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Featured in This Issue

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Listen to the Warnings, Plan for Threats

By Catherine L. Feinman

Incidents often expose planning gaps, but it is not possible to genuinely learn the lessons they offer unless leaders take action to close those gaps before the next event. Research is one way to link the past with the present to create educated predictions for the future. New threats and technologies emerge, but it is essential also to not overlook existing threats and proven methods and resources. This October edition of the *Domestic Preparedness Journal* emphasizes these points.

Emergency preparedness professionals continually strive to protect the lives and health of those within their communities. However, history will likely repeat itself if nothing changes based on past lessons. For example, the perpetrators of many deliberate food-supply contamination cases have used similar means and methods since the 1950s, probably because they continue to work. A lot can also be learned from naturally occurring biological events – especially when endemic events like monkeypox may not be the same as historical outbreaks of the same disease. Unfortunately, whether reviewing pandemic responses or previous wars, it seems that politics often stands in the way of coherent and tested policies.

Learning from the past also means maintaining proven skills that build community resilience. For example, ham radio operators provided critical communications long before cell phones existed. Today, when cell towers go down after a disaster, these operators still fill a critical gap. Food and transportation are other essentials many take for granted during blue-sky days. However, when grocery stores are closed and roadways are blocked, agricultural skills, rescued products, and general aviation pilots may be the only access to food and water for some isolated communities. Community groups and volunteers play a significant role in disaster response but may need more involvement in the planning process.

So much is changing, and it is changing quickly. COVID-19 pushed many agencies and organizations into virtual operations before they were ready, but they adapted. The chemical and other critical infrastructure sectors face challenges that are unique yet interdependent. Moving forward and building resilience involves listening to the warnings of the past and present, then planning for threats using a combination of established reliable resources and new emerging technologies.

Monkeypox: A Public Health Update

By Mabel De Leo & Deborah Sateler

Declared a public health emergency of international concern by the World Health Organization (WHO), monkeypox has been on the news since early May 2022 due to the high number of cases and its worldwide distribution. The current outbreak varies from the historical situation, in which the virus remained endemic in West or Central Africa with occasional international events. Current data shows particularities of this global outbreak of monkeypox in terms of transmission, symptoms, and population at risk that continues to be studied.

Monkeypox has become a challenging and threatening situation worldwide. On July 23, 2022, the WHO declared monkeypox a Public Health Emergency of International Concern (PHEIC). This status involves the expanded spread of a disease that might require a coordinated international response. The ongoing outbreak accounts for most cases in the African, European, and the Americas regions. Detailed data on the cases is available online.

Overview of the Disease

Human monkeypox (MPX) is a disease caused by the monkeypox virus (MPXV), an orthopox DNA virus with a clinical presentation similar to the virus that causes smallpox. MPXV was first isolated in 1958 in a Danish laboratory from pox lesions during an outbreak among monkeys used for research. It was described in humans for the first time in 1970 in the Democratic Republic of Congo. Since then, outbreaks reported in Africa have been mostly associated with wildlife reservoirs (i.e., where an infectious agent lives and multiplies), which are believed to be rodents.

In 2003, the first outbreak outside of Africa was reported in the United States and linked to the importation of infected pet prairie dogs. After that, there have been a few outbreaks in countries outside of Africa related to travel. However, the current global outbreak has been reported in non-endemic countries without links to travel or imported mammals.

Monkeypox virus can infect a wide range of mammal species, but infection in reptiles, amphibians, or birds is considered unlikely. The Centers for Disease Control and Prevention (CDC) developed a list of susceptible animals that professionals who manipulate or are exposed to animals should consult.

The transmission of MPXV can occur animal-to-human (zoonotic) through direct contact with an infected animal's skin or mucosal lesions, blood, or bodily fluids. Exposure to contaminated animal products and inadequately cooked meat are considered risk factors. The human-to-human transmission occurs through large respiratory droplets, close or direct contact with respiratory secretions, skin lesions, and contaminated objects. Vertical transmission (via the placenta from mother to fetus)

is possible. There is no evidence of sexual transmission through seminal or vaginal fluids. Still, this transmission route is being investigated as the current outbreak has disproportionately affected men who have sex with men and has been associated with anal and genital lesions.

Endemic monkeypox is generally self-limited; this means, it will resolve without treatment. The incubation period ranges from 5 to 21 days, symptoms last from 2 to 4 weeks, and the fatality rate is 3% to 6%. Most people who contract monkeypox have mild symptoms (see Figure 1 for a list of human and animal symptoms). As a result, the treatment is mainly supportive and symptomatic (alleviating symptoms such as pain, fever, pruritus, and hydration). Antivirals such as tecovirimat, brincidofovir, and cidofovir are considered an option for severe cases. However, in the U.S., tecovirimat has been approved for its use.

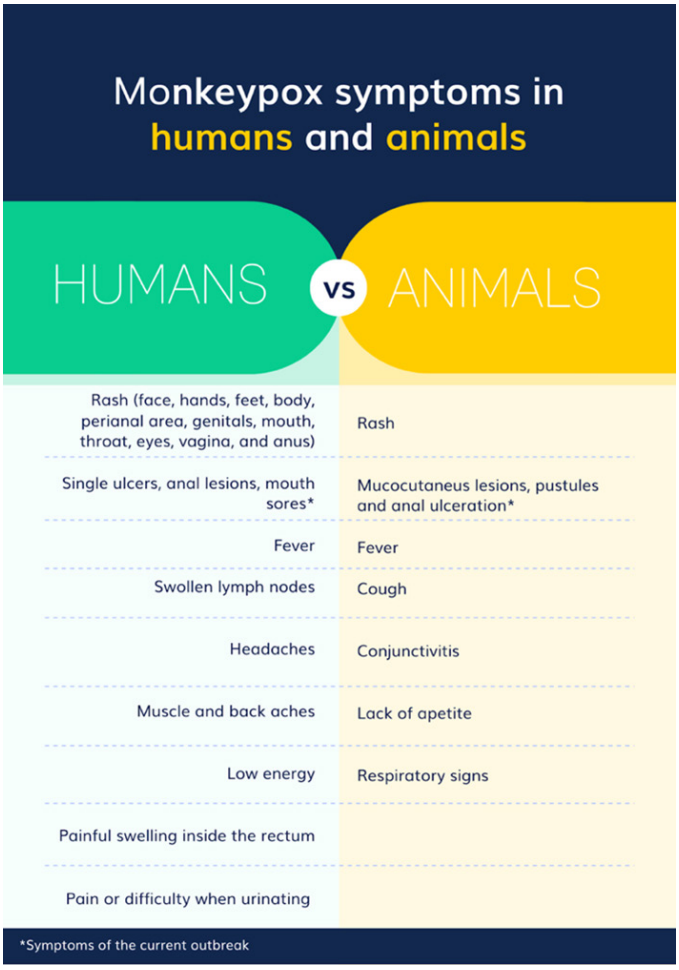


Fig. 1. Monkeypox symptoms in humans and animals. This figure includes all the signs informed by the WHO and highlights those that are specifically associated with the current outbreak.

Disease prevention includes early diagnosis, early vaccine prophylaxis, and key preventive measures, similar to other infectious diseases, such as minimizing contact with the lesions, social distancing, and not sharing bedding, towels, and clothes.

In addition, prior immunization with the smallpox vaccine may have a protective effect against the monkeypox virus and improve clinical manifestations. Therefore, first-, second-, and third-generation vaccines are recommended as the first line of defense against monkeypox. Some first-generation vaccines include Dryvax and Aventis Pasteur Smallpox Vaccine, the second generation is ACAM2000, and the third-generation vaccines are JYNNEOS™, IMVAMUNE, and LC16m8. However, they are not widely available and have adverse effects that must be further studied. Usually, they are recommended for patients living with HIV, hematological conditions, and immunocompromised individuals. The currently available vaccines approved by the U.S. Food and Drug Administration are JYNNEOS™ (live replication incompetent vaccinia virus) and ACAM2000.

Pre- and post-exposure prophylaxis are recommended according to the CDC guidelines in prolonged close interaction with a symptomatic individual without adequate protective equipment.

2022 Monkeypox Outbreak

There are several theories of how monkeypox cases have appeared in non-endemic countries during the ongoing outbreak. A case study published on August 25, 2022, suggests that changes in biological aspects of the virus or changes in human behavior are possible causes associated with decreased smallpox immunity, relaxation of COVID-19 prevention measures, resumption of international travel, and sexual interactions related to large gatherings. The same study revealed that the current outbreak has disproportionately affected men who have sex with men, so improving sexual health advice and education is encouraged to promote safe sex practices. Nevertheless, it is essential to note that the sexual route is not the only form of exposure and that stigma within the LGBTQI+ community results in uncertainty about seeking medical advice.

Increased awareness should be made about the human-to-pet transmission of monkeypox due to the first case of human-to-dog transmission of MPXV reported during the 2022 outbreak. In France in August 2022, a greyhound dog tested positive for the virus after its owners fell ill and shared their bed with the animal. This August 10, 2022 report provides new information about how the transmission of the virus can change and urges public health officials to step up warnings to ensure the virus is contained and prevent the spread back and forth between animals and humans. As a result, the current recommendation is that people suspected or confirmed to be infected with the monkeypox virus should avoid contact with livestock, wildlife, and pets to prevent spreading the virus.

Furthermore, in an August 26, 2022 case study, a 31-year-old man developed acute myocarditis three days after testing positive for monkeypox. The patient was assessed through electrocardiogram, bloodwork, and an MRI that confirmed the heart disease. These reports led clinicians, scientists, and emergency preparedness professionals to increase the monitoring of patients for further recognition of other complications monkeypox may cause in the future.

The monkeypox outbreak is changing daily, and new approaches should be implemented to tackle it. That is why the "One Health" approach should be strengthened

and implemented in endemic countries and nations experiencing outbreaks to increase awareness of the risk of animal-to-human transmission and the adequate handling of pets and livestock animals.

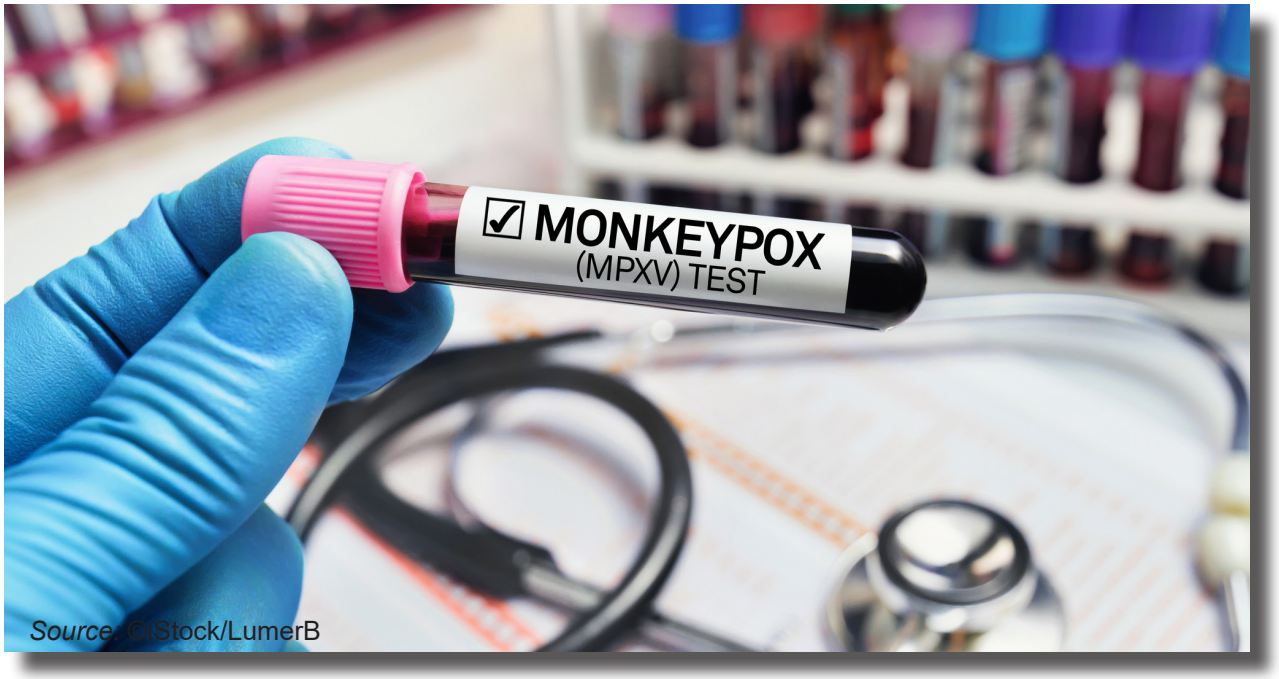
Emergency Preparedness and Public Health Response

Due to the complexity and spread of the monkeypox disease, an Integrated Human-Animal Disease Surveillance Response System should be implemented by public health agencies to define the outbreak and point out the risks of exposure, as well as routes of transmission. Integrated surveillance approaches have been previously used in diseases like COVID-19, West Nile Virus, and avian influenza. In addition, engagement of diverse audiences through traditional public health countermeasures such as risk communication and other community strategies have been implemented in past outbreaks with high success rates and must be considered to contain the current monkeypox outbreak.

The public health response aims to limit the spread of the virus. In healthcare settings, increased vigilance and clinically recognizing disease symptoms have been essential for early detection, notification, and isolation of cases. In addition, community engagement has helped reduce the stigmatization of groups at risk and take preventable actions according to monkeypox transmission routes. Suspected cases should be reported to local and national health authorities immediately, according to the case definitions issued by the public health authorities.

Public Health Guidelines and Recommendations

The need for recommendations among healthcare workers, the community, and the veterinary sector has urged international organizations and centers to control infectious diseases worldwide and establish guidelines to prevent the further spread of the disease. The main strategic recommendations regarding the public health response to monkeypox are summarized below.



Source: iStock/LumerB

Guidelines for healthcare workers:

- Train and educate healthcare workers and healthcare staff about monkeypox.
- Equip healthcare facilities with appropriate diagnostic tools.
- Enforce strict hand hygiene for healthcare workers, patients, and staff.
- Handle contaminated medical equipment with care.
- Adequately dispose of laundry and garbage in hospital settings, in accordance with U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR; 49 CFR parts 171-180).
- Frequently clean and disinfect environmental surfaces.
- Use standard contact and droplet precautions regarding personal protective equipment in outpatient and hospital settings – perform sample collection with a disposable gown, gloves, eye protection (safety glasses, goggles, or face shield), and a NIOSH-approved particulate respirator equipped with N95 filters or higher.
- Implement pre-exposure prophylaxis for staff at research and clinical laboratories and at hospitals when caring for infected patients.

Guidelines for community settings:

- Persons with a positive monkeypox test must be isolated. Cohabitants and caregivers should use standard isolation precautions to monitor the infected person at home.
- Intensify surveillance, contact tracing, and cluster investigation in specific population groups (e.g., men who have sex with men communities).
- Adapt specific control and preventive strategies according to the transmission channels.
- Promote safe mass-gathering events in outbreak regions. Mass gatherings do not amplify transmission but can create a conducive environment for transmission.
- Surveil close contacts: monitor symptoms for 21 days after the last contact with a patient or their contaminated materials.
- If symptoms appear after close contact with a patient with monkeypox, avoid meeting immunocompromised persons, pregnant women, and children under 12 years (and do not donate blood, cells, tissues, and organs).

Guidelines for people working with domestic animals, exotic animals, and wildlife (World Organisation for Animal Health, WOAH):

- Avoid close contact with pets or other animals, especially near any cutaneous lesions.
- Keep possibly infectious and contaminated material, including linens, towels, and clothes from an infected person away from pets and other animals.
- Clean with bleach products any contaminated surfaces in which pets and other animals might come in close contact.

- Do not allow pets to have close contact with other animals either inside or outside the home.
- Do not allow infected animals to have contact with other humans.
- Test animals to confirm an infection.
- Dispose of veterinary waste (cottons, swabs, bandages) according to local veterinary authorities.
- Take appropriate hygiene and biosecurity measures before and after handling animals or wildlife with probable or confirmed monkeypox. Preventive measures include washing hands before and after handling each animal as well as using PPE.
- Vaccinate people working with wildlife only if other risk factors exist.

Additional resources for people in healthcare and community settings:

- WHO Monkeypox Outbreak Toolbox
- CDC Information for Healthcare Professionals
- Monkeypox in the United States – What Clinicians Need to Know (CDC)
- WOAH Risk Guidance for people in contact with domestic, exotic animals and wildlife, with active cases of monkeypox

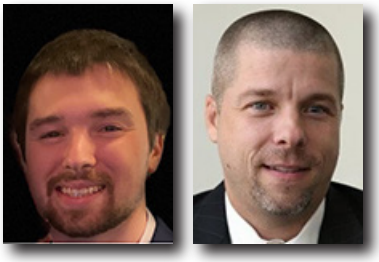
To conclude, monkeypox is yet another example of how human and animal health are interconnected. The challenges in preventing the spread of emerging zoonotic diseases include achieving a balance between sustainably managing resources required for human population growth, safeguarding species conservation and biodiversity, securing animal and human health, and respecting animal welfare. Tackling diseases such as monkeypox and ensuring a safe future for everyone is only possible through multi-sectoral collaboration between animal and public health practitioners, the private sector, and health authorities.

Mabel De Leo is an experienced physician in clinical medicine and infectious diseases, skillful in developing behavioral change communication materials. She has a broad background in sexual and reproductive health as she has taught and conducted public health campaigns in indigenous communities about sexually transmitted diseases. She promotes the transdisciplinary One Health approach by delivering seminars internationally related to One Health and Antimicrobial Resistance and researching the drivers of antibiotic use in low and middle-income countries from a One Health perspective. She is a Medical Doctor and has a Master of Science in Antimicrobial Resistance from the University of Sheffield, UK, and is an active member of the World Medical Association, The British Society for Antimicrobial Therapy, and the American Public Health Association. She is a co-founder of One Health Action!, an organization that disseminates the One Health concept to students and professionals from different backgrounds.

Deborah Sateler has a diverse background in animal and public health, wildlife conservation, and the pharmaceutical industry. Throughout her career, she has led teams for success, executed continuing medical education projects, and developed information dissemination products and strategies for key stakeholders in her industry. As a One Health advocate, she actively participates in global movements in One Health, collaborating with a multidisciplinary team of professionals researching climate change and biodiversity loss in Iberian America from a One Health approach. Currently, she works as a science advisor, providing consultancy services in epidemiology, animal and public health surveillance, and regulatory affairs in Canada. She is a Veterinary Doctor and has a Bachelor of Environmental Health with graduate-level studies in Business Administration and Knowledge Mobilization (ongoing). She is a co-founder of One Health Action!, an organization that disseminates the One Health concept to students and professionals from different backgrounds.

Looking Back to Look Ahead to Protect the Food Supply

By Benjamin Lieb & Jason Bashura



Following the terrorist attacks on the United States, the federal government began to ramp up its arsenal of subject matter experts in the public health arena as it related to the threat of bioterrorism. Among these disciplines, experts in the subjects of food defense and food security were being identified and sought after for a variety of new opportunities to protect the food supply. Intentional acts of contamination in the food supply have occurred for thousands of years. Recently there were reports of Ukrainian citizens feeding Russian soldiers poisoned cake and alcohol that resulted in 2 deaths and 28 other soldiers hospitalized. The Food Defense Consortium and the ASIS Food Defense and Agriculture Security Community (FDASC) recently made an effort to update a foundational food defense research paper and offer recommendations for future research to continue improving knowledge in this area.

> *"For the life of me, I cannot understand why the terrorists have not attacked our food supply because it is so easy to do."*
>
> – Former Secretary of Health and Human Services Tommy Thompson (2004)

Background & Data Collection

As a background, it is important to understand the definitions of a few key terms:

- *Food defense* – "The efforts to prevent intentional contamination of food products by biological, chemical, physical, or radiological agents that are not reasonably likely to occur in the food supply" (as defined by the Food and Drug Administration).
- *Food security* – "The reliable availability of a sufficient quantity and quality of nutritious food for a population" (as defined by the World Health Organization in 2002).
- *Food protection* – The nexus between the food safety practices that are leveraged every day and food defense strategies that are intended to reduce the likelihood of an act of intentional contamination from occurring in the food supply. Elements of food fraud mitigation, food quality, environmental health and safety, and physical security also comprise the concept of food protection.

An internship opportunity in 2022 by the Food Defense Consortium and the FDASC was seeking to have the foundational research paper by G. R. Dalziel, "Food Defence Incidents, 1950-2008: A Chronology and Analysis of Incidents Involving the Malicious Contamination of the Food Supply Chain" updated to include events since 2008. Dalziel

is one of the first, if not the first, to write a compendium about incidents of intentional and malicious contamination. This is done by examining the cases comprehensively and systematically – throughout the whole food supply chain. Dalziel's research paper discussed how the World Health Organization defined the difference between food security and food defense while also discussing how the United States and the Department of Homeland Security (DHS) are involved in the food and agriculture sector.

Dalziel concluded that 98% of the cases occurred later in the food supply chain – nearest to the consumer. Intentional contamination also occurred most often in the food service/retail environment, home, or workplace, while cases at the food service point had the greatest impact on the public's health. While Dalziel also concluded that the total number of casualties was low, the updated appendix also followed this trend – with a few outliers. Of the total number of cases per country, Dalziel had collected 60% of his cases from the United States, the United Kingdom, and Australia. He stated that this is because of the wider proliferation of the western media, with the first case in China not being reported until 1992. The number of cases rose in the mid-1980s with increased extortion cases in retail/food service. However, between 2004 and 2008, there was a decrease in annual reported cases.

The research completed in 2022 included updating events that occurred after 2008 – plus a few that had occurred in 2008 but were not captured by Dalziel. The cases in the appendix are sorted into five categories of agents: chemical, biological, radiological, physical contaminant, and unknown. Many of the cases fell under the classification of chemical. Data collection to update the appendix involved open sources (e.g., news articles and peer-reviewed articles) and collaborators within the Food Defense Consortium and the ASIS FDASC, who submitted incidents for review and inclusion in this updated research. After reading through the different cases, it was determined whether they were intentional acts of contamination. The cases were then categorized by year, country, agent, agent type, number of injuries, number of deaths, and a description of the incident. An analysis was produced on some cases to better understand their contents and the method used (see Figure 1).

Appendix I: Updates to Dalziel's Food Defence Events: 1950-2008, updated to include 2008-2022

Benjamin Lieb – Coastal Carolina University Student, Intelligence and National Security Studies; conferred Spring 2021

Header	Agent	Place	Agent	Death	Injury	Description/Reference
2008	Melamine	China	Chemical	6	300,000	Provinces in China had to seized baby milk powders products. The milk powder contained five hundred times the maximum allowed amount. https://www.bbc.com/news/10565838
2008	Dioxin	Ireland	Chemical	0	0	Irish pork products were tainted with dioxins. The pork products contained 80 to 200 times the allowed limit. The products were reached the high levels of dioxin from pig feed of a producer tainted with an industrial oil. https://www.nytimes.com/2008/12/07/world/europe/07iht-irish.4.18467497.html
2011	Pesticide	India	Chemical	143	Dozens	Multiple illegal liquor businesses were creating tainted alcohol. The alcohol was being mixed with pesticide. https://www.bbc.com/news/world-asia-india-16174531

Fig. 1. Depiction of updated Appendix I (Lieb, 2022).

Mitigation

There are ways to mitigate the risk of food being intentionally contaminated. One way is for food manufacturers to update procedures regularly to ensure that the product cannot be easily accessed, thereby decreasing the feasibility of contamination. The updated procedures can prevent current and former employees from tainting products in the food supply chain. The U.S. Food and Drug Administration (FDA) has developed a resource to aid private sector owners and operators in identifying mitigation strategies to help decrease the intentional adulteration (i.e., contamination) of food in production environments.

The Mitigation Strategies Database "is intended as a starting point for facilities to consider when identifying potential mitigation strategies." Additionally, completing basic food defense awareness training is an important step in raising awareness of food defense concepts, which can directly contribute to reducing the risk of intentional adulteration. For example, free food defense awareness training is available on the Food Safety Preventive Controls Alliance website – for food workers at the retail level (nearest the consumer interface) to manufacturing (food production) and transportation/distribution personnel.

In a strategic and academic sense, another way to help mitigate the number of intentional cases is by updating research (like this endeavor described herein) to demonstrate the methods by which individuals have contaminated food and drink in the past and doubling down and refocusing efforts in these areas moving forward. Operationally, by performing tabletop and functional exercises with cross-functional disciplines represented (regulators, law enforcement, emergency management, food industry), a variety of perspectives can be gleaned, and strengths – as well as gaps – can be identified in these emergency response plans.

Evaluating events in the past can help predict – and possibly prevent – similar incidents from occurring in the future.

The U.S. Department of Agriculture's Food Safety and Inspection Services, FDA, and DHS have all created tabletop exercise toolkits to aid in executing an exercise. However, these resources need to be more readily accessed if they are going to have the intended impacts on the community they are targeted at protecting.

In 2021, one of the teams participating in the DHS's Analytic Exchange Program group focused its research and summary report on critical infrastructure sectors that might be overlooked during a wide-scale natural disaster or man-made event. The final toolkit related to that research is slated to be released at the end of 2022.

Impact of This Analysis

The importance of updating the appendix to Dalziel's work is to better understand how those seeking to harm others have continued contaminating food supply chain products. Mitigating future acts requires an understanding of the products that have been

contaminated, the methods used to contaminate the products, and the reasons behind these actions. Some of the reasons why an individual would contaminate food include:

- An ex-employee seeking revenge;
- A current employee unhappy with their position within the company;
- Retaliation for punishment, delayed promotion, or unfair treatment in the workplace;
- Someone seeking recognition for being diligent in the production environment; or
- Someone simply looking to harm others.

The updated appendix, which can be accessed at the Food Safety Tech's Food Defense Resource Portal (Figure 1), allows for more research on the methods and types of individuals committing these acts. In the future, additional analysis should be performed on the new Appendix I to "categorize" the rationale behind why the contamination occurred. These categories are:

- Type I – Offender has no legitimate relationship with the business or its employees;
- Type II – Offender has a legitimate relationship with the business (as a customer, client, patient, student, or inmate);
- Type III – Offender could be a current or past employee;
- Type IV – Offender may or may not have a relationship with the business but has a personal or perceived relationship with an employee; and
- Type V – Offender is an extremist or value-driven group who feels justified by their beliefs.

Call to Action

The outcomes of this research are important for food protection or safety regulatory programs or those officials from state, county, and local emergency management because it demonstrates the different tactics that can be used to contaminate food within the food supply chain. Although gaining insights into solutions to prevent contamination events in the future may be reactive, understanding the methods of contamination will allow for preventative measures and awareness programs to be put in place. A review of the historical events listed in Dalziel's report and the updated content from the new Appendix I document show that history is likely to repeat itself if actions are not taken now to prevent similar incidents.

"...But if you close your eyes, does it almost feel like nothing changed at all?
And if you close your eyes, does it almost feel like you've been here before?"

– Bastille, "Pompeii" (October 11, 2013)

Finally, further research is needed to evaluate the variation in punishment regarding the penalties related to intentionally adulterating, tampering with, or knowingly introducing contaminated (or potentially contaminated) food, not only within the U.S. but globally. For example, in January 2009, two individuals found guilty of their involvement in China's 2008 melamine scandal – which resulted in 6 deaths, 54,000 hospitalizations, and more than 300,000 affected children – were sentenced to death. Meanwhile, those found guilty for their involvement in a U.S. outbreak associated with contaminated peanut butter were each sentenced to between 60 and 336 months in prison "for their roles in a conspiracy to defraud their customers," which led to 9 deaths and more than 20,000 illnesses.

Summary

The methods of contamination identified in Appendix I will allow for future discussion among cross-functional, multi-disciplinary practitioners on how to prevent and respond to future incidents. Participating in tabletop and functional exercises can help preparedness professionals thwart terrorists and other bad actors from contaminating food (and prove Secretary Thompson wrong). After response plans have been created, they can be tested in a controlled environment utilizing various existing resources to test their effectiveness. Yesterday's plans need to be revised to protect against all of tomorrow's threats. Continuous improvement is necessary to stay ahead of the curve and make a change for the better, for tomorrow. Future iterations of food protection plans need to address a wide variety of threats – those originating from cyber, physical, people sources, or cascading failures of interdependent infrastructures. Food protection plans aim to reduce enterprise risk for food manufacturers and retailers globally and protect the public's health and well-being.

Benjamin Lieb is originally from Cincinnati, Ohio. He attended Coastal Carolina University, where he earned a B.A. in Intelligence and National Security Studies with minors in Anthropology and Criminology. While at Coastal Carolina, he was named to the President's and Dean's lists. Since graduating in May 2022, he has started his career in the Intelligence Community as an officer at the U.S. Department of Homeland Security Transportation and Security Administration. He would like to thank Dr. Smith, the Members of the Food Defense Consortium, the ASIS Food Defense, and Ag Security Community for supporting his throughout this research.

Jason Bashura has been working within the food defense arena since 2002, when he began working with the Connecticut Department of Public Health's Food Protection Program as a food biosecurity (now known as food defense) environmental health sanitarian. After transitioning to the U.S. federal government, he was a food defense policy analyst with the U.S. FDA's Food Defense team where he oversaw the development and utilization of the Food Related Emergency Exercise Bundle (FREE-B) among other critical food defense initiatives. Currently working in industry, he has been leading the informal Food Defense Consortium – in order to bring together those parties with a vested interest in global food defense issues. He is proud of the countless relationships he's dedicated global government, industry, and academic leaders, in an attempt to connect the innumerable dots within the food defense arena. He has a master's degree in Public Health from the University of Connecticut (UCONN) and an undergraduate degree in Public Health from Southern Connecticut State University. He currently resides in Maryland with his family and serves on the Board of Health in the county where he resides.

Earthquakes & Pandemic – Keeping People Fed Amid Crises

By Zsofia Pasztor & Szabolcs Pasztor

When the pandemic emerged in Washington State, the region's already strained food assistance programs became overwhelmed. Since 2011, the agricultural nonprofit organization Farmer Frog had already been servicing about 25,000 families in the Greater Seattle Area through its Good Food Treasure Box program – a subsidized Community Supported Agriculture (CSA) food box program that quickly expanded to support the area's needs. Volunteers packed the boxes as Farmer Frog distributed increasing volumes of food (see Figure 1). The program grew to a nationwide hunger relief distribution operation. With its partner nonprofit, the National Tribal Emergency Management Council (NTEMC), the program has distributed more than 160 million lbs of food and emergency supplies to over three million people in 36 states since 2020 (as recorded through inventory tracking software).

Response to Pandemic, Fire & Ice

Farmer Frog primarily provides services at its outdoor distribution, logistics, and innovation center known as the FLOOR (Food Logistics Operations Offices and Resources). Designated as an official incident command center under Washington Emergency Management Division Mission No. 20-0265, the FLOOR became a pilot hunger relief hub connecting small and large entities across various sectors. After partnering with NTEMC, Farmer Frog increased its distribution rapidly. For example, its regional 35-million-lb food distribution efforts expanded to 160 million lbs nationwide to help feed communities during two years of COVID-19 (2020-2021). Also, in 2021, NTEMC and Farmer Frog shipped half a million pounds of food and personal protective equipment (PPE) to Tribes and Native Villages in Alaska via maritime transport.

Fig. 1. Farmer Frog volunteers pack boxes of food in Washington in March 2020.

During the 2021 response efforts, delivery timing was critical – especially after a local water tower burned down, leaving thousands without water, as Native Tribes and Villages continued to face food, PPE, and other resource shortages.

In emergency response, it is difficult to capture on paper the challenges and experiences faced amid overwhelming amounts of daily pressures. Many Americans do not know where food comes from or how it is transported. For example, the 2021 Alaska relief effort involved moving half a million pounds of food and supplies via a giant barge. A typical load for TOTE Maritime, the generous donor of the barge transportation, is a single container per client – that relief effort required ten! And while most people use refrigeration to keep things cold, the water in that scenario had to be refrigerated to keep it warm enough to prevent it from freezing in the frigid Alaskan temperatures (see Figure 2).

Each experience can better prepare communities for the next crisis and build resources and support networks to respond appropriately – no matter the scale of the event. In Washington State and at the direction of NTEMC, Farmer Frog coordinates distribution via planes in partnership with the Disaster Airlift Response Team (DART) to Tribes in remote locations and delivers a variety of procured, donated, and rescued goods with direct transport – via land, air, and sea to provide full accessibility. Rescued goods are products from farmers and producers that are intercepted before being wasted. For example, during the early days of COVID-19 when restaurants were not selling French fries, some farmers with entire warehouses of potatoes chose to offer their produce to Farmer Frog and other distributors for free or at heavily discounted costs rather than tilling the potatoes into the ground for a complete loss. To provide true hunger relief, the

Fig. 2. TOTE Maritime barge delivering food and PPE during COVID-19 for Farmer Frog in 2021.

organization must send resources where needed, connect with recipients on a personal level (whether a government agency or community-based organization), and ensure they meet the community's needs. The goal is to create an infrastructure that eliminates inefficiencies in the system and provides full-service distribution to increase access to equitable services, especially during an emergency.

Engagement in Earthquake Exercise

After servicing more than 600 different recipient agencies and more than 120 Tribes across 36 states, Farmer Frog and NTEMC used their networking capabilities and team spirit to participate in the full-scale multidiscipline Thunderbird and Whale exercise, practicing the response for a future 9.0-magnitude Cascadia Subduction Zone earthquake. With NTEMC as the exercise's incident command, Farmer Frog provided three main logistics and distribution functions:

- Supported the airlift of food out of Walla Walla, Washington;
- Facilitated and participated in a mass casualty incident exercise; and
- Transported ground deliveries of needed food and supplies while observing (and reporting on) damaged roads, bridges, and communication system challenges as the exercise prescribed.

They also provided labor and supplies in the setup and teardown of the incident command center. Although primarily operating within Emergency Support Function #11 (ESF#11 – Agriculture and Natural Resources), Farmer Frog also provided minor support under ESF#6 (Mass Care, Emergency Assistance, Housing, and Human Services) and ESF#8 (Public Health and Medical Services). These are areas where the organization has gained experience through services provided since 2009, scaled up when COVID-19 emerged in the U.S. in 2020 and implemented during other real-life emergencies.

This volunteer agricultural workers to a culture of emergency preparedness

As a regional team across several states, the 9.0-earthquake simulation demonstrated the challenges that many Tribes of the Pacific Northwest would face in that scenario. However, the lessons learned could also apply to other emergency scenarios affecting these same food distribution routes. This exercise reinforced previous observations that the desire for perfect preparation can slow down or stall a response. Under dire circumstances – such as an earthquake, a hurricane, or another major disaster – when people are hungry, they may not be able to wait till tomorrow for food and water.

During the exercise planning process, Farmer Frog participants had expectations typical of an earthquake – communication lines disrupted, roadways destroyed or inaccessible, etc. – but they learned a lot more than expected and added many new tools and resources to their preparedness toolbox. To provide another opportunity to simulate the air transport of food and supplies, DART asked Farmer Frog to coordinate a food donation of 22,000 lbs. That was a small amount relative to the millions they regularly supply to the community, yet still challenging because of weight restrictions on small

planes. Nevertheless, it was a valuable experience for all, as many of the volunteer pilots were unfamiliar with the requirements to store food in bulk for an extended amount of time, the labor required for loading and sorting, etc. (see Figure 3).

Simulating the earthquake in the context of agricultural work, the team members practiced "Drop, Cover, and Hold On" at the time of impact during the exercise at their homes or facilities. The simulations also accounted for damaged roadways and rerouting food deliveries with (offline) maps of the region. Collaboration with other participants was fluid and could shift if needed based on what would likely occur during an earthquake. In coordination with Farmer Frog, the United States Volunteer Joint Services Command (USV-JSC) simulated a unique triage training with the volunteers. Together, they created "damaged structures" where one of the main buildings – an old heritage barn built in the late 18th century – collapsed atop team members (see the slideshow). Seasoned personnel of USV-JSC, with years of combat experience, jumped into action to free the victims, address wounds, and then direct transport (with Farmer Frog vehicles) to the incident command center, with simulated emergency airlifts to the hospital.

Under NTEMC's emergency response leadership, this large-scale exercise activated a multi-state network of agencies and organizations to simulate harsh conditions and events that would likely occur following a 9.0-magnitude earthquake. Strengthening the

Fig. 3. Farmer Frog and the local DART load donated food to transport from planes to local Tribal communities during the Thunderbird and Whale Exercise, June 2022.

organization's capacity and capability, Farmer Frog participants learned valuable lessons to apply to any future crisis:

- *Strong leadership makes or breaks a response.* In the state of Washington, particularly in food assistance and emergency response, many women have years of experience, wisdom, and unwavering support for those in need. However, during daily and emergency operations, there sometimes are attempts to subvert female leaders in the decision-making process. The result is often wasted time on corrective action and redirection of a response, which can cost lives. Although many agencies and organizations across the country continue to work toward equality and equity, these issues still exist and must be addressed when they arise.
- *Be sure to heed expert advice*. When urgency drives decisions, expert advice and critical information can be overshadowed during emergencies. For example, the leading agricultural expert for the exercise highly recommended that the potatoes and onions should not be shrink-wrapped together for shipment, as they give off certain gases that are not complimentary to food quality or food storage. This information was disregarded, and the products were transported together. Although the food did not spoil because the temperatures remained low, it was not as crisp and fresh as it would have been if they were transported in separate packaging.
- *Time is of the essence in agriculture and disasters.* Farmer Frog recommended distributing the food a day or two before the simulated airlift. Still, the DART volunteers wanted deliveries eight days before the flight date to prepare for the airlift. As a result, the whole distribution team organized, packed, itemized, and labeled all the loads for the airlift on an earlier schedule. However, if the weather had not stayed unseasonably cool and misty during the exercise, the food would not have maintained its quality and value for the recipient Tribes and communities by the time the airlift took place.
- *Diversity in capability and flexibility to pivot allows for swift and appropriate responses*. For example, if roads were blocked or communication interrupted, most communities in the exercise area would be in complete isolation. The only way in or out would be via air or a bulldozer in front of a semi-truck. Communities should evaluate their current capabilities for establishing access to food and critical supplies at the source and ask the following questions:
    - What is available within the community?
    - Is it safe from the elements?
    - Could it be available during a large-scale event or exercise?

- Is there a memorandum of understanding or other agreements with surrounding communities to be hubs outside areas with potentially limited access during an event?

- *Disaster preparedness is a whole community effort*. Over the past two years, agricultural volunteers at Farmer Frog have had many opportunities to learn various skills to protect themselves and their communities during disasters. Activities included PPE measures and distribution procedures during a pandemic, evacuation vs. shelter-in-place decision-making, an introduction to incident command, post-disaster surveillance for passable routes, exposure to emergency communications, and training on bleeding control and basic triage methods during a mass casualty incident.

In summary, for more than a decade, Farmer Frog has been serving local communities with their growing agricultural and food services. With the strong leadership of the NTEMC and their multidiscipline partners, these critical resources are expanding regionally and nationally to help reach communities in need. From providing food and PPE during the pandemic to participating in the broad multijurisdictional Thunderbird and Whale exercise, Farmer Frog is learning how to better prepare for and respond to emergencies and disasters and build more resilient communities for all people in the Pacific Northwest and beyond.

Farmer Frog is a Washington-based 501(c)3 nonprofit with the mission to grow kids, cultivate communities, and nurture habitat for "All Living Beings through Real Food – Sprouting Simple Change." Farmer Frog offers statewide and nationwide emergency response hunger relief by partnering with over a thousand entities nationwide, including Tribal governments and Tribal agencies.

Zsofia Pasztor, executive co-director of Farmer Frog, is a refugee from Hungary during the Soviet times and is one of the founders and executive co-directors of the nonprofit organization Farmer Frog. She teaches restoration horticulture, urban agriculture, aquaponics, and low-impact development at several Puget Sound colleges and abroad. In addition, she trains professionals in sustainable site management, small-scale integrated agriculture, community development, and natural resource conservation. She is a TEDx presenter, an author of professional manuals and the book Rain Gardens for the Pacific Northwest, an award-winning landscape designer, certified Blue Economy consultant, Caring Economy consultant, Low-Impact-Development (LID) designer and construction consultant, professional horticulturist, permaculture designer, Filtrexx designer, commercial urban agriculturist, tree risk assessor, and arborist. With her amazing Farmer Frog Team and sister-partner, Lynda Zambrano, she recently co-founded the Fresh Food Coalition and oversees the distribution of food and supplies nationally to over three million people in need.

Szabolcs (Szabi) Pasztor, director of administration for Farmer Frog, is a first-generation Hungarian American and hard-working millennial dedicating herself to changing the failing systems in America. She has a background in civil engineering, politics, law, advocacy, executive management, food assistance, distribution, and logistics. She is very passionate in her work, especially in preparing her community for what she believes is the greatest challenge humankind has faced – the Climate Crisis. And she also deeply works to recognize, understand, and interface with what she believes is the most significant barrier humanity has faced – institutional systems of trauma and oppression, especially the institution of racism. She fights for what is right and always seeks to understand more about her own privilege as a white transwoman, striving for equity and social justice broadcasted in the principles of her work wherever she goes.

Taking Flight – Creating a Robust Aviation Response, Part 2

By James Origliosso & Sky Terry

This is Part 2 of a two-part article. Part 1 shared the history of general aviation pilots in the Pacific Northwest.

Over the past two years, volunteer general aviation groups in the Pacific Northwest (U.S.) have accelerated their progress in preparing their pilots, ground crews, and communications support teams for emergency and disaster response operations. General aviation aircraft can utilize shorter airfields and grass airstrips if needed, and seaplanes can land on water in locations without road access.

General aviation assisted emergency management efforts in multiple ways in 2021. In January, pilots with the Northwest Region Emergency Volunteer Air Corps (EVAC) delivered food and personal protective equipment (PPE) to isolated tribal communities in Washington State. In March, pilots with the Disaster Airlift Response Team (DART) in Eastern Washington airlifted PPE to Washington tribes. In the Fall, *atmospheric rivers* (i.e., water vapor moving like a river in the sky), a *bomb cyclone*, and other severe weather events brought heavy rains, flooding, landslides, and road closures in Washington and British Columbia (Canada); Washington Governor Jay Inslee issued an emergency proclamation for severe weather damage in 14 counties. Here are just three of the many ways in which general aviation assisted during these events:

- DART pilots supported the U.S. Army Corps of Engineers (part of the U.S. Department of Defense) by transporting 10,000 urgently needed empty sandbags from Seattle to Bellingham when I-5 was not passable.
- At the request of the Clallam County Emergency Management, Clallam County DART airlifted bottled water and other supplies from Port Angeles to Sekiu after a landslide closed SR 112.
- Some DART pilots were placed on standby to deliver bread, milk, and eggs from Arlington Airport to the Makah Tribe when their only store had re-supply issues due to the flooding.

The emergency management community continually plans for future threats and disasters. In the case of the Pacific Northwest, their focus is on the Cascadia Subduction Zone (CSZ), where three tectonic plates are moving eastward and gradually slipping beneath the North American Plate. The CSZ varies from 70 to 100 miles off the west coast and stretches from Cape Mendocino in northern California to Nootka Island in British Columbia. When the next CSZ "megathrust" rupture occurs, the compounded effects of ground motion, subsidence, tsunami, inundation, liquefaction, and landslides will be the most catastrophic natural disaster to hit North America since the last CSZ rupture in January 1700. During the subsequent relief efforts, volunteer general aviation (which fall under Emergency Support Function #1 – Transportation) and amateur radio communications (Emergency Support Function #2 – Communications) assets are critical for disaster response efforts.

Overview of the Exercises

In June 2022, two functional exercises involved airlifts simulating relief response efforts by general aviation in the aftermath of a magnitude 9.0+ "megathrust" rupture of the CSZ. Thunder Run participants delivered food to food banks in vulnerable communities in northwest Washington. Whale Run participants transported food to vulnerable tribal communities in southwest Washington, Oregon, and northern California. A joint supply depot at the Walla Walla Regional Airport in southeast Washington was a common location for both airlifts. The pilots involved in this exercise had different Federal Aviation Administration certificates and ratings and a wide variety of experience, so care was taken to match flight routes to skill sets and capabilities. Cargo that pilots transported for this exercise came from several sources:

- *Perishable and non-perishable food donations* – Farmer Frog donated 24,000 lbs; the British Columbia Airlift Emergency Response Operations (BC AERO) flew nearly 13,000 lbs of additional food across the international border; and
- *Monetary donations* – Serena, a non-profit organization in Redmond, Washington, donated $5,000, and AvFuel, an aviation fuel company, donated $2,500 (monetary donations were used to purchase additional food from a supermarket in Walla Walla).

The BC AERO flights brought food from Canada into Bellingham International Airport, with the remainder trucked to the Walla Walla Regional Airport for loading onto the planes.

Thunder Run Operations

Volunteer general aviation pilots and ground crews, assisted by amateur radio operators, prepare to respond to local disasters by participating in two functional earthquake and tsunami exercises.

Thunder Run was conducted on Saturday, June 18, 2022, and provided the opportunity to thoroughly test the West Coast General Aviation Response Plan (WCGARP). As described in Taking Flight, Part 1, many pilots in this exercise have worked together previously. During Thunder Run, airlifts from Walla Walla went to Renton Municipal Airport for distribution into Grays Harbor and Mason counties and to Oregon. Airlifts from BC AERO went to Bellingham International Airport for re-distribution to airports in Clallam, Jefferson, and Island counties. Amateur radio stations at all airports kept track of the flights and plane manifests using VHF and UHF bands.

The weather did not cooperate along the Thunder Run routes with low freezing levels and heavy clouds across the snow- and ice-covered peaks of the Cascade Mountain Range. Smaller aircraft needing to fly at lower altitudes and with limited instrument flying or deicing ability made flying over mountain passes with 5,000+-ft passes challenging. Even flying in the Puget Sound area did not escape cloudy weather and changing weather conditions. Despite multiple storm systems that delayed flights during the exercise, general aviation pilots flew to all the planned locations, including those between Canada and the U.S.

During the Thunder Run exercise, 57 pilots flew a total of more than ~10,700 air miles. Passing through the U.S. and Canadian customs was new for the general aviation groups, but the experience provided valuable lessons to prepare pilots and ground crews for future emergency responses.

Whale Run Operations

Whale Run was the first exercise for the newly formed Oregon DART (ODART). The exercise design called for 23 pilots to airlift food from the Walla Walla airport to four staging areas in Oregon (Bend, Aurora, Albany, and Creswell) plus two tribal communities (one near Madras, Oregon, and the other near Longview, Washington) on Saturday, June 18. The following day additional flights were to take the food from the staging airports to airfields near tribal destinations.

The weather on the big lift day of June 18 along the Whale Run routes was low overcast, with rain and near freezing temperatures throughout much of the day. Each pilot determined whether they would be able to execute their assigned flight. As a result, pilots flew fewer than half of the flights scheduled that day. The operational flights followed an alternate route along the Columbia River (from Washington to Oregon) to avoid mountainous terrain. Still, Whale Run planes moved approximately 4,300 lb from Walla Walla to the four staging airports.

The weather improved somewhat on June 19, allowing flight operations to move 2,700 lbs to five destinations near tribal areas. On June 20, there were four flights to Newport, Oregon, and one to Chiloquin, Oregon. Finally, on June 21, there was one flight to Camus, Washington, and a truck to Grande Ronde, Oregon, to distribute the last food donations. Amateur radio stations at one staging airport and four destination airports kept track of the flights and plane manifests using the Winlink Global Radio Email system on HF bands.

During the Whale Run exercise, 22 pilots flew a total of ~7,600 air miles. Most importantly, not a single air or ground incident occurred over what turned out to be four days of airlifts.

Slideshow: Preparing to respond to local disasters by participating in two functional earthquake and tsunami exercises (June 18-21, 2022).

Key Takeaways

There was an enormous amount of learning by all who participated in the sky and on the ground. The most significant takeaways included:

- Disaster preparedness requires significant planning and an even greater amount of improvisation. The ability to effectively apply general aviation resources in an actual event will depend on weather conditions during and after the event. Therefore, flight operations must be flexible in responding to changing conditions and varying resource capabilities.
- Greater diversity in supply sources, staging areas, and volunteer resources (planes, pilots, radio operators, ground crews) would provide more robust responses to various conditions.
- Airlift response could be more effective with better integration between state, county, local, and tribal emergency management agencies. Multiple state, local, and tribal agencies conducted separate and independent activities during the exercise. As a result, there were competing requests for resources with no clear command structure to resolve these requests. A primary example was amateur radio volunteers, who were critical to aviation operations, were also requested to participate in multiple independent exercises. The next regional training would benefit from broader pilot participation during the planning phase.
- Pilots should be trained in the Incident Command System (ICS) and the basics of incident management to better integrate into a full-scale response (e.g., FEMA Independent Study Courses IS-100, IS-200, IS-700, and IS-800).
- Disaster response can be improved by making the exercise plans more realistic. In particular, more is needed to integrate flight operations with emergency communications (amateur radio) in a simulated response to an event.
- Mission assignments must match the specific capabilities of volunteer aircraft and pilot experience. These missions were assigned informally by the Air Ops command (Sky Terry, EVAC, and Jim Origliosso, ODART) in individual discussions with pilots. However, a more extensive database of pilot and equipment capabilities would supplement and enhance the process.
- An ODART website is needed to grow the volunteer base and communicate planning activities more efficiently. Currently, ODART is a fledgling effort relying entirely on volunteer resources utilizing multiple spreadsheets. Therefore, some outside funding (through grants and donations) would help grow the organization, and a website is a reasonable first step.

Conclusion

Although the list of improvement opportunities is not trivial, the Whale Run and Thunder Run aviation operations demonstrated that a volunteer force of general aviation and amateur radio resources could provide a legitimate and timely response to a future disaster. Additional exercises of this type will help focus the attention of volunteers and elected officials on future emergency response capabilities, which would improve the ability of communities to respond with aviation resources to an actual disaster.

Jim Origliosso, a licensed pilot with a commercial pilot certificate, has volunteered to organize the Oregon Disaster Airlift Response Team. He currently serves on the Board of Angel Flight West and is a retired Chief Financial Officer in the utility industry. He is also a licensed amateur radio operator.

Sky Terry is a Licensed Practical Nurse (since 2011). Since shortly after the Nisqually Earthquake in Washington in 2001, he has been a primary leader in the development of general aviation (GA) as a critical response resource after the "big one." His experience includes five years in the U.S. Army in communications with a secondary role as a combat lifesaver; three years as a volunteer firefighter at Mukilteo Fire Department and DuPont; two years as a nursing assistant; 14 years in search and rescue for Snohomish and Pierce Counties; and leader for multiple responses to the COVID pandemic in WA with GA resources. Additionally, since 2009, he has been the primary designer and organizer/leader for annual exercises in developing GA as a resource in WA (currently conducting two large-scale drills annually)

Lessons From Leading Virtual Operations

By Jennifer Pearsall

Over the past two and a half years, most emergency preparedness professionals experienced some level of virtual work, even at emergency operations centers (EOCs). Although some would prefer to stay fully remote, the complexity of disasters and other factors may require at least some to report in person. Regardless, it is likely that some aspect of working virtually is here to stay – including during a response. So, when tasked with running a virtual EOC or other operation or assigned to manage a virtual office, the following questions arise:

- What experiences will you draw from the past?
- How will you lead in the same way?
- How will your leadership be different?
- Should it be different?

There are many harrowing stories of having an in-person team one day and at-home staff the next. The following lessons were learned after fumbling through the initial experience of being a virtual EOC manager and planning section chief for a large city emergency management agency in what, at times, some referred to as the "epicenter of COVID." Stumbling through each day provided a wealth of new knowledge to share.

Recreate the Hallway/Watercooler Talk

There is no need to bring in the gossip, but it is critical to see and hear people – especially virtually – to know how they are doing. A physical EOC or office makes it easier to see when people become tunnel visioned or under extreme duress. However, it is difficult to recognize these signs in a virtual environment until it is too late. For example, someone has done something they should not have, or a dedicated worker finally implodes and possibly resigns. None of these are good outcomes.

Keep Pulse: Call, text, or video conference (rather than email) the various team members just to check in. During these check-ins, do not request status updates on work or ask about deadlines. Instead, check in on them, share pet pictures, and ask what is happening in their world. Ask them how they navigate the virtual response and whether they need anything. These check-ins should not be hour-long discussions. Even a quick two- or three-minute check-in can help identify changes in team members' demeanor.

Get Comfortable Being Uncomfortable

This concept involves two parts. The first part of being uncomfortable is the amount of communication. In a podcast episode on leadership, Craig Groeschel says, "We're gonna communicate twice as much as feels natural to you, then double it." This is about frequency, not length of communication. Effective communication is especially critical in a virtual response. Communicate in advance of something. Communicate when something happens. Communicate after something occurs. Assume everyone is building a puzzle, but no one can see anyone else's puzzle piece. You must describe, explain, ask questions, investigate, and be curious.

The second part of being uncomfortable is being vulnerable. Leading any team means being honest. During an intense response, share personal experiences of dealing with (or not dealing with) the latest happenings. For example, talk about how it felt to hear the 7 p.m. cheer for "healthcare heroes" while simultaneously seeing the near-daily protests locally and around the nation.

Keep Pulse: Hold regular time and space for the team to discuss what is occurring. Be the first to admit when things are crazy, difficult, or uncomfortable. Openness from a leader gives the team (especially the newer people) permission to be open. Leaders are not therapists but human beings who should listen more than talk.

Help Put a Face to the Name

Be the first to turn on the camera and do so every time. When someone calls, answer with video. When hosting a virtual meeting, turn on the camera to take the lead in humanizing the interaction. This visual connection is helpful, especially for new staff or partners who joined during a remote operation. However, do not force others to turn on their cameras. Bringing together staff members who are remote, multi-located, and in person, standing up a daily meeting via a video call with a camera and a microphone enables everyone to hear and see the brief. It may seem small at the time, but this daily interaction helps bring people together.

Keep Pulse: Regardless of the amount of communication – virtual or in-person – there will often be individuals who say they did not hear or know something. Maintaining consistent visual communications (such as an EOC brief), especially when everyone or a portion of people are working virtually, can help minimize this disconnect.

Find a Check-In Buddy

Constantly checking in with the staff, ensuring communication is on overdrive, and advocating for video briefs can be exhausting. Since listening can feel like a full-time job, it is essential to have a reliable person to talk with when needed – for example, a daily call to a family member or friend at the end of the day. These personal interactions can reenergize, introduce subjects other than the current response, and help keep leaders grounded when the world feels like it may collapse.

Keep Pulse: Maintaining self-care is just as important as ensuring the well-being of the staff. Demonstrating the importance of self-care and staying grounded is critical for staff members also to build self-resilience.

Key Takeaways

Remember, the emergency manager is the link between leadership and the staff in the (virtual) EOC or office. Therefore, maintain intentionality in every action during a virtual response, which includes maintaining personal and team well-being.

Jennifer Pearsall is a federal emergency manager and founder of EM Peer Wellness, a free peer-driven event newsletter designed to support meaningful connections among emergency managers. For the past eight years, she has served in multiple emergency management roles (paid and volunteer) across nonprofits and at the local and federal levels. She has responded to various disasters, including Tropical Storm Ida, COVID-19, Hurricane Maria, 2016 Louisiana flooding, and 2015 Oklahoma tornados. Pearsall is a proud AmeriCorps alumna, serving in three separate programs. She holds a bachelor's degree in public relations with a minor in leadership from the University of Central Oklahoma. In addition, she has an advanced certificate in emergency management from John Jay College of Criminal Justice.

A Communicator's Overview of a Large-Scale Exercise

By Michael Montfort

Amatuer radio operators often participate in exercises and real-life events to provide critical communications in situations where disruptions may occur. One unique opportunity arose in 2022 when the National Tribal Emergency Management Council (NTEMC) invited amateur radio operators (hams) to participate in a national-level exercise. Planned and executed by the tribal nations, the Thunderbird and Whale Exercise in June 2022 gave hams across the country an opportunity to build their network and practice their skills for a future event that many experts say is inevitable – a large-scale earthquake along the Cascadia Subduction Zone.

In the Thunderbird and Whale exercise, the incident commander and radio operators from the National Tribal Amateur Radio Association (NTARA) and Amateur Radio Emergency Services (ARES) were the first to respond to the NTEMC emergency operations center (EOC) in Woodinville, Washington. In addition, the incident commander and communications lead set up the initial equipment necessary to contact other radio operators throughout the region and, even more importantly, outside the region to coordinate the request for resources from outside the damaged and impacted areas. Ultimately, the co-presidents of NTARA established communications with their sister non-profit, the United States Volunteer Joint Services Command (USV-JSC), with radio operators as far away as Virginia, Florida, Washington, and Southern California.

Equipment Requirements

This exercise introduced several new challenges for hams. First, NTEMC asked hams reporting to the EOC to bring everything they would need to set up a Communications Unit. There would be no pre-positioned radio equipment, antennas, or generators as exercise participants would set up the EOC in a local church. Second, the exercise took place during the work week, limiting the availability of qualified and experienced team members to fulfill critical roles. Local support from Snohomish County's Department of Emergency Management also was limited. Enlisting the help of volunteers was crucial in ensuring that the mission of the communications team was successful.

The equipment used during the exercise was in a "go kit." These go kits are powered utilizing commercial power (120 volts), battery power, or solar power (12 volts). Operators used battery power during the exercise as a *proof of concept* for the tribal partners new to amateur radio. However, the go kit concept is not new. Hams worldwide use this type of kit to allow both ease of transport for radio equipment and some degree

Fig. 1. "Go kit" used in the June 2022 Exercise.

of environmental protection – for example, some kits are built in air-tight and waterproof cases. The go kit for the June exercise (see Figure 1) included: a Yaesu FT-991 (HF/VHF/UHF) radio and HF dipole tuner (bottom row); storage for a laptop and Kenwood VHF/UHF radio for digital (middle row); and power supply and lighting (top row).

Despite the amount of communications equipment frequently seen during large-scale exercises and disasters, the Communications Unit can be very effective with a smaller footprint than expected. Figure 2 displays the essential operating tools to establish emergency communications: laser printer, laptop for Winlink/email, go kit, and administration and safety center.

Complexities of Establishing External Communications

The exercise was quite complex, spanning a multi-state region, which required the communications team to set up a 35-foot-tall x 250-ft-long wire antenna called a dipole. This type of antenna is primarily for long-distance communications. However, due to poor radio band conditions, a radio program called Winlink allowed operators to send email messages via a computer over a ham radio. Sending one of these messages enabled the ham operators to request an AT&T FirstNet Satellite Cell On Light Truck (SatCOLT) and a cache of some FirstNet devices. The SatCOLT restores limited cell services with priority to the EOC and first responders nearby equipped with First Net systems. These FirstNet devices allowed the Communications Unit to establish email, internet, and cell phone traffic for the entire EOC staff.

Fig. 2. Essential set-up for the Communications Unit in the EOC (June 2022).

Ham operators also used the Winlink and amateur radio systems to send daily situation reports for the USV-JSC and their commander in Southern California. Historically, digital messaging like Winlink has been used for sending health and welfare messages out of disaster zones. These messages can be typed into a laptop, saved on a thumb drive, and walked into a communications center where they can be sent via amateur radio to relatives out of the disaster zone.

Key Takeaways

When an incident occurs, rapidly establishing reliable communications is critical for exchanging information and ensuring that responders know the resources needed for the affected areas. As the June exercise demonstrated, amateur radio operators equipped with go kits provide an agile and adaptable opportunity for connecting communities when power and traditional communications are interrupted. Several takeaways should be considered for future exercises:

- *Train more local teams to support communications needs.* In the weeks leading up to the large-scale Thunderbird and Whale exercise, the communications team had great difficulty finding and engaging radio operators due to the shortage of operators available. Training more radio operators would help to alleviate this problem in the future. As a result, the NTEMC now offers weekly amateur radio training sessions and quarterly testing opportunities via Zoom for all new operators who are potentially interested.

- *Encourage tribal governments to access training to build out amateur radio operations*. In rural and remote areas, communications may take longer to restore than in more populated urban areas. As such, pre-positioned ham radios and equipment could provide tribal communities with critical communications capabilities. Since the June exercise, more tribal emergency managers are now engaging in NTARA training with more in-person and online workshops to learn about equipment needs, how to procure and build go kits and larger-scale radio stations with the best equipment that meets their needs, and most importantly how to utilize the equipment
- *Conduct regular radio exercises with tribal, city, county, state, and federal partners*. Frequent activities would allow tribes to prepare for any communication loss and accept help from trained non-tribal local members, such as ARES Teams.

The key takeaways from the June 2022 exercise are already helping to improve collaboration and communications throughout the region.

- *Create a memorandum of understanding with the Amateur Radio Relay League (ARRL)*. With public service as one of its five pillars, ARRL's national association of ham radio operators is an excellent resource for agencies and organizations to collaborate with when preparing for emergencies, exercises, or special event planning.

The Thunderbird and Whale exercise simulated a real-world response and pushed ham radio operators to the limits to establish critical communications where none were available. These events present unique challenges and assemble people with various skill sets to find solutions and close communication gaps. With the lessons learned from this exercise, the event planners have already started working on Thunderbird and Whale 2024. The 2024 event will include a weekend with more local amateur radio teams, clubs, and tribal community members to build a more robust network. The facets of amateur radio are especially beneficial to tribal and remote communities. This exercise demonstrated that ham radio could provide greater resilience and promote new working relationships with neighbors. However, there are still many more opportunities to explore.

Special thanks to the following volunteers for making the EOC operations a success: JD Shaw, K7LCW, who is the Kitsap County emergency coordinator with the Amateur Radio Emergency Services (ARES); and Randall LeVeque, KJ7WLT, and his wife Loyce Adams, KJ7ZOL, who are members of Seattle (WA) Auxiliary Communications Service (ACS).

Michael Montfort is currently an assistant section emergency coordinator (ASEC) for preparedness in western Washington and serves as an all-hazards communications leader for Kitsap County (WA) Department of Emergency Management. He is experienced in managing disaster communications in many types of natural disasters. He is a retired paramedic, certified safety engineer, and U.S. Air Force Veteran.

Rationale for Structuring Pandemic Response on a War Footing

By Thomas Russo

National emergencies result in legislation that institutionalizes organizational structures with the necessary infrastructure for future incidents that rise to the level of a national emergency. Americans expect Congress to act whether the crisis is a war, terrorism, or pandemic.

Two world wars for which America was unprepared resulted in the National Security Act of 1947. The 9/11 attacks were followed by the merging of 22 federal agencies into a centralized agency whose mission is to keep the U.S. secure from foreign threats. However, when the COVID-19 pandemic emerged in the U.S., the lead agency, the Department of Health & Human Services (HHS), was ill-prepared to adequately respond to a highly contagious biological agent, despite two decades of pandemic planning. As a result, more agencies were activated, and the response resulted in a "whole-of-government" approach.

The National Security Act of 1947 legislated federal agencies that unified the military, created the Department of Defense, formalized the Central Intelligence Agency, and established the National Security Agency to advise the president on national security. Today, the commander-in-chief can order special operations to deploy anywhere with the essential supplies, backup, and supply chains to sustain operations.

The COVID-19 Response

Despite two decades of pandemic planning and over $21.2 billion spent on preparedness since 2002, the COVID-19 pandemic created chaotic circumstances worldwide. In addition, COVID-19 revealed some preparedness failures:

- A vaccine was not readily available that could mitigate the SAR-CoV-2 virus.
- A testing program had yet to be conceived.
- Hospital-based ventilators were in short supply.
- Personal protective equipment had not been stockpiled in sufficient quantities, and inventories were dependent on offshore supply chains disrupted by the pandemic.
- Data-gathering systems were either absent or inadequate to capture COVID-19 case rates, hospital fatalities, and testing results.
- The federal response structure was inadequate to manage an infectious disease outbreak that rose to the level of national emergency

The Trump administration responded with Operation Warp Speed (OWS), which mobilized the private sector in concert with federal agencies and accelerated vaccine production (from ten years to ten months). Furthermore, it engaged the military and

its logistics capabilities with HHS to plan the vaccine distribution to 64 Centers for Disease Control and Prevention awardees. The goal of OWS was to produce 300 million doses of the COVID-19 vaccine, with initial doses available by January 2021. In addition, the Federal Emergency Management Agency (FEMA) engaged its local connections to augment mass vaccination and essential supplies such as personal protective equipment and ventilators. Also, new software had to be developed to manage vaccine distribution and track dose administration. The software called Tiberius was made available, but its rollout caused further complications. New, untested, and with a steep training curve, it became too much for an already-overwhelmed healthcare sector.

At the first anniversary of OWS (December 12, 2021), *USA Today* published that OWS was perhaps "the most successful public-private partnership since World War II." However, on January 20, 2021, with the transition of administrations, President Joseph Biden dropped the OWS reference and adopted the Countermeasures Acceleration Group to describe the continuous national vaccination campaign. By May 2021, the group became the HHS-DOD COVID-19 Countermeasures Acceleration Group (CAG), and then CAG management transitioned from the U.S. Department of Defense (DOD) to HHS by December 31, 2021. However, the impact of OWS remains. A transparent, non-partisan, and comprehensive analysis comes from the Government Accountability Office dashboard, where OWS facets are explored and presented. For example, the "Looking Ahead" tab of the dashboard includes a comparison of H1N1 (2009 Pandemic) to COVID-19, the various phases of mass vaccination, and how lessons learned carried forward to the COVID-19 response.

Has the time come to put the country on a warlike footing for pandemic response with a coherent, institutionalized, and tested pandemic policy?

The Historical Role of Politics in Response

Politics has played a part in policies that shaped the pandemic response – for example, the renaming conventions of the response structures described above. However, politics in emergency response during national emergencies is not new. To compare, it took two wars before Congress enacted the National Security Act in 1947. In the interim period between the two world wars, preparedness planning did not occur outside the military – either federal organizational structures or industrial mobilization and its linkage to the military. Today this linkage is referred to as the military-industrial complex.

With the U.S. entry into World War I, President Woodrow Wilson created the War Industries Board to manage the economy and mobilize industry to produce the supplies needed in the first national emergency. The nation was not prepared militarily, nor was its industrial base equipped to make the essential munitions the army and navy needed to supply its forces as they shipped to the European theater. General Pershing used French weapons when his troops arrived on the Western front. The U.S. lagged not only industrially but technologically as well. Germany had begun the process of synthetic nitrates used for both gunpowder and fertilizer. Western nations relied on natural sources only available from Chile, but Germany managed to sequester those supplies.

Even though a War Industrial College was established in 1924 by Bernard M. Baruch (War Industries Board chairman) and mobilization planning resulted, it remained sequestered in the military to avoid upsetting the public with perceived "sword rattling."

As a result, the lessons of WWI had not been acted upon by Congress when Pearl Harbor was attacked. The U.S. responded with a declaration of war for which the nation and its military were unprepared. President Franklin D. Roosevelt, through executive action, hesitated to prepare before the attacks and to mobilize emergency committee structures once the war was declared. There was no adopted industrial mobilization plan, nor were organizational structures in place that could respond to the national emergency. The War Production Board was established in January 1942. However, each *mobilization* crisis brought on by the U.S. engagement in the European continent and the Pacific expanded the needs. New agencies also were created, such as the Office of Economic Stabilization in October 1942, followed by the Office of War Mobilization in May 1943, each overlapping the mission of its predecessor. Meanwhile, time was lost as the economy converted from peacetime to wartime mobilization.

COVID-19 strained the nation's resources beyond the healthcare sector, workforce, and vaccine manufacturers. Mass vaccination planning for venues and vaccinators was inadequate. Supply-chain issues, limited personal protective equipment, the absence of an established testing program, controversial non-pharmaceutical interventions, politically-laden protocols, and mandates all required tremendous effort to surge response capacity. Contact tracing, a long-time public health tool virtually unknown outside of public health, became a household name after January 1, 2020, as a non-pharmaceutical intervention method – coupled with isolation and quarantine measures – to track the spread of COVID-19. Isolation and quarantine measures resulted in both physical and mental consequences. For example, dietary changes and lack of physical activity exacerbated health conditions, while the mental health impacts resulted in social isolation, depression, and the stigma associated with it. Equally noteworthy is that federalism played out in the courts as states took the White House to court over state's rights while federal authority for a lead agency lacked clarity between HHS, FEMA, and the Department of Homeland Security. The public's response was vaccine hesitancy and apprehensiveness about whose "science" to follow.

Next Steps for Pandemic Response

Given 20 years of pandemic planning, is it not surprising when people ask, "Why were we not ready?" Given the persistent emergence of novel infectious diseases and the performance of the nation's lead health agency, this question should be explored whether the time has come to put the country on a warlike footing for pandemic response with a coherent, institutionalized, and tested pandemic policy. For example, the pandemic response should mimic an enhanced, robust seasonal influenza vaccination campaign – a policy and model depicted in the aftermath of the 2009 H1N1 Pandemic.

A January 2022 Government Accountability Office report designated HHS's leadership of public health emergencies as high-risk and stated that it is a federal program requiring a transformation. The rationale for a warlike footing for pandemics is that the nation

A hospital in Kansas during the Spanish flu epidemic in 1918 (*Source:* Otis Historical Archives, National Museum of Health and Medicine, Public domain, via Wikimedia Commons).

The federally supported California State University Community Vaccination Center is equipped to administer up to 6,000 vaccinations per day (*Source*: FEMA, February 2021).

needs emergency structures that are established legislatively rather than leave it to the whims of administrations and partisan politics. With COVID-19 and the transition of White House occupants, the changing of response structures (OWS versus CAG) is reminiscent of Roosevelt and his reluctance to mobilize the nation for WWII and the naming of WWII emergency structures. Pandemic organizational structures should be legislated through congressional action as well as defining the lead federal agency in the whole-of-government approach. The executive office executes responses through existing structures rather than fashion new structures with titles that mimic pop culture. It became apparent the effective response took on a vast logistics operation that integrated the medical response. A logistics model then supplanted the medical model – a model the nation had depended upon for its planning scenarios since the 1950s.

The passage of the National Security Act demonstrated that the nation needed continuity with its security institutions to provide the commander-in-chief with an informed council required in emergencies. From these concerns came the National Security Act in 1947 and the Defense Production Act of 1950, used in 2019-2020 to acquire pandemic supplies during the national crisis.

In a June 9, 2020 white paper by the U.S. Senate Committee on Health, Education, Labor, and Pensions, referring to the coordination of federal agencies, it states:

> *It is Congress' responsibility to provide a foundational structure that administration after administration can build on instead of creating a new structure with each new emergency. The laws that Congress passed do not seem to have anticipated fully the scope of a pandemic such as COVID-19 and the need for a whole-of-government approach.*

Legislated actions on the order of the National Security Act of 1947 would build essential resilience to public health emergencies of national significance. Resilience could be achieved by a sustained public-private partnership that brings offshore critical supply chains onshore and supplements vaccine production. This partnership brought pharmaceutical manufacturers onshore after 2009 and illustrated federal government efforts to accomplish these feats. In 2009, only one onshore manufacturer produced vaccines. Today, four pharmaceuticals produce vaccines from U.S.-based facilities. Resilience will be realized when pandemic preparedness is a sustained, systematic process at all levels of government, not an afterthought amid a crisis that permits politics to create temporary emergency response structures.

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Chemical Sector Perspectives

By Patrick Coyle

Section 1016 of the USA Patriot Act (codified at 42 USC 5195e) provides the current definition of critical infrastructure, describing systems and assets that are "so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." With the diversity of chemical facilities across the country, it is easy to see why the chemical sector is one of the 16 critical infrastructure sectors outlined in Presidential Policy Directive #21.

What makes this sector critical to the nation and what possible effects does it have on states and local communities?

Chemistry has long been known as the central science because it connects the physical sciences. Similarly, the chemical manufacturing, transportation, and storage industry could be considered the central sector as it provides key materials for each of the 16 critical infrastructure sectors.

With sprawling chemical facilities like petrochemical refineries, it is easy to see that the gasoline, diesel, and other fuels they produce play an essential role in the commerce of state and local communities. But even those fuel-producing giants produce hundreds of lesser products used as raw materials in other chemical manufacturing concerns across the country. Those chemical facilities, in turn, produce chemicals that keep all parts of the economy moving forward.

An interesting class of chemicals manufactured at large, medium, and small chemical facilities across the country is monomers. These are self-reactive chemicals used to form repetitive chains of molecules known as polymers. When most people hear the word polymer, they think about the bottles and food containers that create so much of the plastic pollution seen along roads and waterways. But a more important use of polymers is in treating drinking water and wastewater. Those polymers remove particles of dirt and debris found in most water sources. Without their use, there would be no safe drinking water, and human wastes would pollute the rivers and lakes to the point that they would not be safe to approach, must less swim in or boat upon.

Another critical use of polymers is in the blades of the massive wind turbines that are becoming an increasingly important part of this country's electric power generation mix. Lightweight polymers form the skin of those blades that catch the wind and change it into the rotational energy used to produce electricity. Failure to produce those blades would impact the expansion of wind power or keep existing turbines from being replaced when damaged.

Most of these polymers are manufactured at medium-sized chemical facilities. Smaller chemical facilities typically blend operations that mix and package chemicals to perform specific functions in various manufacturing operations. Many of these products were specifically designed for a particular niche, with only a single manufacturer producing that specific chemical blend. Interruptions to the supply of those chemicals can have an effect further down the supply chain.

A special group of very small chemical manufacturers supports the pharmaceutical sector. First, they make small batches of critical chemicals used to manufacture new drugs in small volumes for various parts of the drug testing and approval process. Then, as drugs are approved for use and sale, these often one-room manufacturing facilities can grow into small manufacturing plants that are sole-source suppliers for those same chemicals to the pharmaceutical companies to chemically assemble into the drugs headed to market.

What are this sector's key assets and interconnected/interdependent systems (physical or cyber)?

The chemical sector is, in essence, a manufacturing sector. Consequently, it depends on many of the same supporting structures found in any manufacturing system: raw material, power, water, transportation, waste treatment, and manufacturing facilities.

As noted earlier, a significant source of chemical raw materials comes from petrochemical refineries, which come from crude oil and natural gas producers. But a large variety of chemical raw materials come from mineral mining operations. Some materials are used as mined (common salt or sodium chloride is an important example), but others are processed via physical or chemical means to produce raw materials for multiple chemical processes. Another increasingly important source of chemical raw materials is the agricultural sector.

Power for chemical manufacturing comes in two primary forms: electrical energy from the national grid and chemical energy from burning fuels. Electrical energy is typically used to power the production facility's process equipment and administrative machinery. However, in many cases, it is directly applied to raw materials as part of the manufacturing process. Natural gas is the common fuel used for heating in chemical manufacturing. Seldom are flames used directly to heat chemical process equipment. Typically, boilers are used to generate low- or high-pressure steam to provide heat for chemical manufacturing. Where higher heat levels are required, electrical resistance heating is frequently used.

Water is an essential part of many chemical manufacturing processes. It is commonly used (and typically recycled) as a heat transfer fluid for heating and cooling chemical processes. Water is also a common solvent used in many processes. While that solvent

water may be included in the finished product, more frequently, some or all of that water is removed from the process. That extracted water may be recycled in the same or similar processes at the facility. Still, it is typically processed on-site as non-hazardous waste, sent off-site to be processed as hazardous waste, or shipped (via industrial sewers) to a local wastewater treatment facility.

Transportation of raw materials and supplies to chemical manufacturing facilities and the transportation of products to customers take many of the same forms seen in typical production facilities. Truck and rail transportation are the most common forms of transportation, but many facilities also use pipelines or waterborne transportation assets for incoming and outgoing materials. While many chemical products can be packaged in small containers that are boxed for transportation, the most common chemical packaging is done in drums of various sorts and sizes or intermediate bulk containers of a few hundred gallons. Larger bulk containers are shipped by truck, rail, or vessel.

Waste treatment is an integral part of the chemical sector. As previously discussed, water is used as a solvent, but many other chemicals are used as solvents in various stages of many chemical manufacturing processes. As with water, many of these solvents form an essential part of the final product, but more of it is removed from the process. Every effort is made to recycle such solvents on-site, but large amounts of them need to be sent to specialized outside facilities for retreatment or disposal. Since many solvents are hazardous, they are treated as hazardous waste.

The Chemical Sector is one of 16 sectors identified as critical infrastructure under the Cybersecurity & Infrastructure Security Agency.

The manufacturing facilities used by chemical process industries vary with the processes used. There are three common types of chemical manufacturing processes: continuous process, batch process, and blending. In continuous process facilities, raw materials enter a series of process vessels in a continuous stream. Each processing zone's heat, pressure, and catalysis conditions remain nearly constant during the active process, changing only during start-up and shutdown. In a batch process facility, the raw materials are sequentially added to a single process vessel, with the process conditions being changed as needed for each step of the production process. Blending operations are the simplest chemical manufacturing process, with two or more materials being added to the mixing vessel with no chemical reactions. Many chemical facilities have multiple types of processing on-site.

What are this sector's dependencies (physical, cyber, geographic, and logical) and interdependencies with other critical infrastructures?

Power, water, and transportation are the three most obvious areas where chemical manufacturing facilities depend on other sectors for continued operations. Therefore, interruptions or even reductions in the supply of raw materials adversely impact the continued operations of these facilities.

Chemical manufacturing is power intensive, and any electricity supply interruption would disrupt operations. While some facilities have limited on-site power production capabilities, it is generally for short-term operations to carry over through short-term power outages or emergency shutdown processes. However, longer-term shutdowns place many facilities in potentially dangerous situations as many chemicals require automated environmental controls to keep them from energetically decomposing or undergoing exothermic self-reactions.

Consistent supplies of water are essential for many low-level cooling operations. Many facilities use freshwater flow as an emergency backup for refrigerated cooling systems. While not as effective as electrically powered refrigeration for maintaining environmental controls to prevent decomposition or self-reaction, drinking water supplies can provide a cooling bridge for short-term interruptions in electrical power.

Interruptions of the supply of raw materials and operating supplies are an obvious problem for the continued operation of chemical facilities that transportation issues would cause. High-volume transportation by pipeline, rail, or barge is typically a sole-source transportation mode for critical raw materials. It is challenging to replace if that transportation mode is damaged. Batch operation facilities can frequently switch production to alternative products during short-term supply problems. Continuous operation facilities faced with unexpected supply outages would be forced to conduct emergency shutdowns. Such unplanned shutdowns are typically the most dangerous operation conducted at such facilities.

Raw material supply issues can also arise when suppliers experience problems interfering with their operations. For example, although alternative suppliers may be available, high-volume raw materials may be difficult to obtain when a supplier has an unexpected shutdown. Even when alternative suppliers are available, minor differences in product quality can cause process problems that require additional work to ensure the smooth production of quality products. This is a particular problem when the raw material is based on the processing of *natural* products. The complex blend of organic chemicals in plant or animal products may vary significantly due to local agricultural production conditions.

What are this sector's current and emerging vulnerabilities, hazards, risks, and threats?

The variety of supply chain issues currently affecting the broader U.S. economy is impacting the chemical sector. Chemical manufacturers in China and East Asia have increasingly become suppliers of chemical intermediates to American manufacturers. The ocean-going shipments of those chemicals have been interrupted by the same issues facing other products shipped from Asia. Some of those products have no domestic sourcing available.

The railroad shipping issues identified in a recent hearing before the Surface Transportation Board affect many chemical manufacturers. Delays and interruptions in both the shipping of finished goods and the receiving of raw materials are having ongoing impacts on chemical manufacturers. Many chemical manufacturers see this problem on their operations' shipping and receiving sides. Even when manufacturers are not using rail transportation, the upstream interruptions of raw materials can still have supply impacts.

The shipping problems also extend to the backbone of chemical shipping, the trucking sector. As the number of available truck drivers continues to decrease nationwide, fewer trucks are available to handle bulk and packaged chemical loads. Bulk chemical drivers are frequently required to unload chemicals at customer locations, reducing the number of drivers interested in handling such loads. Further, a significant percentage of bulk chemical loads are hazardous chemicals and require a special endorsement to the driver's commercial driving license to handle such chemicals. The background check requirements for that Hazardous Materials Endorsement even further reduce the number of available truck drivers.

Industrial control systems and industrial internet of things (IoT) devices are becoming increasingly ubiquitous in chemical manufacturing facilities. These electronic systems allow for closer control of process variables, increase product quality, and decrease manufacturing costs. They also move the ability to monitor and control chemical processes out of the sole purview of the control room, allowing process engineers and production managers more remote access to process data and process control than ever before. Additionally, remote access increases the potential for criminals, nation-state actors, and competitors via cyberattacks to gain process access.

The threats from cyberattacks span a wide variety of potential types and scopes of attacks on both the industrial control systems and administrative computer systems at manufacturing facilities. Commercially driven attacks could include competitors' theft of process design or process control data to bootstrap their operations or even process manipulation by those competitors to increase processing costs or decrease product quality to gain a commercial edge. Criminal attackers could use ransomware to drive high payments to release administrative or control system access/control back to the manufacturing

organization. Nation-state actors could use cyberattacks to provide a low-cost method of disrupting the national economy or even interfering with the timely delivery of military supplies. Larger chemical facilities can afford a robust cybersecurity operations center to protect their systems, but this option is not economically viable for smaller operations.

A yet unrealized threat is an attack of the killer drones. While there is a long history of the U.S. military using sophisticated unmanned aerial vehicles (UAV) in the War on Terror, the current military operations in Ukraine are pointing out that a lower level of sophistication in drone operations can be very effective. Combined with the use of armed drones by the Mexican drug cartels, chemical facility owners should be concerned about the potential for terrorist attacks using these readily available aerial delivery systems. Currently, facility owners are prohibited by law from interfering with the operation of UAVs over their facilities. The Federal Aviation Administration has yet to issue regulations allowing critical infrastructure to request registration as a no-fly zone. Interfering with a drone is still a violation of 18 USC 32.

How would a human-caused, natural, or technological disaster impact this sector's preparedness, response, and recovery efforts?

In the summer of 2017, flooding caused by rains from Harvey inundated large portions of the Texas and Louisiana coast. During that time, a relatively small (for Texas) organic peroxide manufacturing facility outside Crosby, TX, became the focus of the chemical process and emergency response community when the refrigeration systems and their backups began failing at the facility. Unusually high flood waters compromised the safety and backup safety systems that protected the storage of various organic peroxides manufactured and stored on-site. The Chemical Safety Board reported that the facility's "safeguards could likely provide adequate protection for a 100-year flooding event." Preparing for a 100-year flood event has been a standard technique for emergency flood planning, but it is increasingly becoming clear that relying on such historical standards is no longer adequate.

As climate change increases the intensity of rain events and the average strength of winds and storm surges associated with tropical storms and hurricanes, coastal and riverine chemical facilities must adapt their emergency planning to deal with new

realities. And the larger these storms get, the wider the affected area, which means restoring utilities at these facilities would take longer. Thus, these chemical facilities must plan for more prolonged outages and have more backup power systems to support critical services.

Since so much of the crude oil and chemical refinery capacity in this country is located on the Gulf Coast, these extended storm-related outages have a downstream impact on many other chemical facilities outside of the storm-damaged areas. In addition to shortages of fuel and natural gas, a wide variety of hydrocarbon feedstocks from these refineries serve as raw materials for facilities across the country, which in turn use those *simple* hydrocarbons to make more complex molecules that feed even more chemical facilities. Thus, facilities that use fuel, natural gas, hydrocarbons, and other chemicals from Gulf Coast facilities need to have plans in place to deal with such longer-term shortages.

There remains a potential long-term threat of terrorist attacks on chemical facilities. These could take the form of attacks on facilities to cause the release of toxic chemicals on local neighborhoods or fires and explosions at such facilities that would adversely impact those same communities. These neighborhoods are often comprised of populations that could be targeted for hate crimes and are already particularly vulnerable to environmental hazards. Another type of attack would be stealing toxic chemicals, chemical weapon precursors, or explosive precursors for use in terrorist attacks on entirely different targets. The U.S. Department of Homeland Security maintains two chemical security-related regulatory programs that address these vulnerabilities: the Cybersecurity & Infrastructure Security Agency's (CISA) Chemical Facility Anti-Terrorism Standards (CFATS) program and the Coast Guard's Maritime Transportations Security Act (MTSA) program. In addition, CISA has recently started a second voluntary (non-regulatory) chemical security program, the ChemLock program, for facilities not covered by the other two programs.

Finally, with an increase in frequency of gun violence in this country, the possibility of encountering an active shooter incident is becoming more likely, which could impact a chemical facility. Although many guidance documents are available for responding to active shooter incidents, none have dealt with the unique hazards associated with gunfire. In an environment where the muzzle flash from a handgun can ignite chemicals in the air or stray bullets fired by either the gunman or responders can penetrate chemical storage tanks and release toxic or flammable chemicals into the atmosphere.

What else do emergency preparedness, response, and recovery professionals need to know about this sector?

Such professionals must first remember that each chemical manufacturing facility is unique. Even facilities built by the same company that produces the same products have design differences – including safety and security measures – built upon production lessons learned and changes in the regulatory environment since earlier plants were designed. Further, each facility evolves in different directions as time progresses. This evolution

affects emergency preparedness, response, and recovery planning. Since no two plans are identical, they must be updated as the facility adds new chemicals and changes process layouts or equipment.

The next thing to understand is that all chemicals are potentially dangerous. Even water in a sealed container is subject to becoming a bomb if heated to its boiling point in a facility fire. The simple reading of a Safety Data Sheet (the document each facility must have for each chemical on-site) explaining the hazards of that chemical seldom provides a complete understanding of the hazards associated with that single chemical. Given that a small chemical manufacturing facility may have hundreds of chemicals on-site in large and small containers, no one can understand all the hazards at a facility. Emergency planning can only concentrate on the most dangerous chemicals on-site in significant volumes. Less hazardous chemicals in smaller containers still can seriously injure or even kill first responders at the site during emergencies. Therefore, training emergency response personnel in basic chemical safety is required.

Another common hazard at chemical manufacturing facilities is high voltage electric systems. These systems are used to power pumps, vacuum systems, and mixing motors, to name a few types of high-energy process equipment. During emergency response situations, responders must be aware of this potential danger and where to find the facility shutoff for such power to reduce those hazards.

Finally, emergency response planning needs to address runoff, specifically during firefighting operations at the facility. For many safety reasons, a standard method that fire departments use in fighting fires at chemical facilities is to flood the area with water to help keep unaffected storage containers cool and stop spreading flames to other parts of the facility. Frequently, facility sprinkler systems have automated deluge systems in process areas of the facility designed to do the same thing. With high volumes of water flowing out of the facility, water contaminated with an unknowable combination of chemicals would be released during the incident. Incident commanders must have plans to contain that water to prevent it from entering public waterways. Facility owners must have plans in place for post-incident collection and disposal of that contaminated water, water that is frequently hazardous waste.

The chemical sector is a vast and diverse part of the U.S. economy. Its products help support and even drive the successes of the other 15 critical infrastructure sectors. The way the sector is internally and externally integrated, failures at even small chemical facilities can have a cascading impact on other chemical and non-chemical product manufacturing. Understanding that integration is an essential part of the job of any professional responsible for emergency preparedness, response, and recovery planning.

Patrick Coyle is a 15-year veteran of the U.S. Army and has worked for 26 years in the chemical process industry – including 16 years as a process chemist and four years as a quality assurance manager. He also has taught industrial safety and has been a freelance writer since 2006. For the past sixteen years, he has used his unique background to write a chemical security blog, the "Chemical Facility Security News."

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