NTI Paper

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Learning from Catastrophe: Lessons from the COVID-19 Pandemic for Preparing for and Responding to a Domestic Radiation Emergency

SUMMARY

The COVID-19 pandemic has raised important questions about resiliency and preparedness for other catastrophic disasters, including nuclear and radiological emergencies. Based on expert interviews with dozens of response practitioners, this paper assesses potential gaps in preparedness for nuclear and radiological emergencies, including challenges pertaining to coordination, training, equipment shortages, expertise deficits, and crisis communication with the public. The paper proposes recommendations to policymakers on how to bolster preparedness for nuclear and radiation emergencies in order to better protect the public from these catastrophic risks.

Major General Julie Bentz (Ret.)

20 YEARS OF NTI BUILDING A SAFER WORLD

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Foreword

The human, economic, and societal devastation caused by the COVID-19 global pandemic laid bare the fact that the international community, including some of the richest countries in the world, was (and still is) poorly prepared for low-probability, high-consequence catastrophes. Questions about how much preparedness is enough for such events have long dogged policymakers, academics, and budget drafters—and will be at the heart of the effort to rebuild our societies to make them more resilient to withstand such catastrophic risks.

The COVID-19 global pandemic brought back into the spotlight the need for broader emergency preparedness for the unthinkable.

Among such risks are nuclear and radiological emergencies. Ever since the Soviet Union tested its first nuclear device in 1949, policymakers in the United States have had to plan for and equip communities with the resources to respond quickly, sometimes in mere minutes, to save lives and mitigate catastrophic damage from a nuclear blast. The Three Mile Island, Chernobyl, and Fukushima nuclear power plant accidents further enhanced our collective understanding of and preparedness for radiological emergencies and sensitized policymakers and the public to the importance of effective radiological emergency preparedness and response. A May 2019 radiation release at a hospital in Seattle underlined the ongoing need for such preparedness, even when lives are not immediately on the line. And while communities have made progress in preparing for the unthinkable, more still needs to be done.

As the COVID-19 global pandemic highlighted the challenges in local and global health preparedness, it brought back into the spotlight the need for broader emergency preparedness for the unthinkable. In response, NTI sought to assess the state of domestic readiness for nuclear and radiological emergencies, noting that even the most well-prepared countries, such as the United States, still managed to suffer enormous consequences from the pandemic. NTI commissioned Maj. General Julie Bentz (ret.) to conduct this analysis; her findings are included in the sections that follow. We hope that they serve as a useful guide for policymakers and practitioners as they consider ways to bolster our country's preparedness for nuclear and radiological emergencies.

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Introduction

The U.S. response to the COVID-19 pandemic offers invaluable insights and lessons for policymakers and practitioners involved in preparedness for other major disasters, including public radiation emergencies.[1] This report explores these lessons learned from the pandemic response to identify key challenges and recommendations for nuclear and radiation emergency preparedness.

Overlaying observations from responses to COVID-19 onto a public radiation emergency provides a compelling framework for reassessing long-standing assumptions of public reactions to news, information, and direction. Public decisions in the immediate aftermath of a radiation emergency will directly impact the success of the response. Competing or conflicting direction on appropriate response before and during a crisis may generate distrust of government, while potential misinformation could sow doubt about the veracity of the warning.

Individual actions may have significant impact on emergency response effectiveness.

As a parallel to a no-notice public radiation emergency, the COVID-19 response suggests that decisions made by authorities are not the only drivers of emergency response, and that individual actions may have significant impact on emergency response effectiveness. Just as individual decisions to wear masks and follow social distancing guidelines impacted the spread of the virus, individual choices after a nuclear or radiological emergency will affect the impact of the emergency. In particular, individual decisions to shelter in place or leave an affected area in the immediate aftermath of a radiation emergency will have one of the greatest impacts on short- and long-term casualties. This suggests that planning assumptions should include the tenet that an "informed public" can act on their own can save more lives following a nuclear blast. If this assumption proves correct, preparedness efforts should expand planning actions to include public awareness and education efforts. This will require taking response plans off the shelf and getting them into the hands of the local decisionmaker and the general public.

This study also uncovered a critical finding about the individual citizen, both in the nation's planning assumptions and the unexpected public response to COVID-19. In almost all federal planning efforts, the basic assumption that "the constituent matters" is not well understood. Weapons of mass destruction (WMD) policies and operational planning were written for federal government actors and exercised in a limited way with state and local counterparts. As a result, the individual citizen has been systematically left out. The COVID-19 pandemic has presented the glaring challenge of how to give the average citizen enough information to make key decisions during a prolonged crisis. This provides a parallel application in the response to a public radiation emergency. For example, after a nuclear or radiological emergency, individual citizens may take it upon themselves to determine (1) where they go in the immediate aftermath of a public radiation emergency; (2) which sources of information they will listen to for guidance; and (3) how comfortable they are about returning to an area that they had to leave because of radiation exposure.

[1] For the purposes of this project, public radiation emergencies include those involving accidental or malicious releases of radiation affecting public areas. Examples include the detonation or other use of a radiological dispersal device, an improvised nuclear device, or a limited number of state nuclear weapons, such as a successful North Korean nuclear strike on a West Coast city.

To fully appreciate the impact of COVID-19 on the individual citizen, one cannot lose sight of the sheer number of compounding catastrophes and crises that added to the stress and the demand on response capabilities across the United States. These other events include the highest number of named hurricanes in a single season; 135 major fires, including three of the largest in history; election security concerns in both the spring primaries and the fall general election; civil unrest resulting in discord between law enforcement personnel and citizens; cyberattacks from adversarial nations; and an attempted insurrection at the Capitol. Further research on these compounding factors could reveal a wealth of data and shed light on known concerns in the nuclear preparedness community, such as the loss of the electric grid, cyberattack, and climate-related catastrophic events. Responding to these types of catastrophic events will require an integrated national planning effort.

This report provides a qualitative assessment of local preparedness for public radiation emergencies. It is based on interviews with current and recently retired federal, state, and local decisionmakers, emergency management officials, public health experts, nuclear facility operators, responders, national laboratory experts, individuals responsible for developing guidance on policy and planning, and other key stakeholders (see Appendix A). Senior-level practitioners in nuclear and radiological emergency preparedness and response were queried at the beginning and end of this project to determine if their insights on preparedness for public radiation emergencies changed as the pandemic evolved. A questionnaire also was developed for the National Guard WMD-Civil Support Team (WMD-CST) community for insights into local exercises, training, and other capacity-building initiatives.

A list of concerns provided at the start of this project laid out well-documented decade-long challenges in responding to public radiation emergencies. These challenges included concerns about limited resources, differing levels of responder training, limited expertise, lack of proficiency assessments outside the federal government, varied awareness of roles and responsibilities, and lack of consensus on "how clean is clean" or "how safe is safe." The investigation into the 2019 radiological dispersal incident in Seattle uncovered specific issues relating to response timeliness, leadership mechanisms, lack of awareness of roles and responsibilities, and handoffs between organizations. These findings were analyzed for consistency with the findings of this report. Similarities with the pandemic response were the slow buildup to response and and the difficulty in seeing the "end." The response and cleanup efforts for the 2001 anthrax attacks in Washington, D.C., at the Brentwood postal facility, and Senator Tom Daschle's office had similar components, particularly in communicating risks and an understanding of what is safe to the general public. Senior-level practitioners unanimously expressed concern with regard to communicating technical topics to a public that is increasingly susceptible to misinformation.

Findings

Extensive interviews with practitioners and experts produced five overarching themes: improving preparedness, improving response, prioritizing actions, communicating guidance and direction, and strengthening coordination with local governments. Based on these findings, the study also makes key recommendations. While some findings are ripe for immediate actions, others require better science and creative solutions to resolve.

1. Improving Preparedness

- After the terrorist attacks on the World Trade Center and the Pentagon in 2001, the United States embarked on an aggressive training and exercise regime to increase national resilience and preparedness for a potential WMD event. **However, over the past decade, training capacity and response capabilities have atrophied due to insufficient resources—both funding and planning**. The number of exercises focused on WMD response has decreased and the level of expertise in responding to catastrophes has diminished. While federal, state, and local partners expressed eagerness at the opportunity to conduct training within current budgetary constraints, exercises for large-scale radiological events remain relatively infrequent due to new training priorities—for example, prioritizing training on higher-probability situations (such as active shooters and floods) rather than lower-probability, high-impact events like a nuclear attack.

- State- and municipal-level radiological response capabilities also vary significantly. For example, states with nuclear reactors and with a history of high levels of federal engagement expressed a greater familiarity with federal guidance and radiological/nuclear emergency protocols and preparedness than states that did not have substantial nuclear infrastructure. Apart from these communities near nuclear power plants and a few major cities, most local emergency management agencies are unlikely to be effectively trained, equipped, or otherwise prepared to respond to public radiation emergencies.

- Even when local exercises include a radiological/nuclear scenario, the focus tends to be on accidental releases from nuclear facilities and not on state-sponsored or terrorist detonations or releases. If any training is available, the central focus tends to be on development of individual responder skills (maintenance, calibration, interpretation of readings, and other technical responsibilities) rather than on how all the various parts of the response system would operate together. If a nuclear detonation scenario is used, the exercise typically takes on a relatively narrow law enforcement scope (for example, is there a second device to be found?) or on the exceedingly early stages of the response (e.g., who do we call?, etc.) rather than integrating all these challenges together. Given limited capacity of state and local authorities to organize such "system-wide" exercises and the usual limits of these exercises, discussions of mitigation, cleanup, or large-scale mapping of contamination zones are largely overlooked or avoided. There is also a lack of attention to medical response and preparedness. Hospitals also voiced their concerns about the lack of

adequate instrumentation and expertise for radiological emergencies and identified the need for training in radiological patient care.

- Responding in a multi-echelon environment requires specialized training and equipment and overtime support for large-scale exercises, but trainings such as the robust multi-agency exercises involving several municipalities conducted as part of the Department of Defense's Chemical Biological Radiological Nuclear Response Enterprise are rare in most states. These gaps could be mitigated with additional training augmented by industry, universities, and non-governmental organizations (NGOs) even though equipment and overtime support might be prohibitively expensive for entities that are not receiving federal funds for these exercises.
- **No entity outside the federal government has conducted a recent assessment of preparedness for a public radiation emergency.** A preparedness assessment is important on many levels. It can uncover transportation issues, the need for greater empathy and clarity in communication, and gaps in supply and maintenance support chains. NGOs, industry, and government experts have critical decision points that should be inventoried as well. Those involved in the response should participate in exercises and planning processes so that responders understand key stakeholder perspectives. This includes planning for triggering certain types of authority that are uniquely federal and identifying critical resource shortages. Better coordination and action will require the involvement of advisory networks, including university or industry experts, to create trusted channels to advise state and local leaders, bolster state health departments, and coordinate with national-level counterparts.

Most local emergency management agencies are unlikely to be effectively trained, equipped, or otherwise prepared to respond to public radiation emergencies.

- State and local authorities define their capability to respond to a public radiological emergency through relationships with locally based federal and regional partners. These partners can include the Federal Bureau of Investigation (FBI) Stabilization Teams, the FBI WMD coordinator, Department of Homeland Security field partners, Department of Energy (DOE) Radiological Assistance Program teams, DOE national labs, state Radiation Safety Offices, state and regional hazmat teams, state-level law enforcement, and others. As mentioned earlier, state and local preparedness efforts vary depending on where the federal government has focused funding efforts and whether these communities have substantial nuclear infrastructure. Local organizations, including NGOs, community alliances, and private-public partnerships have not been mined to the extent needed for this type of response.
- **The development of national planning scenarios can help determine who is best suited to provide critical mission functions within a state; the development teams can adapt the scenarios for crises frequently experienced in that state.** Moreover, the knowledge of radiological/nuclear preparedness planning can be leveraged and transferred through regional and national collaboration, integrating radiological/nuclear response capabilities and protective actions into existing state and local plans for natural disasters. Building useful partnerships between these communities should be a key component in preparedness. Additionally, because partnerships

increase a state's capacity to respond to a radiological/nuclear event, there should be a focus on developing and grounding relationships between subject matter experts and decisionmakers. Expert practitioners could be provided with opportunities to cycle through positions in public policy (such as American Association for the Advancement of Science fellowships), academic teaching (particularly for health professionals), and other "rounding" environments through initiatives sponsored by all levels of government, NGOs, and public-private partnerships.

- Exercises for radiological emergencies should incorporate disruptions. Planners need to insert unscheduled crises into the normal exercise cycle with adapted responsibilities for decisionmakers as crises evolve or become multilayered. Just as mayors and governors had to grapple with responses to COVID-19, hurricanes, mass protests, and economic devastation all at the same time, local decisionmakers may have to grapple with multiple emergencies at once while responding to a public radiation emergency. Exercises must effectively reflect this, and training protocols must be designed to deal with rapidly evolving situations.

2. Improving Response

- **Call centers can provide critical real-time information to specific communities.** Understanding the content of the data that call centers collect can be critical to decisionmakers in an emergency. During the response to the 2011 accident at the Fukushimi Daiichi reactors in Japan, for example, the US Centers for Disease Control and Prevention (CDC) noticed an increased use of the poison control hotline for questions regarding KI (potassium iodide). This uptick in call center usage led the CDC to release immediate guidance to the general population on safe KI use.

- As a result of existing limitations in response resources—for example, monitoring equipment, personal protective equipment (PPE), medical supplies, and dosimeters—the coordination and distribution of critical items requires a better understanding of existing and future inventory requirements. During the COVID-19 pandemic, **states and counties that had conducted an inventory of their resources were better equipped to rapidly prioritize resource distribution and find creative solutions to repurpose existing supplies.** The flexible use of existing PPE and radiation detection capabilities is critical in a public radiation emergency and will require public authorities to be aware of proper usage and disposal of PPE specific to a radiation emergency. Training on the use of PPE and other equipment for a radiation emergency could be instituted through an existing accreditation or mandate or provided as guidance through a dedicated training module.

- During the COVID-19 pandemic, community leaders found that **keeping existing supply chains operational was key.** However, the need to preserve PPE, accelerate distribution, and pivot to allocation led to innovation within the supply chain. With so many supply chains dependent on foreign or single-source suppliers, the response to COVID-19 proved that **innovation is critical to supply chain vulnerabilities and their management.**

- Focused exercises could be used to identify some of these gaps for decisionmakers to help develop potential workarounds. Businesses that provide necessary capability through the supply chain also could be included in exercises and training. Another identified concern from local responders

during COVID-19 was the challenge of receiving resources with no accompanying training or additional human resources to operate the equipment. This resulted in equipment not being used appropriately, if at all.

- Procurement requirements for cybersecurity equipment and field devices need to be assessed and their supply chains validated. Factory and site acceptance testing should include cybersecurity considerations. On the other hand, as institutions put in place constraints or limitations for valid reasons—for example, air gaps designed to prevent cyberattacks from propagating—they must make the rules explicit and provide for emergency suspension of such rules when they impede response efforts. Consider how information can be shared and develop usable risk matrixes to help decisionmakers when compromised systems must be used.

- Public health authorities and authorities responsible for Federal Emergency Management Agency (FEMA) logistics used different pathways (systems, decisionmakers, and end users) for distribution. Because of varied access to resources within states, municipalities with public health offices in their counties experienced less disruption than municipalities without these offices. In some cases, State authorities would communicate directly with county governments without necessarily including authorities at the municipality level. Those mayors with public health offices in their jurisdiction often had better access to information being passed down from the state than locally elected officials without such public health offices. These types of logistic pathways should be recognized and accounted for in future planning and exercises for public radiation emergencies.

- A major public radiation emergency also may require resources beyond current budget constraints. While the Defense Production Act provides the legal authorities to expedite and expand the supply of materials and services for the U.S. industrial base, **a review of the U.S. manufacturing capability would be useful to determine the production capacity needed to support a response to a public radiation emergency.** New medical countermeasures such as nucleic acid amplification for radiation injuries need to be incorporated into existing plans. This could serve as the foundation for creating an integrated clinical diagnostics system to enhance surge capacity and develop a national concept of operations (CONOPs) for hematology techniques, lymphocyte depletion kinetics, dicentrics assessments, novel dosimetry methods, and radio bioassay.

- **Online tools that focus on state and local preparedness for public radiation emergencies should be included and assessed during exercises and training with feedback mechanisms for focused improvement.** FEMA provides funding for many of these tools, so they should be integrated into training exercises to improve response capabilities. One such tool is RadResponder.net, a website dashboard and phone app developed by DOE with more than 10,000 subscribers. Other online tools include portals developed by the National Institutes of Health,[2] CDC,[3] Department of Homeland Security,[4] and DOE. Local websites have also been developed by many state emergency management agencies and regional preventive radiation and nuclear detection focus groups. These tools should be assessed during exercises for their utility in a crisis situation.

[2] https://remm.hhs.gov/.

[3] Information for Public Health Professionals, CDC, https://www.cdc.gov/nceh/radiation/emergencies/publichealth.htm.

[4] Radiological Dispersal Device (RDD) Response Guidance Planning for the First 100 Minutes Report and Video, Science and Technology Directorate, DHS, https://www.dhs.gov/publication/st-frg-rdd-response-guidance-planning-first-100-minutes.

3. Prioritizing Actions

- **Adjustments to the pandemic response will require reprioritization as new challenges arise and put at risk the most fundamental services in the community.** A responder's highest priority is conducting triage during a crisis. Establishing priorities among a community's critical needs requires rapid decisions. These prioritized actions become extremely complex when multiple crises arise simultaneously. Fires, storms, climate-related catastrophes, and other concurrent disasters will require attention and will inevitably pull limited resources in multiple directions. As discovered in the response to the California wildfires, COVID-19 spread at locations people gathered to fight fires. Similarly, wildfires moving rapidly through a populated area may shift the focus away from decontamination efforts, because immediate lifesaving responses are given higher priority and may take resources away from the response to a radiation emergency. Prior to a crisis, state and county governments and their local municipalities should understand and prioritize response and recovery actions, particularly those requiring time-sensitive decisions. Using these critical functions as guideposts can provide leaders with a framework for decision making, regardless of whether they are planning for natural disasters or a public radiation emergency.

- **Addressing community disparities prior to a crisis is also important in providing services to vulnerable populations that require more assistance during a crisis.** The challenges facing individuals with specialized functional and access needs often get shunted to the end of the planning and response tables. Using such populations as the "hard case" scenario can often solve other concerns, especially in impoverished communities that struggle with lack of transportation. Effective whole-of-community engagement before the crisis should include outreach to community and faith leaders who could serve as trusted interlocutors to disadvantaged groups. This kind of preparedness engagement would set up trusted spokespeople for risk communications during an incident.

- During COVID-19, evaluations of public communication about public health threats and harm mitigation strategies revealed a mismatch between the literacy demands of crisis response (that is, cognitive skills necessary to process, understand, and act upon provided content) and the literacy levels of vulnerable populations. Many of these communities struggled to access standard resources offered in emergency preparedness, response, and recovery. **Addressing factors that determine individuals' ability to comprehend and effectively use information may overcome communication and actions within such communities.**

- **In a public radiological emergency, there may be competing interests among federal agencies fueled by overlapping authorities or gaps in program mandates.** For example, lead agencies (FBI for law enforcement and FEMA for emergency management) may compete for limited resources designated for situations in which chemical, biological, radiological, nuclear, or explosive materials are present. Similarly, law enforcement and emergency management response agencies may grapple with limited authorities that allow them to respond only to a specific crisis. These two types of responses both have needs for small, specialized assets such as the DOE Radiological Assistance Program and the National Guard Weapons WMD-CSTs, and the division of labor might be an issue. Determining what standby resources are available to address these deficiencies will be needed to both respond and communicate effectively during a crisis.

- Planners should also recognize nuanced differences in relationships between local communities and their respective uniformed service population as they think about involving uniformed services in crisis response. For instance, in states that more frequently respond to hurricanes and fires (such as Florida and California), the military is typically seen in positive terms and is involved in the response effort for many state-level incidents and crises. However, in states that do not see activation of their National Guard with regularity, there is a hesitation to use it, especially if this triggers law enforcement authorities. For example, when there is civil unrest or other security issues, some populations outright reject a military presence. **With the likely surge in crowd movement and control after a public radiation emergency, each state should reassess in their planning whether deploying their National Guard or other uniformed personnel would be an asset or a hinderance.**

Effective communication must bolster public trust to reduce misinformation during an emergency.

4. Communicating Guidance and Direction

- **Identifying decisionmakers early in a crisis is critical.** If there is no federal guidance, states and local governments will likely make their own decisions, as the responses to both COVID-19 and the Fukushima accident proved. This suggests that **the response framework needs to be flexible to allow states to make independent decisions alongside federal planning and response.** Since the state Radiation Safety Office (or equivalent) seems to be the responsible entity for radiological emergencies in most states, these offices should be incorporated into federal planning activities.

- Another key finding was that **not all decisionmakers have sufficient awareness of federal guidance and its implementation relating to the crisis.** During COVID-19, this varied significantly by state and municipality; because of the lack of information or coordination, some localities did not make full use of the relevant federal guidance. This suggests that non-governmental organizations and sector leaders should be consulted during planning and exercises and throughout a public radiation emergency. The National Alliance for Radiation Readiness (NARR), a coalition of public health, healthcare, and emergency management organizations, is one key organization that represents practitioners in the field of radiation readiness. NARR includes state and local public health practitioners, elected officials at the state and local level, and first-responder and first-receiver groups. NARR seeks to address limited public awareness of radiation preparedness, confusion about roles and responsibilities among partners in a radiological incident, and the need for robust tools for practitioners in the field.

- **Effective communication must bolster public trust to reduce misinformation during an emergency.** For example, the challenges of producing effective messaging for the COVID-19 vaccine provide insights on why clarity is so critical. When scientists speak to a national audience, their message can often be misinterpreted by groups that do not understand the science behind the messaging or the various risks and uncertainties associated with a vaccine rollout. This can feed directly into preexisting antivaccine misinformation and public anxiety. Addressing such issues will

require identifying and training public spokespeople who can be embraced by the community as trusted agents.

- **Communicating with empathy is a skill that needs to be practiced; if it is not done, or it is done poorly, it can lead to distrust.** During the Fukushima accident, government spokespeople had backgrounds in food, epidemiology, health and medicine, and the environment. They provided critical technical information to decisionmakers, responders, and the impacted communities. The pandemic showed the usefulness of including an industrial hygienist or other medical professional to provide guidance and credibility to mitigation and response efforts. Anthropologists are useful in dealing with long-term disasters; for example, their training may enable them to demonstrate the value for an individual to change habits, thereby increasing implementation of guidance from officials.

- **Misinformation or the intentional and malicious sowing of doubt is a challenge in a crisis and must be factored into planning for nuclear and radiological emergencies.** Public response to the pandemic was significantly stymied by misinformation and disinformation. Open societies are especially vulnerable to disinformation campaigns that sow confusion, undermine confidence, and highlight false information. Training exercises and planning documents regarding public radiation emergencies should factor in the possible effects of misinformation and disinformation.

- Decisionmakers should explore ways to improve public messaging to effectively communicate guidance and direction. Identifying credentialed, respected non-governmental voices on social media can result in more effective communications in the context of hostile commentary. Communicating real-time information on technical details, such as radiation plumes and ground deposition, should also be examined and communication capabilities bolstered. Communication after the Fukushima accident was too slow and difficult to interpret. Official technical data was overtaken by other sources, including misinformation about contaminated food and water supply.

- Another key challenge in the early stages of COVID-19 was managing transitions from one response phase to another. Transparency is key. Tension between the public and government officials resulted when transitions in guidance were done poorly or in a vacuum. In a long recovery process, surprising the populace with sudden changes is counterproductive and breeds distrust. Changing significant activities/responses from what individuals had become accustomed to requires an explanation before it happens on (1) why the change is needed, (2) when the change will occur, and (3) who has the responsibility for the specific information that will no longer be communicated by leadership.

- Other transition points in a public radiation emergency include the disposition of contaminated property and decisions on when individuals can safely return home. As seen with the hurricanes and wildfires, many people returned to their homes before authorities determined it was safe to do so in order to protect their property from looters. **The question of what standards would apply to post-event clean-up remains unsettled. There is still no consensus among federal, state, and local authorities on standards for radiation cleanup and area rehabilitation.** This will likely serve as a major impediment to a "return to normal" for areas affected by a public radiation emergency. With no consensus, individuals will decide for themselves. Although it might not be easily resolved in the near term, some help from a broadly constituted NGO community might clarify the very real

issues and conflicting objectives. As part of such an effort, recommendations could be developed regarding the role of the federal government in the exclusion of people—including former residents—from contaminated areas, as well as the transportation and disposal of low-level waste resulting from decontamination efforts or reconstruction. Even where there are currently licensed disposal sites, it is not clear state governments will allow the transit or long-term disposal of large volumes of radioactive debris originating from another state.

5. Strengthening Coordination with Local Governments

- The distribution of information during the pandemic resembled the old-fashioned game of telephone, in which a message is altered as it passes from one person to the next. **States translated the federal guidance, counties translated their state guidance, and local municipalities were left with a patchwork of confusing messages that only became more confusing to the general public over time.** Relationships between state, county, and municipal elected leadership impacted decisions at the local level, resulting in confusion and mishandling of resources. Directly engaging locally elected officials in emergency management from the earliest stages could help build the necessary relationships and awareness within states.

Directly engaging locally elected officials in emergency management from the earliest stages could help build the necessary relationships and awareness within states.

- **Providing simple and accessible access to real-time information will facilitate standardized actions and an appropriate public response.** In April 2020, Google and Apple jointly created the Exposure Notifications System to help governments and the global community fight the COVID-19 pandemic through contact tracing. An Exposure Notification app suddenly appeared on smartphones enabling authorities to track COVID-19 infections and gain awareness of where and at in what numbers cases were occurring in their area. This app was brilliantly conceived but its use languished in the United States because knowledge of its development, use, and application was not effectively disseminated. With proper planning, these types of apps can provide critical ground truth to response authorities and the general public during a public radiation emergency. However, more work is needed to identify the appropriate entity to develop and distribute these types of tools, as well as to educate the public of their availability and utility.
- User-friendly data visualization products such as graphs, maps, and infographics were essential in the COVID-19 pandemic and could prove useful in response to a radiological emergency. These products helped the public understand the nature of the virus, its spread, and regions impacted. The radiological/nuclear community can apply some of these lessons to translate data into appropriate protective actions. As with many low probability/high consequence events, there is no single platform or network to connect the non-governmental radiological/nuclear community to media or public officials. It will be important to develop such a mechanism to share such resources and tools, including technical methods and information.

- Common operating platforms are extremely useful, but access, training, and usage varies across the nation. Establishing a common operating/information platform will be key, especially if current regulations prohibit such access due to classification concerns and associated requirements for their use.
- **Public-private partnerships are a force multiplier.** The partnership between FEMA and national pharmacies (for example, Walgreens, Rite Aid, and Walmart) to provide COVID-19 testing shows how industry expertise could be applied and expanded in support of state and local government responses to public radiation emergencies.
- A negative element within every response is the subset of citizens who cash in on the vulnerability of the public during a disaster. **Another key lesson drawn from COVID-19 is the need to combat various forms of profiteering when there is a sudden surge in demand and the legitimate supply chain cannot quickly ramp up.** The public is particularly vulnerable to a shortage of needed supplies, such as protective equipment and N95 masks, that can be misrepresented or counterfeited. The less understood the supplies are, the easier it is to misrepresent them. Another example was the sale on Facebook of pills falsely advertised as potassium iodide, a drug used to mitigate the effects of radiation poisoning. During a crisis, monitoring and prosecuting such cases becomes difficult to prioritize.
- **It is important to not underestimate the strength of local volunteers.** Every disaster begins and ends locally, and local engagement from the beginning to the end of any disaster is critical for success. Local citizens can acquire the skills necessary to engage in the response either by prior experience or by just-in-time training. During the West Coast wildfires, texts were sent to neighbors instructing them to provide personal equipment (such as chain saws or axes) to assist in the fire line. These volunteers were able to redirect the fast-moving fires away from small rural towns that fire departments were not able to protect because of their limited resources. Volunteerism promotes community-building and gives the individual a sense of purpose during a crisis. For COVID-19, volunteering empowered private citizens to contribute to the response efforts. Community involvement in the pandemic response was slow because it took time for officials to properly characterize the threat posed by COVID-19 and determine how citizens could help slow the spread of the virus. Operational planning needs to account for volunteers and factor in what assistance they can provide. Community associations and other local volunteer organizations should be part of the planning process via exercises and conferences to establish a better understanding of their roles.

Conclusion

These findings and conclusions, based on dozens of hours of interviews and qualitative research, lay the foundation for possible adjustments in domestic preparedness for nuclear and radiological emergencies. As the country begins to rebuild after the devastation of the COVID-19 pandemic, many of the recommendations in this paper should be implemented to improve resilience for other catastrophic risks. Most importantly, federal agencies should undertake a more comprehensive assessment to identify vulnerabilities and bolster response capacity. This paper offers a starting point for this risk assessment and will hopefully inspire decisionmakers and planners to think again about our preparedness for public radiation emergencies.

Appendix A: Interview Methodology and Acknowledgments

Senior-level practitioners in nuclear and radiological emergency preparedness and response were queried at the beginning and end of this project to determine if their insights on preparedness for public radiation emergencies had changed as the pandemic evolved. A questionnaire also was developed for the National Guard Weapons of Mass Destruction-Civil Support Team (WMD-CST) community for insights into local exercises, training, and other capacity-building initiatives. During the course of this research, 57 WMD-CSTs were queried, and 13 states responded, encompassing all 10 Federal Emergency Management Agency (FEMA) regions. Leaders from government, business, and industry also shared valuable insights learned from the cumulative crises of 2020 (COVID-19, hurricanes, wildfires, election security, civil unrest, and cyberattacks). These insights were provided in both personal interviews and presentations at various virtual conferences and meetings. The Environmental Protection Agency shared preliminary results from its media monitoring for FEMA's Community-Based Testing Site Task Force. For three-and-a-half months, the task force analyzed about 6,000 news articles and social media posts, looking at media coverage of federal guidance for COVID-19 testing, issues affecting specific testing locations and different types of testing methodologies. Many of their initial lessons learned on public communication are reflected in the paper findings.

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About the Author

Julie Bentz is a retired Major General of the United States Army National Guard. Much of her time on active duty was spent serving on three Presidents' security councils at the White House working to reduce global threats from weapons of mass destruction. Julie started her career as member of the Army's Radiological Advisory Medical Team, assessing the environmental impact of released radionuclides on U.S. military forces in the aftermath of the April 1986 Chernobyl nuclear power plant accident. Following the March 2011 Japanese earthquake, tsunami, and Fukushima nuclear safety crisis, she played a pivotal role in the U.S. response, advising and assisting the President of the United States and senior government officials with technical support. She holds a Doctorate in Nuclear Engineering and a Master of Science in National Security Strategy.

About the Nuclear Threat Initiative

NTI is a nonprofit global security organization focused on reducing nuclear and biological threats imperiling humanity. www.nti.org

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