

# REGIONAL HEALTH AND PUBLIC HEALTH PREPAREDNESS FOR NUCLEAR TERRORISM:

Optimizing Survival in a Low Probability/High Consequence Disaster



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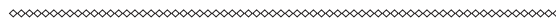


## EXECUTIVE SUMMARY

The United States remains unprepared to cope with the possibility of an attack on a major city by terrorists capable of acquiring and detonating an improvised nuclear device. Long-held anxieties about the non-survivability of nuclear war promulgated during the intense U.S.—Soviet arms race from the late 1940s through the 1980s, and reluctance to consider low probability/high consequence events among local disaster planning priorities, are barriers to developing plans that could dramatically save lives in the event of a terrorist-based nuclear detonation.

In a speech in Prague on April 5, 2009, and reiterated in his 2010 State of the Union message, President Obama articulated themes about nuclear terrorism that have circulated in U.S. political debate since the collapse of the Soviet Union, and with greater urgency since 9/11:

“...We must ensure that terrorists never acquire a nuclear weapon. This is the most immediate and extreme threat to global security. One terrorist with one nuclear weapon could unleash massive destruction. Al Qaida has said it seeks a bomb and that it would have no problem with using it. And we know that there is unsecured nuclear material across the globe. To protect our people, we must act with a sense of purpose without delay.”<sup>1</sup>



This paper begins by describing the reality of the threat of nuclear terrorism to the United States and the enormous scale of lives lost and physical destruction that would result from the detonation of even a small improvised nuclear device (IND) in an American city. It then systematically lays out the gross inadequacy of current response capabilities, and highlights the critical unmet need for urgent, deliberate and well-funded planning efforts to address those deficiencies. In the Recommendations section, Columbia University’s National Center for Disaster Preparedness (NCDP) calls for targeted public health and medical care regional planning and response efforts focused on “gray zones”—areas where significant life saving opportunities would exist following an IND detonation, and where preparedness planning and proper training can meaningfully enhance survival and recovery.

The collapse of the Soviet Union dramatically reduced the Cold War “doomsday” threat of nuclear war against the United States. Yet, the danger of a nuclear attack has not been eliminated; rather it has evolved into a new and dramatically different threat—*nuclear terrorism*. The risk of a nuclear

weapon being used today by terrorists is, in fact, a growing threat and “our margin of safety is shrinking.”<sup>2</sup> Future nuclear threats “will be defined first by the desire and then by the ability of non-states to procure or develop crude nuclear weapons.”<sup>3</sup>

Although the detonation of a low-yield IND in an American city is one of the 15 planning scenarios developed by the White House Homeland Security Council for use in security preparedness activities, local and regional emergency planning activities have not given attention commensurate to this threat. Barriers to planning for such a catastrophic event are not well understood but may be related to fatalistic beliefs or concepts of improbability, with many believing that other disasters are more probable and merit the focus of emergency planners. “The Cold War threats of nuclear war between states suggested total destruction, making preparedness measures futile, but the same is not true for nuclear terrorism. Furthermore, emergency planners are frozen by the ‘myth of planning futility,’ in which planners hold on to the belief that nuclear detonations are not survivable. However, despite the enormous scale of potential lives lost and destruction of infrastructure, data from Drs. William Bell and Cham Dallas and from Lawrence Livermore National Laboratory suggest a ‘gray zone’ in which hundreds of thousands of lives would be saved, and the injury severity could be mitigated with appropriately targeted planning.”<sup>a</sup>

Following a nuclear detonation, a response based on *threat-specific strategies will be essential to maximize time-sensitive life-saving opportunities*. Public protective actions to reduce exposure and injury, critical within the first hours, will depend greatly upon a well thought out, pre-event messaging strategy and the ability to communicate easily-understood information to the public. The risk for injury and nuclear detonation effects does not end after the initial blast; the public must understand the correct protective actions and when to take them throughout the response and recovery phases.

Long before significant levels of federal and extra-regional assets would arrive, local and state officials would need to launch numerous operations—many at the same time. Meeting the enormous scale of health care demands, including the vital tasks of triage and decontamination as well as sheltering and evacuation needs, is a logistical challenge that will require the coordination of efforts at local, state, and, most importantly, regional levels.

The NCDP believes that large-scale and integrated regional and national response planning is needed to prepare for a detonation of an IND. The absence of such planning is an urgent and unmet need. To initiate this process, emergency planners should first understand the reality of the threat and appreciate the unprecedented scale of response that regional governments will have to mount.

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The detonation of even a small IND in almost any major American city would cause massive mortality and morbidity as well as a collapse of infrastructure that would create long lasting and far reaching impacts. Regional planning bodies must accelerate substantive planning that is framed by the assumption that survivability and recovery can be maximized, and that the public's understanding of their role in the response is vital to this end. Responsible units of government at all levels need to establish regional planning agendas with scalable, realistic objectives, and rigorous periodic exercises now, before disaster strikes. The NCDP urges the development of regional response plans based on optimizing survivability in the gray zone and recommends a number of concrete steps to achieve that outcome:

1. Require all jurisdictions that are federally designated as high risk IND target communities to develop and sustain appropriate preparedness for possible nuclear terrorism;
2. Strengthen regional alliances and coalitions developed to implement effective response strategies;
3. Require all federally funded regional alliances to demonstrate robust plans for *region-wide* health, public health and sheltering response to IND detonation;
4. Provide sufficient funding for all aspects of preparedness for IND terrorism;
5. Greatly expand capacity of national rescue and recovery efforts, including relevant federal agencies, to respond in the event of an IND attack anywhere in the U.S, including specialized training with respect to functioning in high-level radiation events;
6. Clarify incident command roles and operational integration procedures among federal, state and local authorities in the event of an IND attack;
7. Ensure that Strategic National Stockpiles of countermeasures—as well as corresponding stockpiles on a state level—are relevant for an IND detonation and are scaled up to meet the likely demand;
8. Accelerate—and exercise—multi-sector response planning that includes government entities, non-governmental organizations and private sector assets;
9. Research and implement strategies designed to communicate risks and appropriate public responses to an IND detonation;
10. Pursue relevant research to improve effectiveness of countermeasures;
11. Ensure that highly redundant and multi-format modalities of communicating with the public during and after IND terrorism are developed, tested and available; and,
12. Consider re-opening and/or developing stocked public shelters for populations in high risk communities.



## NUCLEAR TERRORISM: THE REALITY OF THE THREAT

In an analysis of the U.S. Department of Energy's nonproliferation programs with Russia, a 2001 bipartisan task force concluded that nuclear terrorism is "*the most urgent unmet national security threat to the United States.*"<sup>a</sup> During the 2004 presidential campaign, Senator John Kerry and President Bush agreed that nuclear terrorism is a leading threat to the security of the homeland and, in a 2008 report to the United Nations General Assembly, then International Atomic Energy Agency (IAEA) Director General, Dr. Mohamed ElBaradei, again alerted the world that the "possibility of terrorists obtaining nuclear or other radioactive material remains a grave threat."<sup>5</sup> He also commented on the lack of security of these materials; "Equally troubling is the fact that much of this [missing] material is not subsequently recovered... Sometimes material is found which had not been reported missing."<sup>b</sup> Most recently, at the July 2009 G8 summit in L'Aquila, Italy, President Obama pressed his Prague agenda for confronting nuclear terrorism, announcing "an international effort to secure vulnerable nuclear materials within four years, break up black markets, detect and intercept materials in transit, and use financial tools to disrupt illicit trade in nuclear materials."<sup>6</sup>

"The probability of a nuclear weapon one day going off in an American city cannot be calculated, but it is larger than it was five years ago."

—A. Carter, M.M. May, *Center for International Security and Cooperation*, June 2007.

The desire and the ability to acquire and construct nuclear weapons exist in conjunction with terrorists groups' openly-stated intent to detonate such weapons. Al Qaeda has expressed interest in acquiring nuclear weapons. In 1993, members met with Salah Abdel al-Mobruk, a military officer and former Sudanese government minister, who reportedly offered to supply the terrorist organization with weapons-grade uranium in exchange for \$1.5 million. In August 2001, Osama bin

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<sup>b</sup> During 2004-2007 there was a 75% increase of non-recovered lost or stolen materials, IAEA, Illicit Trafficking Database, Fact Sheet

Laden met with two former Pakistani nuclear officials to find out if they would help recruit Pakistani scientists with nuclear weapons expertise.<sup>7</sup> There is little question that if terrorists groups acquired nuclear weapons they would not hesitate to use them.

### *Construction of a nuclear weapon*

The 1945 Manhattan Project required an interdisciplinary team of scientists and weapons experts. Today, nuclear weapons experts unanimously agree that the scientific knowledge necessary to construct nuclear weapons is not a significant impediment to nuclear terrorism. Much of the basic science and technical knowledge necessary to construct a nuclear weapon is widely understood and publicly available.<sup>8</sup> INDs can be constructed from fissile materials such as highly enriched uranium (HEU) and Plutonium (Pu). It is easier to make a crude IND with HEU.<sup>9,10</sup> According to IAEA, a small quantity of HEU, 25 kilograms, would suffice to construct a nuclear weapon.<sup>11 c</sup> Furthermore, despite the considerable level of technical skills and specialists required to construct an IND, some weapons such as a gun-type device<sup>d</sup> may not pose the same technical barriers nor require the assembly of a large scientific team.<sup>12</sup>

Nuclear weapons experts unanimously agree the largest obstacle to nuclear terrorism is the acquisition of nuclear weapons or the fissile materials needed to construct an IND. Terrorist groups would need either to steal a nuclear weapon from a nation-state's nuclear arsenals or acquire the fissile materials to assemble a crude IND. Terrorist organizations likely do not have the capability to develop fissile materials on their own at this time; however acquiring highly enriched materials is certainly within the realm of possibility.

### *Acquisition of nuclear weapons or fissile material*

After the collapse of the former Soviet Union, political and economic instability threatened the security of the former state's vast nuclear weapons and fissile material stockpiles, opening potential pathways to their acquisition by terrorist groups. The Nunn-Lugar Cooperative Threat Reduction program (also known as the 1991 *Nunn-Lugar Act*) has provided approximately \$7 billion of financial and technological assistance to Russia and the countries of the former Soviet Union to identify, deactivate, dispose of, and secure the Cold War's nuclear arsenal. Notwithstanding

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c 25 kg of HEU is about the size of a grapefruit and 8 kg is about the size of a soda can. National Nuclear Security Administration. (2007, January). Office of Global Threat Reduction Strategic Plan, 2. Retrieved from: [http://nnsa.energy.gov/nuclear\\_nonproliferation/documents/GTRI\\_StrategicPlan.pdf](http://nnsa.energy.gov/nuclear_nonproliferation/documents/GTRI_StrategicPlan.pdf).

d A gun-type weapon is the simplest nuclear bomb to build. HEU material is fired down a gun barrel into a ring of HEU creating a critical mass and triggering the detonation. The 'Hiroshima' WW II bomb was a gun-type device.

significant accomplishments, progress has been slow and incomplete; not all targeted sites have implemented security upgrades. Furthermore, large quantities of nuclear material stored at Russian facilities with inadequate security are not part of the U.S.-Russian cooperative security agreement.<sup>13</sup> The enormous quantity and geographic distribution of remaining HEU used in facilities such as research reactors, in Russia and other countries, including those of the former Soviet Union, pose a significant threat for theft or diversion.<sup>14</sup> According to a Harvard University report commissioned by the Nuclear Threat Initiative (NTI):

*Real risks remain, from persistent under-funding of nuclear security systems, weak nuclear security regulations, widespread corruption, and conscript guard forces rife with hazing and suicide, coupled with threats ranging from surprise attack by scores of heavily armed terrorists to sophisticated insider theft conspiracies.*<sup>15</sup>

Unless the United States and Russia jointly embrace a much more aggressive timetable for reducing their nuclear arsenals, it is likely to be decades before the volume of fissile material contained in existing warheads ceases to be a concern. Russia currently has about 14,000 total warheads, the U.S. about 10,500.<sup>16</sup> Even before Presidents Obama and Medvedev announced new, more ambitious objectives for arsenal reductions in May 2009, both countries faced huge backlogs in dismantling those warheads already slated for elimination and disposing of their fissile material. In the United States, the timeframe extends beyond 2030, in Russia possibly even later.<sup>17</sup>

The security of Pakistan's nuclear arsenal is of equal (if not greater) concern, given the chronic political instability in that nation, evidence that Al Qaeda's base of operations is in Pakistan, the increasing incidence of terrorist acts against domestic targets, and the destabilizing presence of the Taliban inside Pakistan's borders. Since the end of 2002, North Korea reversed previous commitments to abandon its nuclear program and restarted facilities it previously had shut down.<sup>18</sup> Recent nuclear testing activity<sup>e</sup> and announcements of creating "nuclear deterrent" further indicate the Pyongyang government's intentions to continue its nuclear-capacity build up, and thus,

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e May 25th, North Korea defied world powers and carried out a second underground test of a nuclear bomb Russian officials said was comparable to those that obliterated Hiroshima and Nagasaki. MSNBC. (2009, May 25). North Korea conducts powerful nuclear test. Retrieved from: [www.msnbc.msn.com/id/30921379/](http://www.msnbc.msn.com/id/30921379/). Soon after the test, the UN Security Council unanimously condemned the DPRK's provocative behavior. NTI. (2009, June 25). Issue Brief: North Korea's Nuclear Test and its Aftermath: Coping with the Fallout. Retrieved from [www.nti.org/e\\_research/e3\\_north\\_korea\\_nuclear\\_test.html](http://www.nti.org/e_research/e3_north_korea_nuclear_test.html).

poses a “grave threat” as described by President Obama.<sup>19</sup> U.S. intelligence analysts do not believe that Iran—although getting close—has yet achieved the ability to produce highly enriched uranium. The U.S. government is extremely concerned about nuclear security in these regions.

Experts believe that over 50 nations, beyond those previously mentioned, maintain poorly protected fissile material stockpiles.<sup>20</sup> Security at many storage sites, according to the NTI, consists of “no more than a night watchman and a chain link fence.”<sup>21</sup> The authors of *Securing the Bomb 2008* described an armed break-in at a South African facility where hundreds of kilograms of HEU are stored, the arrest of a Russian colonel for soliciting bribes to overlook violations of nuclear security rules, and other security breaches that suggest an increased possibility of nuclear materials reaching terrorists’ hands.<sup>22</sup>

When these security concerns are read alongside the bipartisan September 11 Commission’s 2005 report, which gave the U.S. government’s efforts to secure weapons of mass destruction a grade of “D,”<sup>23</sup> it becomes clear that inadequate security barriers for nuclear materials provide opportunities that can connect nuclear materials to terrorists’ hands. Preventing the movement of small amounts of nuclear materials across borders has proven to be exceedingly challenging. Materials can be smuggled across borders in various transportation methods, such as: being carried in personal cars, walked across, hidden in trucks, or delivered by a small covert boats navigating below radar surveillance. In some areas where border security is imperfect, materials likely could be transported across with little effort.

### *Preventing Importation of Nuclear Materials*

Since nuclear stockpiles in America are, theoretically, stored under extremely high security, it is thought that terrorists would need to acquire fissile material or pre-assembled bombs abroad, and transport those items into the United States intact or in ready-to-assemble pieces.<sup>24</sup> The Department of Homeland Security (DHS), operating through its Customs and Border Protection (CBP) and Domestic Nuclear Detection Office (DNDO) units, has the primary responsibility for ensuring that nuclear material does not enter the United States through hundreds of seaports and formal border crossings or the thousands of miles of unguarded borders with Canada and Mexico.<sup>f</sup> CBP employs thousands of uniformed and plain-clothes border guards and port security

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<sup>f</sup> The Department of Energy also has significant responsibilities in this area, mainly related to the scanning—in foreign ports—of cargo containers that are loaded onto ships headed for the United States. An overview of the “Megaports Initiative” is at [www.nnsa.energy.gov/nuclear\\_nonproliferation/1641.htm](http://www.nnsa.energy.gov/nuclear_nonproliferation/1641.htm).

officers. The agency also gathers intelligence to flag suspicious cargo, helps shippers and importers employ minimal cargo security policies and procedures, helps port officials prevent unauthorized access to sensitive port facilities, and deploys military-inspired surveillance technology to monitor the northern and southern borders.

One of CBP's primary jobs is to scan (or ensure that foreign port officials scan) cargo containers as they are loaded onto U.S.-bound ships and as they are unloaded from ships in U.S. ports. DNDO is responsible for procuring radiation detectors and other high-tech scanning equipment that can sniff out even heavily-shielded plutonium or HEU hidden in a cargo container, oil tanker, imported car or any other item entering U.S. territory. DNDO has entered into multi-billion dollar contracts to develop cutting edge radiation scanning technology.

DHS's multi-pronged efforts have produced significant improvements in supply chain security. The 2008 "report card" on the 9/11 Commission Recommendations from the Partnership for a Secure America gave U.S. cargo security efforts a "B."<sup>25</sup> However, a number of recent GAO reports have noted continuing deficiencies in CBP's programs to keep nuclear material out of U.S.-bound containers and from crossing the land borders.<sup>26, 27</sup> These reports also have indicated that DNDO was far behind schedule and that consequently, CBP might not be able to deploy more sensitive and accurate radiation detectors until 2012.<sup>28</sup> A recent announcement from DHS stated that it will not be able to meet Congress's 2012 deadline for 100% screening of U.S.-bound cargo containers.<sup>29</sup>

These observations, coupled with the readily available knowledge of how to construct a nuclear weapon, unchecked access to inadequately secure nuclear stockpiles, porous borders, unchecked cargo containers, and other subjective information substantiate the threat of nuclear terrorism.



## THE DETONATION OF A 10 KILOTON (KT) IMPROVISED NUCLEAR DEVICE

### *Response Issues*

Under the U.S. National Preparedness Guidelines, National Planning Scenario 1 describes the detonation of a 10 Kt IND in a large U.S. city.<sup>g</sup> Although the planning scenario is set within a single metropolitan area, the overall impact and response would not be a local event, by any means. A nuclear detonation of that magnitude would most assuredly be a catastrophic *regional* event. It would demand a broad response, involving jurisdictions that are far from ground zero as an exodus of survivors from the impacted local region and the threat of radioactive fallout are realized. Yet regional governance in the United States is the exception rather than the rule. Although a few major metropolitan areas have genuine metropolitan governments and interstate compacts exist for purposes of economic development and mutual aid, there are no existing metropolitan or interstate frameworks capable of planning for or coordinating the necessary responses to the detonation of an IND.

A major challenge will certainly be the unprecedented scale and scope of emergency operations, starting with the mobilization and coordination of existing regional resources and the need for a workforce to be brought into the area to support response operations. In the early hours of response and mass casualty management, local incident managers would need to organize and carry out operations on the assumption that significant federal resources would not be available for one to three days. Their immediate concerns will be maximizing survival, rapidly obtaining situational awareness, undertaking rapid damage and needs assessments, and maintaining social order. These activities will place a huge burden on the overwhelmed local jurisdictions, states and neighboring regions.

In order to maximize the impact of limited healthcare resources, it will be essential for officials to coordinate the various assets of the health and public health systems. They will need to know the real-time status of medical care facilities, Emergency Medical Services (EMS) and fire agencies, law enforcement officials, public health responders, private sector entities, and volunteer assets within the region. It is likely that certain potential issues will hamper these coordination

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<sup>g</sup> The fifteen “National Planning Scenarios” are included in the “National Preparedness Guidelines” promulgated pursuant to Homeland Security Presidential Directive 8. Retrieved from [www.dhs.gov/xlibrary/assets/National\\_Preparedness\\_Guidelines.pdf](http://www.dhs.gov/xlibrary/assets/National_Preparedness_Guidelines.pdf). The 10-kiloton parameter for the IND is set forth at [www.dhs.gov/xoig/assets/mgmtrpts/OIG\\_06-07\\_Nov05.pdf](http://www.dhs.gov/xoig/assets/mgmtrpts/OIG_06-07_Nov05.pdf).

efforts, including inoperative communications equipment, poor visibility and access due to dust and debris, panic and the limited availability of workers willing to place themselves at unknown risk to carry out response operations. There are numerous variables that will challenge the ability of a region to respond to an event of this scale.

### *Impact on Population and Infrastructure*

The catastrophic impact of a 10 Kt nuclear detonation differs from other large scale disasters not only in magnitude, but also with regards to the high incidence of burns and traumatic injuries that will overwhelm the capacities of local and regional medical care to provide assistance. The immense energy discharged upon a nuclear detonation would cause an enormous loss of life, widespread destruction of infrastructure and the contamination of large geographic areas with fallout. The destructive forces are the initial fireball at the epicenter of detonation, followed by blast forces, prompt radiation and thermal heat. The heat would vaporize all close-by matter, including soil and water, and lift it into the hallmark ‘mushroom cloud.’ Half of the total energy from the detonation would occur in the form of blast forces, one third as thermal energy and approximately one sixth as radiation. This final category would include both initial or “prompt” radiation (5%) and delayed radiation or fallout (10%) that would last for minutes to years as it decayed.<sup>30</sup> Close to the point of detonation, blast forces and thermal effects would be fatal to all persons, and cause near-total destruction. However, the destructiveness of those forces would diminish with distance from ground zero (see Figure 1, page 14). The same is true for the prompt radiation released during the first minutes following detonation; the intensity and lethality would diminish quickly with increasing distance from the point of detonation.<sup>31</sup> Depending on their proximity to the detonation, victims may experience radiation effects ranging from rapid death to only delayed, minor sickness. Even with a strong to moderate dose, some victims who become ill could survive with proper medical care. While some effects of radiation can be immediate, many of the medical consequences would not manifest themselves for days to weeks, or even years.

A combination of rapid sheltering-in-place followed by informed evacuation would likely maximize chances of survival and recovery.

Health risks from prompt radiation will exist within approximately 20 kilometers, and longer-lasting radiation in the form of fallout particles will reach the ground downwind from the detonation site. As the cloud of radiation-containing debris moves downwind, fallout will contaminate

tissue, penetrate thin walls and glass, and contaminate soil, exposed food and the water supply.<sup>32</sup> The fallout is dictated by wind and weather variations and can create a zone of high radioactivity as far as 100 miles downwind.<sup>33</sup> Life saving activities likely will focus on placing the public out of harm's way either by evacuation or sheltering-in-place.

**Distance, shielding, and time** are critical variables in determining the nature and severity of injuries the population would sustain from the blast wave, heat, prompt radiation or fallout. A person in a basement or reinforced building might survive, whereas a person in the open might not. Similarly, someone far from the blast would be less likely to be injured than someone in closer proximity to it.

A combination of rapid sheltering-in-place followed by an informed evacuation would likely reduce exposure to radiation and injury and maximize chances of survival and recovery. "Shelter" in this sense does not need to be a formal structure built for this purpose; being in a building or a basement would provide significantly more protection than being in the open or in a car. An "informed evacuation" implies that a person understands both when to leave a shelter, and which direction they should head to minimize their exposure to radioactive fallout and other hazards. While many variables contribute to determining how best to combine the efforts of sheltering and evacuating, experts now believe that prompt sheltering for several hours would save the most lives, since the most lethal radiation levels from fallout decay rapidly over several hours after a detonation. After that, depending on the type of shelter, many would benefit from quickly leaving the area and avoiding exposure to residual fallout radiation.

In addition to an informed public, maximum survivability depends significantly on responders and medical care providers having a keen understanding of the types of injuries that may occur at various distances from the detonation and of the geographic zones in which victims might be able to survive. It also depends upon the immediate dissemination of public health messages informing displaced people and individuals needing decontamination where, how and when to find and get to shelters and other functional facilities. While this sounds reasonable to accomplish, the technical and logistical barriers to determining safe versus unsafe zones and identifying functional facilities after a detonation are massive; it would require unprecedented planning efforts and effective accumulation and analysis of essential data to be successful.

Regardless of how the blast destruction, ensuing fires and radiation spread out from the detonation point, there would exist an area—a gray zone—between the areas that are obliterated and those that offer reasonable opportunities for survival without extraordinary measures. Survivors in this gray zone would experience a range of medical issues from trauma and burns to entrapment and radiation exposure. While some in the gray zone undoubtedly would sustain fatal injuries, many would be able to survive depending on the prompt actions of public health officials and the public to carry out protective actions.

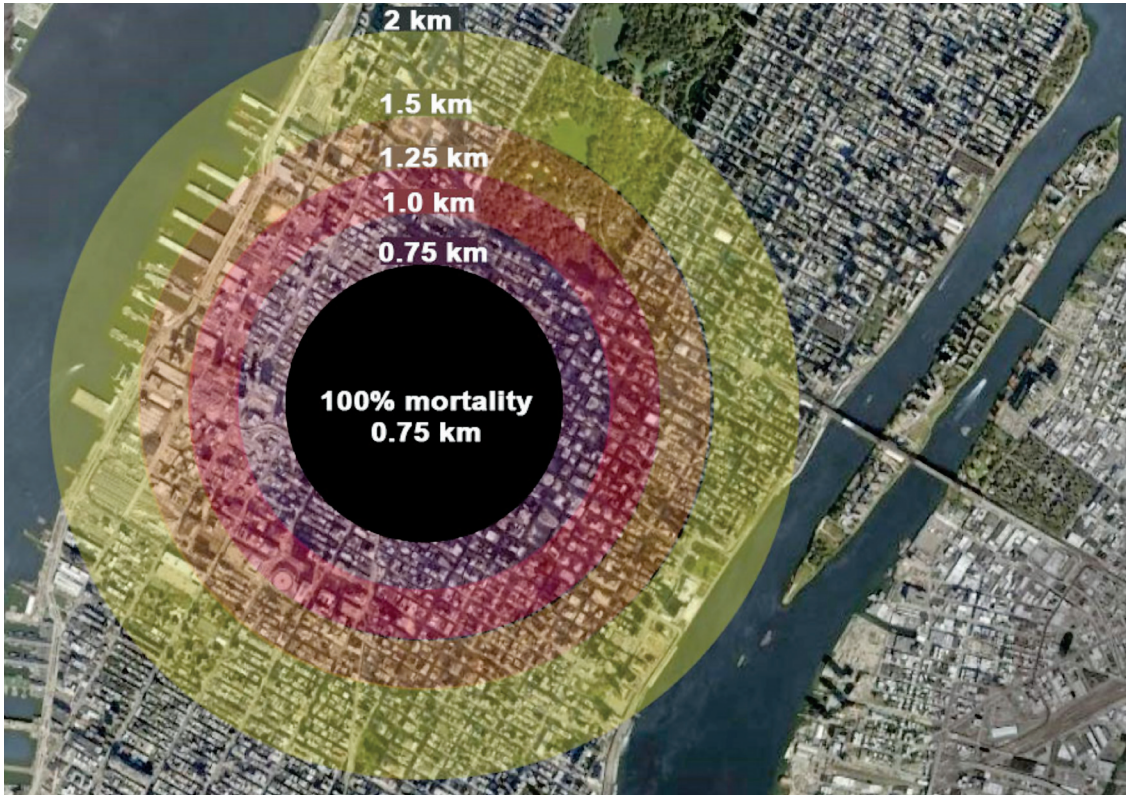
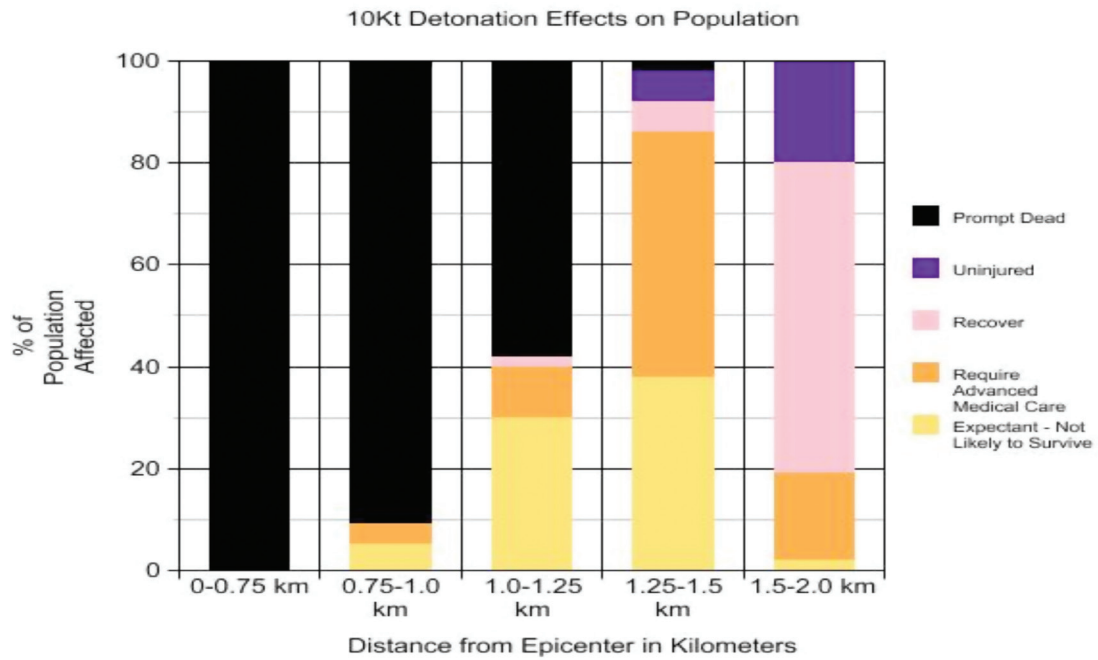


Figure 1-2. 10Kt Detonation Effects; Times Square, New York City

Ring model and data source: Lawrence Livermore National Laboratory Presentation-409771



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## SURVIVAL IN THE GRAY ZONE

### *Planning Guidelines for Life Saving Opportunities*

In addition to Lawrence Livermore National Laboratory's detonation-effects modeling in New York, recent modeling of the effects of nuclear detonations in several American metropolitan areas by Drs. William Bell and Cham Dallas also suggest that lives can be saved and recovery efforts maximized through prompt actions of those in the gray zone. The gray zone is descriptive of areas where non-lethal injuries can be expected and survival is possible, but by no means guaranteed. The availability of basic healthcare treatments within a reasonable amount of time is essential to maximize survival in this group of injured survivors. Understanding zones of different injuries would result in a more effective targeted response.

There is no way to accurately predict how many victims would be exposed to more than one effect (blast, thermal burns, prompt radiation and fallout) of the nuclear detonation, but it is clear that a person exposed to multiple effects would have a far worse prognosis than someone exposed to only one of those effects.<sup>h</sup> The goal of taking urgent action after a detonation would be to limit the exposure to as many of the hazards as possible, as much as possible.

No amount of modeling can accurately capture all of the variables that would exist when a detonation occurred in an urban environment. The concentric circles of damage that are commonly seen on maps illustrating the effects of a detonation are based upon data from cold war era nuclear weapons tests that the U.S. conducted in open desert areas containing few water bodies, buildings or other structures. It is very unlikely that the effects of an IND detonation in a dense urban area would result in areas of damage that were as clearly demarcated and which could be easily defined. The inability to confidently predict distinct zones of anticipated injuries and damage would greatly complicate the efforts of responders. However, response planners can adopt the concept of survival in these gray zones and focus efforts on rapidly identifying appropriate areas for minimizing fatalities and suffering.

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<sup>h</sup> Of course, any one of the forces released at or near ground zero will, by itself, annihilate all life unfortunate enough to be there.



## RESPONSE SYSTEMS CAPACITY

### *Public Health and Medical Care Systems*

The public health response to a nuclear detonation will have to begin immediately after a detonation. Appropriate authorities will have to make time-sensitive decisions and rapidly communicate with the public in harm's way in order to facilitate evacuation, sheltering, decontamination, and mass medical and mental health care. In an event of this magnitude and urgency, a regionally distributed network of public health stakeholders would face even greater challenges speaking with one voice and communicating emergency instruction to the public, than would be the case in other emergencies. Therefore, risk communication plans for such an incident must already be in place, and they must be familiar to those who are responsible for providing these services to the public.

The Association of State and Territorial Health Officials (ASTHO) recently published a status report summarizing state and local preparedness capacities six years after the initiation of the Centers for Disease Control and Prevention's (CDC) Public Health Emergency Preparedness Program.<sup>34</sup> The report, a compilation of survey responses from members of four major organizations—ASTHO, the Association of Public Health Laboratories, the Council of State and Territorial Epidemiologists, and the National Association of County and City Health Officials—found that six years of CDC funding of preparedness planning had produced many improvements, but that critical gaps remained. Many local health departments lack plans for mass patient care and fatality management and face inadequate staffing and work-force development. One third of respondents indicated a need for improvements in medical and hospital surge capacity, radiation response, and disaster recovery.<sup>35</sup>

### *Hospital and Healthcare Systems*

The loss of healthcare resources and emergency response capacity in the affected area would substantially complicate response and recovery operations. Hospitals remaining open following an IND detonation can expect a tremendous, unprecedented surge of patients with some combination of burns, multiple traumas from the blast effects and radiation sickness from the high prompt radiation dose. In addition, it should be expected that large numbers of uninjured or mildly affected individuals would rush to healthcare facilities seeking to confirm potential radia-

tion exposure. While most studies do not support the notion that populations panic during and after large-scale disasters, we propose that “radiation panic” may be a potential phenomenon in the aftermath of an IND attack.

The demand for assessment and treatment would overwhelm available supplies, personnel, pharmaceuticals, and hospital space in the nation’s urban centers or the regions that surround them. At present, hospitals, EMS systems and other healthcare resources do not have the capability to handle the extreme volume of patients that would follow a nuclear detonation.<sup>36</sup> Given the likelihood that such an attack would damage health care facilities, damage the infrastructure and impede the delivery of health and first responder services, and reduce the number of available healthcare providers, preparedness planners have not adequately accounted for the unprecedented challenges that will complicate healthcare delivery. An innovative approach is needed to provide medical treatment to the large number of people sickened and injured by a nuclear explosion. While the DHS *Concept of Operations* document details an organizational model for positioning triage and treatment resources for victims both inside and outside of the gray zone, this type of theoretical plan will have little value if it has not been exercised before a disaster occurs.<sup>37</sup>

The availability of basic healthcare treatments within a reasonable amount of time is essential to maximize survival.

Some hospitals and emergency response agencies have resisted developing genuine nuclear preparedness plans because they perceive a combination of overwhelming demands and few workable solutions. A report from the Center for Biosecurity at the University of Pittsburgh Medical Center (UPMC) notes, “Hospitals often do not have the time or resources to undertake comprehensive disaster preparedness planning, and some are unaware of their presumed roles and responsibilities within larger community disaster plans.”<sup>38</sup> The paper argues that with 30% of hospitals losing money, hospitals are simply not likely to allocate enough resources to disaster preparedness. For example, a 2006 survey of 19 acute care hospitals in the Maryland region revealed that only 11 maintained a dedicated reserve supply of pharmaceuticals to treat radiological event victims.<sup>39</sup> And the total supplies of these materials in the 11 stockpiles would only represent a minute fraction of what might be needed in the event of a proximal IND detonation. The survey also notes that, “pharmaceutical preparedness for radiological incidents remains least addressed at the regional level. Limited supplies of potassium iodide and chelating agents [useful in some types of radiation and nuclear incidents] for radiation exposure were found regionally.”<sup>40</sup>

Congress created the Strategic National Stockpile (SNS) in 1999 to supplement and replenish state and local medical and pharmaceutical resources and ensure availability and rapid deployment of life-saving medical countermeasures during and after a disaster. Most hospitals expect to receive emergency supplies within 48 hours from this federally coordinated stockpile, although it is uncertain if, under the conditions that would exist after an IND detonation, this timeline could be met. The Center for Biosecurity study notes that supplies from the SNS should theoretically be available within 12 hours.<sup>i</sup> However, the Maryland pharmaceutical preparedness survey indicates that “[the] logistical challenges of the actual delivery, distribution, and dispensing to people in need may contribute to delays.”<sup>41</sup> The logistic and distribution challenges following an IND attack would likely dwarf the circumstances which impeded relief efforts in the Haiti earthquake of January 2010. In short, local authorities and medical professionals simply cannot rely on immediate availability of state and federal resources in the aftermath of a disaster and must plan to function independently for an extended period.

Following an IND detonation, many hospitals also would face severe shortages of the specialized equipment and highly-trained health care personnel they would need in order to provide care for burn and trauma victims and patients requiring intensive care and respiratory therapy, not to mention the resources they would need for pharmaceutical intervention and mass decontamination.

According to a 2001 study published in the *Annals of Emergency Medicine*, 73% of the hospitals surveyed believed they were unprepared to handle a nuclear incident.<sup>42</sup> This is a critical preparedness gap; according to a 2002 disaster scenario published in the *British Medical Journal*, a 12.5 kiloton ground-level explosion in a New York City port would destroy 1,000 hospital beds from the blast and contaminate 8,700 more beds with sufficient radiation to cause radiation sickness.<sup>43</sup> According to Dr. Dallas, the effect of a nuclear detonation on healthcare resources in the United States would be devastating. He commented, “The nationwide trend of locating a majority of the major urban healthcare institutions in downtown areas would result in a staggering loss of the total institutional health care delivery following nuclear weapons use.”<sup>44</sup> Dr. Dallas estimates that if terrorists successfully detonated a 20Kt bomb in New York City, the resulting fallout could—depending on the wind patterns—wipe out most of the healthcare systems in Manhattan.<sup>45</sup> Even with a 10 Kt IND, it is clear that a significant percentage of healthcare facilities, depending on location, would be destroyed or dysfunctional at varying levels of capacity and capabilities.

The magnitude of the effects on healthcare resources in other cities would be similar. A 20 Kt bomb in the Washington D.C. area would affect more than half of the hospitals in the D.C. area.

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i SNS Mission statement is to release from federal SNS and deliver to State SNS Coordinators within 12 hours; States will then deliver to local SNS Program for local DOH to receive and distribute to general public within 48 hours.

However, in Chicago and Atlanta, an explosion of that size device would leave many suburban hospitals physically unaffected and functional,<sup>46, 47</sup> albeit completely overwhelmed by patients. Suburban hospitals also might be less prepared than urban academic medical centers to handle the tremendous influx of trauma patients and patients suffering from radiation poisoning. With healthcare resources in an entire region severely compromised, it is unclear where patients caught in the gray zone would be able to go for lifesaving help.

### *First Responders*

First responders after a nuclear incident include personnel with public safety, rescue, emergency medical, life safety, critical infrastructure, and public health responsibilities. A small nuclear detonation would completely overwhelm even the most sophisticated and capable urban first response systems. Testifying in the Senate about nuclear preparedness in April 2008, John Gibb, the Director of the New York State Emergency Management Office said:

*There is no ready system in place or planned for that would result in the victims of this type of event receiving pre-hospital or definitive care in any reasonable time frame.<sup>48</sup>*

A reliance on either EMS or hospitals to absorb the surge in demand for medical care during a nuclear disaster is unrealistic. The dangers associated with responding to a nuclear incident would far exceed the typical risk associated with being a first responder, which may limit the number of personnel willing to report for duty. In addition to widespread fires, poor visibility, and mountains of dangerous debris, radiation levels will severely limit the time responders could be in the affected areas and further compromise rescue and recovery operations. The typical occupational guidelines for radiation exposure will be difficult or impossible to follow after a nuclear detonation. For example, Gibb notes that New York State typically does not expect first responders to expose themselves to more than a minimal dose of radiation during rescue operations. However, following a nuclear detonation Gibb argues that there would be life-saving and security missions in areas exposed to drastically higher radiation levels—levels that could have serious or even fatal health consequences for the first responders. Gibb argues, “We need to re-examine and provide guidance and alternative approaches to federal, state and local emergency planners that will allow us to address this issue.”<sup>49</sup> In other words, the public and government must ensure that IND event preparedness models provide guidance to incident commanders in balancing the risks to first responders against the need to carry out lifesaving operations. They must develop such guidelines—and others that address the unique challenges of nuclear terrorism—in consultation with the people whom they’re expecting to place themselves in harm’s way.

### *Patient Triage Systems and Altered Standards of Medical Care*

Decision making to determine which victims will receive immediate versus delayed care is an additional special medical resource in casualty management. Following a nuclear detonation, the sheer enormity in numbers of victims within the context of limited resources would become immensely challenging and would require very different approaches from current standard triage protocols. The level of medical care, where available at all, most likely would be substantially lower than expected in other emergencies.

A 2008 GAO report also highlights the need to adopt alternative medical standards during a mass casualty event that overwhelms available resources. The report notes that some states had “*not begun work on altered standards of care guidelines* [italics added], or had not completed drafting guidelines, because of the difficulty of addressing the medical, ethical, and legal issues involved...”<sup>50</sup> It is clear that limited resources would make delivering best-practice medical care impossible.

The United States Department of Health and Human Services (HHS) triage model is designed for small events and is posted with the following disclaimer: “Caution: Algorithm guideline modifications will be required in mass casualty events.”<sup>51</sup> At present there is no generally-accepted triage protocol that accounts for the severe resource shortages that would exist following a nuclear event. In fact, Drs. David Cone and Kristi Koenig of Yale University claim “no mass casualty triage scheme has become accepted as a gold standard.”<sup>52</sup> However, they propose a very simplistic triage system to be used following a nuclear detonation that deserves some attention; Drs. Cone and Koenig propose a system where patients are classified based on their ability to independently walk, breathe and follow commands.<sup>53</sup> Although their system is not comprehensive and does not attempt to address the full array of medical, ethical and legal issues that medical staff would encounter when allocating scarce resources, it does provide a basis to prioritize patients in the immediate aftermath of a nuclear event. Preparedness efforts must be attentive to the realities of extraordinarily high need and extraordinarily limited resources, or medical facilities would simply not function in the wake of a nuclear detonation.

### *Workforce Absenteeism*

One of the most difficult factors to account for in drafting a comprehensive nuclear disaster response plan would be the lack of information regarding who actually would report to work after this type of incident. Personnel from first responders to physicians and city emergency management employees would confront competing priorities. Many would have to choose between

reporting to work and attempting to take care of their family, friends and property. While most emergency services employees report a high level of commitment to service, people have not always reported to work in past disasters.

There is limited understanding of responder willingness to report to work following a nuclear detonation, yet some conclusions can be drawn from a Columbia University NCDP survey of EMS providers that inquired about workforce willingness to respond to a radiological dispersal device (RDD or “dirty bomb”) event. The 2003 survey concluded that only 83.4% of providers would be able to report to work and only 73.8% of providers would be willing to report to work following an RDD explosion in a school that injured 500 children.<sup>54</sup> While these data indicate that many EMS workers would accept the personal risks of reporting to work following an RDD incident, they also emphasize that more than a fourth of EMS might not report to work due to logistical issues relating to family or home needs, or a personal fear of becoming injured or sick. It is important to acknowledge that the perceived personal risks of responding to a nuclear detonation are likely to be much greater than those associated with responding to an RDD, and that the number of responders unable or unwilling to report to work following the detonation of an RDD would certainly be much higher.

A 2008 GAO report noted that states have similar concerns about hospital staff shortages. The report notes:

*While 19 of 20 states we surveyed reported that they could increase numbers of hospital beds in a mass casualty event, some state officials were concerned about staffing these beds because of current shortages in medical professionals, including nurses and physicians.<sup>55</sup>*

In the context of a nuclear disaster this assessment indicates that even if the hospitals in the gray zone, where the infrastructure may be physically intact and functional, could accommodate a patient surge, hospitals would likely lack the medical personnel to care for the casualties.

While this information about medical personnel’s willingness to work may seem to cast doubt on the efficacy of medical preparedness efforts in general, the 2003 NCDP survey cited previously includes several statistics that show otherwise. For example, 83% of EMS providers surveyed cited a “sense of responsibility” and 77% of EMS providers cited the “ability to provide care” as the primary reasons to report to work. Of those who stated that they would not report to work, 44% cited “concern for family” as their foremost reason.<sup>56</sup> This may indicate that if a disaster plan includes innovative approaches that provide special protection to the families of medical personnel, some portion of those who otherwise would stay at home, may report to work.

As a regional event, an IND detonation will severely challenge the ability and willingness of emergency personnel to report for duty. A recent study by the NCDP explored the barriers to hospital employees reporting for duty during a public health emergency, and found that the most significant barriers included the need to care for a child or adult at home, and a fear for the safety of themselves and their family<sup>57</sup>. Many of these issues will be deal-breakers for all types of emergency personnel at all levels. As such, it is important for emergency planners to factor extreme levels of absenteeism at all levels into the region's emergency operations plan.

### *An Effective Public Response Requires Preparedness*

The American public is concerned about terrorists exploding a nuclear bomb on United States soil.<sup>58</sup> In a series of nationwide focus groups, conducted by the Saga Foundation, Americans cited nuclear terrorism as a “top fear” and believed that if a terrorist organization acquired nuclear weapons, it would use them.<sup>59</sup> Furthermore, researchers Wray, Becker, et al. (2008), found that faced with the threat of a public health emergency, the public would respond by “seeking protective information and taking self-protective action.”<sup>60</sup> These findings suggest that the public's ability to receive, understand, and believe emergency messages, and then act upon them would significantly enhance survivability and health outcomes. A recently released DHS *Concepts of Operation* guide states “the most effective life-saving opportunities...in the first 60 minutes [after a nuclear detonation]...would be the decision to safely shelter or evacuate people in expected fallout zones.”

62%	Are concerned about the possibility of a nuclear attack on U.S. soil
49%	United States will experience a nuclear attack within 5 years
59%	Terrorist organizations like Al Qaeda will acquire nuclear weapons over the next decade
73%	If a terrorist organization acquires nuclear weapons it will use them

Distance and shielding, previously described within this paper, are essential concepts in strategies to maximize survival and mitigate illness, yet these personal risk reduction and protective actions are not well understood by the general public. As many as 90% of the respondents in Wray and Becker's study stated they may not follow instructions to shelter-in-place even if they receive the message to do so.<sup>61j</sup>

In the minutes and hours after the detonation of an IND, the public would need to make a few key decisions in order to maximize their chances of surviving and minimize their injuries and long-term health effects:

1. Is it better to evacuate now or later?
2. If I stay put, how should I shelter and decontaminate myself to prevent further injury?
3. When I do evacuate, where should I go to avoid placing myself at an increased risk from fallout?

Survival in the 'gray zone,' while by no means assured, will be highly dependent on effective pre-event planning – including evacuation and shelter-in-place plans communicated to the general public and practiced.

– *Dr. Irwin Redlener, May, 2008*

Individuals will very likely need to make these decisions in the absence of official directions. If local health officials are to dramatically increase the percentage of affected people who can survive, they must make the public aware of the benefits of these initial life-saving responses actions and of knowing what to do in an emergency. Despite the benefits that these simple protective measures can have, it seems that the widely-known images of the nuclear devastation in Hiroshima and Nagasaki, and subsequent fictionalized portrayals of nuclear conflict in movies and television-program images of total nuclear devastation have led people to conclude either that preparedness is impossible or that the federal government already must have done everything in its power to protect the country. Both assumptions are inaccurate.

In the United States, virtually no public education has taken place about what an individual should do in the event of a nuclear detonation, although there is urgent and critical need for such

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j The status of family members, especially children in school and knowledge of preparedness plans for family members in other locations are determining factors for adherence to shelter-in-place directives.

education, especially for those living in potential target areas. Also lacking are pre-developed, exercised and well-tested communication plans to deliver rapid information from officials to the public following a nuclear incident.

The advocacy group Physicians for Social Responsibility (PSR), in a 2006 report about America's preparedness for nuclear terrorism, noted the absence of either "a central coordinating authority empowered to immediately step in to direct the response and rescue efforts"<sup>62</sup> or any "communication with the public on preparedness for nuclear terrorism..."<sup>63</sup> The decentralized responsibility for and lack of public communication about nuclear preparedness highlighted by the PSR report might help explain the previously-discussed public unawareness of nuclear terrorism preparedness.

A public education campaign that addressed these issues could save lives and reduce injury in the gray zone by empowering the public to initiate life-saving actions without the need for official advice, which may never arrive. Immediate protective actions in the first moments after a detonation are critical. Considering that it might be impossible to get emergency messages to the public after a detonation, it is sensible to equip the public now with basic information on how to best protect themselves and their family should they ever confront this type of disaster.

### *Federal Emergency Response*

As previously mentioned, a nuclear detonation will have significant regional level impacts that cut across city and state boundaries. Consequently, regional resources will be critical in the hours before federal assistance arrives. *And once external resources do arrive, coordination among local, regional, federal and other assets will require highly complex systems-integration capacities in a dynamic and unpredictably expanding scenario.*

In the earliest phases of an IND response, the federal government could only make limited resources available to augment local and state response capabilities. Local and state first responders and medical professionals cannot assume that the federal government would be able to materially support their local activities for the first few days. For example, even when the Department of Homeland Security activated all of its more than 50 Disaster Medical Assistance Teams (DMAT)<sup>k</sup> to provide urgent medical care to victims of Hurricane Katrina, the assistance was insufficient to accommodate the patient load.<sup>64</sup> A nuclear detonation would produce a vastly greater number of patients with more complex and life-threatening injuries. The need for decontamination would further complicate an already daunting medical challenge. Therefore, local healthcare professionals should not assume that federal response teams would be able to provide the needed surge

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<sup>k</sup> DMAT teams are civilian teams of medical professionals and support staff, administered through HHS via the National Disaster Medical System (NDMS)

capacity. Furthermore, although HHS also operates National Pharmacy Response Teams (consisting of pharmacists, pharmacy students and pharmacy technicians) to help rapidly distribute medication in a disaster region, these resources would be grossly insufficient to accommodate the increased demand following a nuclear detonation.

In the U.S. federal system, state and local governments and non-profit organizations always have shouldered the primary preparedness and response burden. Operating under the principle of “Home Rule,” state and local authorities maintain the vast majority of power and control over a disaster response and coordinate, in their area, the rescue and recovery operations as well as the post-disaster cleanup. As multiple assessments of the Federal Emergency Management Agency’s (FEMA) administration of the Stafford Act have noted, obtaining federal disaster assistance can be a cumbersome, protracted process. States must first conduct assessments, verify resources spent, and then declare that they need federal help. FEMA must review such requests and the President must declare a disaster before the federal government can provide disaster aid.<sup>65,66</sup> For the federal government to provide an immediate response, Congress needs to revise the protocols governing presidential disaster declarations so that there will be an automatic Presidential declaration upon any nuclear detonation. It is not known if such protocol revisions already exist, however.

A nuclear detonation would almost assuredly overwhelm local, state and regional resources to the point where they would struggle to provide an accurate assessment of the situation. It also would invoke responses from an unprecedented number of local and regional and extra-regional agencies and personnel and trigger deployment of multiple federal agencies in the interest of national security and law enforcement. The Federal Bureau of Investigation (FBI) is the designated lead federal agency for the investigation of all terrorism incidents. In addition to traditional disaster response agencies such as FEMA and HHS, specialized civilian and military support teams have been established to provide technical expertise to federal responders. The response would undoubtedly be complicated and protracted as federal assets, state responders and local agencies converged to assess the situation, communicated with the public, coordinated an evacuation, issued emergency instructions, established health care systems, and began an investigation. Absent substantial pre-planning, the amassing of numerous federal and local agencies following a nuclear incident would affect existing local command and coordination plans and create confusion as to how these various agencies should interact.

Some emergency preparedness advocates argue that the federal government should pre-assign the military an increased role in the response to a large disaster as they already possess the advanced field capabilities in the areas of damage assessment, search and rescue, transportation, logistics, communications, medical care, and in maintaining order.<sup>67</sup> Recent announcements from the Department of Defense (DoD) indicate that steps are being taken to provide this type of assis-

tance with the development of domestic Rapid Reaction Forces. Initial reports indicate that nearly 5,000 active duty troops are available for this purpose at this time, with the number expected to grow to 20,000 by 2011. These troops would work under the United States Northern Command (USNORTHCOM), established in 2002 to support the homeland security mission and civil support role of the DoD. In addition to the civilian DMAT teams available through HHS, the DoD has a robust capability to deliver field medical care through the use of a tiered system intended for deployment during operations. These include Battalion Aid Stations, Forward Support Medical Battalions, Forward Surgical Teams, and the modular Combat Support Hospitals. While the use of these assets remains an option for federal officials, their integration into the civilian healthcare system as part of a regional response to an IND event would be challenging without significant preplanning. Experience from the 9/11 terrorist attacks demonstrated that under the current system it takes at least 3-7 days to authorize and deploy federal active duty or reserve troops.<sup>68</sup> It is assumed that many of the processes have been streamlined, however, in the subsequent nine years.

To increase the military's role in domestic emergencies beyond that contemplated for USNORTHCOM would require a significant reassessment of *both* policy concerning the use of military forces to perform domestic law enforcement functions *and* the statute that has governed that domain for over a century, the 1878 Posse Comitatus Act (PCA). This law generally prohibits the use of the military in civilian law enforcement and supports protection of individual civil liberties, although relief operations are not restricted under the legislation. The PCA applies to active and reserve units of the Army, Air Force, Navy, and Marines but not to the Coast Guard (In 2003, the Coast Guard came under the auspices of the Department of Homeland Security). As a rule, a state's National Guard is considered a state asset, i.e., under the command of its own Governor. While a state asset, the National Guard is not subject to the limitation of PCA and the Governor may call up the Guard for law enforcement activities and other duties upon a disaster. However, in those infrequent occurrences when the Guard is federalized by Presidential authority, it is subject to the limitations of PCA.<sup>69</sup> Furthermore, various federal statutes provide express exceptions to the PCA, including upon emergencies involving nuclear materials.<sup>70</sup>

The federal government must refine its role in disaster response if the U.S. is to be prepared for detonation of an IND. The current system does not contain surge capacity or provide planning support commensurate with the challenges of such a disaster. Given the legal framework of the PCA and existing statutory exceptions, legislators and other policymakers need to clarify the potential functions of the U.S. armed forces following an IND detonation. In January 2008, Congress acknowledged the urgency of addressing these issues by mandating the creation of an advisory panel to "carry out an assessment of the capabilities of the Department of Defense to provide support to United States civil authorities in the event of a chemical, biological, radiological, nuclear or high-yield explosive (CRBNE) incident."<sup>71</sup> This panel began its work in September 2009.<sup>72</sup>



## CLOSING THOUGHTS

The very real threat of nuclear terrorism is evidenced by terrorists' well-documented desire to use nuclear weapons against the United States and the ability to procure, develop and use nuclear weapons. Although it is impossible to quantify this threat with any precision, the availability of poorly-secured fissile material in many locations, imperfect controls on the entry of people and cargo, general knowledge about nuclear fission technology and, as previously discussed, the political instability of Pakistan and potential instability of other nuclear states, have led most observers to believe that the threat is real and imminent enough to demand the highest priority from lawmakers and society as a whole. The effects of even a 10 Kt nuclear detonation in an urban area would be overwhelming. Yet, although there would be enormous loss of life, housing and infrastructure, an IND detonation is a survivable event for many. Well thought out and rehearsed disaster response plans could literally make the difference between life and death for hundreds of thousands of people.

Counter-proliferation initiatives, cooperative nuclear security programs, strong supply-chain, cargo and border security programs and robust, multi-layered counter-terrorism, intelligence and law enforcement programs, collectively provide our best hope of preventing nuclear terrorism in the United States. Yet these and other prevention efforts thus far have been limited and met with barriers and delayed goals. Equally troubling, prevention programs exist within an environment of unstable governments and serious and dangerous trafficking of nuclear materials, technology and scientific expertise. As discussed previously, however, no set of prevention efforts is fool-proof, and the consequences of a single failure could be disastrous.

Senator Joe Lieberman, Chair of the U.S. Senate Committee on Homeland Security and Government Affairs, clearly articulated our responsibility to confront the nuclear threat when he said,

*Al Qaeda has demonstrated a clear intent to develop and use nuclear weapons to achieve its violent jihadist goals. This is daunting and jarring information, but it is our responsibility to bring it forth and do something about it. Our purpose today is not to encourage unrealistic fear but rather to confront the fearful realities we face in the world today so that we can then deal with them in defense of our country and people and our way of life.<sup>73</sup>*

Senator Lieberman's statement is an undeniable charge to the United States government and the general public. It should be an injunction to emergency planners at all levels to move forward now and develop and exercise preparedness and response mitigation plans for potential nuclear terror-

ist attacks within our country. Elected officials and emergency planners at all levels of government must understand the reality of the nuclear terrorism threat and come to grips with the almost certain catastrophic effect on a regional population, infrastructure and health, not to mention far reaching consequences that include damage to national confidence and psyche as well as a global effect. The public and our emergency planners must get beyond Cold War notions of total nuclear devastation and adopt planning assumptions around *survivability*. Our pre-event planning would be decisive in determining our response competencies and outcomes should such a dreadful event ever occur.

Survivability in the 'gray zone' must be a principle guiding response, mitigation, and recovery planning at all levels of government and non-government response agencies.

Disaster planning is a core responsibility at all levels of government. In fact, many jurisdictions have encouraged their public to prepare for a variety of natural and man-made disasters, including an outbreak of pandemic influenza. Moreover many non-government response agencies and private sector entities have implemented disaster contingency response plans. Planning for a nuclear detonation scenario, however, has not been on the table in any deliberate or sustained way. We should follow the logic of prevention and give ourselves the skills to increase our chances of surviving and recovering from an IND disaster as well. It is time to synthesize known threats and plausible consequences into action. To this end, the NCDP recommends a range of regionally planned IND-specific response strategies, including:

1. Require all jurisdictions that are federally designated as high risk IND target communities to develop and sustain appropriate preparedness for possible nuclear terrorism;
2. Strengthen regional alliances and coalitions developed to implement effective response strategies;
3. Require all federally funded regional alliances to demonstrate robust plans for *region-wide* health, public health and sheltering response to IND detonation;
4. Provide sufficient funding for all aspects of preparedness for IND terrorism;
5. Greatly expand capacity of national rescue and recovery efforts, including relevant federal agencies, to respond in the event of an IND attack anywhere in the U.S , including specialized training with respect to functioning in high-level radiation events;

6. Clarify incident command roles and operational integration procedures among federal, state and local authorities in the event of an IND attack;
7. Ensure that Strategic National Stockpiles of countermeasures—as well as corresponding stockpiles on a state level—are relevant for an IND detonation and are scaled up to meet the likely demand;
8. Accelerate—and exercise—multi-sector response planning that includes government entities, non-governmental organizations and private sector assets;
9. Research and implement strategies designed to communicate risks and appropriate public responses to an IND detonation;
10. Pursue relevant research to improve effectiveness of countermeasures;
11. Ensure that highly redundant and multi-format modalities of communicating with the public during and after IND terrorism are developed, tested and available; and,
12. Consider re-opening and/or developing stocked public shelters for populations in high risk communities.

In the meantime, Congress should urgently expand funding to enhance our understanding of the barriers to nuclear preparedness planning and to substantially bolster and clarify the capacity and legal authority of the federal government to deploy massive resources in the event of a nuclear terrorism attack anywhere in the nation. Until planning barriers are resolved and concrete steps are taken, nuclear-threat-specific regional planning remains an urgent and unmet need.



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## ABBREVIATIONS

ASTHO	The Association of State and Territorial Health Officials
CSI	Container Security Initiative
CBP	Customs and Border Protection
DoD	Department of Defense
DHHS	Department of Health and Human Services
DHS	Department of Homeland Security
DMAT	Disaster Medical Assistance Teams
DNDO	The Domestic Nuclear Detection Office
EMS	Emergency Medical Service
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
GAO	Government Accountability Office
HEU	Highly Enriched Uranium
IND	Improvised Nuclear Device
IAEA	International Atomic Energy Agency
Kg	Kilograms
Kt	Kiloton
NCDP	National Center for Disaster Preparedness
NEST	Nuclear Emergency Support Teams
NTI	Nuclear Threat Initiative
PSR	Physicians for Social Responsibility
Pu	Plutonium
PCA	Posse Comitatus Act
RDD	Radiological Dispersal Device or “dirty bomb”
SNS	Strategic National Stockpile
USCG	United States Coast Guard
USNORTHCOM	United States Northern Command
UPMC	University of Pittsburgh Medical Center



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## END NOTES

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## ABOUT THE NATIONAL CENTER FOR DISASTER PREPAREDNESS (NCDP)

The NCDP is an academically-based resource center dedicated to the study, analysis and enhancement of the nation's ability to prepare for and respond to major disasters, including terrorism. The NCDP has a wide-ranging research, training and education, and advocacy agenda, with a special interest in megadisasters. Senior faculty and staff have testified at Congressional hearings, presented at numerous conferences and meetings, and consulted with governmental, healthcare, non-profit, industry, and community leaders. Founded in 2003 by Irwin Redlener, MD, the NCDP engages the public health workforce and communities in preparing for catastrophic events, while helping to integrate preparedness efforts into the nation's existing infrastructure. The Center encompasses the CDC-funded Center for Public Health Preparedness at Columbia, which has trained over 15,000 responders in public health preparedness, incident management, and recognition and response to incidents involving weapons of mass destruction using table-top drills, exercises, and distance learning technologies.

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