mazzochi Center collaborates with NIEHS Hazard Disaster Preparedness Training Program to train responders, workers, and community workers after a disaster. The Special Emergency Response Trainers (SERT) travel around the country with NIEHS after disasters in order to reach affected areas. Their training focuses on the hazards inherent in different disasters, how to protect against these hazards, and how to prepare for working disaster response or cleanup. They also determine distribution points for personal protective equipment as well as inform trainees about resources available to them and how to access those resources.

The SERT team faces challenges in its work related how to not only identify their target trainee population but also how to reach them effectively. It's important to build partnerships prior to a disaster and keep in contact to make this step less challenging. Additionally, the question of when to train poses challenges, as it is sometimes difficult to know the appropriate training times when workers are coming and leaving constantly. An additional challenge is optimizing placement of resources for the most effective distribution. ✂

THE ROLE OF A RESEARCH TOXICOLOGIST IN RESPONDING TO PUBLIC HEALTH EMERGENCIES: AN EXAMPLE OF PFAS
Jamie DeWitt (East Carolina University)

DeWitt used per- and polyfluoroalkyl substances (PFAS) as a case study in the role scientists have in engaging communities. PFAS is of particular concern in NC because these substances were found in the Cape Fear river, meaning that exposure is widespread in the general population of the state. Due to widespread exposure not only in NC but throughout the country, there are many stakeholders with whom researchers must engage. These stakeholders have diverse perspectives, thus the questions they ask of researchers are very diverse.

DeWitt points out that the type of questions that researchers ask are not from the same perspective as other stakeholders, and therefore the answers produced by researchers may not adequately address other stakeholder questions. Additionally, stakeholders ask questions relatively quickly after learning of potential exposures, but researchers may need to take mush time to investigate the potential exposure from many angles in order to address questions of health consequences. DeWitt also brings to attention that exposure to pollution is a very personal matter, and community members look to researchers for answers concerning their personal risk or the risk of their loved ones. Community members are not always able to access scientific research because of certain gatekeeping mechanisms, but their perspectives are valuable in thinking about what questions to ask of data and how to frame results from that data.

DeWitt closed by stressing that science communication with community members is primarily about communicating and making information accessible; information must be understandable. Additionally, researchers must be compassionate when interacting with other stakeholders, making sure to validate stakeholder perspectives and give as much accurate information as they can. �

NC INCLUSIVE DISASTER RECOVERY NETWORK
Andrew Shoenig (Rural Forward)

Shoenig gave a description of NC Inclusive Disaster Recovery Network (NCIDR) which focuses on connecting mainstream organizations with community-based leaders to facilitate inclusive and well-managed disaster recovery. It values community reinvestment, asset-based community development, and equitable opportunity. NCIDRN maintains contacts in a wide range of over 365 contacts within organizations including disaster recovery organizations, leaders of faith-based communities, state and local government, and advocacy organizations. It is organized into action teams, each of which is tasked with a specific type of engagement. These types of engagement are information sharing across organizations, developing programs and policies to generate knowledge and guide practice, advocacy actions to influence policymakers, and building capacity of organizations and coalitions. Projects include presentations on trauma-informed disaster recovery and participating in research concerning why some efforts toward inclusive recovery are successful and other are not. Shoenig urged participants towards collaborative action to improve systems of disaster response. NCIDR meets every 4th Tuesday 2:03pm Eastern time (http://bit.ly/NCIDRzoom). ✖

PRIVATE WELL LESSONS LEARNED AFTER HURRICANE HARVEY
Kelsey Pieper (Northeastern University)

Pieper described a project investigating well water quality after Hurricane Harvey. Private wells can become contaminated through a variety of ways, including become submerged or being affected by nearby contaminated wells. There isn't much research addressing well water contamination after disasters. In the area affected by Hurricane Harvey, over 500,000 individuals utilized private wells at the time and over 15,000 may have had their wells submerged by floodwater. These well users were not isolated to rural counties, but were also in counties deemed urban. This is important to consider when directing resources during disaster response.

Well systems which were submerged in water were 8 times more likely to show indications of fecal contamination. Pieper's work also shows that individuals who considered their well water to be unsafe for cooking, drinking, or bathing were more likely to have indications of fecal contamination than those who were not concerned, showing that there is local knowledge about well water quality. Pieper's work also indicated that fecal contamination indicators decrease each week and return to baseline about 2 months after peak flooding, indicating the need for immediate data collection after a disaster. ✖

HURRICANE MATTHEW AND NORTH CAROLINA PRIVATE WELL TESTING
Wesley Hayes (Northeastern University, University of Alabama, NC Department of Health and Human Services)

Hayes presented a project designed to investigate the private well risks of hurricane induced flooding and to assess how accessible post-hurricane testing is to NC residents. NC has a large number of private well users, and this use is widespread. This dispersion makes it difficult to collect granular data that effectively covers the entire affected area. The analysis found drastic increases in the proportion of wells testing positive for E. Coli contamination following Hurricane Matthew compared to pre-hurricane, indicating a need to make private well testing available after such an event. Hayes put these results into the context of environmental justice (EJ) communities, highlighting that these communities may face higher risks of contamination and lower access to services designed to mitigate these effects. These inequities exist outside of and are far exacerbated by disaster events. In this context, barriers to private well testing may be due to a lack of knowledge concerning private well testing or reduced capacity to take advantage of testing services. ⬯

PROVIDING HIGH QUALITY INTERDISCIPLINARY EDUCATION AND TRAINING, RESEARCH, AND SERVICE IN OCCUPATIONAL SAFETY AND HEALTH
John Staley (UNC Chapel Hill, NC Occupational Safety and Health Education and Research Center)

Staley described the NC Safety and Health Education and Research Center (OSHERC) and its role in disaster related research. This center is a National Institute for Occupational Safety and Health (NIOSH) funded center as well as Total Worker Health Center of Excellence. NC OSHERC serves the community through training, service, and research. It has provided training to faculty and staff concerning COVID-19 response, has provided over 12,000 COVID-19 education hours to the community, and has initiated several projects including Promoting Safe Practices for Employees Return (PROSPER) and COVID-19 in Farming and Food Processing Industries in North Carolina (COFF-NC). OSHERC also offers degree and post-graduate training programs through Duke, UNC Chapel Hill, and NC State University in a variety topic areas including industrial hygiene, occupational safety and hygiene, and occupational medicine. OSHERC also offers education to individuals working in healthcare and businesses including the military, construction, manufacturing, and those in essential businesses. ⬯

REFERENCE VALUE ARRAYS – A TOOL FOR RISK MANAGERS AND EMERGENCY RESPONDERS
George Woodall (US Environmental Protection Agency)

Woodall explained the utility of reference value arrays to disaster response. Reference values are exposures of chemicals with known lack of health consequences or specific consequences. Reference value arrays were developed by the US Environmental Protection Agency (EPA) to address needs during the responses to the 9/11 disaster and anthrax attacks. Reference value arrays compress all of the information available about reference values into a graphical representation, including lethal dose limits, emergency response limits, occupational exposure limits, and general public exposure limits. In these graphs, concentration is on the y-axis and duration of exposure on the x-axis (see Figure 3). Note that these axes are on a log scale to allow for representation of a wide range of concentration and exposure duration values. Reference value arrays also come with derivation tables detailing how each exposure limit was determined. This information is critical when deciding the appropriate course of action during a response to ensure that health effects resulting from chemical releases are minimized. �
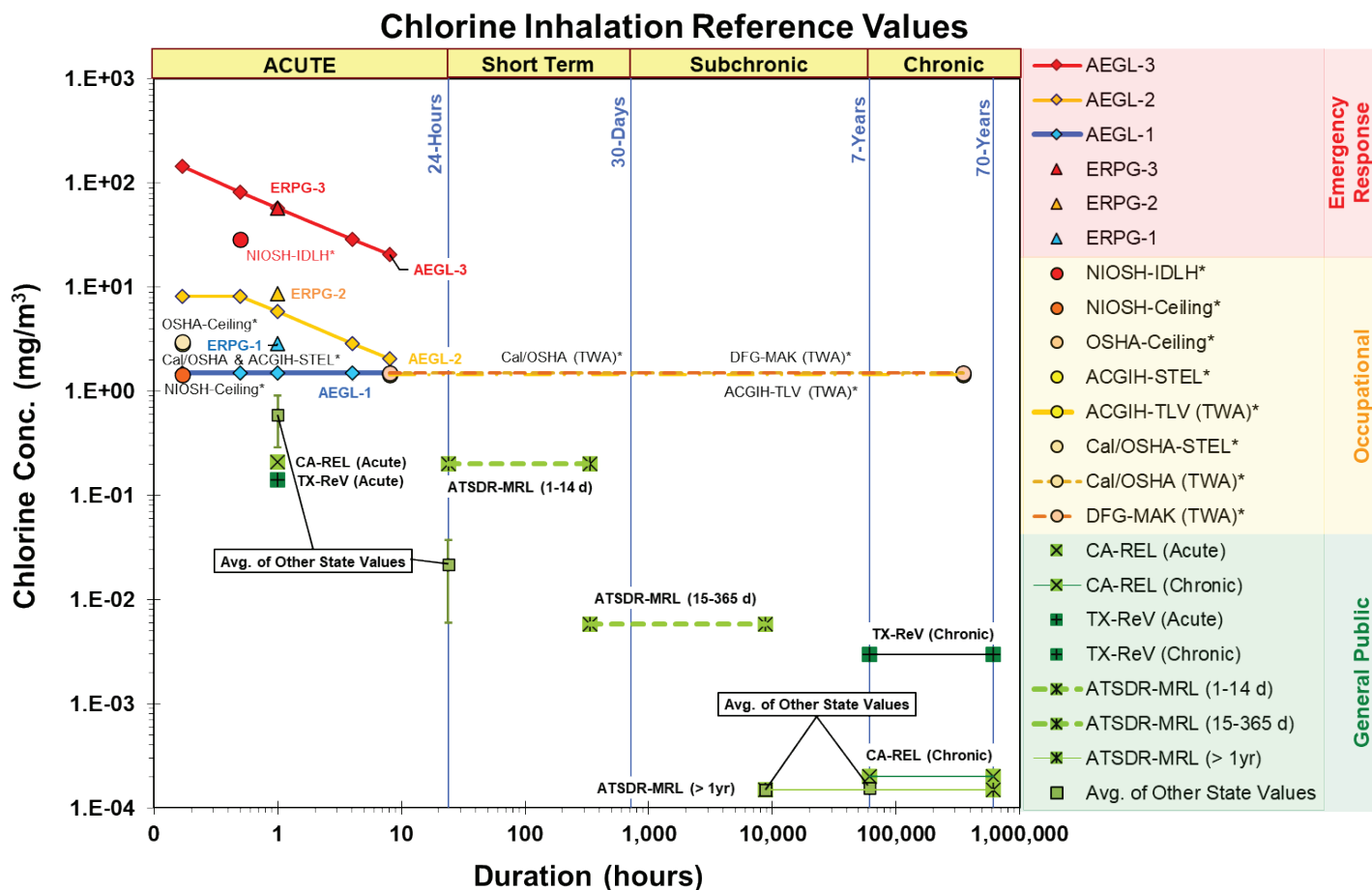

Figure 3: Chlorine inhalation reference values graph

MOBILIZING FAITH-BASED COMMUNITY ORGANIZATIONS IN PREPARING FOR DISASTER
M. Chris Herring (NC Central University/ Sandhills Community College)

Herring gave an overview of the topics offered in the MGT 405 course, Mobilizing Faith-Based Community Organizations in Preparing for Disaster, which aims to provide a framework for inclusive disaster response planning built on collaboration between government and community partners. It fosters communication between stakeholders prior to a disaster, allowing for resource coordination, and formalizing resource agreements to hep fill emergency planning gaps.

This course was designed for emergency managers, management level first responders, local government, and faith-based community/non-religious charitable/ nonprofit organization representatives. The topics covered in this course include disaster management system organization (emergency infrastructure at federal, state, county, local levels), components of a county disaster response plan, unique assets of faith-based community organizations, and faith-based community organization emergency plans. This training allows for more participation of faith-based community organizations in disaster response efforts.

THE HURRICANE HARVEY OUTREACH PROTECTION PLAN WORKER AND RESIDENT SURVEY
Brett Perkison (University of Texas)

Perkison described an initiative to provide individuals affected by Hurricane Harvey with training and PPE for cleanup. The Southwest Center for Occupational and Environmental Health (SWCOEH) at the University of Texas School of Public Health distributed PPE kits and gave training on the proper usage of items in the kits. These kits included N-95 masks and nitrile gloves, as well as written instructions for use. These kits were distributed through faith-based networks, charity organizations, and academic organizations. PPE training was given by volunteers who were all centrally trained. The SWCOEH not only provided kits, but also determined from where those kits should be distributed.

A survey assessed the success of the initiative: both written and verbal instructions were given high effectiveness scores and 97% of respondents utilized the provided masks. Lessons learned from this initiative are the centrality of creating a large network of distribution, educating community members concerning the hazards of different disasters, and the importance of being mindful about where from where supplies should be distributed for optimal efficiency and to support less resourced areas. Perkison introduced PocketArk which is a mobile app under development to provide cleanup workers with real-time hazard information as well as locations where they can acquire PPE.

SYSTEMS FOR ENGAGING THE ENVIRONMENTAL LAB
Andrew Jones (Duke)

Jones described work his lab is currently pursuing to make drinking water safety monitoring easier and more accessible. The team is in the process of developing a faucet mounted monitor that is small, low maintenance, low cost, and supply free in an effort to overcome many of the challenges that current water monitoring systems suffer from. Currently, the team has patented a system that allows for lead in water to be dissolved and for the water to be subsequently tested. �

NIEHS DR2: DEVELOPING NEXT GENERATION RESEARCH TOOLS
Richard Kwok (NIEHS)

Kwok elaborated on Miller's pre-summit presentation of the DR2 program and presented a funding opportunity (RFA-ES-19-011) which is uniquely designed to fit the needs of disaster researchers. This opportunity calls specifically for studying unforeseen events. This funding opportunity has monthly receipt dates and its review and funding processes are designed to be rapid to enable timely data collection. This opportunity provides $275,000 for a 2-year project duration. ✖

NC CLINICIANS FOR CLIMATE ACTION ORGANIZATION OVERVIEW
Stephanie Johannes (NC Clinicians for Climate Action)

Johannes gave an overview of Clinicians for Climate Action, emphasizing the organization's dedication to remedying the health impacts of climate change especially as pertains to exacerbation of existing inequities created by socioeconomic stressors. Johannes brough to attention the myriad ways that climate change affects health including through increase frequency of disasters, forced migration, changes in pathogen vector ecology (e.g. expanding mosquito range thereby expanding the range of arboviruses). This organization takes action by educating clinicians, engaging in advocacy and with the community through state and federal advocacy campaigns and health equity events, and in climate-smart healthcare. Climate-smart healthcare recognized that healthcare both contributes to and suffers from climate change, thus it aims to reduce greenhouse gas emissions due to healthcare by investing in reduced impact supplies and energy. It also calls for hospitals to plan ahead and build resilient infrastructure and supply chains. ✖

OPERATIONS RISK INSIGHTS FROM WATSON
Tom Ward (IBM)

Ward explained the intricacies and usage of Operations Risk Insights (ORI) which was produced by IBM to not only support its own business resilience but also the resilience of other community stakeholders. ORI utilizes a plethora of diverse data sources to assess the hazard risks to locations of interest. These data sources are range from relatively static (e.g. geographic composition of the surrounding area) to extremely volatile (e.g. weather data) and include information on population vulnerability, historical records indicating susceptibility, geospatial information (e.g. roadway location) and infrastructure resilience. The process intakes data from these sources and determines which locations are most likely to be affected and which of those locations has more vulnerable populations, thereby identifying optimal placement of disaster response resources. This process involves machine learning and artificial intelligence. This service is utilized by Day One Relief in their online dashboard (see page 7). This project saves lives, protects assets, reduces economic impact, supports community resilience, and improves public safety by improving disaster planning and response with real-time hazard and vulnerable population information. This service will be widely available in the future. ✳

POST-HURRICANE WELL WATER CONTAMINATION IN NC ENVIRONMENTAL JUSTICE COMMUNITIES
Andrew George (UNC Chapel Hill)

George described two projects centering on community engaged research and citizen science in an environmental justice (EJ) community in NC to examine private well water contamination. As 25% of NC residents utilize private wells and considering that the 3rd largest coal ash spill in US history occurred in NC, George asserts that projects such as these are essential work.

The first project, which took place in Stokes County, consisted of sample collection (well water purge, well water first draw at point of delivery, and a soil sample), reporting results back to participants, and providing filters for participants. These sampling techniques and community engagement necessitated sample collection on weekends and oftentimes very early in the morning. Over the course of this project, the team learned that increased community engagement, promises of result confidentiality, and commitment to report back to the community greatly improved the study design.

The second project relied on citizen science and involved community members self-collecting both first draw and flush water samples. This project used two recruitment methods – extension service of existing county-wide well clinics and direct recruitment in EJ communities. Incorporation of citizen science greatly improved participation in well sampling, enabling yet more individuals to test their wells for contamination. In these projects, 48% of participants were able to test their water for the first time, indicating the need for future community engagement when providing resources to and researching in EJ communities. George called for more focus on EJ communities, establishing relationships with community members prior to disasters, and more integration of citizen science. ✳

CHALLENGES IN COMMUNITY-UNIVERSITY BIDIRECTIONAL COMMUNICATION FOR DISASTER RESPONSE
Elizabeth Shapiro-Garza (Duke)

Shapiro-Garza described the Duke Superfund Research Center's Community Engagement Core, which fosters bidirectional communication and mutual trust between researchers and affected communities. The core has been maintaining relationships since 2016, focusing on communities along the Cape Fear River. These communities are primarily low resourced communities and thus are more vulnerable than others. It had made many connections with community partners prior to Hurricane Florence. Their community partners reached out with concerns of exposures that resulted from the storm and its associated flooding. The center was not able to find personnel able to address all of the needs of their community partners. To this point, Shapiro-Garza also highlighted that academic institutions can support communities in different ways over time. In the short term, institutions can leverage and support their professional connections to get community questions answered, provide community members with information about hazards and how to protect themselves from those hazards, and provide baseline data on contaminants for later comparison to post-disaster samples. In the medium term, institutions can provide communities with interactive tools and empower them with the knowledge of where the potential sources of contamination are in their immediate area. Long term support can look like research translation and providing answers to community concerns, such as providing results about soil contamination on community school property. ⬥

PFAS AND YOUR IMMUNE SYSTEM
Krystal Taylor (East Carolina University)

Taylor presented an ongoing project concerning the effects of PFAS on the immune system. Given the widespread use of PFAS in an extremely large number of products including paint, water repellant compounds, non-stick cook wear, and fast food packaging, it is important to study the potential health effects of PFAs exposure. PFAS exposure has been linked to a number of negative health consequences in humans, among them thyroid disease, pre-eclampsia, and decrease response to vaccines. Taylor's project is designed to examine the effects of PFAS ingestion on immunity in mice; it will examine markers of immune suppression and relative proportions of different subpopulations of immune B cells which can remember past antigen exposure or produce antibodies against an antigen. ⬥

Discussion Groups

One of the largest benefits to a summit such as this is that it brings together a vast array of stakeholders with diverse perspectives. Bringing participants into discussion groups to share their thoughts is one of the primary ways for virtual summits to facilitate networking and generate new ideas for future research and propose solutions to some widespread challenges. These discussion groups were guided, all with the same suggested topics to address. Suggested topics of conversation for the first session were about the organizations that each participant hailed from: their roles in disaster response and disaster research as well as data collection/sharing capabilities, suggested ways for collaboration with researchers to utilize existing data or collect new data, and perceived community health concerns in NC. The second breakout sessions focused on identifying challenges related to disaster research and suggesting potential solutions to those challenges. ⚒

BREAKOUT SESSION 1: ORGANIZATION ROLES AND CAPACITIES

Breakout groups included members from a wide array of backgrounds including the armed services, recovery non-governmental organizations, chemists, epidemiologists, emergency health specialists, faith-based organization leaders, and occupational medical practitioners. These members brought equally as diverse interests, from mental health to concerns about transient worker health and follow-up to equity and access among minority populations and chemical releases.

Groups stressed the need for researchers to be intentional about how they collect and share data. Many researchers collect data on the environment or on research participant health while many services collect information on program success and health departments collect surveillance data on the general public. The DR2 platform can provide resources for data collection which is can be used in concert with other data through common data elements. Poison Control Centers and NC Detect are good resources for data on non-occupational chemical exposures while occupational safety training programs provide information on participants and the trainings they attended. NC 2-1-1, an informational and referral service where individuals can get information on health and the locations of nearby human services resources, could be a good resource as well, though the demographic data they collect may be limited. The NC state laboratory provides results of lead tests and can provide exposure analysis for suspected chemical terrorism events. Data sharing was another theme of the breakout session, with an emphasis on bidirectional information sharing and fulfilling needed roles. While the federal and state government may collect much data, researchers are counted upon to provide analyses and yield insights from those data. The COVID-19 pandemic has revolutionized data sharing, resulting in more data downloading dashboards and virtual resources portals than there previously had been and making data sharing easier. Groups were also careful to point out that data should be in a format that is feasible to use when it is shared.

Information sharing with communities was another topic of conversation, bringing to bear questions of how researchers can be a trusted source of information for communities and how to help communities. Though not generally able to provide data to researchers, service providers are, however, able to connect researchers to potentially affected communities and facilitate information sharing. This is especially important considering the digital divide that makes communities less able to receive or transmit information. Recognizing that disasters start

and end at the local level, and convinced of the necessity of partnering with communities, groups struggled with implementation of such recommendations. There was a clear need for more guidance in exactly how to effectively engage communities in a culturally competent way to facilitate mutual trust relationships; one group suggested that a list of previous articles explaining their community engagement process would be helpful. Participants also wanted guidance on how to maintain these relationships once they were built.

It is important, groups agreed, to recognize the power dynamics inherent in research – who has the data and who needs it? It is the responsibility of researchers to support local change and long-term recovery and resilience in affected communities, and one way to do this is through information sharing. Researchers should make concerted efforts to not only utilize the data but also to ensure that their results are widely disseminated in communities. To this point, the data tells a story and these stories must be used to improve human health by informing policymakers; researchers can both collect information for research as well as use it in service of the community (e.g. advocacy). One group noted that crowdsourcing for data collection and feedback on projects would greatly improve the

quality of disaster research projects. It was noted that when reporting back, researchers should be clear that while knowing about negative health consequences naturally prompts expectations for exposure risk to be reduced, it is not always possible to do this due to limitations in a variety of spheres.

Other discussion points surrounded how to actually benefit communities with research. How do we make sure that communities actually benefit from a relationship with researchers? One way researchers can aid communities is by identifying "philanthropic deserts" or geographical gaps in FEMA and NGO assistance provision, and understand how to fix this gap in service provision. Additionally, researchers can make efforts to include all parts of a community in the process, as oftentimes not all stakeholders are included in discussions and therefore are not able to communicate their needs, interests, and capacities. All of these activities take time, and as has been seen in the presentations, prior planning is essential for research success. Groups pointed out that funding should be provided prior to a disaster to allow the sort of pre-disaster planning and preparation, including building relationships with communities and growing their data collection capacities. ✠

BREAKOUT SESSION 2: CHALLENGES TO DISASTER RESEARCH AND SOLUTIONS

Central challenges that groups discussed include intentionality in information and data sharing with other researchers as well as communities, reporting back to communities, avoiding effort duplication, hitches in getting into the field post-disaster, and balancing data collection with safety and disaster response concerns.

Data sharing could be achieved by facilitating interface between researchers. Data sharing within and between institutions can be challenging, with some data sharing rules tightly restricting use. Additionally, it would be best if data were in one format to facilitate easy sharing and usage where possible. This would be easier with a shift in cultural values to encourage data sharing within and between institutions. To avoid duplication of research efforts, it would be beneficial to have a centralized database for disaster research taking place in NC. This indirect communication between researchers would enable individuals to register their research and would facilitate collaboration between researchers who might otherwise unknowingly duplicate efforts.

Information sharing between communities and researchers is also a challenge to disaster research. Day One would like to enable a bridge between researchers and communities to facilitate this bidirectional communication. Additionally, an interface called EnviroScan is currently under development and would be a way for communities to receive data. Once a bridge is created between researchers and community members, though, it is important to make any information given very accessible and accept any information being given back. Accepting information back and adjusting accordingly will make communities feel like they are part of the process and more willing to provide feedback to improve the project. This would also create a relationship of mutual respect between researchers and communities.

Several recommendations to facilitate accessible dissemination of information include defining acronyms and providing a list of acronym definitions for reference, using more photos to explain concepts and topics, and intentionally pausing to make sure all audience members are up to speed. One effective way of disseminating information is through social media, press releases, and flyers. Audiences also have different characteristics and it is important to be mindful that those from different cultures or who grew up in different times have different expectations for communication; older individuals may not be comfortable going online to access information. Relatedly, the need to communicate much information can become burdensome for community partners, so it is important to make the process as easy as possible for them. Language barriers then must be taken into account, not only among those who do not primarily speak English; different industries have different terminology and it is important to be mindful of this foe maximal understanding. All of this takes time and intentionality; researchers must include time to communicate in their funding plans.

Getting into the field immediately post-disaster is not always possible for a variety of reasons, some of which can be remedied. Researchers can be sure to train their team members in anticipation of a disaster and keep a record of who has been trained to an acceptable level to collect data post-disaster. Additionally, prior planning by bringing together a team of disaster researchers (both within one's home institution and outside of it) and designating team roles will smooth the process (e.g. one person knows that they need to brief the team on safety protocols). Researchers can greatly expedite the data collection timeline by having the RAPIDD protocols already in place with their IRB. This sort of prior preparation is essential to apply to communities as well; researchers must have relationships built on trust with affected communities prior to a disaster. This would also enable researchers to collect baseline data in the area. ✳

Conclusion

This summit brought together a wide variety of stakeholders from across (and beyond) NC and gave them both a platform to present their work as well as the opportunity to communicate with each other. Participants included researchers, community leaders, faith-based leaders, government employees, and a myriad of others. This summit focused on identifying challenges to disaster research and workshopping solutions to those challenges. This information is critical so that disaster research can be strengthened and utilized to improve disaster planning, response, and recovery especially as it pertains to populations that already suffer from inequitable health statuses.

Throughout the summit, themes centered on the necessity of planning and preparation for activities surrounding disaster response and data collection prior to crisis events. Funding mechanisms should be available in anticipation of disasters to allow for the necessary planning and preparation for successful research endeavors. These plans must take place well before a disaster occurs and must be inclusive of community members to ensure equity of the response. It is critical to form and maintain relationships based in mutual trust and agreements well in advance of crisis events. This not only means that community members are likely to be more willing to participate in research but also that researchers may have the chance to collect baseline data.

Part of building relationships with communities is facilitating community engagement; researchers must not only transmit information, but also receive it and use it to inform their research design. Their research will be more relevant to the community and potentially of higher quality because of the feedback. Being inclusive in this process also means that communities which have historically been marginalized, who are under- resourced, composed of those who do not primarily speak English, or EJ communities may be more willing to trust the researcher. Including these communities is essential to responding appropriately to disasters, as they are disadvantaged populations whose already inequitable health statuses are at risk of exacerbation by disasters. Recognizing the clear importance of community relationships, there was a pronounced desire among summit participants for guidance on how to create and maintain community relationships. In the absence of comprehensive guidance, the summit presentations provided important points to consider – producing easily accessible and culturally appropriate information via a variety of sources as well as receiving feedback with grace are essential to building mutual respect. It is the responsibility of researchers to utilize data to tell a story which can then be used to inform policy makers and improve the long-term recovery and resilience of vulnerable communities.

Also part of discussions was the need for communication and data sharing among researchers. The DR2 platform enables resource sharing between researchers and encourages data harmonization through use of common data elements. Data should be shared within and between institutions to allow for more robust projects. One suggestion to avoid redundant effort was a database where researchers can share their project topics, potentially opening the door for collaborations. The COVID-19 pandemic has made data sharing platforms far more widespread, making data sharing easier should the culture encourage it.

This summit was just the beginning of improving support for disaster research; there will continue to be challenges to disaster research and these challenges must be overcome with inclusive collaborations of many stakeholders working together. Planning together, preparing together, and responding together, we can improve our responses to disasters and reduce the burdens they place on our most vulnerable community members. �

The Research Triangle Environmental Health Collaborative supports a united environmental health resource that connects organizations and institutions; links research and policy; and joins government, academia, industry, and public interest groups to mutually consider, discuss, and debate the future of environmental health on a regional, national, and international level.

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