



National Institutes of Health

Disaster Research Response Workshop

Participant Guide

TUCSON, ARIZONA
February 28- March 1, 2019



THE UNIVERSITY OF ARIZONA
Mel & Enid Zuckerman
College of Public Health



THE UNIVERSITY OF ARIZONA
College of Pharmacy



BIOS
Institute

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1. Introduction

Progress in disaster preparedness, response, and recovery is often hampered by the relative absence of scientific data that can help guide systems development, protocols and procedures, citizen action, and use of medical countermeasures. Short and long term health consequences to a variety of exposures often go unknown. Behavioral health consequences have been identified, but preventive and mitigating measures are not yet fully understood. While there are many reasons for the overall lack of disaster science, a major contributor is the inability to conduct disaster research in the immediate post-disaster period when critical information is most perishable. Public health and medical responders have recognized the need to conduct disaster research for years. While research grants have been awarded to study the aftermath of disasters, such as the BP Deepwater Horizon Oil Spill and Hurricanes Sandy, Harvey, and Maria; research efforts came to fruition only after long periods in which protocols were developed and approved by Institutional Review Boards (IRB) and after funding became available. In these instances, local responders were well into the recovery period when research activity began. To date, there is no systematic research infrastructure to support public health and medical investigations following disasters.

In response to recent disasters and the research conducted in their wake, NIH has committed to fund the NIH Disaster Research Response Program (DR2). This program, developed by the National Institute of Environmental Health Sciences (NIEHS) in collaboration with the National Library of Medicine (NLM), aims to create a disaster research system consisting of coordinated environmental health disaster research data collection tools and a network of trained research responders. Elements of the system include epidemiologic questionnaires and clinical protocols, specially trained disaster researchers, environmental health disaster research networks, a reach-back roster of subject matter experts, and a support infrastructure that can be activated and deployed during public health emergencies and declared disasters. NIEHS is building on its extensive program capabilities, research networks, and field experience in leading this program.

NIEHS and its partners held the first DR2 Tabletop Exercise on April 7, 2014 in the Port of Long Beach, California. The goals of the first exercise were to test and gather feedback on the concept of operations (ConOps) and to facilitate DR2 integration with state, local, private, and federal stakeholders. The exercise served to bring together these stakeholders to discuss the process of integrating research responders into the response system. NIEHS used the resulting feedback to revise the key components of the ConOps. The Major Findings Report can be found on the NIEHS website:
https://tools.niehs.nih.gov/wetp/public/hasl_get_blob.cfm?ID=10101.

NIEHS and its partners held the second DR2 Tabletop Exercise in Houston, Texas on February 16, 2015. Like the 2014 exercise, the format for the second exercise was also a facilitated discussion to consider potential procedures for including a research component

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in the larger response following a disaster. The exercise was comprised of two sessions: The morning session consisted of a facilitated discussion with all stakeholders to assess and evaluate research capabilities and capacities, identify mechanisms to engage federal partners, and explore future partnerships between all stakeholders. The afternoon session involved an interactive activity where participants had an opportunity to learn about and provide input to a NIEHS Rapid Acquisition of Pre- and Post-Incident Disaster Data (RAPIDD) research protocol designed for the rapid collection of baseline information from responders and disaster workers. The format for this session simulated enrollment of participants into a comprehensive post-disaster research study and the goal was to allow the exchange of ideas among government officials, academia and community stakeholders on best practices for study operations.

A third workshop was held on July 19, 2016 in Boston, Massachusetts at the Thomas P. O'Neill, Jr. Federal Building. The workshop brought together local, state, and federal public health and emergency response offices, community members, worker organizations, private industries, and other stakeholders to better understand how long-term, large scale research is requested at the local and state level, and the process in which outside assistance research requests are managed. Participants also assessed how a process, working off of the current infrastructure, might facilitate collaborations between the differing groups to come together to develop and implement needed research.

This fourth workshop is being held in conjunction the University of Arizona College of Medicine - Tucson, the Mel and Enid Zuckerman College of Public Health, the University of Arizona College of Pharmacy and the Bio5 Institute, with the aim of exploring how stakeholders can come together to enhance both the population-based disaster research, as well as clinical disaster research.

Important Notices:

- Please be aware that notes from this workshop will not attribute comments to individuals or agencies.
- There will be a videographer on site filming the event. If footage of a statement you make is used you will be contacted for approval before a video is released.



Disaster Research Response Workshop

Day 1: February 28, 2019

8:30 a.m.	Sign-in and Registration Kiewit Auditorium Arizona Cancer Center 1515 N. Campbell Ave. Tucson, Arizona 85724
9:00 – 9:45 a.m.	Welcome, Introduction, and Overviews <ul style="list-style-type: none">• <i>Linda Birnbaum, Director, National Institute of Environmental Health Sciences</i>• <i>Irving Kron, Interim Dean, University of Arizona College of Medicine-Tucson</i>• <i>Jennifer Barton, Director of the University of Arizona BIO5 Institute</i>• <i>Brian Erstad, Head of the Department of Pharmacy Practice and Science at the College of Pharmacy</i>• <i>Jeff Burgess, Associate Dean for Research, Mel and Enid Zuckerman College of Public Health</i>
9:45 - 10:45 a.m.	General Background on Disaster Management Health Issues <i>Facilitator: Jeff Burgess, University of Arizona College of Public Health</i> <ul style="list-style-type: none">• <i>Chris Anderson, Deputy Chief, Tucson Fire Department</i>• <i>Jeff Guthrie, Director of Pima County Office of Emergency Management</i>• <i>Stacey Arnesen, National Library of Medicine</i>• <i>Keith Mundy, International Chemical Workers Union Council</i>• <i>Jim Remington, NIEHS Worker Training Program</i>
10:45 - 11:00 a.m.	Break
11:00 - 11:05 a.m.	Student Flash Talk <ul style="list-style-type: none">• Impacted Disaster Area• Impacts of Chlorine and Pesticide
11:05 a.m. - 12:05 p.m.	Acute Emergency Management Information for Health Protection <i>Facilitator: Kevin Yeskey, HHS Principal Deputy Assistant Secretary for Preparedness and Response</i> <ul style="list-style-type: none">• <i>Chris Anderson, Deputy Chief, Tucson Fire Department</i>• <i>Keith Fehr, Banner Health</i>• <i>Jeff Guthrie, Director of Pima County Office of Emergency Management</i>• <i>Mazda Shirazi, Arizona Poison and Drug Information Center</i>• <i>Louie Valenzuela, Pima County Health Department</i>• <i>Ray Vasquez, Union Pacific</i>• <i>Debra Wise-Parks, El Rio Health</i>
12:05 – 1:05 p.m.	Lunch
1:05 – 2:05 p.m.	Medical Care and Treatment <i>Facilitator: Chuck Cairns, Dean, College of Medicine and Health Sciences, United Arab Emirates University</i> <ul style="list-style-type: none">• <i>John Scherpf, Chief Operating Officer for Banner – University Medical Center Tucson and Banner – University Medical Center South</i>• <i>J. Perren Cobb, Keck School of Medicine at University of Southern California</i>• <i>Christopher Edwards, University of Arizona College of Pharmacy</i>• <i>Gregory Measer, Food and Drug Administration</i>• <i>Jarrod Mosier, University of Arizona College of Medicine</i>• <i>Trisha Pearce, Southern Arizona VA Health Care System</i>• <i>Frank Walter, University of Arizona College of Medicine</i>



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2:05 – 2:35 p.m.	Overview of Steps and Information Needs for Health Care and Community Studies & Introduction to Data Map <ul style="list-style-type: none">• <i>Steve Ramsey, Social & Scientific Systems</i>• <i>Karen Lutrick, University of Arizona College of Medicine</i>
2:35 -2:45 p.m.	Break
2:45 – 3:45 p.m.	Health Care Information Collection Demonstrations <ul style="list-style-type: none">• <i>National Library of Medicine Common Data Elements and NIEHS RAPIDD</i><ul style="list-style-type: none">○ <i>Stacey Arnesen, National Library of Medicine and Steve Ramsey, Social and Scientific Systems.</i>• <i>Meridian/AKIDO Demonstration</i><ul style="list-style-type: none">○ <i>J. Perren Cobb, Keck School of Medicine at University of Southern California</i>• <i>FDA RAPIDD Mobile Data</i><ul style="list-style-type: none">○ <i>Greg Measer, Food and Drug Administration Crowd Movement Model</i>• <i>Young-Jun Son, University of Arizona Department of Systems and Industrial Engineering</i>• <i>Poison Control Center Demonstration</i><ul style="list-style-type: none">○ <i>Mazda Shirazi, Arizona Poison and Drug Information Center</i>
3:45- 4:30 p.m.	Breakout Sessions: Clinical Data <ul style="list-style-type: none">• <i>Clinical Data</i> <i>Room 3978</i>• <i>Environmental and Animal Data Collection</i> <i>Main Auditorium</i>• <i>Data Use, Permissions and Research</i> <i>Room 4978</i>
4:30 – 5:00 p.m.	IRB Discussion of Ethical Considerations and Issues for Health Studies <ul style="list-style-type: none">• <i>Mariette Marsh, Director, Human Subjects Protection and Privacy Program, University of Arizona</i>• <i>Joan Pakenham, National Institute of Environmental Health Sciences</i>
5:00 – 5:05 p.m.	Wrap Up



Disaster Research Response Workshop

Day 2: March 1, 2019

8:30 a.m.	Sign-in and Registration Kiewit Auditorium
9:00 – 9:30 a.m.	Report Back from Clinical Data Breakouts
9:30 – 10:35 a.m.	Understanding Community Health Impacts <i>Facilitator: Liam O’Fallon, NIEHS</i> <ul style="list-style-type: none"> • Paloma Beamer, Southwest Environmental Health Sciences Center, UA • Sonia Colina, National Center for Interpretation at University of Arizona • Kristen Pogreba-Brown, University of Arizona College of Public Health • Kim Tham, Pima County Health Department • Ann Marie Wolf, Sonora Environmental Research Institute, Inc. (SERI) • Kenneth Komatsu, Arizona Department of Health Services
10:35 – 11:00 a.m.	Student Flash Talks <ul style="list-style-type: none"> • Using Toxin Exposure Surveillance in Animals to Predict Toxin Exposure in Humans • Addressing Service Gaps for Those with HIV in a Tucson Disaster • PACC Housing Animals during an Evacuation • Using Emergency Alert Systems to Generate a Disaster Registry: The Potential Role of IPAWS in Identifying Affected Persons • Understanding vulnerability and adaptive capacity to large-scale power failure • Psychological Interventions and Data Collection Methodology for Early to Mid-term Stages of Post-Disaster Relief • Monitoring First Responders for Health Effects Using Epigenetic Markers
11:00 - 11:05 a.m.	Break and Move to Breakout Sessions
11:05 a.m. - 12:00 p.m.	Breakout Sessions: Understanding Community Health Impacts <ul style="list-style-type: none"> • Environmental Data Collection Room 4978 • Community Resilience & Long-Term Recovery Room 3978 • Community Data Collection Main Auditorium • Community Engagement Room 2920
12:00 – 12:15 p.m.	Report Back
12:15 – 1:30 p.m.	Lunch and Poster Viewing
1:30 – 3:30 p.m.	Research to Support Long-term Recovery and Well-being <ul style="list-style-type: none"> • Michael Allison, Arizona Department of Health Services • Dean Billheimer, Southwest Environmental Health Sciences Center, UA • Linda Birnbaum, Director, National Institute of Environmental Health Sciences • Jeff Burgess, University of Arizona College of Public Health • J. Perren Cobb, Keck School of Medicine at University of Southern California • Leremy Colf, HHS Assistant Secretary for Preparedness and Response • Joseph “Chip” Hughes, NIEHS Worker Training Program • Kim Janes, Pima County Health Department • Andreas Theodorou, BUMG Chief Education Officer, UA Vice Chair Clinical Affairs and Quality, Department of Pediatrics
3:30 – 3:35 p.m.	Student Flash Talk <ul style="list-style-type: none"> • Evaluation
3:35 – 4:30 p.m.	Translating the Workshop to Improve Future Disaster Research <ul style="list-style-type: none"> • Local Reflections • National Reflections • Group Discussion

3. Logistics

3.1 Transportation and Parking

The Tucson International Airport (TUS) is the closest airport to the University of Arizona College of Medicine – Tucson Campus.

The University of Arizona CatTran provides shuttles around campus:

<https://parking.arizona.edu/campus-services/cattran/>

Visitor Parking is available in metered parking lots and garages around campus. For specific information please visit: <https://parking.arizona.edu/parking/>

3.2 Registration and Sign-in

Registration is free, but required for this workshop. Seating is limited.

The workshop sign-in desk will be located outside the Kiewit Auditorium on the University of Arizona Medical Center Campus (1515 N. Campbell Ave. Tucson, Arizona 85724)

Registration will open at 8:30 a.m. Please sign-in and collect your nametag and a folder containing materials for the workshop. Staff members can be identified by their nametags.

3.3 Meals

Coffee and water will be available in the back of the room and is generously being provided by the University of Arizona BIO5 Institute. Lunch will be on your own.

Lunch options:

The closest lunch option is **the Banner-University Medical Center Tucson Hospital Cafeteria**. The cafeteria offers breakfast, grilled foods, salads, made-to-order pizza and more.

Additional nearby Campus options:

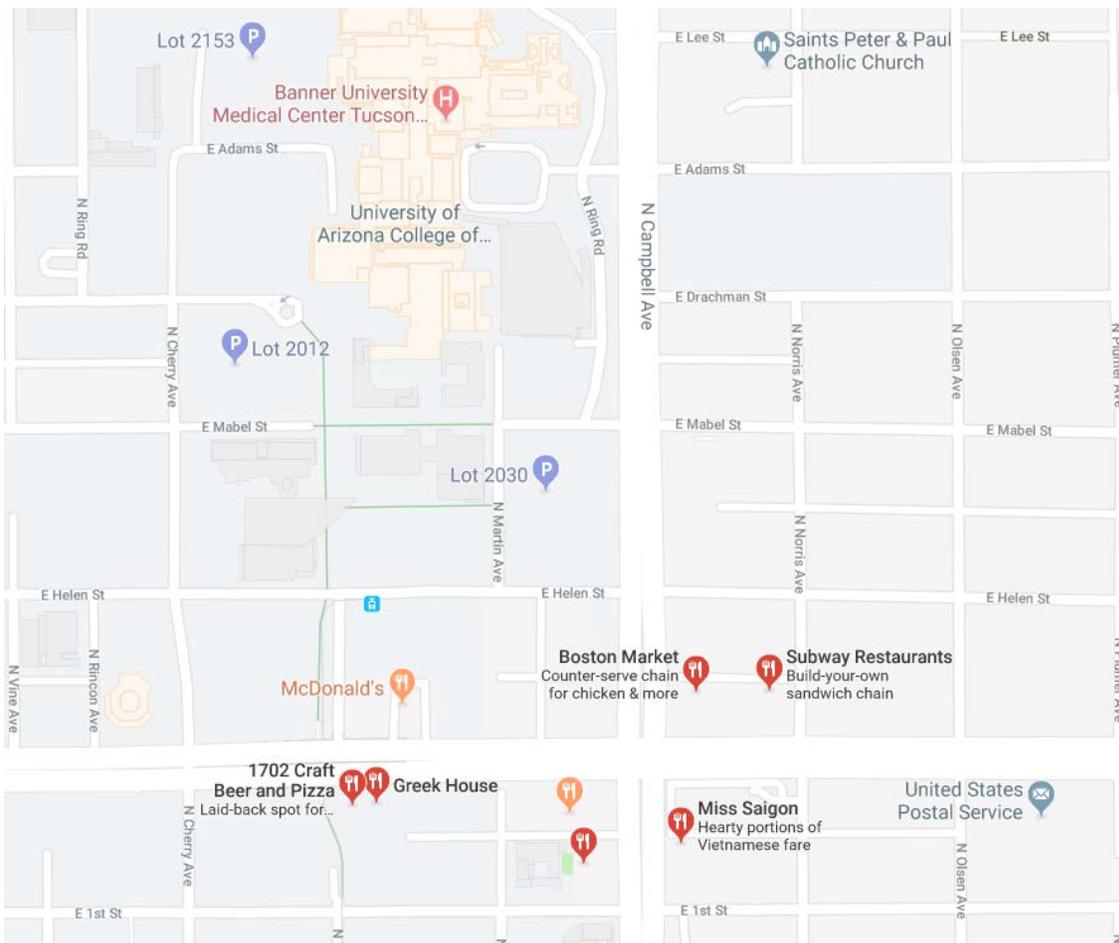
- Catalyst Café (A UA sandwich/coffee bar near the BIO5 building)
 - 1303 E. University Blvd., Tucson, AZ 85719

Nearby Neighborhood Options

- Before you reach the walkway/underpass:
 - McDonalds
 - 1711 E Speedway Blvd, Tucson, AZ 85719
- If you take the underpass across Speedway:
 - 1702- Pizza & Salad
 - 1702 E Speedway Blvd, Tucson, AZ 85719

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- Greek House- Greek food
 - 1710 E Speedway Blvd, Tucson, AZ 85719
- Bentley's Coffee & Tea- Sandwiches & Salads
 - 1730 E Speedway Blvd, Tucson, AZ 85719
- On the corner of Speedway & Campbell Ave:
 - Wendy's
 - 1005 N Campbell Ave, Tucson, AZ 85719
 - Taco Bell
 - 1818 E Speedway Blvd, Tucson, AZ 85719
 - Boston Market
 - 1903 E Speedway Blvd, Tucson, AZ 85719
 - Subway
 - 1927 E Speedway Blvd #111, Tucson, AZ 85719
 - Trident Grill- Full service restaurant, bar & grill
 - 2033 E Speedway Blvd, Tucson, AZ 85719
 - Miss Saigon-Vietnamese
 - 1072 N Campbell Ave, Tucson, AZ 85719



4. Overall Concepts

4.1 Objectives

Workshop Objectives

- Foster increased understanding of the importance of rapid data collection and research in response to disasters by a wide audience of stakeholders, including impacted communities
- Identify strategies and platforms for multiple stakeholders to improve their capabilities for rapid clinical and population investigations and research
- Facilitate relationships and knowledge sharing between local, state, federal, academic, and community stakeholders
- Explore research tools, protocols, and processes that help support the design, review, and implementation of timely clinical and epidemiologic research in response to disasters

4.2 Guidelines

Format

The workshop will consist of facilitated discussions, breakout group sessions, panel presentations, and poster presentations.

Facilitated Discussion

Participants are strongly encouraged to come prepared by reviewing the materials prior to attending the workshop. While facilitators may direct discussion questions to panelists, audience members are welcome to speak up and share their perspective.

It is important to remember that the objective of the workshop ***is not to focus on finding a single answer to the questions. Rather, we are interested in talking through the process of identifying procedures, resources and relationships that can be used to respond to and recover from disasters and we expect that discussions may lead to further questions.***

Poster Session

This year, the workshop is hosting posters submitted by the University of Arizona students and other researchers working in disaster research. The aim of the posters is to highlight disaster-related research response strategies, tools, or processes discussed during the workshop. Poster abstracts can be found in Appendix E.

5. Evaluation Survey and After-Action Report

Students from the University of Arizona have created an evaluation survey. At the conclusion of the workshop, please complete the survey and turn it in to any staff member or leave it at the sign-in desk. Your input will be used to enhance DR2 as well as future workshops. A few weeks following the workshop, NIEHS will prepare and distribute an after-action report.

6. Workshop

6.1 Assumptions

Participants should take into account the following assumptions as they engage in the dialogue:

- Funding is not an issue
- Each agency has capacity/capability limits that are based on this moment in time plus the constraints of maintaining their actual operations plus the considerations of the impact of this disaster on the personal lives of their workforce
- Decisions/ actions will reflect current plans

6.2 Scenario

The scenario has been selected to represent a plausible local event. It is purposefully vague so as to not limit discussion topics. The artificialities in the scenario should be used to generate discussion. If you have any questions about scenario specifics, please ask your facilitator to provide additional explanation.

February 28, 8:00 a.m.

A freight train has collided with another train in Tucson at the Union Pacific Rail Yard. The immediate collision has resulted in a large explosion and derailment of several railroad cars carrying industrial chemicals, including propane, chlorine, and malathion. It is reported that chemicals are leaking from several of the cars and the smell of chlorine is very strong. Injuries have been reported and firefighters are arriving on the scene to assess and control the situation. Winds are blowing at 4 miles per hour out of the east.

The derailment and the response have disrupted traffic on roads south of Broadway and north of East Ajo Way between South Park Avenue and South Columbus Boulevard, including major bridges crossing the rail yard at 22nd Street and the South Kino Parkway, and Aviation Parkway (Highway 210) and stretches of the South Kino Parkway. Traffic on the I-10 corridor has been impacted by the incident.

February 28, 10:00 a.m.

Fire and chemical plumes are flowing into neighboring communities in Pueblo Gardens, South Park, Las Vistas, and South Tucson. Approximately 6,000 people are living in these communities. Evacuation efforts have been initiated for those within 1 mile of the rail yard, and shelter-in-place orders have been issued for those located between 1 and 2 miles of the yard.

The chemicals released from four of the breached railroad cars included liquid propane; chlorine (90-ton car); and malathion, an organophosphate pesticide (80-ton car). One

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railroad car carrying flammable propane, located further away from the other railroad cars, exploded during the accident, sending a fireball high into the sky. A gaseous plume with the distinct smell of chlorine has been reported (chlorine measurements taken within .1 miles of the site were 90 ppm). Workers and residents near the rail yard are being transported to Banner Health. High numbers of incident-related injuries and seven deaths have been reported at this time.

Note: There are approximately 34,000 people living within a 2-mile radius of the crash site.

February 28, 2:00 p.m.

At this time, nine deaths have been confirmed. Ambulances have been taking the injured to Banner University Medical Center and nearby hospitals. Other area clinics and health treatment facilities are reporting an increase in calls and visits by worried and sick individuals. Victims have skin, mucosal, respiratory, neurological, and gastrointestinal symptoms that are consistent with exposure to burning particulate, chlorine, and organophosphate pesticides.

February 28, 6:00 p.m.

Numerous area workers and residents, including children, nursing home residents, and others, have been arriving at Banner, as well as at care facilities throughout the Tucson area. Available beds, front-line medical treatments, and other resources are rapidly being depleted.

The news media is reporting that a child living near the site is in critical condition due to what appears to be pesticide-related exposure.

Health experts are reportedly working to understand the health impacts of the situation and the best courses of treatment. As standard treatments for victims are being used, the team begins discussing the use of alternative treatments in case standard options run out. Local health officials are working closely with the U.S. Department of Health and Human Services, the Centers for Disease Control and Prevention, and the Food and Drug Administration to access and administer needed medical treatments.

March 1, noon

As of now, the incident has resulted in 16 deaths and over 200 hospitalizations for health effects stemming from toxic chemical exposures.

14 Days Post-Incident Status

The immediate explosion of the liquid propane railroad car resulted in additional fires in the area and metal projectiles that ruptured the three other railroad cars. The fires and chemical releases lasted from several hours to days, further complicating the situation and spreading ash, debris, and chemicals into the surrounding neighborhoods. Investigations regarding the incident are still underway. An estimated 90 tons of liquid chlorine was released from one railroad car, which quickly vaporized, producing a thick cloud of chlorine gas that spread for a mile throughout the area. Approximately 80 tons of malathion aerosols were released from the other two railroad cars.

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Local environmental assessments are continuing in impacted areas and have found elevated concentrations of malathion in area soils, surface water, plants, and house dust. As a result of the spill, efforts were made to evacuate approximately 6,000 people living within 1 mile of the site while HAZMAT teams and cleanup crews decontaminated the area. Evacuated citizens are being permitted to return to their homes to begin the cleanup and repairs. As seen with other disasters, many did not leave their homes.

Private businesses and manufacturing are working to clean up and reopen. Local workers are being hired to assist with the cleanup. Out-of-area workers and volunteers, including groups of unskilled workers and volunteer organizations, have also shown up to help with the recovery.

Due to the severity of the cases reported by the news media, local emergency departments, and local responders, requests have been made to the local public health department to investigate the health effects related to the exposures.

Community residents and local workers are complaining of a variety of symptoms, including stress, anxiety, skin rashes, shortness of breath, dizziness, headaches, and tingling in the extremities. Area health treatment facilities are continuing to report increased cases of those seeking medical attention for health and mental health conditions related to the situation. Additionally, community residents and local workers in the surrounding communities are complaining of ongoing smells, debris, ash, and dust from the accident. Residents are also reporting dead birds and rabbits, and illnesses in their pets. Area residents are increasingly worried and distrustful about the safety of the community:

- Are the playgrounds and yards safe for children?
- What about food grown in home gardens?
- Is it safe to swim in local pools?

Community members (especially the elderly, pregnant women, and children's advocates), responders, and cleanup workers are alarmed about reports of those still being seen with symptoms that many believe to be associated with residual contamination of homes, businesses, playgrounds, etc., and are requesting that the health commission investigate the affected populations.

30 Days Post-Incident Status

Tucson stakeholders have received funds to quickly identify the current health symptoms/problems, health care needs, environmental exposures, and related concerns for all community members living in a 1-mile radius of the site. Decision-makers wish to answer the following questions:

- What is the nature and prevalence of health problems?
- What contaminants of concern are present in the environment?
- What are the residents' major concerns that need to be addressed?

The community continues to express concerns about being involved in all aspects of data collection efforts, ensuring that their concerns and health needs are being addressed, as well as the safety of their homes and neighborhoods.

Many groups are concerned about achieving meaningful long-term recovery for the community in the months to years ahead.

60 Days Post-Incident Status

Over the past 60 days, at least 1,200 people, including cleanup workers, have sought medical attention at area hospitals and clinics for exposure-related health complaints. Many of those who were treated and have returned home are still complaining of lingering health problems. People treated in the hospital have returned home, with about 35 percent of those treated receiving various levels of ongoing care at Banner and other community health care facilities.

Several cross-sectional community health and environmental assessments have been completed and have revealed increases in health problems, including respiratory, skin, and neurological symptoms, as well as elevated levels of malathion in homes, yards, and playgrounds. Additionally, individuals living in these communities are still complaining of cough, chest tightness, shortness of breath, wheezing, eye irritation, skin rash, tingling in extremities, abdominal cramps, headaches, diarrhea, vomiting, and nausea. Local responders involved in the community cleanup efforts in these areas have also reported similar symptoms. Hospitals are also reporting increased cases of individuals from the surrounding areas with similar complaints, as well as symptoms of acute anxiety and stress from the situation.

Residents continue to report dead birds and rabbits, and illnesses in their pets. Area residents are increasingly worried and distrustful about the safety of the community. Numerous meetings have been held between health officials and area residents. In addition to environmental testing and monitoring, community leaders have been calling for health studies similar to what was done for the Graniteville, South Carolina, community in response to a train derailment in 2005. These community health assessments included psychosocial health surveys, vital signs measurements, medical and exposure histories, pulmonary function and reactivity tests, and evaluation of a lung inflammation indicator. Additionally, members of the community are calling for additional health care services and longer-term support for the mental health trauma and health effects for those impacted by the event.

A request has been approved and funded for assistance to perform timely health research for as many as 10,000 community members and workers from the impacted areas to understand:

- The cause of health symptoms and illnesses.
- The safety and effectiveness of health treatments.

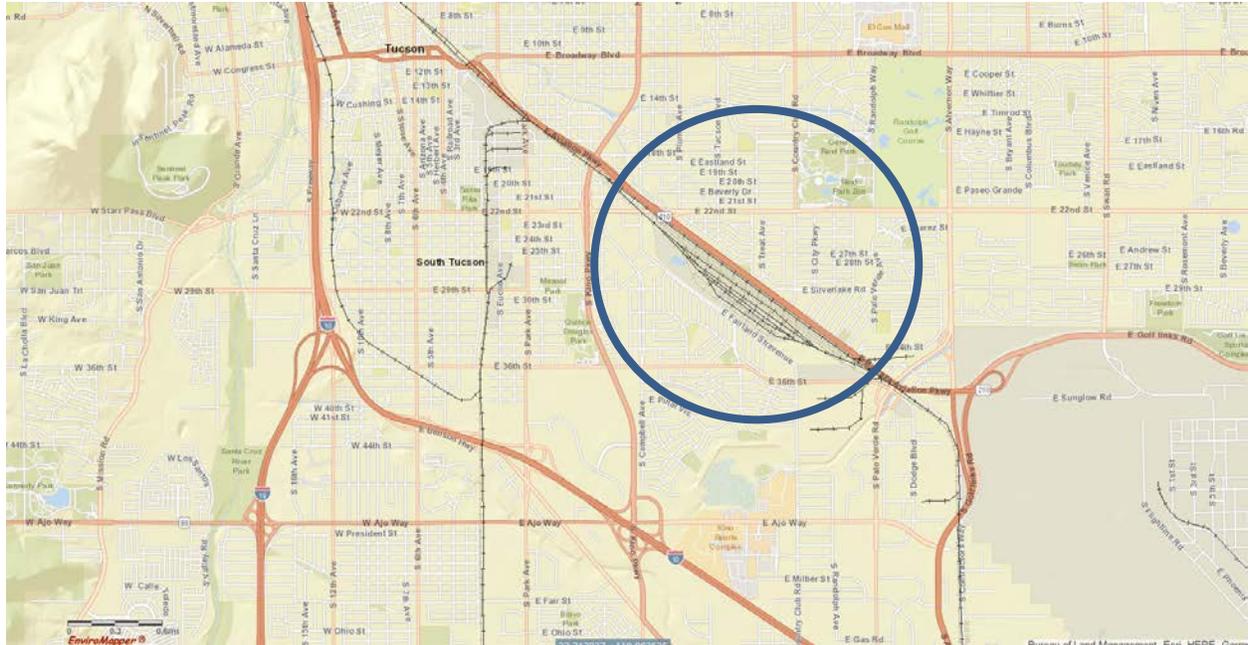
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- The magnitude and severity of the actual health impacts to better guide needed treatment and mitigation efforts.
- Ongoing environmental risks.
- Longitudinal health risks for workers and at-risk community populations.

Tucson stakeholders have developed the Clinical and Community TRACE Protocols, which have been approved by the Institutional Review Board. It is now time to implement the longer-term research protocols and associated data collection efforts that will support ongoing recovery efforts.

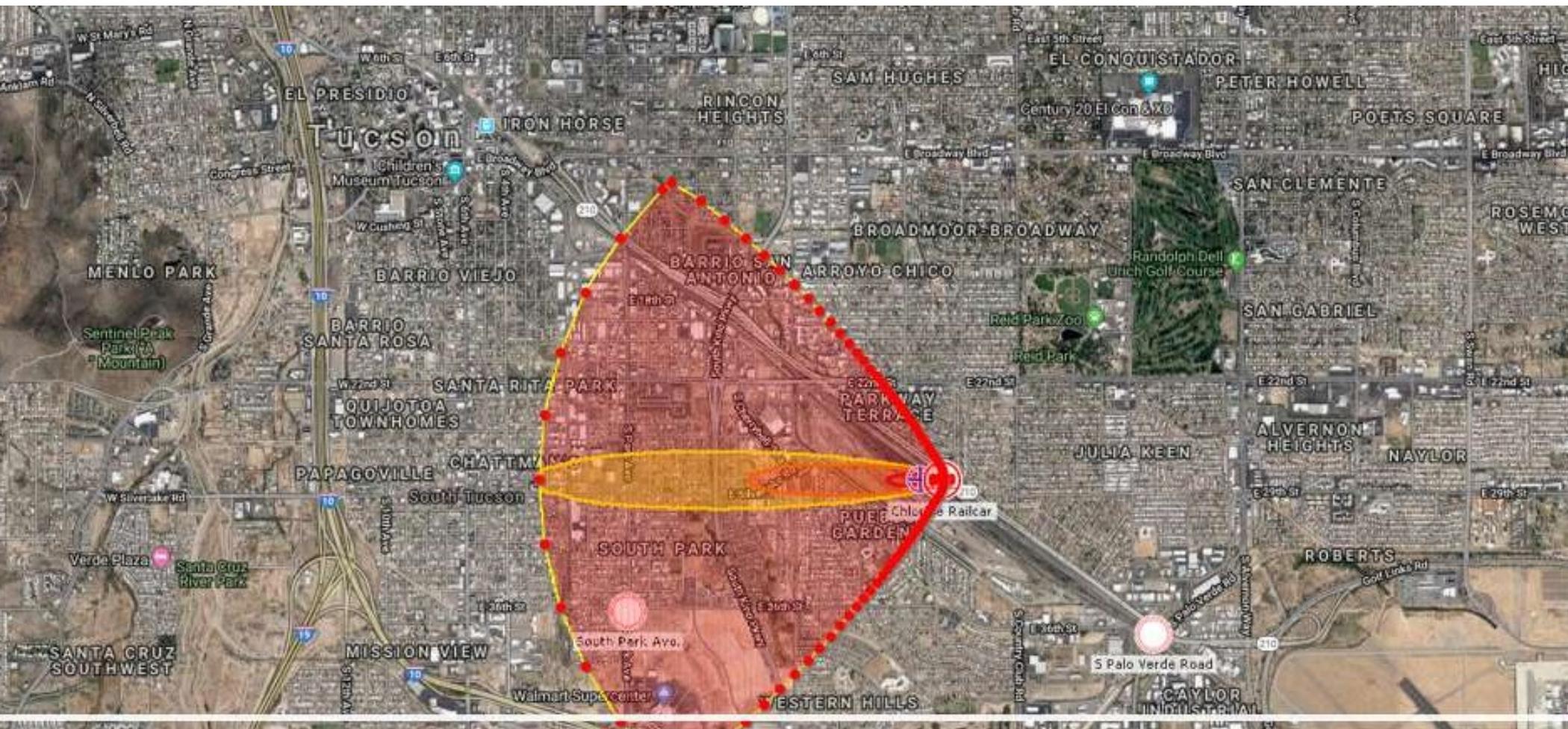
Appendix A. Scenario Details

Location of the Tucson Rail Yard



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The plume map below, created by the ICWUC team using a software called ALOHA, shows the areas impacted by chlorine in only the first hour following the incident based on the projected wind speed and chlorine properties



Affected Communities

In general, the populations living in South Park, Las Vistas, and Pueblo Gardens have the following characteristics that differ from the rest of Pima County and the overall United States. Residents of these communities tend to have lower incomes, are likely to be foreign-born of Hispanic descent and are more likely to speak languages other than English.¹ Following are brief profiles of the affected communities.

Las Vistas

Las Vistas neighborhood has a population of approximately 4,600 people. Approximately 42.6 percent of the population are Hispanic/Latino. The median household income is \$31,000.²

Pueblo Gardens

Pueblo Gardens has a population of approximately 2,990 people. The median household income is \$30,288. Seventy-eight percent of this neighborhood's residents have Mexican ancestry and 2.2 percent have Native American ancestry. Fifty-nine percent of its residents five years old and above primarily speak Spanish at home. Research shows that this neighborhood has an income lower than 88.1 percent of U.S. neighborhoods. With 46.5 percent of the children here below the federal poverty line, this neighborhood has a higher rate of childhood poverty than 89 percent of U.S. neighborhoods.³

South Park

South Park has a population of approximately 3,100 people, with approximately 70 percent of Mexican ancestry. The median household income is \$27,300, which is lower than 91.8 percent of U.S. neighborhoods. Nearly 50 percent of the children are below the federal poverty line, a higher rate than 91.1 percent of U.S. neighborhoods.⁴

Barrio Centro

Barrio Centro's population is approximately 950 people, with approximately 59 percent of Mexican ancestry. The median household income is approximately \$45,000, lower than 73 percent of U.S. neighborhoods. Nearly 16 percent of the children are below the federal poverty line, a higher rate than 50 percent of U.S. neighborhoods.⁵

Julia Keen

Julia Keen has a population of approximately 4,300 people. Seventy-seven percent of the population is Caucasian and 42 percent is Hispanic/Latino. It has a median household income of \$43,000, lower than 73 percent of U.S. neighborhoods. Sixteen percent of the children are below the federal poverty line, a higher rate than 50 percent of the U.S. neighborhoods.

¹ University of Arizona. "South Park, Las Vistas & Pueblo Gardens Community Profile."
<https://azprc.arizona.edu/sites/default/files/SouthPark-LasVistas-PuebloGdnsProfileFinal.pdf>

² <https://www.areavibes.com/tucson-az/las+vistas/demographics/>

³ <https://www.neighborhoodscout.com/az/tucson/pueblo-gardens>
<https://www.weichert.com/search/community/neighborhood.aspx?hood=55586>

⁴ <https://www.areavibes.com/tucson-az/south+park/demographics/>
<https://www.neighborhoodscout.com/az/tucson/park-ave#overview>

⁵ <https://statisticalatlas.com/neighborhood/Arizona/Tucson/Barrio-Centro/Household-Income>
<https://www.areavibes.com/tucson-az/barrio+centro/livability/>

Appendix B. Toxic Exposure Information

Malathion

Malathion is a pesticide that is used to kill insects on agricultural crops, on stored products, on golf courses, in home gardens, and in outdoor sites where trees and shrubs are grown at home; it is also used to kill mosquitoes and Mediterranean fruit flies (medflies) in large outdoor areas. Malathion interferes with the normal function of the nervous system. Because the nervous system controls many other organs, malathion indirectly can affect many additional organs and functions. Exposure to high amounts of malathion in the air, water, or food may cause difficulty breathing, chest tightness, vomiting, cramps, diarrhea, watery eyes, blurred vision, salivation, sweating, headaches, dizziness, loss of consciousness, and death. If persons who are exposed to high amounts of malathion are rapidly given appropriate treatment, there may be no long-term harmful effects. If people are exposed to levels of malathion below those that affect the function of the nervous system, few or no health problems seem to occur. There is no evidence that malathion affects the ability of humans to reproduce. There is also no conclusive proof that malathion causes cancer in humans, although some studies have found increased incidence of some cancers in people who are regularly exposed to pesticides, such as farmers and pesticide applicators. The main target of malathion toxicity in children is the nervous system, the same as in adults. There is no information in humans regarding transfer of malathion to the fetus or to nursing infants. IARC classifies malathion as a class 2A chemical, possibly carcinogenic to humans (<https://monographs.iarc.fr/wp-content/uploads/2018/06/mono112-07.pdf>).

ATSDR Report: <https://www.atsdr.cdc.gov/phs/phs.asp?id=520&tid=92>

Chlorine

If chlorine is spilled into water or onto soil or if it is released from a tank into the air, the chlorine will evaporate very quickly forming a greenish-yellow cloud that is heavier than air and can be carried by the wind away from the source. Exposure to low levels of chlorine can result in nose, throat, and eye irritation. At higher levels, breathing chlorine gas may result in changes in breathing rate and coughing, and damage to the lungs. In general, people who suffer from respiratory conditions such as allergies or hay fever, or who are heavy smokers, tend to experience more severe effects than healthy subjects or nonsmokers. Short-term exposures (minutes) to high concentrations of chlorine affect children in the same manner they affect adults, but children may be more sensitive. We do not know what the effects could be in children following longer-term, low-level exposure to chlorine gas or hypochlorite solution. We do not know whether exposure to chlorine gas during pregnancy can result in damage to unborn babies because there are no studies of pregnant women or pregnant animals exposed to chlorine gas.

ATSDR Report: <https://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=200&tid=36>

Appendix C. List of Acronyms

ASPR	Assistant Secretary for Preparedness and Response, HHS
CDC	Centers for Disease Control and Prevention
CDE	Common Data Elements
ConOps	Concept of Operations
DR2	Disaster Research Response Program
ED	Emergency Department (also known as an ER or Emergency Room)
EHR/EMR	Electronic Health Records/Electronic Medical Records
HHS	U.S. Department of Health and Human Services
HIPAA	Health Insurance Portability and Accountability Act of 1996 (HIPAA)
IRB	Institutional Review Board
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NIH	National Institutes of Health
NLM	National Library of Medicine
NTP	National Toxicology Program
PHERRB	Public Health Emergency Research Review Board
RAPIDD	Rapid Acquisition of Pre- and Post-Incident Disaster Data Protocol
WTP	Worker Training Program, NIEHS

Appendix D. Stakeholder Information

The workshop will bring together diverse groups of emergency response professionals, health care providers, researchers, environmental and government agency representatives and community members. Attendees may not be familiar with all the other stakeholders in the room and are encouraged to read in advance about services or skills of other stakeholders.

Arizona Poison & Drug Information Center
<http://azpoison.com/>

Banner - University Medical Center Tucson
<https://www.bannerhealth.com/locations/tucson/banner-university-medical-center-tucson?loctype=hospital>

Discovery Program for Resilience and Emergency Preparedness (PREP)
<https://www.sccm.org/Research/Research/Discovery-Research-Network>

El Rio Health
<https://www.elrio.org/>

FDA Medical Countermeasure Monitoring and Assessment Webpage
<https://www.fda.gov/emergencypreparedness/counterterrorism/medicalcountermeasures/mcmissues/ucm561377.htm>

Pascua Yaqui Tribe
<https://www.pascuayaqui-nsn.gov/>

Pima County Health Department
http://webcms.pima.gov/government/health_department/

Pima County Office of Emergency Management
http://webcms.pima.gov/government/office_of_emergency_management_homeland_security/

Southwest Environmental Health Sciences Center
<https://swehsc.pharmacy.arizona.edu/>

Tohono O'odham Nation
<http://www.tonation-nsn.gov/>

Tucson Water
<https://www.tucsonaz.gov/water>

Tucson Fire Department
<https://www.tucsonaz.gov/fire>

U.S. Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR) Region 9
<https://www.phe.gov/about/aspr/Pages/default.aspx>

Union Pacific - Tucson Rail Yard
<https://www.up.com/customers/premium/intmap/tucson/index.htm>

Appendix E. Poster Abstracts

Student Flash Talks & Associated Posters

Disaster Impact Map

Hiram Martinez, CEC Intern, Ben Richmond, MPH, Assistant CEC Director, Marti Lindsay, PhD, Director, Community Engagement

Southwest Environmental Health Sciences Center- Community Engagement Core

This poster is a map of the disaster area for this workshop. It highlights both the exclusion zone of the disaster and the organizations that would be impacted by this disaster; our stakeholders. The entire map shows south-central Tucson from 6th street in the north to Ajo Way in the south and Sentinel Peak Park and Sahuarita Avenue from west to east, respectively.

Chlorine & Pesticides

Adam Chacon, CEC Intern, Ben Richmond, MPH, Assistant CEC Director, Marti Lindsay, PhD, Director, Community Engagement

Southwest Environmental Health Sciences Center- Community Engagement Core

This poster provides background information on chlorine and pesticide products. Pesticides and Chlorine are often mixed with other toxic chemicals for the production of pest eliminators, household cleaners, and sanitizers. Routes of exposures are both discussed and displayed on the poster as well as the potential health risk or concerns an individual may have if they should come in contact with these chemicals. Protective equipment is displayed as a reference for the safe handling and application of pesticides in occupational professions, as well as proper labeling and storage of pesticides and chlorine products that can be found in the household. For further information on chemical ingredients, or laws and regulations, on chlorine and pesticides please visit the United States Environmental Protection Agency (EPA) website <https://www.epa.gov>.

Using Toxin Exposure Surveillance in Animals to Predict Toxin Exposure in Humans

Popp, J.

University of Arizona

This presentation will focus on the involvement of veterinary health centers as part of a One Health Response to the DR2 scenario. The focus is incorporating veterinarians into the notification system for connecting potentially exposed persons to treatment centers. Following the logic of the canary in the coal mine, domestic animals act as a sentinel system for exposure by presenting symptoms either before or at the same time as the owner. Either by regular check-ups or recommended screening, veterinarians will be vetting domestic animals for toxin exposure. By already having an owner profile for any suspected

cases, this information can be sent immediately to a human treatment center. Human healthcare teams can then contact the owner and recommend screening for them based on the evidence of exposure in their pet. Veterinarians will also inform the owners of symptoms of toxin exposure and also where these centers are and that they will likely be contacted about their animals' exposure. The most likely medium for this information exchange would take place over an app that veterinary centers could ask owners to voluntarily fill out their information or have the staff fill it out for them, thus giving consent to be connected to a toxin screening center. Phone applications using notification systems for animal disease outbreaks have already been used in several countries. Expanding the nodes of surveillance to animals will not only expand the ability to detect human cases but also potentially catch cases of exposure in humans before they develop, given animals' natural interaction with the environment. There is potential to expand this type of application to animal care centers such as the Pima Animal Care Center, zoos, and wildlife centers so they can act as additional indicators of potential human exposure.

Addressing Service Gaps for Those with HIV in a Tucson Disaster

Peterson, G.

University of Arizona, College of Public Health

Human Immunodeficiency Virus (HIV) is a chronic illness whose progression to life-threatening Acquired Immunodeficiency Syndrome (AIDS) can be mitigated with antiretroviral medications, when taken consistently and when other health needs are met. The provision of meals, transportation, emergency housing, and other essential services through the federally-funded Ryan White program allows these medications to be effective. While Arizona has published HRSA-compliant standards of care for the delivery of these services, no policy exists for the situation of delays in connection to services. This project proposes an action plan to address gaps in service delivery in the event of a disaster in the South Tucson area. Success will rely on collaboration and established partnerships with local agencies, including the Pima County Health Department, local HIV-service providers, and contracted agencies for additional Ryan White services. Data will be collected from service providers, as well as surveying of recipients and geospatial census and health department records. A thorough assessment of needs and services used by HIV-positive Tucsonans will inform the creation of an action plan in the case of local emergencies. Risk assessments in combination with geospatial analysis will provide an accurate and comprehensive view of how designated community partners should respond. This will prevent premature disease progression and death in those using these services, while also identifying community members whose needs are not currently met and connecting them to care. By establishing a protocol for continued care, the state and county health departments ensure the wellbeing of this vulnerable population in Tucson and the local population as it relates to the transmission and worsening of HIV.

PACC Housing Animals during an Evacuation

McKaughan, C., Pogreba-Brown, K., Auerbach, K.
University of Arizona

The presentation will focus on the evacuation plans for the city of Tucson regarding pets. This directly impacts human health during emergency situations because research on past disasters has shown vulnerable populations making decisions based on the safety of their pets. This means that people most affected by natural disasters or emergency situations are focusing on the safety of their pets first over their own safety which puts themselves at even higher risk. The objective of this project would be to mitigate any additional risk to human health while also creating a safe place for animal companions. Luckily, Tucson has one of the most sophisticated animal shelters in the country - Pima Animal Care Center (PACC). The goal would be to partner with PACC in emergency situations so community members could feel secure about leaving their pets at PACC and reassured they will be returned after they are settled. PACC has a well-established foster parent system in place that allows members of the community to temporarily foster animals which could be used in times of crisis when and if there is not enough space for all the animals on site. Through this partnership, we would be able to establish a more effective and efficient pet-friendly evacuation plan for the Tucson community.

Using Emergency Alert Systems to Generate a Disaster Registry: The Potential Role of IPAWS in Identifying Affected Persons

Souders, K., Trejo, M.
University of Arizona, College of Public Health

Disaster situations often result in mass exposure to chemicals, injuries, and trauma, among other things. These situations give rise to the possibility of long-term cohort studies to study the exposure. However, the ability to quickly create population-based cohorts has been difficult in the past. After disaster situations, affected persons may scatter geographically, either to obtain necessary resources, or because they are not otherwise connected to the disaster area. Studies assessing the outcomes of disaster situations may fail to capture a representative sample of affected persons, thus exposing results to sample biases. The Integrated Public Alert & Warning System (IPAWS) poses a potential solution to the problem of sample bias in disaster research, by capturing all individuals with personal technology devices in a designated area. IPAWS alerts can be disseminated immediately after a disaster, can be tailored to specified geographic regions, and can include a link to an external database, such as REDCap. We have explored the feasibility of using IPAWS to create a post-disaster registry of affected persons. Individuals with personal technology devices located in affected regions would receive an IPAWS alert with a link to a registry form, allowing them to volunteer for contact by research personnel at a later date. Special consideration must be made towards the accessibility and acceptability of this tool, such that it succeeds in capturing a representative sample of the affected population.

A Collaborative Partnership to Address Environmental Health Concerns of the Community following a Mass Exposure: A process for Collecting Environmental, Household, and Biomonitoring Data

Ornelas Van Horne, Y., Wagoner, R., Tham, K., Alshammari, M., Blohm, J., Eaker, D., Quintanar, D., Beamer, P.
University of Arizona

This collaborative partnership will bring together community members, public health professionals, and researchers from the University of Arizona, Pima County Health Department (PCHD), Pima County Department of Environmental Quality (PDEQ), and the City of Tucson Water Department to develop and implement a sampling plan to address community concerns based on the CASPER framework. Our focus is to address the following community questions: what are the malathion concentrations in the environment and how do they differ over time; what are the community's exposure levels over time? The poster will outline the necessary phases of a community-driven environmental health research project. The first phase will occur once HAZMAT has cleared the affected area. During this phase we will collect, air, water, soil, and dust wipe from homes, community gardens, playgrounds and drinking water samples from the potable water distribution system in the affected area. Listening sessions will be conducted to identify additional community areas of concern. The second phase occurs 45 to 60 days after the environmental sampling phase and will utilize an existing Community Health Worker (CHW) model to recruit, assess household contamination levels, and report back information to household participants. From each home we will follow established protocols to collect personal, air, water, soil, and dust wipe samples and drinking water samples from the potable water distribution system in the affected area. Participants will answer mental health, residential pesticide use, risk perception, and stress questions. After environmental samples and questionnaires have been analyzed, CHWs will report results back to individuals and at community events.

Psychological Interventions and Data Collection Methodology for Early to Mid-term Stages of Post-Disaster Relief

Skobic, I.
University of Arizona

Natural and man-made disasters test individuals' and communities' psychological resources. Disaster-related upheavals, displacement, injury, familial separation, and shattered assumptions regarding one's safety in the world may place individuals and communities at risk for trauma and stressor-related disorders, as well as for other forms of psychopathology and impaired functioning. The efficacy of widely used practices, such as immediate debriefing following potentially traumatic events, has recently been called into question. Experts have proposed a set of guidelines for post-disaster intervention and prevention efforts that include promoting: 1) a sense of safety, 2)

calming, 3) a sense of self; and community efficacy, 4) connectedness, and 5) hope. Yet, there is a paucity of literature on how these guidelines may translate to clinical and non-clinical interventions in the early to mid-term stages of post-disaster relief, as well as on methods of evaluating the effectiveness of these interventions. This poster explores the potential effects of incorporating these guidelines into psychological response efforts following a disaster and proposes methods for evaluation and data collection.

An Approach for Utilization of a Hazard Model and Dispersion Model in Chemical-spill Disaster Response

Alshammar, M., Hadeed, S., Ornelas Van Horne, Y., Blohm, J., Wagoner, R.
University of Arizona

Dispersion and hazard models are useful in estimating the spread, dispersion, and concentrations of environmental contaminants from point and mobile sources. This information can be useful in disaster planning, especially if a catastrophic event were to occur in a densely populated area. The goal of this project is incorporate two widely used dispersion and hazard models, Hybrid Single Particle Lagrangian Integrated Trajectory Model (HYSPLIT) and Areal Locations of Hazardous Atmospheres (ALOHA) in a disaster situation. Both HYSPLIT and ALOHA incorporate meteorology, trajectory, deposition, and resuspension of pollutants as they move through the environment. The project will be facilitated in two phases: In phase 1, malathion and chlorine will be entered into the ALOHA software to identify threat zones and can guide evacuation of communities. In phase 2, a more detailed analysis into the dispersion of malathion and chlorine will be modeled using HYSPLIT, which incorporates some of the variables lacking in the ALOHA model including: chemical reactions, adhesion to particulate matter, chemical mixtures, terrain, and turbulent environments. This will provide a more comprehensive dispersion profile of the pollutants in the atmosphere over a larger period of time. This framework can be applied widely in the context of disaster response.

Understanding Vulnerability and Adaptive Capacity to Large-scale Power Failure

Kurtz, L., Chakalian, P., Hondula, D.
Arizona State University, School of Human Evolution and Social Change

Technological hazard events often require rapid deployment of research methods to assess public health and wellbeing. Data gathered in the immediate aftermath of disaster can offer valuable insights into differential hazard impacts and household and community capacities, as well as provide an empirical foundation for long-term monitoring of individual and community recovery and health outcomes. Yet due to the short timeline required for rapid post-disaster research, collecting highly contextual qualitative data presents a challenge. Access to participants may be disrupted by disaster conditions and qualitative methodologies frequently require a significant time investment for both researchers and participants. We addressed these issues during a case study of rapid research deployment in the wake of Florida's Hurricane Irma in 2017. We used a systematic sampling

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strategy for recruiting participants across diverse sociodemographic and geographic strata and accelerated data collection method by combining close-ended questions with a semi-structured interview protocol. With these methods, we investigated household vulnerability, access to resources, adaptation strategies, and impacts from a technological disaster. This work advances methods for sampling and deployment of instrumentation after disaster strikes and offers insights into the advantages of qualitative data collection and analysis as a complement to traditional public health.

Monitoring First Responders for Health Effects Using Epigenetic Markers

Jung, A.M., Bautista, J.R., Zhou, J., Jenkins, T.G., Gulotta, J., Wallentine, D., Griffin, S.C., Dearmon-Moore, D., Littau, S.R., Burgess, J.L.
University of Arizona

Introduction: First responders have diverse exposures during disasters, particularly with fire events, but we lack sufficient biomarkers to assess risk of future disease associated with these exposures. Epigenetic markers in blood are associated with multiple disease outcomes, most notably cancer. The purpose of this study was to evaluate epigenetic markers in firefighters, a group at increased cancer risk.

Methods: Blood microRNA expression and differential DNA methylation (CpGs) were compared in Tucson Fire Department incumbents and new recruits, and among new recruits after two years.

Results: We found 9 microRNAs (eight associated with cancer) and 5 CpGs (4 associated with cancer) differentially expressed among incumbents versus new recruits. Pathway analysis of DNA methylation also revealed activation of gastrointestinal, lung and skin cancer in incumbent firefighters, consistent with prior epidemiologic studies showing higher rates of these and other cancers. Preliminary longitudinal analysis of the new recruits suggests that these changes can occur within two years.

Discussion: Our results suggest that evaluation of epigenetic markers can provide a measure of future risk following exposures in first responders. More widely adopted baseline and post-exposure biological sample collection from first responders would greatly expand our knowledge of the health effects of disasters.

Evaluation

Wrona, J., CEC Intern, Richmond, B, Assistant CEC Director, Lindsay, M., Director, Community Engagement

Southwest Environmental Health Sciences Center- Community Engagement Core

Evaluations are used to assess program impact, determine factors contributing to program success or failure, highlight areas for improvement, and justify continuation. The DR2 survey collects demographic data, feedback on sessions, activities, and event logistics, and assesses if workshop objectives were met. The goal of evaluating the DR2 Workshop is to continue to improve the program. The survey also aims to support the continuation of the workshop by exploring how knowledge learned contributes to departments or communities and desired topics for future workshops.

Other Informational Posters

The University of Arizona's National Center for Interpretation

Colina, S.

University of Arizona National Center for Interpretation

Effective communication with limited-English proficient (LEP) populations in disaster response situations is crucial to avoid miscommunication, and the exclusion of the LEP community. Failure to respond to the needs of LEP communities places public health and safety at risk. This poster offers some guidance on how to provide effective communication with LEP populations and the role the UA's National Center for Interpretation should play in these situations. Effective LEP communication is a two-fold process that involves (a) access policies and procedures and translation and interpreting services that respond to community needs (b) research on the effectiveness of the communication provided. Consequently, NCI proposes a participatory, community-based approach to translation and interpreting services for disaster response that engages the relevant university experts and professionals, as well as community members and users in the provision of services; pilots materials for comprehension and usability, and engages in ongoing data collection to test effectiveness. Our hypothesis is that LEP communication will be more effective with a participatory, community-based approach because it engages community members and other stakeholders to provide community-oriented, community-vetted services.

NIEHS WTP Disaster Site Trainer and Researcher Deployment Guides

Lee Pearson, J., Hughes, J., Remington, J., Weinstock, D.

National Institute of Environmental Health Sciences

Disaster sites can be austere environments in which local infrastructure is completely overwhelmed and responders and researchers who respond to the event face hazardous environments and are at high risk for physical and mental injury. The NIEHS Worker Training Program (WTP) and NIH Disaster Research Response Program (DR2) have extensive experience in responding to disasters caused by severe weather events. Under Worker Safety and Health Support Annex of the National Response Framework and the National Disaster Recovery Framework, WTP and its awardees have been actively involved in several natural disasters through the years to deliver training that aims to protect workers who may face multiple threats and hazards while responding and rebuilding in the aftermath of the destruction. In order to minimize risks to those who will be responding to disasters, NIEHS WTP has developed two deployment guides, for trainers and researchers, that provide guidance and recommendations for those deploying to a disaster. These guides help workers and researchers to better prepare their teams and families prior to, during, and after disaster response deployment. The goal of this poster will be to provide an overview of critical disaster site worker information needed to better prepare researchers, responders and trainers for deployment for disaster sites.

Appendix F: Additional Resources and Information

Medical Care & Treatment Information including information on Medical Countermeasures

Monitoring and Assessment of Medical Countermeasures as Part of a Public Health Emergency Response

Measer GT, Maher CT, Hu-Primmer J. Am J Public Health. 2018 Sep;108(S3):S224-S226.

Introduction

Ensuring the availability of safe and effective medical countermeasures (MCMs) is an essential part of any emergency response involving a chemical, biological, radiological, nuclear, or emerging infectious disease threat. For more than a decade, the US government has developed and refined the capabilities necessary to rapidly distribute, dispense, and administer MCMs—what many traditionally call “the last mile.” However, full-lifecycle surveillance to monitor MCM use and assess safety and effectiveness during an emergency response has not kept pace with preparedness efforts. The US government has a limited capacity to rapidly collect, share, and analyze MCM data in real-world settings

Full text: <https://www.ncbi.nlm.nih.gov/pubmed/30192659>

Clinical Care Research

Development of a core clinical dataset to characterize serious illness, injuries, and resource requirements for acute medical responses to public health emergencies

Murphy D, Rubinson L, Blum J, Isakov A, Bhagwanjee S, Cairns C, Cobb J, Sevransky J. Critical Care Medicine. 2015 Nov; 43(11): 2403-2408. doi: 10.1097/CCM.0000000000001274

Abstract

OBJECTIVES: In developed countries, public health systems have become adept at rapidly identifying the etiology and impact of public health emergencies. However, within the time course of clinical responses, shortfalls in readily analyzable patient-level data limit capabilities to understand clinical course, predict outcomes, ensure resource availability, and evaluate the effectiveness of diagnostic and therapeutic strategies for seriously ill and injured patients. To be useful in the timeline of a public health emergency, multi-institutional clinical investigation systems must be in place to rapidly collect, analyze, and disseminate detailed clinical information regarding patients across prehospital, emergency department, and acute care hospital settings, including ICUs. As an initial step to near real-time clinical learning during public health emergencies, we sought to develop an "all-hazards" core dataset to characterize serious illness and injuries and the resource requirements

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for acute medical response across the care continuum. **SUBJECTS:** A multidisciplinary panel of clinicians, public health professionals, and researchers with expertise in public health emergencies. **DESIGN:** Group consensus process. **INTERVENTIONS:** The consensus process included regularly scheduled conference calls, electronic communications, and an in-person meeting to generate candidate variables. Candidate variables were then reviewed by the group to meet the competing criteria of utility and feasibility resulting in the core dataset. **MEASUREMENTS AND MAIN RESULTS:** The 40-member panel generated 215 candidate variables for potential dataset inclusion. The final dataset includes 140 patient-level variables in the domains of demographics and anthropometrics (7), prehospital (11), emergency department (13), diagnosis (8), severity of illness (54), medications and interventions (38), and outcomes (9). **CONCLUSIONS:** The resulting all-hazard core dataset for seriously ill and injured persons provides a foundation to facilitate rapid collection, analyses, and dissemination of information necessary for clinicians, public health officials, and policymakers to optimize public health emergency response. Further work is needed to validate the effectiveness of the dataset in a variety of emergency settings

Full text: <https://doi.org/10.1097/CCM.0000000000001274>

Building a National Capability to Monitor and Assess Medical Countermeasure use during a Public Health Emergency: Going beyond the last mile: Proceedings of a workshop

National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Sciences Policy. 2017 Oct.

Full text: <https://www.ncbi.nlm.nih.gov/pubmed/29323850>

Examples of Research from a Real Train Disaster in Graniteville, South Carolina

Acute health effects after exposure to chlorine gas released after a train derailment. Van Sickle D, Wenck MA, Belflower A, Drociuk D, Ferdinands J, Holguin F, Svendsen E, Bretous L, Jankelevich S, Gibson JJ, Garbe P., Moolenaar RL. Am J Emerg Med. 2009 Jan;27(1):1-7. doi: 10.1016/j.ajem.2007.12.006

Abstract

In January 2005, a train derailment on the premises of a textile mill in South Carolina released 42 to 60 tons of chlorine gas in the middle of a small town. Medical records and autopsy reports were reviewed to describe the clinical presentation, hospital course, and pathology observed in persons hospitalized or deceased as a result of chlorine gas exposure. Eight persons died before reaching medical care; of the 71 persons hospitalized for acute health effects as a result of chlorine exposure, 1 died in the hospital. The mean age of the hospitalized persons was 40 years (range, 4 months-76 years); 87% were male. The median duration of hospitalization was 4 days (range, 1-29 days). Twenty-five (35%) persons were admitted to the intensive care unit; the median length of stay was 3 days. Many surviving victims developed significant pulmonary signs and severe airway inflammation; 41 (58%) hospitalized persons met PO₂/FiO₂ criteria for acute respiratory distress syndrome or acute lung injury. During their hospitalization, 40 (57%) developed abnormal x-ray

findings, 74% of those within the first day. Hypoxia on room air and PO₂/FiO₂ ratio predicted severity of outcome as assessed by the duration of hospitalization and the need for intensive care support. This community release of chlorine gas caused widespread exposure and resulted in significant acute health effects and substantial health care requirements. Pulse oximetry and arterial blood gas analysis provided early indications of outcome severity.

Full Text: [10.1016/j.ajem.2007.12.006](https://doi.org/10.1016/j.ajem.2007.12.006)

Engaging a Chemical Disaster Community: Lessons from Graniteville

Abara W, Wilson S, Vena J, Sanders L, Bevington T, Culley JM, Annang L, Dalemarre L, Svendsen E. *Int. J. Environ. Res. Public Health* 2014 May;11, 5684-5697. doi: 10.3390/ijerph110605684

Abstract

Community engagement remains a primary objective of public health practice. While this approach has been adopted with success in response to many community health issues, it is rarely adopted in chemical disaster response. Empirical research suggests that management of chemical disasters focuses on the emergency response with almost no community engagement for long-term recovery. Graniteville, an unincorporated and medically underserved community in South Carolina was the site of one of the largest chlorine exposures by a general US population. Following the immediate response, we sought community participation and partnered with community stakeholders and representatives in order to address community-identified health and environmental concerns. Subsequently, we engaged the community through regular town hall meetings, harnessing community capacity, forming coalitions with existing local assets like churches, schools, health centers, and businesses, and hosting community-wide events like health picnics and screenings. Information obtained from these events through discussions, interviews, and surveys facilitated focused public health service which eventually transitioned to community-driven public health research. Specific outcomes of the community engagement efforts and steps taken to ensure sustainability of these efforts and outcomes will be discussed.

Full text: <https://doi.org/10.3390/ijerph110605684>

Rapid Assessment of Exposure to Chlorine Released from a Train Derailment and Resulting Health Impact

Wenck MA, Van Sickle D, Drociuk D, Belflower A, Youngblood C, Whisnant MD, Taylor R, Rudnick V, Gibson JJ. *Public Health Reports* 2007 Nov;122(6): 784-792. doi: 10.1177/003335490712200610

Abstract

OBJECTIVES: After a train derailment released approximately 60 tons of chlorine from a ruptured tanker car, a multiagency team performed a rapid assessment of the health impact to determine morbidity caused by the chlorine and evaluate the effect of this mass-casualty event on health-care facilities. **METHODS:** A case was defined as death or illness related to chlorine exposure. Investigators gathered information on exposure, treatment received, and outcome through patient questionnaires and medical record review. An exposure severity rating was assigned to each patient based on description of exposure, distance from derailment, and duration of exposure. A case involving death or hospitalization > or = 3 nights was classified as a severe medical outcome. Logistic regression was used to examine

factors associated with severe medical outcomes. RESULTS: Nine people died, 72 were hospitalized in nine hospitals, and 525 were examined as outpatients. Fifty-one people (8%) had a severe medical outcome. Of 263 emergency department visits within 24 hours of the incident, 146 (56%) were in Augusta, Georgia; at least 95 patients arrived at facilities in privately owned vehicles. Patients with moderate-to-extreme exposure were more likely to experience a severe medical outcome (relative risk: 15.2; 95% confidence interval 4.8, 47.8) than those with a lower rating. CONCLUSIONS: The rapid investigation revealed significant morbidity and mortality associated with an accidental release of chlorine gas. Key findings that should be addressed during facility, community, state, and regional mass-casualty planning include self-transport of symptomatic people for medical care and impact on health-care facilities over a wide geographic area.

Full text: [10.1177/003335490712200610](https://doi.org/10.1177/003335490712200610)

Follow-up assessment of health consequences after a chlorine release from a train derailment--Graniteville, SC, 2005

Duncan MA, Drociuk D, Belflower-Thomas A, Van Sickle D, Gibson JJ, Youngblood C, Daley WR. J. Med. Toxicol. 2011 Feb;7(1): 85-91. doi: 10.1007/s13181-010-0130-6

Abstract

INTRODUCTION: After a train derailment released chlorine gas in Graniteville, South Carolina, in 2005, a multiagency team performed an epidemiologic assessment of chlorine exposure and resulting health effects. Five months later, participants were resurveyed to determine their health status and needs and to assist in planning additional interventions in the community. **METHODS:** Questionnaires were mailed to 279 patients interviewed in the initial assessment; follow-up telephone calls were made to non-responders. The questionnaire included questions regarding duration of symptoms experienced after exposure and a posttraumatic stress disorder (PTSD) assessment tool. **RESULTS:** Ninety-four questionnaires were returned. Seventy-six persons reported chronic symptoms related to the chlorine exposure, 47 were still under a doctor's care, and 49 were still taking medication for chlorine-related problems. Agreement was poor between the first and second questionnaires regarding symptoms experienced after exposure to the chlorine ($\kappa=0.30$). Forty-four respondents screened positive for PTSD. PTSD was associated with post-exposure hospitalization for three or more nights [relative risk (RR) = 1.7; 95% confidence interval (CI)=1.1-2.6] and chronic symptoms (RR=9.1; 95% CI=1.3-61.2), but not with a moderate-to-extreme level of chlorine exposure (RR=1.2; 95% CI=0.8-1.8). **CONCLUSIONS:** Some victims of this chlorine exposure event continued to experience physical symptoms and continued to require medical care 5 months later. Chronic mental health symptoms were prevalent, especially among persons experiencing the most severe or persistent physical health effects. Patients should be interviewed as soon as possible after an incident because recall of acute symptoms experienced can diminish within months.

Full text: <https://doi.org/10.1007/s13181-010-0130-6>



CHEMICAL PLUME SOFTWARE TRAINING

This class looks at unintentional and/or intentional atmospheric chemical releases and allows participants to get hands-on experience with computer modeling software. [CAMEO, MARPLOT, and ALOHA]

Beginners, as well as those with advanced computer skills, should have no problems with this course. This course goes at a slower pace with lots of hands-on time on the computer. It is a very interactive course with plenty of time for discussion. At course completion participants will be able to use the software in pre-planning for releases that may affect their workplaces and/or their communities.

The most effective way of reducing the likelihood of workplace emergencies or the severity of an incident, that could not only impact productivity but your relationship with your community, is to have a well trained workforce.

For decades the ICWUC Center for Worker Health and Safety Education has helped employers and their employees create safe and healthy workplace environments. By using proven adult participatory training techniques our customized training program can establish a culture of working together.

Contact the ICWUC CWHSE if you are interested in **Chemical Plume Software Training**, or to discuss other workplace health and safety training.

hsed.icwuc.org
tfrazee@icwuc.org

Since 1988 the Center consortium partners have been leading the way and is a nationally recognized worker trainer entity. As one of the original NIEHS WETP grantees and by using various adult participatory training techniques we understand workers and the adult learning process.

OTHER TRAINING AVAILABLE

Chemical Emergency Response

Train the Trainer

Incident Command System

**OSHA Outreach,
General Industry & Construction**

Mold Awareness/Remediation

Hospital First Receiver

Disaster Site Training

First-Aid, CPR/AED

Health & Safety Computer Skills

Your Place, Or Ours...

The ICWUC CWHSE has a computer lab at its facility located in Cincinnati Ohio. We can also bring the Chemical Plume Software Training to you; using your computers, or we can bring ours.

For more information and class specifics please contact:

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Administered By

International Chemical
Workers Union Council

In Cooperation With

United Food and Commercial Workers Union

International Association of Machinist and
Aerospace Workers

Coalition of Black Trade Unionists

American Federation of Teachers

American Federation of Government Employees

University of Cincinnati Department of
Environmental Health



ICWUC Center for Worker
Health and Safety
Education
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Chemical Plume Software Training

A chemical plume is like smoke from a fire. Some chemicals if released in the atmosphere have the potential to travel many miles in a concentration that could harm the population in it's path.

The chemical plume software training will teach the student how to use the computer programs CAMEO, MARPLOT and ALOHA to predict the direction of the plume, the health effects on the population and the distance the plume could travel before dissipating based on area specific information.

This knowledge can be a valuable aid to a company, workers, and the community to preplan for possible emergencies or offer support during a chemical release emergency.

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Health and Safety Education***

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