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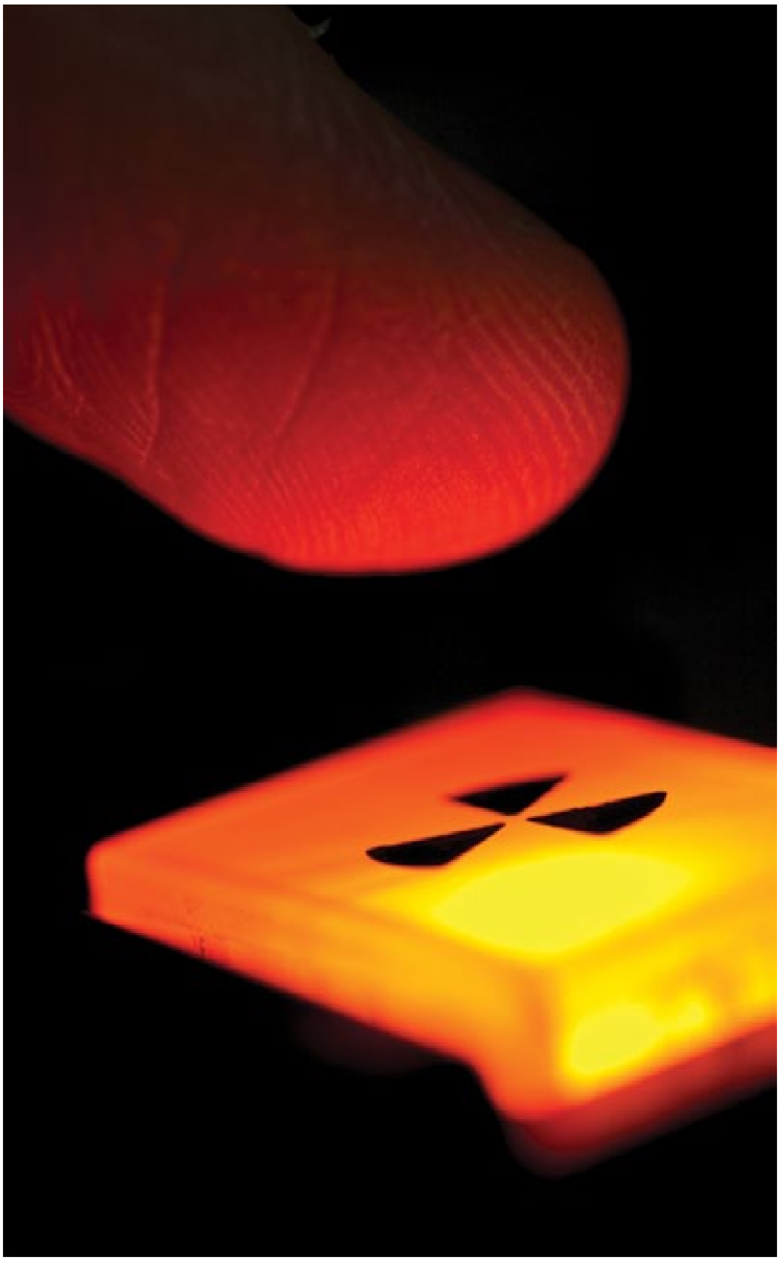
Radiological Preparedness



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Editor's Notes

By James D. Hessman, Editorial Remarks

Next month marks the 50th anniversary of the October 1962 Cuban Missile Crisis – which, most historians agree, was the closest the world has yet come to an all-out nuclear war. Unofficial and unprovable estimates suggested that the U.S. death toll from such a conflict would have been 100 million or so, and that the Soviet Union death toll would have been somewhat higher. The worldwide physical, economic, and psychological damage inflicted would have been both massive and long-lasting.

The ten authors and one major U.S. agency featured in this issue of *DomPrep Journal* focus their individual expertise and collective attention on what is an extremely important responsibility of government today: The prevention of nuclear war. Jeffrey Williams starts the discussion with a basic "Primer" on radiological preparedness – a topic much in the news since the earthquake/tsunami disaster in the Fukushima area of Japan last year. Richard R. Schoeberl follows with a knowledgeable summary of various intelligence reports suggesting that at least some nuclear weapons may already be for sale in the international black market. The U.S. Domestic Nuclear Detection Office (DNDO), however, provides welcome reassurance that its Mobile Detection Deployment Program is prepared to cope with all types of radiological/nuclear "events" that occur anywhere within the United States.

But what happens if, in fact, a nuclear accident or incident does occur? That question is answered, at least in part, by several other *DPJ* authors. Craig DeAtley discusses the immense responsibilities instantly assumed by hospitals and other healthcare facilities in the three concentric zones surrounding ground zero. Craig Vanderwagen follows with a knowledgeable analysis of: (a) the short- and long-term dangers caused by exposure to nuclear radiation; and (b) the countermeasures that can and must be taken immediately by those who survive the initial blast. Stephen Grainer comments on the command-level decisions, by Presidents George W. Bush and Barack Obama, that spell out the federal government's plans and policies to cope with any CBRNE (chemical, biological, radiological, nuclear, explosive) "event" threatening or actually striking the United States and/or any of its territories or possessions.

Who will protect the protectors, though? That question is answered in part by John Lazier, who focuses special attention on the personal protective equipment needed by the nation's first-responders. Joseph Cahill points out the equally important need to protect, and/or have immediate replacements for, the fleets of ambulances and other vehicles used in times of sudden disaster. Theodore Tully discusses recent cost restraints that could hamper future readiness – the answer to which, he adds, is whole-community preparedness.

Audrey Mazurek analyzes the impact of recent hurricanes, wildfires, and floods, and points out that these and many other natural disasters are now much more manageable – thanks to the rapid gains in overall community and national preparedness. Erica Canzler rounds out the issue with a brief discussion of the helpful roles played by two Emergency Preparedness Agency units: the agency's Consequence Management and Advisory Team, and the EPA National Homeland Security Research Center.

About the Cover: Radiological releases, both deliberate and accidental, pose an ongoing threat to nations around the world. Among the knowns and unknowns of radiological hazards is whose finger is lingering over the radiation button – where will the next incident occur and how will emergency planners, responders, and receivers manage it? (iStock Photo)

Radiological Preparedness: A Short Primer

By Jeffrey Williams, Viewpoint

The devastating tsunami and subsequent meltdown of four reactors at Japan's Fukushima Power Plant last year served as a reminder of the changing and expanding arena of emergency management in the field of radiological preparedness. The meltdown, the evacuation, and the public reaction that followed all provided real-world examples of some of the difficult issues and concerns that might well be encountered in a terrorist-based radiological event. However, most previous real-world disasters requiring terrorist-related emergency planning and response operations have involved explosives, chemicals, and biological agents, rather than radiological hazards.

Fortunately, the Fukushima meltdown had no terrorist involvement exacerbating the release of radioactive material. Even so, the incident drew widespread reaction – curiosity, concern, and response – from the public at large and visibly demonstrated that there is little knowledge of important radiological issues, including the response capabilities of the general population.

The incident itself, and subsequent release of dangerous radioactive materials, certainly raised levels of concern. However, it also provided a measured opportunity for response operations and for determining current weaknesses that should be studied to improve future event management capabilities not only in Japan but elsewhere.

The Initial Priorities: Education & Detection

It has been obvious for some time that there is a compelling need for public education on radiation terminology and radiological dangers. In addition to explaining the details of nuclear plant operations and conditions during last year's crisis, many news reports tried, without too much success, to: (a) define radiation in terms understandable to the non-expert; (b) fully and accurately describe the health hazards posed by radiation; and (c) explain the potential worst-case impact of radiation leaks (and/or incidents, whether deliberate or accidental).

The difficulty of addressing such a technically challenging topic became evident during the early stages of reaction and response operations. The close "relationship" between radiation itself and the source carrier materials was not discussed, and that important omission led to numerous problems in the public's understanding of both contamination itself and of decontamination techniques. At least one televised Fukushima report showed the use of incorrect decontamination procedures, which further exacerbated the problem of understanding how people could become contaminated and exposed.

The dangers posed by radiological "debris" were also difficult to explain, leading many citizens to be understandably concerned about even extremely low levels of detection in the United States because there was no risk analysis to put the information into a proper context. For that and other reasons, there is now a demonstrable need to develop relatively simple and easy to understand guidelines – and provide the training materials needed therein – for educating the public. The development and use of such guidelines should clearly be carried out well before the onset of an actual radiological event.

Radiation: Detection & Dangers

Another area of concern in any discussion of radiological preparedness involves the use of radiation detectors. There are four major types of ionizing radiation: alpha, beta, gamma, and neutron. Three of these – alpha, beta, and neutron – deal with the emission of subatomic particles from an atom; gamma radiation consists only of energy. Regardless of the type or form of radiation, human senses are not able to detect radiation on their own, so determining whether or not radiation is present requires the use of a radiation detector. Primarily for that reason, a response plan for any potential radiological event should include some form of radiation detection, along with information on the proper use of a detector to spell out, in significant detail, the actions required to deal with the presence of radiation if and when it is detected.

However, the immediate availability of a detector is not sufficient in itself. It is equally important that responders fully understand the functions and capabilities of the instrument to be able to cope effectively with the hazards being encountered. The best and most reliable detectors are specialized in nature – i.e., sensitive both to the type of radiation (alpha, beta, gamma, neutron) encountered and to the radiation energy being emitted.

In layman's terms, this means that a device that detects gamma radiation, for example, may not necessarily detect neutrons as well and vice versa. Recognition of this limitation is critically important in responding to any radioactive release, particularly from unknown sources.

In general, gamma radiation detectors are both more rugged and more useful than other detectors because almost all types of radioactive materials give off at least some gamma radiation – even if the principal emissions are of another type. This operational characteristic allows a gamma detector to be a reasonably accurate key indicator, in virtually all event scenarios, of the presence or absence of radiation – even if there is some degree of uncertainty about either the total amount of radiation that might be present and/or the other (non-gamma) types of radiation in any given area.

The detectors also possess sensitivities that reflect the energy of the radiation. An instrument that can detect gamma within a specific energy range may not be useful, though, if the gamma energy of a source is lower or higher than the range capabilities of the detector used.

Protecting Both Responders & the General Public

After the presence of radiation has been confirmed by a detector, the protection of responders and the local population immediately becomes the highest priority. It should be remembered, though, that the protection needed after a terrorist event is different in several ways from the protection required in an industrial or occupational setting. This distinction in priorities is due primarily to differences in duration of the exposure. For example, in a controlled occupational setting, the potential for contact and exposure might continue over a longer period of time. Alternatively, in an emergency-response situation, such as an attack or industrial accident, the immediate and most important goals are to remove people as quickly as possible from the scene and decontaminate them to shorten the duration of exposure.

In all radiation situations, another very important goal is to minimize the *level of exposure* as well as its duration, with a critical need to prevent the accumulation of radioactive material actually within the human body. The advantage of dealing with external radiation sources is that the person exposed can move away, or be taken away, from the radiation source and some, or all of it, can be washed off. This reduces exposure to the person.

Of much greater concern is an internal source of radiation, because removing material from inside the human body is almost impossible, particularly if there is more than just a minor amount of debris in a wound. The highest concern in the spectrum of internal radiation is respiratory protection, because the inhalation of radioactive material results in the permanent embedding of material within the inner recesses of the body, which increases long-term exposure of sensitive organs.

In preparing for any emergency or other dangerous event, the guidelines and other information provided should be set forth as clearly and simply as possible. Developing and disseminating easily understood descriptions of potential hazards, and the various protective procedures needed to cope with such hazards, is imperative. Those highest-priority guidelines may be even more critical in dealing with radiological issues, as was demonstrated at Fukushima, because of the more complex nature of the information provided. Applying the lessons learned from that disaster and from other incidents can help to mount more effective responses to similar events in the future.

Jeffrey Williams has served over the last 20 years as an environmental engineer in the U.S. Department of Defense. He also has served on two different emergency response teams, during which assignments he became an expert on radiological dispersal devices and various related topics. He has been a speaker at a number of public and private forums on topics ranging from environmental regulations to radiological preparedness. Prior to assuming his DoD post, he worked on the design and construction of hazardous-waste disposal sites for industrial facilities.

Securing Weapons of Mass Destruction: A Continuing Challenge

By Richard R. Schoeberl, Law Enforcement

As events of the past week have shown, the 18-month upheaval that has devastated Syria continues to present a major risk that the Syrian government's caches of CBRNE (chemical, biological, radiological, nuclear, and explosive) materials might fall into the hands of looters, defectors, opposition groups, and/or terrorist organizations. Moreover, as governments throughout the world continue to combat terrorism, groups with weapons-making capabilities, combined with clear intentions to acquire and use CBRNE materials, particularly nuclear, pose a threat of unprecedented magnitude.

In fact, even after the death of Osama bin Laden in 2011, the once strong but now weakened Al-Qaida organization continues to pose a serious international threat. The group's targets and methods of attack will likely continue to focus on various "economic" targets such as transportation hubs, commercial aviation facilities, and energy production and distribution centers. In addition, it is uncertain whether current Al-Qaida leaders will seek to acquire CBRNE weapons from the black market, the mysterious "lost" caches in Libya, or similar stockpiles now being pilfered in Syria.

Prevention and detection are important factors in locating and securing nuclear materials. International collaboration and cooperation are the keys, therefore, in reducing the growing threat posed by nuclear terrorism.

Over the past two decades, Al-Qaida has repeatedly attempted both to purchase stolen nuclear materials and to recruit nuclear expertise. The organization purportedly has conducted tests of conventional explosives for its nuclear program in the Afghan desert and other areas. Moreover, as far back as 1998, Bin Laden himself publicly declared that it was his "religious duty" to acquire weapons of mass destruction. In recent years, there has been no sign that the group has abandoned its nuclear ambitions, but there is also no convincing evidence that Al-Qaida has actually acquired "weapons-usable" nuclear materials – or the expertise needed to incorporate such materials into an actual bomb or missile. Regardless, the possibility that even one terrorist organization may be able to acquire, deploy, and detonate a nuclear weapon is enough to justify the full range of urgent actions needed to reduce and defeat such risk.

The Mitigation of Nuclear Risk

Two months after the 11 September 2001 terrorist attacks against the United States, Bin Laden told the mass-circulation *Dawn* newspaper in Pakistan that Al-Qaida already possessed both chemical and nuclear weapons. "My cause will continue after my death," Bin Laden said. "They [the United States and its allies] think they will solve this problem by killing me. It's not easy to solve this problem. This war has been spread all over the world." Because of Al-Qaida's frequently expressed interest in carrying out CBRNE attacks of any type, there has been a growing concern that the organization's current leadership, and/or other terrorist groups, could use the chaotic situation in Syria to steal or buy CBRNE materials from either the struggling Syrian government or from one of several opposition groups.

More than two years ago, in April 2010, the day before a multi-nation summit in Washington, D.C., U.S. President Barack Obama affirmed that, in his opinion, "The single biggest threat to U.S. security, both short-term, medium-term and long-term, would be the possibility of a terrorist organization obtaining a nuclear weapon. We know that organizations like Al-Qaida are in the process of trying to secure nuclear weapons or other weapons of mass destruction, and would have no compunction in using them."

Khalid Sheikh Mohammed, the mastermind of the 9/11 attacks, was involved in orchestrating a range of additional plans for: (a) attacks on U.S. nuclear plants; and (b) a so-called "nuclear hellstorm" attack in America – referring to a statement by another senior Al-Qaida commander that the terrorist group had hidden away a nuclear bomb in Europe that could be quickly detonated if Bin Laden was ever caught or assassinated.

It is worth pointing out that Syria is not only a member of the Treaty on the Non-Proliferation of Nuclear Weapons but also has supposedly reached a number of broad nuclear safeguard agreements with the International Atomic Energy Agency (IAEA). In September 2007, however – in an attack

known as Operation Orchard – Israeli fighter jets destroyed a complex at Al-Kibar in the Syrian Desert believed to be a plutonium-producing reactor. Although the U.S. government became aware as early as 2005 that North Korean and Syrian scientists and engineers were working together in Syria's eastern region, it was not until the spring of 2007 that intelligence sources confirmed that a nuclear reactor was being built.

In a 24 May 2011 report released by the International Atomic Energy Agency (IAEA) – which encourages the use of nuclear energy, but opposes nuclear weapons – the agency concluded that the building destroyed by the Israelis was very likely a secret nuclear reactor and should have been so declared by Syria itself. The IAEA also found that Syria had breached its obligations under the Treaty on the Non-Proliferation of Nuclear Weapons.

Nuclear Capabilities Around the Globe

There are now eight countries known to have nuclear weapon capabilities: China, France, India, Israel, Pakistan, the Russian Federation, the United Kingdom, and the United States. It is estimated that these nations collectively possess approximately 20,000 nuclear weapons. Moreover, all eight nations also have plans to modernize, upgrade, and/or extend the lives of these nuclear weapons. A nuclear-armed Pakistan is of particular concern not only because of that nation's instability but also because of its vulnerability, real or potential, to the Taliban and Al-Qaida bases in Pakistan's own tribal areas.

Today, even though the international community recognizes the impending dangers posed by nuclear terrorism, it has yet to develop the effective, cooperative, and comprehensive strategy needed to lower the risks. There are, in fact, no globally accepted criteria for effectively safeguarding nuclear materials. Former Democratic Senator Sam Nunn – Co-Chairman and Chief Executive Officer of the nonprofit and nonpartisan organization Nuclear Threat Initiative (NTI) – stated on 11 January 2012 at The National Press Club in Washington, D.C., that there is today "a large supply of plutonium and highly enriched uranium – what we call weapons-usable nuclear materials – spread across hundreds of sites in 32 countries, too much of it poorly secured. There is also greater know-how to build a bomb widely available; and there are terrorist organizations determined to [build such weapons]."

Near the end of the Cold War in the early 1990s, the Soviet Union was believed to possess an estimated 22,000 nuclear weapons, most of them in storage sites across Russia and in neighboring states such as Kazakhstan, Armenia, Belarus, and the Ukraine. Since the dissolution of the Soviet Union, there have been serious international doubts that "all" of the weapons-usable materials were recovered and/or otherwise accounted for during the lengthy period of time when countless warheads were dismantled. Those doubts developed partly because of the political turmoil at the time and the lack of meticulous record-keeping, but there might also have been some "diversion" of materials and/or outright theft as well.

Today, while terrorist groups are looking for ways to acquire nuclear materials, stable and conscientious governments are seeking better ways to secure those same materials. The amount of material needed for a relatively small nuclear weapon would be very difficult to detect in any case. Therefore, attempts to halt nuclear smuggling, and/or to recover nuclear materials that have been stolen, would be extremely difficult and, in some circumstances, perhaps impossible. The principal focus for reducing the risk, therefore, must be to secure nuclear material and weapons by continually improving the several levels of security involved.

Preventing, Detecting, Locating & Securing Nuclear Materials

According to an earlier (2010) NTI report, there have been 18 confirmed thefts of weapons-usable nuclear materials. Such stolen nuclear material has intermittently been known to be "for sale" on the black market. Most currently known black-market seizures originated from sites in the former Soviet Union or in Eastern Europe. According to a 15 March 2012 *New York Times* report, the Moldovan police disrupted a smuggling ring in 2011 that had been attempting to sell enriched uranium – one member of that ring is still at large and is believed to possess a full kilogram of the material. Other nuclear trafficking seizures have been recorded in Georgia – in 2003, 2006, and 2010.

Although international collaboration is the crucial factor in thwarting the sale or transfer of nuclear materials, responsibility for the response to a specific nuclear incident remains with the individual nation(s) directly involved. Prevention and detection are key elements in any response actions, but preparedness is the paramount consideration. The nuclear threat itself, as well as the damage to property and to the public, from CBRNE incidents can be minimized to at least some extent through a combination of the following: (a) use of a risk-based methodology in developing security plans; (b) the continuing and effective protection of CBRNE materials; (c) an improved exchange of security-related information between nuclear-capable nations; (d) the continuing development, advancement, and use of CBRNE detection systems; and (e) establishment of the political and operational tools needed to quickly and effectively manage CBRNE incidents.

Moreover, implementation of a comprehensive global plan should and would necessarily involve all of the stakeholders involved, and should focus primarily on prevention, detection, and preparedness. First, prevention involves the use of accurate risk assessments to prioritize the high-risk CBRNE materials, along with the security systems and measures needed to maintain effective control of nuclear materials and the facilities where they are stored. Second, universal and modern detection is an essential complement to prevention and absolutely necessary to mount an effective response. For that reason, it is particularly important that universal and modern detection systems be available to all nations possessing nuclear weapons, not only to those that can afford such systems. Third, preparedness – at every level of government – is vital in mitigating the risk of an actual nuclear catastrophe by ensuring that proper training has been carried out, and that effective workable equipment is available, in the quantities needed.

The probability of a nuclear terrorist attack is, or at least seems to be, reasonably low – but, on the other hand, the price of such an attack would be extremely high. Continued cooperation and collaboration between countries with nuclear stockpiles, however, will improve global as well as local security, and also help maintain an aggressive stance against nuclear smuggling. Identifying and thwarting potential plots are among the key steps needed to reduce the danger of nuclear terrorism.

Even so, as long as terrorist organizations pursue the acquisition of weapons of mass destruction, there will continue to be problems for nations seeking to secure the nuclear materials already available. Coordinated efforts and a unilateral agreement between and among the United Nations, the IAEA, and the current nuclear-capable countries will not only help secure the illicit nuclear materials on the market (and the facilities where they are stored), but also assist in locating the currently missing "weapons-usable" nuclear materials that may be available on the black market. In short: prevention and detection are key elements; preparedness is paramount; and locating and securing all nuclear material is essential.

For additional information on:
The 2010 quote by President Obama, "Obama takes non-nuclear pledge to world leaders," by Anne Gearan, Associated Press, 11 April 2010, visit http://www.standard.net/topics/obama/2010/04/11/obama-takes-non-nuclear-pledge-world-leaders

The 24 May 2011 report by the IAEA Director General, visit http://www.iaea.org/Publications/Documents/Board/2011/gov2011-29.pdf

Bin Laden's discussion with Dawn, "Osama claims he has nukes: If US uses N-arms it will get same response," by Hamid Mir, Dawn, 9 November 2001, visit http://archives.dawn.com/2001/11/10/top1.htm

The International Atomic Energy Agency (IAEA), visit http://www.iaea.org

NTI's "Securing the Bomb" reports, 2010, visit http://www.nti.org/about/projects/Securing-bomb/

Nunn's remarks at The National Press Club, visit http://www.nti.org/analysis/speeches/nunn-nti--index-launch/

Richard Schoeberl has over 17 years of counterintelligence, terrorism, and security management experience, most of it developed during his career with the Federal Bureau of Investigation, where his duties ranged from service as a field agent to leadership responsibilities in executive positions both at FBI Headquarters and at the U.S. National Counterterrorism Center. During most of his FBI career he served in the Bureau's Counterterrorism Division, providing oversight to the agency's international counterterrorism effort. Schoeberl also was assigned a number of collateral duties – serving, for example, as an FBI Certified Instructor and as a member of the agency's SWAT program. He also has extensive lecture experience worldwide and is currently a terrorism and law-enforcement media contributor to Fox News, Sky News, al-Jazeera Television, and al-Arabiya.

Radiation Contamination of Emergency Equipment

By Joseph Cahill, EMS

In 1945, Nagasaki became the second Japanese city destroyed by an atomic bomb in the closing days of World War II. The nuclear explosion caused immediate damage and killed tens of thousands of people, but the radiological contamination that remained took many additional lives. A crisis at a nuclear power station such as the one that devastated the Fukushima area in the northeast corner of Japan's main island in 2011 posed many of the same challenges as a deliberate radiological attack.

Even after the energy caused by radiation is completely gone, a person can still become contaminated. The damaging effects continue as long as radioactive material is on or near the person. To address this concern, considerable work has been carried out to prepare emergency medical services (EMS) for operations that might endanger EMS staff and other responders. However, less thought has been given for protection of the other major "component" of an EMS system – more specifically, ambulances and other vehicles.

Airflow Factors, Design Concepts & a Cloud of Dust

The radiological threat is unique. The contaminated area may be so large and/or the contamination may be so long-lasting that otherwise routine EMS operations may have to extend into the contaminated area. In these cases, protecting ambulances and other vehicles from radiation presents a difficult challenge.

The so-called "Star of Life Ambulance" (officially designated the 2002 KKK 1822) is the current national standard that addresses the safety requirements set by the National Fire Protection Association (NFPA). However, it has become clear that the professional community that established the manufacturing standards for ambulances must continue to work on more advanced design concepts to help maintain and improve staff safety and vehicle operability in and through a contaminated environment.

Within the ambulance itself, for example, there are three types of airflow that must be taken into consideration: (a) airflow to the engine; (b) airflow to the cab; and (c) airflow through the patient compartment. Here it is worth noting that the engines of the response vehicles that rushed to the World Trade Center on 11 September 2001 were almost immediately clogged with dust and rendered inoperable.

Most current ambulances were designed with airflow in mind for the patient compartment. To decrease the risk to EMS staff caring for a contagious patient, the air in the compartment is changed – by sucking air in from outside – approximately every 2-3 minutes, and usually cannot be turned off. In addition to protecting against contagions, this same air exchange also reduces the risk posed by airborne radioactive contamination. All three types of airflow require additional filtering to further reduce the risk of contamination.

Concerns, Recriminations & Difficult Cost Decisions

However, contamination can only be reduced, not completely eliminated. In addition to airflow concerns, ambulances and other purpose-built vehicles have irregular nooks and crannies that can trap radioactive contamination, thereby making total decontamination almost impossible without complete disassembly of the vehicle.

Another concern that also must be addressed is that any vehicle used for extended operations in a contaminated zone runs the risk of becoming unusable for normal operations after the immediate crisis is over. Largely for that reason, planners, managers, purchasers, and other decision makers must give serious thought to pre-designating at least some vehicles for operations in contaminated spaces and environments, and other vehicles for operations outside those areas.

A clear plan can be formulated to only use vehicles that are nearing the end of their individual life spans within contaminated areas. In reality, though, it can be difficult to implement that plan during an actual crisis situation. Therefore, the on-scene commanders must seriously consider the use of: (a) vehicles that can be intentionally sacrificed; and (b) other vehicles that have already been previously contaminated, but not to the degree that they are no longer usable.

It is important that the EMS and emergency management communities carry out their planning discussions well ahead of time so that, before the next crisis occurs, staff can make intelligent and cost-effective decisions based on pre-planned engineering controls, without the worry of future recriminations. Having such conversations in advance also means making allowances at the federal level of government for the loss of vehicles that are or should be covered, under a Stafford Act Emergency declaration, in the wake of any disaster.

Joseph Cahill is a medicolegal investigator for the Massachusetts Office of the Chief Medical Examiner. He previously served as exercise and training coordinator for the Massachusetts Department of Public Health and as emergency planner in the Westchester County (N.Y.) Office of Emergency Management. He also served for five years as the citywide advanced life support (ALS) coordinator for the FDNY – Bureau of EMS. Prior to that, he was the department's Division 6 ALS coordinator, covering the South Bronx and Harlem.

Hospital Response to a 10-Kiloton Nuclear Detonation

By Craig DeAtley, Health Systems

For many years, federal, state, and local authorities throughout the United States have planned and trained for the notional possibility of a 10-kiloton improvised nuclear device being detonated within a major metropolitan area. If that were to occur, the hundreds of thousands of fatalities and life-threatening injuries that may follow would severely challenge, if not overwhelm, all components of any healthcare community – especially hospitals.

Considering this scenario, within the first 24 hours after a detonation, all hospitals in and around the blast area will face numerous response issues. To help determine the possible extent of the damage and need for assistance, most experts agree that there are three distinct blast-damage zones created when a nuclear detonation occurs: (a) a *severe* damage zone; (b) a *moderate* damage zone; and (c) a *light* damage zone.

The severe damage zone encompasses the area immediately surrounding the detonation site, and extends to a radius of about 0.5 mile. Damage in this area will be extensive, with few if any above-ground buildings remaining structurally sound and very few persons within the zone surviving. In addition, high radiation levels would pose an ongoing danger to any survivor or responder within the zone.

The moderate damage zone adjacent to and surrounding the severe damage zone extends to a distance of about one mile from ground zero. Some reinforced concrete buildings may remain standing, but most lighter commercial and residential buildings would collapse, thus trapping and possibly killing anyone inside. In addition to the blast injuries suffered by any survivors, there also would be significant fallout of radiation particles that, along with the extensive dust clouds created, could cause serious medical problems.

The light damage zone surrounding the moderate damage zone extends to about three miles from ground zero. The overpressure wave created by the detonation will likely cause somewhat less severe structural damage in this zone, but still lead to numerous injuries and fatalities caused by flying debris. Although the radiation levels in this zone tend to be lower than in the severe and moderate damage zones, there may be isolated areas of concentrated danger. Moreover, many survivors in this zone will likely suffer from extensive soft-tissue and orthopedic injuries, ruptured eardrums and abdominal organs, and/or flash blindness.

Hospital Response & Incident Command Issues

The detonation of a 10-kiloton improvised nuclear device obviously would have a profound and extremely adverse effect not only on the healthcare facilities in the immediate impact area but also in areas farther away. More specifically, if the facilities in the severe damage zone were totally destroyed and those in the moderate damage zone were severely damaged and facing evacuation, the facilities in the moderate and light damage zones that do remain open, and fully functioning, would undoubtedly confront a series of rapidly intensifying administrative, operational, and resource-management response issues.

The hospitals in this last category would have to quickly implement an incident command system (ICS), using whatever trained personnel are immediately available to fill vital command positions. Off-hour responses obviously could be further complicated by traffic congestion and the disruption of normal transportation systems, thus delaying and sometimes preventing numerous hospital personnel from being able to return to work in a timely manner.

Any plans developed to establish and maintain the ICS must address the continuing need – for days, if not weeks – to staff all essential command positions. Moreover, initial and ongoing decision making depends on the receipt of accurate and comprehensive situational awareness reports provided by public safety and emergency management officials, who themselves may be seriously challenged in their efforts to maintain an effective and complete grasp of the situation.

Notwithstanding such challenges, the principal response objectives for each operational period will necessarily focus on: (a) meeting the physical and behavioral health needs, under extremely austere conditions, of a large number of seriously injured patients; (b) continuing facility operations within a potentially contaminated environment; and (c) maintaining health and safety standards as well as those related to facility security.

The hospital's incident management team, previously selected and trained, will be further burdened by the need to share information on a continuing basis not only with other healthcare facilities, in accordance with established protocols, but also with local health and emergency management officials, particularly those in the nearest Emergency Operations Center (assuming one is operational).

Corporate headquarters officials also must be kept informed, if the hospital is part of a corporate healthcare system. Complicating all of these communication efforts and the operation of other electronic equipment – including systems focused on patient care – is the possibility of an electromagnetic pulse (EMP) caused by the detonation, which could create additional direct or indirect damage within a 2- to 5-mile radius from ground zero. Facilities in the light damage zone that could experience an EMP disruption might be able to at least partially recover by turning the equipment off and on again and/or by installing new batteries in the systems and devices still operational.

Initial Response Operations

The initial response steps obviously will be extremely difficult; nonetheless, most would have to be taken almost simultaneously. Among the highest-priority tasks that must be carried out as quickly and safely as possible are the following (not necessarily in this order):

- Moving current patients and staff to the interior or basement areas of the facility until peak radiation levels dissipate;
- Performing a quick assessment of building integrity (structural and otherwise) to determine the possible need for partial or complete evacuation of both patients and staff;
- Determining the need to shut down heating, ventilation, and air conditioning units, and to cover air-intake vents;
- Requiring staff to don appropriate personal protective equipment, along with the personal radiation monitoring devices needed before triaging and treating patients;
- Initiating the mass decontamination of newly arriving victims by first scanning patients for radiation levels and locations and then using such information to help establish triage priorities (although lifesaving tasks normally take precedence over external radiation decontamination, facilities experiencing a large influx of contaminated victims may have to decontaminate patients prior to entry in order to keep interior radiation from rising to dangerous levels);

- Prioritizing patients for radiographic examinations, surgeries, and admission in the face of a quickly depleted bed supply (caused in part by the inability to send patients home because it is either unsafe to do so or no transportation is available);
- Addressing the ongoing needs of patients suffering from Acute Radiation Sickness (ARS);
- Establishing an "expectant care" location, with suitable staffing and medications available, to provide at least some comfort care for those who are not expected to survive their injuries; and
- Communicating early and frequently with staff and patients to provide both groups with needed information, reassurance, and instructions.

Hospitals not in the moderate or light damage zones will nonetheless find themselves confronting many of the same issues mentioned above. They should, therefore, anticipate requests to receive transfer patients from facilities in the inner zones that are either damaged and must close, or are simply overwhelmed by the huge number of patients requiring admission and/or specialty care. In some cases, particularly in the hours or days immediately following the detonation, many survivors seeking primary care for their injuries may make their own way – via emergency medical services transportation or self-directed travel – to a more distant facility.

Resource Management

Hospitals anywhere in the general vicinity of a nuclear detonation will quickly confront a very large number of resource management issues including, but not limited to:

- Inadequate staff because of injuries or the inability or unwillingness of staff members to report to work;
- The lack of needed medical equipment and supplies as well as medications – any of which might require activation of a "crisis standard of care" contingency plan;
- A reduced quantity of supplies because of travel restrictions, competing demands, and/or other needs that exceed the immediately available vendor supplies;
- An inability to sustain decontamination activities either because of insufficient staff or the lack of personal protective equipment and/or various other items needed to remain fully operational;
- The inability to transfer patients to other facilities because of traffic congestion and/or the lack of transportation; and
- Staff attrition, over a varying period of time, caused by fear and/or fatigue.

To briefly summarize, the detonation of a nuclear device of any size, in any community, would inevitably have a profound series of effects on a broad spectrum of all healthcare facilities in the area, including those that survive the detonation itself. Training plans and exercises will certainly improve general preparedness for this type of incident, but the initial and ongoing patient-care requirements still would be overwhelming – and remain that way for a considerable period of time. Rapid and comprehensive regional, state, and federal assistance, in large quantities, will be required to save as many lives as possible and, while doing so, promote and support the recovery of the community's overall healthcare system.

Craig DeAtley is Director of the Institute for Public Health Emergency Readiness at the Washington Hospital Center, the National Capital Region's largest hospital; he also is the Emergency Manager for the National Rehabilitation Hospital and co-executive director of the Center for HICS Education and Training. He previously served as an Associate Professor of Emergency Medicine, for 28 years, at George Washington University, and now also works as an Emergency Department Physician Assistant for Best Practices, a large physician group that staffs emergency departments in Northern Virginia, and has been both a volunteer paramedic with the Fairfax County Fire and Rescue Department and a member of the department's Urban Search and Rescue Team. He also has served, since 1991, as the Assistant Medical Director for the Fairfax County Police Department.

Understanding the Mobile Detection Deployment Program

By The Domestic Nuclear Detection Office, Special Events

Protecting the American people from terrorist threats remains the Department of Homeland Security's (DHS) highest priority. In order to address radiological and nuclear terrorism threats, the Domestic Nuclear Detection Office (DNDO) was established in April 2005. Responsibilities of the DNDO include: (a) coordinating U.S. government efforts to detect and protect against the unauthorized importation, possession, storage, transportation, development, or use of a nuclear explosive device, fissile material, or radiological material in the United States; and (b) protecting against attacks from persons who plan to use such devices or materials against the people, territories, or interests of the United States.

Collaboration between federal, state, local, and tribal law enforcement and public safety agencies and organizations is crucial to the government's layered approach to security. To assist DNDO's state, local, and tribal partners with detecting and reporting radiological and nuclear threats, DNDO developed in 2008 the Mobile Detection Deployment Program (MDDP), which is a national radiological and nuclear detection "surge" asset. MDDP was designed to supplement the existing radiological and nuclear detection and reporting capabilities of first responders, particularly in support of national and other special security events.

Capabilities of Detection Units

Each Mobile Detection Deployment Unit (MDDU) contains radiation detection equipment housed in a mobile trailer package and used by approximately 40 emergency responders. MDDU trailers are stationed in various locations across the United States and are primarily deployed to pre-planned special events – such as sporting events – and to support state and local operations that are driven by intelligence or law enforcement information.

Each MDDU is equipped with vehicle-mounted detection systems that can be temporarily integrated into first responder vehicles. The equipment includes portable backpack radiation detection units, high- and low-resolution radiation identification hand-held instruments, personal detection devices, and interoperable communications and tracking equipment. The detection instruments in each MDDU provide emergency personnel with the ability to detect radiological and nuclear material in a wide range of operational profiles.

In addition, two subject matter experts from a coordinated network of National Laboratories – sustained by the Department of Homeland Security Office of National Laboratories – travel with each MDDU. The responsibilities of these experts include: (a) providing the first responders with on-site training; (b) managing equipment distribution; and (c) performing on-site equipment maintenance. The combination of equipment and laboratory experts facilitates the integration of MDDUs into a variety of local law enforcement and other first responder operations.

Requesting Assistance

There are three ways to request the deployment of an MDDU: (a) contact DNDO directly; (b) contact a local Department of Energy Radiological Assistance Program regional representative; or (c) download the MDDU request form from DNDO's SharePoint website. After the MDDU deployment is approved by DNDO, the requesting jurisdiction will be contacted by MDDU personnel from a National Laboratory, who will deploy with the detection package. The MDDU team lead and the jurisdiction's planning lead will discuss how the unit will be integrated into existing or developing security plans along with logistics, equipment needs, required training, and deployment dates. The MDDU typically arrives a day or two before an event to allow for pre-event training and mission planning.

Since 2008, DNDO has assisted numerous agencies and thousands of first responders by deploying this important detection capability. In order for state, local, and tribal law enforcement agencies to request an MDDU, they must have a current nuclear detection program structure – with some equipment, training, protocols, and standard operating procedures in place – to ensure that technical reach back and adjudication of alarms and warnings can be handled effectively during the deployment. If needed, DNDO can assist jurisdictions in establishing this level of capability as well.

For additional information on:
How to become a partner in this important national security mission; contact the DNDO Program Assistance office: DNDO.SLA@hq.dhs.gov, 1-877-440-3636

DHS's National & Federal Laboratories & Research Centers, visit https://www.dhs.gov/national-federal-laboratories-research-centers

DNDO's SharePoint website, visit https://gnda.energy.gov/login/registration/home.aspx

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The Domestic Nuclear Detection Office (DNDO) is a jointly staffed agency within the Department of Homeland Security. DNDO is the primary entity in the U.S. government for implementing domestic nuclear detection efforts for a managed and coordinated response to radiological and nuclear threats, as well as integration of federal nuclear forensics programs. Additionally, DNDO is charged with coordinating the development of the global nuclear detection and reporting architecture, with partners from federal, state, local, and international governments and the private sector.

CBRNE & NIMS: Complementary, Not Contradictory

By Stephen Grainer, Fire/Hazmat

Some critics of the U.S. National Incident Management System (NIMS) have cited a wide variety of examples to justify their claims that the NIMS policy guidelines will not fully and/or effectively serve the nation's needs in managing future emergency-response situations. In 2010, for example, when the *Deepwater Horizon* drilling rig in the Gulf of Mexico exploded and began the uncontrolled release of millions of barrels of oil into the local waters, some of those same critics used the incident to validate their claims that the management of such major incidents is beyond the scope of the NIMS guidelines. It seemed obvious at that time, however, that state and local governments were unable, even with help from the private business sector, to cooperate and collaborate effectively enough to stop the release through a unified-command organizational structure.

The critics further argued, though, that the *Deepwater Horizon* incident was simply another example – similar to the failures of the 2005 post-Katrina response efforts – of the NIMS being flawed both in concept and in application. Some critics even predicted that if the United States were to experience a significant CBRNE (Chemical, Biological, Radiological, Nuclear, or High-Yield Explosive) incident, the NIMS policies would not be capable of meeting the formidable operational challenges that would immediately follow.

Fortunately, although there have been a number of other potential CBRNE incidents since Hurricane Katrina – including several attempted or at least planned terrorist attacks – and other mass-casualty situations, the core NIMS concepts and precepts still seem both sound and productive.

The Implementation of Presidential Directives

The NIMS policy guidelines were established by the issuance in February 2003, by then President George W. Bush, of Homeland Security Presidential Directive-5 (HSPD-5), "Management of Domestic Incidents." In December 2003, it was incorporated with a National Preparedness Goal that was also issued by President Bush under Homeland Security Presidential Directive-8 (HSPD-8), "National Preparedness."

In March 2011, President Barack Obama issued Presidential Policy Directive-8 (PPD-8) to further describe "the nation's approach to preparing for the threats and hazards that pose the greatest risk to the security of the United States." When used conjunctively, these directives provide the current framework of the policies now in place to guide the nation's efforts to prevent, protect against, mitigate the effects of, respond to, and recover from virtually any major threat against the United States, including CBRNE incidents.

In May 2010, when Faisal Shahzad, a Pakistani American, attempted to bomb the Times Square area of New York City with a sport utility vehicle loaded with propane cylinders, gasoline containers, and an improvised explosive device (IED), the first emergency call came from a street vendor who had noticed that the vehicle was smoking and emitting sparks. The initial presumption was that there might be a vehicle fire in the making.

The New York City Fire Department (FDNY) was the first agency on the scene. Upon arrival, the FDNY incident commander – who was trained to identify potential dangers not immediately visible to a civilian – immediately implemented a number of actions to protect not only the FDNY personnel but also the public at large. Among the most important of those actions was a decision to isolate and secure the area, while also calling for the New York City Police Department (NYPD) bomb squad to investigate the situation and take whatever additional steps might be needed to secure the area.

The actions taken by the responders are excellent examples of how the core NIMS precepts are intended to work. The FDNY officials not only communicated their observations appropriately but also mobilized the additional resources needed to manage the situation. As this example demonstrates, the *management* of such incidents or events, rather than the tactical operations that follow, is the primary intent of the NIMS policy.

The core components of NIMS include the following: (a) Preparedness (the training needed both to recognize potential threats and to initiate appropriate actions); (b) Resource Management (identifying, inventorying, and mobilizing the appropriate personnel and material resources needed); (c) Communications and Information Management (the effective communication and management of the information needed not only by responders and incident commanders but also by the media and general public); (d) Command and Management (coordination of the unified command and multi-agency operations required under ICS (Incident Command System) guidelines;

and (e) On-Going Management and Maintenance. These five major goals are the fundamental elements essential for effectively managing any challenge, from any cause, anywhere.

A Key Resource: The U.S. National Guard

In assessing whether the NIMS is applicable to CBRNE scenarios, it is important to first determine what resources are likely to be readily available for use in confronting and managing CBRNE emergencies. Fortunately, a primary resource that is immediately available within each state is the National Guard, which provides operational support in the form of a Civil Support Team (CST) and/or a CBRNE Enhanced Response Force Package (CERFP) – either or both of which can be mobilized within hours following an official request through the appropriate state channels.

The composition of the nearest/most immediately available CST and/or CERFP may differ slightly from one state to another. However, the core composition of a CST is typically about 20 full-time National Guard and other personnel who have been highly trained to the HazMat Technician level, at a minimum. The CST is equipped for rapid mobility and carries state-of-the-art systems and other equipment needed to assist in the detection and threat assessment aspects of CBRNE situations.

The typical CERFP, on the other hand, which can provide more than just CBRNE operational assistance, is composed of a larger number of personnel trained and prepared to provide what is officially described as "Defense Support to Civil Authorities" (DSCA). The CERFP resources are primarily intended, in accordance with federal National Guard Bureau policies, to provide direct support to local and state emergency-responder agencies and organizations.

In order to meet these responsibilities and acknowledge the commitment of state and local emergency response resources to conform to the NIMS policy and operational tenets, the National Guard Bureau issued a policy in 2004 that all state National Guard units will be "NIMS Compliant." To meet that goal, these units have been aggressively training to facilitate the effective integration of National Guard resources with those available to state and local emergency response units.

Despite the claims voiced by some critics, the National Incident Management System (NIMS) was not created in a vacuum and is not intended to be limited to certain types of mass-casualty situations. In fact, it can be particularly effective in managing CBRNE events.

For example, by working in close cooperation with the Virginia Department of Fire Programs and Department of Emergency Management, Virginia's Guard personnel have received, at the minimum, the Introduction to NIMS (IS-700) training required and the core ICS training (ICS-100 and ICS-200). In addition, the Virginia Guard's officers and supervisors have also received Intermediate ICS (ICS-300) training, and commanding officers have received Advanced ICS (ICS-400) training as well.

In most operational situations, local emergency management services, fire, law enforcement, and/or other emergency responders will have been at the incident scene – and conducting some type of operations – prior to the arrival of the first CST or CERFP units. For that reason, it should be emphasized that an important principle of the National Guard philosophy is that the Guard will provide *support* to civil authorities within the ICS framework rather than simply assuming command of operations involving CBRNE threats. According to Lieutenant Colonel William Patton, Commander of the Virginia Guard's 34th Civil Support Team, "CBRNE incidents are well within the All-Hazards approach [as defined in the NIMS]." It is in that context, he added, that "We work for the police, fire, or other incident commander when we [the Guard units] are tasked to respond to a local incident."

Operational, Supervisory & Technical "Backup"

Whether in a weapons context, a terrorist scenario, or simply an accident involving a hazardous commodity or product, CBRNE materials remain, first and foremost, hazardous materials. As Major Shawn Talmadge, Chief of Current Operations at the Virginia National Guard's Joint Operations Center, described it: "Our approach to the management of incidents involving weaponized agents is similar to … [the approaches typically] used in traditional hazardous materials responses."

Moreover, although a CBRNE response is almost automatically considered to be a unique security threat, management of the tactics, personnel, and resources is fundamentally the same as dealing with "routine" incidents. What this means, essentially, is that incident command will involve: (a) the designation of the same command and general staff (as necessary under the circumstances); and (b) the assignment of appropriate supervision for the tactical resources required.

The bottom line is that today's National Guard personnel are trained, equipped, and philosophically prepared to support the incident commander as needed in either an operational or supervisory capacity. Typically, CST or CERFP resources arrive on-scene fully prepared to function in an operational capacity. However, they also can be assigned as technical specialists for planning activities, or even for intelligence gathering and investigations. Moreover, because National Guard personnel also bring with them their individual "day-job" capabilities, they may have expertise in such fields as logistics, finance and administration, and/or planning, and therefore can augment local personnel in these functions when needed. In Talmadge's words, National Guard personnel can be considered "another asset on call." In that context, National Guard personnel can serve as a unique value-added resource pool that is ready and able to augment the local resource inventory. By functioning within the framework provided by NIMS, the National Guard units, and individual members, can integrate themselves more readily into the overall response effort.

Incidents involving CBRNE materials generally cannot be considered "ordinary" events or everyday risks. Although local emergency response resources may be prepared to confront and resolve many incidents using local resources, CBRNE incidents of any type or magnitude present unusual challenges that may require integration and coordination with other more highly specialized resources such as a CST or CERFP. The NIMS guidelines provide an operational template by which additional and sometimes uniquely specialized resources can be made available to support the response effort.

As proponents and practitioners of the NIMS and the ICS philosophies, National Guard members are another valuable asset already available and well prepared to integrate its capabilities to support the nation's overall efforts to prevent, protect against, mitigate, respond to, and recover from a CBRNE threat. Despite criticisms leveled at the NIMS, the doctrine's core concepts still provide a comprehensive and well-articulated "roadmap" to available resources, which can be used effectively to meet the unique challenges facing "National Preparedness" and "Management of Domestic Incidents."

Stephen Grainer is the chief of IMS programs for the Virginia Department of Fire Programs (VDFP). He has served in Virginia fire and emergency services and emergency management coordination programs since 1972 in assignments ranging from firefighter to chief officer. He also has been a curriculum developer, content evaluator, and instructor, and currently is developing and managing the VDFP programs needed to enable emergency responders and others to meet the NIMS-compliance requirements established by the federal government for incident management. In 2010, he was elected President of the newly established All-Hazards Incident Management Teams Association.

Countermeasures to Cope With Radioactive Exposure

By Craig Vanderwagen, Emergency Management

The threat posed by an intentional manmade explosion from a radiation dispersal device, a nuclear detonation, or an accidental failure of a nuclear power plant persists. Recent events have brought these threats into focus over the past couple years – e.g., the Iranian plans for nuclear development and the earthquake/tsunami/nuclear radiation event in Fukushima.

Emergency managers have not lost sight of radiological/ nuclear threats in their planning processes and are aware of the public perception that some of these events may be existentially threatening and perhaps not survivable. However, considerable progress in coping with such events has been made and emergency managers can now more affirmatively ensure that future responses and post-event recovery will be more effective.

Radioactive Threats Posed by Terrorists

In 2009, the Obama Administration announced several changes in the U.S. nuclear posture, with the primary intent of reducing the nuclear threat to domestic and global well-being. President Barack Obama highlighted the threat posed by state actors, armed with nuclear weapons, who may pose a global threat. As part of the revised policy, there was prominent acknowledgment of the threat from non-state actors, an observation that instigated a new focus on prevention of a terrorist-delivered nuclear detonation. The timeliness of this policy change was significant, as were the subsequent efforts to ensure that such catastrophes never occur.

The intent and capability of al Qaeda and/or other terrorist organizations to obtain and use weapons of mass destruction is well documented – even in the stream of unclassified information available to the general public. Intelligence officials and scientific experts have testified that, despite the death of Osama Bin Laden, there is still a significant chance of a similar event occurring within the next five years. However, prevention capabilities may have limits, and the 2009 policy statement did not publicly address the most serious issues of response and recovery should such an event actually occur.

Various credible and respected groups have analyzed not only the threat potential but also the preparedness status of local, state, and federal agencies to cope with such threats, and have consistently reported that most Americans are unprepared to deal with these events. Currently, there are simply not enough medical facilities, trained personnel, or medical supplies in place to treat all of those who could potentially be injured from the detonation's blast and burn effects.

In addition, there are no proven medical countermeasures available to prevent or lessen the severity of the toxic effects of what is termed Acute Radiation Syndrome (ARS) – i.e., reduction in the human body's blood-producing and infection-fighting capacity at even relatively low levels of exposure, and/or the more harmful effects on the gastrointestinal tract and the brain at higher levels.

Nuclear Power Accidents

The 2011 Fukushima disaster in Japan exposed another significant vulnerability in the threat posed by radiation disasters – more specifically, nuclear power generation. In Fukushima, the multiple failed attempts to prevent the release of radiation materials from the core of a reactor led to the widespread exposure of citizens in the vicinity to radioactive iodine, cesium, and other heavy metals. The global social impact of that event raised greater safety concerns about nuclear reactors being used as an energy source. Nonetheless, nuclear power generation will almost assuredly continue for the foreseeable future as a viable use of nuclear technologies, thus presenting a persistent challenge to responders.

Fukushima also revealed a significant lack of the technological tools needed to address the public health and medical impacts of radiation exposure, particularly one caused by the breakdown of a nuclear power plant. Although potassium iodide was pre-staged, there were few other intervention possibilities available. That failure in preparedness created a panic environment – as citizens realized there were few alternatives available to prevent and treat exposure-related diseases, it was difficult to quell the anxiety. Political decision makers around the world now realize that much more must be done to create a sense of survivability and resilience in the populations at risk.

Although the scope and nature of the radiation exposure from a deliberate terrorist detonation differ somewhat from the effects of an accidental nuclear explosion, both scenarios have a common element: namely, the historical lack of the tools needed to prevent and treat exposures to ionizing radiation.

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Intensive ionizing radiation wave energy, which is released during a nuclear blast of any type, causes immediate damage to human body cells. In a nuclear facility accident, the exposure is more commonly associated with the radioactive elements that are being inhaled, ingested, or otherwise absorbed, thus continuing to emit radiation either on or inside the body.

Both types of incidents can cause ARS. Exposure to ionizing radiation during an event, particularly a nuclear detonation, can be mitigated to some extent by certain shelter-in-place approaches. However, there is little available to treat those who have been exposed to quantities of ionizing radiation large enough to cause various forms of ARS.

Current Approaches Available

The severity and scope of illnesses associated with exposure to ionizing radiation depend primarily on the total level of radiation absorbed over a short period of time. The initial ARS effects may be as simple as fatigue, nausea, and vomiting, but can progress to an increased risk of bleeding, an inability to fight infections, and ultimately neurological and respiratory damage leading to death. Long-term, low-level exposures also can cause cancer and/or other diseases, whereas short-term, high-level exposures also lead to severe life-threatening illnesses.

Accidents at nuclear power plants and deliberate releases of radioactive material are two examples of a growing threat that requires careful planning and effective countermeasures to combat the potentially devastating effects.

In medical terms, radiation exposure is usually measured in what are called "grays" – i.e., the amount of radiation actually absorbed, as opposed to the ambient radiation in the environment. The short-term exposure to levels above 1 gray causes changes in: (a) the bone marrow; and (b) the ability of the body to produce blood cells. This lowers not only the number and capability of the red cells that carry oxygen, but also the platelets necessary for clot formation and the body's infection-fighting white cells. In Fukushima, all of the patients examined were reported to be below this level of exposure.

When the exposure/absorption rises to 3-6 grays, the gastro-intestinal system is affected. In essence, the cells lining the stomach and intestine are killed and slough off, causing bleeding and the inability to digest nutrients. Moreover, as exposure continues to climb, the lungs, skin, and brain also are affected, thus causing a simultaneous failure of many of the body's vital systems. Anyone within one mile of a 10-kiloton nuclear detonation is likely to receive this level of exposure/absorption. The risks are progressively lower (depending on the fallout cloud pattern) as the distance from the detonation increases. In nuclear facility accidents, however, it is unlikely that many, if any, people in the area would absorb a level of radiation that high.

Because exposures related to nuclear power plants are more frequently associated with the ingestion of radioactive materials, one strategy recommended for preventing illness, and/or reducing the exposure over time, is to speed the elimination of radioactive materials from the body. This can be accomplished through the use of chemicals that bind the radioactive material and move it through and out of the body before it can attach itself to any vital cells. The chemicals used in this process are generally described as "chelating" agents – i.e., agents that bind to the materials through a chemical process and are swiftly eliminated through the kidneys (or gastrointestinal tract).

Potassium Iodide is the best known agent used in radiation exposure protection, but is not a chelating agent per se. Instead, it simply saturates the body with stable iodine and, by doing so, prevents radioactive iodine from being absorbed. Among the best known of the true chelating agents are such drugs as Prussian Blue (which binds cesium) and CaDTPA (which is effective in binding platinum, americanum, and curium). These chelating agents are not useful as treatments for ARS, but: (1) they can reduce ongoing radiation exposure; and (2) are widely available for use. Although they present certain challenges in administration and have potential side effects, they would still have a clear role to play in certain types of radiation exposure events.

Exposures to waves of ionizing energy cause immediate changes in cells that can quickly lead to cell death. One strategic approach used in drug development for ARS focuses on interrupting the cell-death process. Fortunately, scientific research in the late 20th century led to an improved understanding of the pathways that lead to cell death stimulated by radiation exposure. Capitalizing on these theoretical and laboratory-developed insights, drug developers have conducted animal studies using various compounds that may inhibit or halt the cell-death process. These compounds hold promise for preventing the development of ARS despite a significant absorption of radiation.

Advanced development research in mice and non-human primates (i.e., monkeys and apes) also has shown great promise. In some studies where large numbers of non-human primates were exposed to >7 grays (a level that usually would be expected to kill 60 to 70 percent of hosts), the compounds saved more than 70 percent of the animals when used within 24-48 hours of exposure. Many additional studies on the human-safety aspects of such products are still required to ensure that the drugs do not cause unacceptable side effects in humans, but those products seem to be quite promising in providing protection, particularly when administered in a single dose within a short time after exposure. There also seems to be less need for medical monitoring and/or clinical service support, which could reduce surge on the medical delivery system. Of course, more studies must be completed to demonstrate the most appropriate use of these compounds as well as the safety implications, but some of the compounds may be available for use as early as in the next 2-3 years.

Other & Better Drugs Now Being Evaluated

Another approach currently being explored involves the study of drugs that may stimulate a quicker recovery of the blood-forming elements of the body after their destruction by radiation. It is known that some drugs currently in use for cancer therapies can stimulate the development of white and/or red cells after the destruction of the body's own capability to do so. One class of drugs being studied closely for use in radiation-exposure situations is called Granulocyte-Clone Stimulating Factors (G-CSF), which has been used for many years to restore the body's own immune-system capabilities following the use of cancer or transplant therapies.

Other studies also are being planned to assess the use of these drugs as therapeutic tools in the wake of a nuclear or radiation event. The advantages provided by the use of G-CSFs are that: (a) they have been in use for many years; (b) their side effects are well understood; (c) the medical management protocols needed already have been established; and (d) the daily use of these drugs will reduce the need for a separate stockpile supply. The disadvantages discovered thus far include: (a) multiple doses are needed for them to work; (b) they require frequent medical evaluation and supportive medical care; (c) they address only the radiation effects associated with the blood-forming functions of the body; and (d) they may be able to provide only supportive care for people exposed to more than 1-2 grays.

Significant Progress – But Several Questions Remain

After a nuclear event, hundreds of thousands of people may be exposed to radiation levels high enough to cause ARS, which can be quite lethal. The number exposed after a nuclear plant accident may be smaller, but still significant. The chelating agents described above can play a major role in reducing the overall number of deaths and serious illnesses. However, there are at present not enough medical facilities and/or staff that would be needed for full management of the health effects of a widespread population exposure to significant doses of radiation.

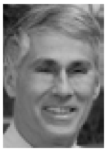
One approach for managing this problem is to identify or develop other drugs that may reduce the total number of deaths and illnesses caused by radiation. Ideally, these drugs: (a) could be given post-exposure; (b) would require fewer doses; and (c) would need little in the way of medical follow-up. Such drugs are currently in the research stage, but have not yet received full safety and efficacy approval. However, advanced development is underway for other promising compounds that also may be effective in countering radiation. Moreover, some drugs that are already available for other uses may be able to address certain aspects of the ARS syndrome.

These ongoing developments are a significant cause for optimism about the survivability of those exposed to radiation in a future nuclear attack or accident. In addition to their current public information strategies and sheltering approaches, emergency management personnel should closely monitor the progress achieved in developing countermeasures. After all, a belief in survival is, in itself, frequently a significant factor in both response and recovery.

Craig Vanderwagen, M.D., is a Senior Partner with Martin, Blanck, and Associates (MBA). His most recent government post prior to joining MBA was as Assistant Secretary for Preparedness and Response, 2006-2009, for the U.S. Department of Health and Human Services (HHS). Dr. Vanderwagen has a special interest and significant experience in biodefense, domestic disaster preparedness and response, international humanitarian and disaster response, federal health delivery systems, innovative organization development and evaluation, and cross-cultural healthcare.

Hospitals Must Prepare Now for Future Contingencies

By Theodore Tully, Health Systems



Considering the financial constraints already in place, and the likelihood that there will be continuing reductions in federal grant funds for preparedness, the challenge facing U.S. hospitals and other healthcare facilities to do more with less has perhaps never been greater. More specifically, in preparedness planning and operations, very few U.S. health systems are financially stable enough to be able to stockpile materials, and/or train personnel, with the funds available from "discretionary" budgets to the extent that the health systems themselves feel reasonably comfortable and/or fully prepared for the next major mass-casualty incident or event.

Making the situation worse is that one unexpected byproduct of a long-term lull in disasters often might be an understandably lower focus, by hospital administrators, on future "what if" emergencies. Even when not faced with a pandemic flu, a natural disaster, or a terrorist event in the foreseeable future – events that might never happen – hospital CEOs must still cope with the problem of balancing shrinking revenue against the cost of routine daily operations.

In those circumstances, a request from the hospital CEO to cut budgets by another 15 percent, or face layoffs, will almost always receive greater and more immediate attention from administrators than would the less likely possibility of a "dirty bomb" explosion in New York City's Times Square. The real question then becomes this: "How do hospitals continue to be ready for a major incident when their focus starts to wane?"

Acute Unplanned Events

Putting that question, and that problem, into clearer focus is the fact that one apparently deranged gunman, acting alone, opened fire in a crowded movie theater in Aurora, Colorado, on 20 July 2012, killing 12 and wounding dozens of others. That horrific incident served as a wake-up call to health administrators throughout the United States for many reasons – the most obvious being that it was clear proof that it does not take a hurricane, tornado, or a terrorist attack to seriously and immediately affect an entire community.

As has been seen in other recent mass-casualty events in various areas of the country – e.g., the Columbine, Virginia Tech, and Milwaukee Sikh Temple killings – mass-casualty incidents can happen anywhere and at any time. A community may not be able to stop such massacres from happening, but the preparedness level of that community can often determine how many victims will survive.

In Aurora, the hospitals involved in the incident, as well as the community's overall response system, reacted almost exactly as had been expected. Those in charge quickly put their preparedness plans in motion and effectively used their emergency training, which ensured a higher survival rate. By distributing the wounded to several hospitals in the area, rather than inundating a single trauma center, the Aurora first responders demonstrated, at least to some degree, that community planning efforts can be effective even in dealing with traumatic events that cannot be anticipated.

The community response also showed that hospital preparedness requires more than the willingness and ability of an individual hospital to plan and prepare for future contingencies strictly by itself. In today's world, the individual hospital must be developed within and incorporated into a much larger community-readiness framework.

Events Resulting in Service Loss

In some situations in which sudden events destroy and/or effectively close healthcare facilities, a larger support framework must step up to face the challenge. When there is an overall community-at-large plan in place to react to such events, the harmful effects can still be minimized. Hurricane Irene last summer put many hospitals up and down the U.S. east coast in harm's way and required some hospitals to temporarily close or evacuate.

The community support provided by other healthcare centers, as well as the community plans already in place to cope with such events, significantly minimized the hurricane's health-related effects. Moreover, the after-action analyses provided by the affected hospitals affirmed the consensus that hospital emergency planning, combined with the community emergency planning developed over the past decade, had a direct and positive impact on the eventual outcome.

Some federal and state emergency preparedness-grant deliverables, as well as some requirements for hospitals with the Joint Commission accreditation, have required not only that hospitals plan on a broader scale but also share their emergency plans with other hospitals, health centers, and first-responder agencies and organizations within their home communities. Compliance with these requirements is demonstrated through discussions, drills, and actual events and incidents. Time and again, community after-action reports point to planned preparedness as a primary factor in helping the hospitals involved react both quickly and effectively.

The Future Outlook for Hospital Resilience

Because of the projected decrease in or elimination of grant funding, many individual hospitals are left with the following choices: (a) fund their own preparedness plans; (b) cut back on the efforts (and funding) needed to prepare adequately; and/or (c) plan in ways that can allow several hospitals in the same general geographic area to share and mutually benefit from community-wide preparedness funding.

Some of the nation's larger healthcare systems already have been successful in pooling their hospital resources and allowing them to be used in a total-systems approach. In some areas, non-affiliated hospitals have formed emergency planning groups. New York State, for example, created a number of Regional Resource Centers that coordinate hospital preparedness in various regions throughout the state. In other states, hospital compacts have been developed that not only share equipment and pharmaceutical stores but also, in certain crisis situations, allow the emergency credentialing of medical personnel for working within and between different health systems.

The future will obviously challenge hospitals to strengthen their relationships with other hospitals and even healthcare competitors. Because emergency preparedness promotes resiliency within the healthcare system and does not actually give a competitive edge to individual hospitals, the opportunity and obligation to work together and share resources will almost assuredly continue to grow. With healthcare dollars becoming even scarcer, the voluntary increase in cooperation, combined with a joint community emergency response system, is perhaps the best way to ensure and improve hospital readiness.

Theodore (Ted) Tully, AEMT-P, is President of STAT Healthcare, an Emergency Management consulting group. He previously served as Administrative Director for Emergency Preparedness at the Mount Sinai Medical Center in New York City, as Vice President for Emergency Services at the Westchester Medical Center (WMC), as Westchester County EMS (emergency medical services) Coordinator, and as a police paramedic/detective in Greenburgh, N.Y. He also helped create the WMC Center for Emergency Services, which is responsible for coordinating the emergency plans of 32 hospitals in the lower part of New York State.

Protecting Responders From the Known & Unknown

By John Lazier, Standards

Responders put themselves in harm's way on a daily basis, often responding to emergencies with limited information. During the response, additional information is gathered and the evaluation of the situation continues with safety as a primary concern. One important safety aspect is ensuring that all responders are wearing the proper personal protective equipment (PPE) for the present hazard, regardless the task.

When responding to a possible terrorist or Chemical, Biological, Radiological, and Nuclear (CBRN) incident, the response can vary for each incident. For example, the R in CBRN stands for radiological, but implies ionizing radiation and radioactive materials that can include any solid, liquid, or gas that emits radiation. Therefore, it is necessary to identify the hazard and protect responders and receivers accordingly.

Breathing Clean Air – Standards for PPE

When encountering a CBRN incident, one priority is selecting the proper PPE to protect the respiratory system and prevent any contact or inhalation of the material. The National Institute for Occupational Safety and Health (NIOSH) tests and certifies respirators for occupational use and has a separate CBRN test and certification for Self-Contained Breathing Apparatus (SCBA), Air Purifying Respirators (APR), Powered Air-Purifying Respirators (PAPR), and Air-Purifying Escape Respirators (APER).

When selecting an SCBA, it is important to check for NFPA 1981 (Standard on Open-Circuit Self-Contained Breathing Apparatus) certification. However, the selection of an APR or PAPR is slightly more complicated. Each filter is designed to protect against specific gases at concentrations below IDLH (Immediately Dangerous to Life or Health) values. When a responder arrives on the scene, the hazard itself may be known but not the concentration. Therefore, it is important to err on the side of caution and utilize an SCBA until all unknown factors have been determined.

Vapor-tight suits are another PPE option for entering an area with an unknown hazard. Ensembles that are certified to NFPA 1991 (*Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies*) provide the most protection and have been tested and certified by an independent agency. In addition, decontamination teams and personnel supporting warm zone operations should wear clothing certified to NFPA 1992 (*Standard on Liquid Splash-Protective Clothing for Hazardous Materials Emergencies*) or NFPA 1994 (*Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents)*. Law enforcement personnel can also select PPE that meets NIJ Standard-0116.00 *(CBRN Protective Ensemble Standard for Law Enforcement)*.

It is important to note that various protective clothing for CBRN and hazardous materials operations are constructed from different materials. As such, manufacturers must provide test data on the performance of their various products against specific chemicals.

Finding the Right Products

With so many considerations to analyze, it can be a daunting task to determine which equipment best meets an organization's needs. In order to assist agencies in obtaining as much information as possible about responder equipment, the Responder Knowledge Base (RKB) was developed. The RKB is an online, integrated source of information on products, standards, certifications, grants, training, and equipment-related information that is funded by the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA).

More than 80,000 people – consisting of first responders, government officials, purchasers, and planners – use the RKB website to make educated purchasing decisions. More than 8,000 products can be found by going to the "Products" page of the website and searched based on the specific capability of a product and its related information: product type, manufacturer/organization, a standard related to a specific product, or a keyword in the "Search" field.

On the Product Details page, the Knowledge Links in the right sidebar provide specific information related to each product, including: training, certifications, standards, operational assessments, publications, safety notices, and other related products. Product information is provided by the manufacturers themselves in order to ensure accuracy and completeness of information. Products that are associated with the Standardized Equipment List (SEL) – a list of product categories that can be used for events that threaten the security of the nation – also will be identified in the Knowledge Links section.

The RKB provides the support that responders need to maintain their readiness for duty. By using the RKB, well-informed equipment purchasers can help organizations prepare their resources in the best way possible.

For additional information on:
The RKB website and CBRN resources, visit https://www.rkb.us

Assistance for using the RKB, contact the RKB Help Desk via e-mail at RKBMailbox@us.saic.com or by phone at 1-877-336-2752

John Lazier is a Subject Matter Expert (SME) for the Responder Knowledge Base website, the U.S. Department of Homeland Security/ Federal Emergency Management Agency's online source of information dedicated to First Responders. He provides perspectives on issues pertaining to Fire Protection, Hazardous Materials, and Emergency Management. He has served as a Firefighter/Fire Officer and Instructor for more than 22 years and has supported numerous U.S. Department of Defense and U.S. Department of Homeland Security responder-based projects over the last 9 years.

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Public Health Response & Severe Weather Emergencies

By Audrey Mazurek, Public Health

Public health professionals are constantly building the capacity and capabilities needed to respond to a variety of possible emergencies such as biological events, pandemic influenza, emerging diseases, manmade disasters, and a host of other dangers. It can be argued that weather emergencies over the last few years have become more severe and unpredictable, causing a major increase in the widespread damage that results. Because severe weather events and other natural disasters are the only such events almost guaranteed to occur several times a year across the United States, public health is playing an increasingly important role in the nation's preparedness, response, recovery, and mitigation efforts. In response to these and other natural and manmade hazards, the public health role during response efforts will continue to grow, evolve, and mature.

When extreme weather hits, first responders, faith-based organizations, non-profit groups, volunteers, private-sector businesses, and other community partners mobilize to respond and ensure a quick recovery with minimal disruption to lives, property, and the environment. Weather emergencies and natural disasters have outcomes that public health professionals are not only legally charged to address, but are often what they already do every day.

The U.S. Centers for Disease Control and Prevention (CDC) lists on its website the following types of natural disasters and weather emergencies: earthquakes, extreme heat, floods, hurricanes, landslides and mudslides, tornadoes, tsunamis, volcanoes, wildfires, and severe winter weather. The public health response to these events is focused primarily on mitigating their effects and outcomes by: preventing disease and injury; responding to food, water, and sanitation concerns; controlling the damage caused by animals and insects; ameliorating environmental problems; coping with power outages; providing the special care needed by at-risk/vulnerable populations (e.g., pregnant woman; children; the elderly; those suffering from asthma, cardiovascular problems, and/or other respiratory diseases; and persons living in rural and/or isolated areas); helping those stressed by trauma and disaster-related mental health problems; educating the public on emergency preparedness matters in general; and promoting both individual and community resilience.

Public Health's Role in Natural Disasters

In the years since the unprecedented destruction caused by Hurricane Katrina in 2005, numerous reports have been written about the frequently inadequate response and recovery efforts of the various agencies responding at that time; somewhat less discussed are the public health implications that follow such disasters. One area that public health specifically responds to during and after hurricanes involves the damaging effects of flooding and heavy rainfall. These can often lead to and/or exacerbate, among other problems: sewage overflows that might quickly and easily contaminate the food and water supply; an increase in the dangers caused by waterborne parasites; and storm-water runoff that contaminate community water supplies.

In California, to cite another example, environmental health concerns prompt quick public health responses during wildfires. The 2008 wildfires that ravaged both northern and southern California were particularly devastating, leaving many citizens injured and several communities partially or totally destroyed. Public health is particularly concerned with the dangerous effects of wildfire smoke, for example: an increase in fatalities; the aggravation of pre-existing respiratory and cardiovascular diseases; the dangers posed by carbon monoxide exposure; and other problems, particularly in at-risk/vulnerable populations.

In 2010, two years after the wildfires disaster, the nation's Mid-Atlantic States experienced the same type of problem, but in reverse – namely, the extremely severe back-to-back snowstorms, now known as "Snowmaggedon," that forced epidemiologists to quickly assess and evaluate the acute and chronic health effects caused by human exposure to extremely cold temperatures. The authorities in charge quickly realized the need to operate public shelters and to ensure that the organizations that serve at-risk/vulnerable populations were provided the resources required to carry out their mission. One typical example that could happen anywhere, in any country, is when a weather emergency prevents dialysis patients from receiving their scheduled treatments, thus creating major problems for emergency medical services agencies, the community's overall healthcare system, as well as the individual patients directly affected.

Double-Duty Thermometers – Different Degrees of Danger

In addition to extremely cold temperatures, extreme heat also requires not only an epidemiological response but the expenditure of material resources as well (to operate air-conditioned shelters, for example). Moreover, although providing mass care is not necessarily the direct responsibility of the health department, public health plays an integral role in providing resources, staffing such as doctors and nurses, various types of health services, and facility inspections. In addition, epidemiological surveillance and monitoring tracks potential health-related changes and patterns and, using that information, can help determine what additional resources might be required and then plan an appropriate response.

Disaster epidemiology also focuses specific attention on such topic areas as acute and communicable diseases, environmental health, occupational health, chronic diseases, injuries, and mental and behavioral health – all of which are separate aspects of a continuing effort both to assess the short- and long-term adverse health effects of various types of disasters and to predict the likely consequences of future mass-casualty events and incidents.

The summer of 2012 was hotter than usual, but whether it was a major exception or a "new norm" has yet to be determined. Nonetheless, almost *every* year, heat waves cause the most common weather-related deaths, usually from heat stroke and dehydration, throughout the country. Higher air temperatures also often increase the number of cases of bacteria-related food poisoning reported and, in 2002, even created a new strain of West Nile Virus.

In ways similar to those used in charting any other weather emergencies or natural disasters, studies show that certain at-risk/vulnerable population groups are more vulnerable than other citizens to weather-related illnesses. The Chicago heat wave of 1995, for example, actually resulted in the deaths of over 700 people in those same statistical categories. Public health departments, of course, are charged with the responsibility of identifying, reaching out to, and coordinating the medical services required by these and other at-risk/vulnerable populations.

Learning From Yesterday To Improve Future Planning Efforts

Hurricane Katrina forced emergency managers and a broad range of first responders along the Gulf Coast to rethink their short-term as well as long-term preparedness and response plans. Public health departments across the country, along with federal and state government agencies, also planned and carried out major public outreach and education campaigns to promote both individual and family preparedness. In addition, numerous public health emergency preparedness programs were established specifically to address such closely related topics as mass care, fatality management, medical surge, environmental health and safety, healthcare for at-risk/vulnerable populations, and behavioral health needs – before, during, and after a major disaster.

Many of the preparedness plans created during that busy period were tested, revised, and updated by and for the various jurisdictions along the East Coast that responded to Hurricane Irene in 2011. Although Irene was not as devastating as originally anticipated, it did cause widespread flood damage, required several closures of mass transportation hubs and the evacuation of a number of New York City neighborhoods, and precipitated some massive power outages.

Irene also reinforced the need for public health agencies to develop and/or update their previous plans for shelters, the continuity of operations, and responder safety and health. One of the more important national areas of responsibility it reinforced was the need for a public health presence (as spelled out in the Federal Emergency Management Agency's *Emergency Support Function #8 – Public Health and Medical Services Annex*) at emergency operations centers.

In June 2012, the Mid-Atlantic and Midwestern United States were hit by unexpected, fast-moving, and extremely powerful thunderstorm complexes called a *derecho* (a wide-area windstorm associated with a fast-moving line of thunderstorms). In the greater Washington, D.C., area, more than one million residents were left without power for days. Thanks to the lessons learned from previous emergencies, and from a number of effective training exercises, the overall public health response to the storm was fairly quick, and the collaboration with traditional first-responder agencies was immediate.

The public health emergency-preparedness agencies in all jurisdictions in the D.C. area received well-deserved praise for their performance in: (a) quickly and effectively activating their Emergency Operations Plans and the Incident Command System; (b) working long hours, at a high level of intensity, in various Emergency Operations Centers; (c) testing and validating their Communication and Information Sharing Plans; and (d) in certain areas, implementing their Public Health Mass Care/Shelter Plans.

Foreseeable Future of Public Health Responses

Clearly, weather emergencies of all types will continue to occur – and to validate the need for various types of special resources and operational capabilities. As a still fairly new and continuously evolving component of national preparedness, public health emergency preparedness (PHEP) programs must continue to use the lessons learned from previous weather events to improve their current and future preparedness and response efforts.

Although public health has successfully taken a more forward role in some emergency planning, preparedness, and response efforts, an even greater focus is still needed. Among the more important guidelines needed to ensure that PHEP programs can effectively build and sustain the community-wide communications, cooperation, and overall resilience needed to cope with all likely hazards are the following:

- Continue to engage with partners and to participate in jurisdiction-wide and/or regional preparedness planning groups (e.g., healthcare coalitions, advisory committees);
- Ensure that public health leaders and managers, and local decision makers, are fully vested in PHEP initiatives – and in promoting the participation of all health department staff in planning efforts, training exercises, and a broad spectrum of response and recovery efforts;
- Use national standards – such as the CDC's *"Public Health Preparedness Capabilities: National Standards for State and Local Planning"* and/or the NACCHO (National Association of County and City Health Officials) *"Project Public Health Ready"* – in preparedness efforts both to ensure and enhance efficient and effective planning and to increase overall response capabilities;
- Use outreach efforts and partnerships (with members of the Medical Reserve Corps, for example, as well as those participating in other PHEP activities such as local Closed Point of Dispensing Sites) to continue to work with non-traditional partners such as the private sector and academia;
- Participate in and/or help coordinate exercises that test the specific capabilities most likely to be needed during future emergencies; and
- Take an active part in any "hot wash" reviews (which should be carried out after *every* major emergency) to ensure that: (a) the appropriate decision makers and other leaders are in attendance; (b) the lessons learned, particularly those related to public health, are included in the incident's After Action Report and Improvement Plan; and (c) that all of the "right people" (i.e., political leaders, budget managers, and other decision-makers) not only read such reports but also act upon them early and effectively.

In March 2009, public health officials coordinated evacuations, temporary housing, and healthcare for acute injuries as well as other long-term health risks – including hypothermia, bacteria, and mold – after heavy floods inundated several areas of North Dakota. In September 2009, public health partners worked together again – in the days and weeks after an earthquake and tsunami devastated many areas of Samoa, American Samoa, and Tonga – to ensure there would be an appropriate medical response. Those and other emergencies have shown the progress that public health has already made in establishing itself and proving the continuing need for an all-hazards approach to deal with such incidents. But there is still much more that has to be done.

For additional information on:
CDC's "Natural Disasters & Severe Weather,"
visit http://emergency.cdc.gov/disasters/

CDC's "Disaster Epidemiology," visit
www.cdc.gov/nceh/hsb/disaster/epidemiology.htm

FEMA's "Emergency Support Function #8 –
Public Health and Medical Services Annex," visit
http://www.fema.gov/pdf/emergency/nrf/nrf-esf-08.pdf

NACCHO's "Project Public Health Ready," visit
http://www.naccho.org/topics/emergency/PPHR/index.cfm

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Significant contributions to this article were made by Raphael M. Barishansky.

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EPA's Role in Domestic Preparedness

By Erica Canzler, Viewpoint

The terrorist attacks of 11 September 2001 and the anthrax attacks following shortly thereafter led to a significant expansion of the role played by the Environmental Protection Agency (EPA) in the prevention of, response to, and recovery from not only such attacks but also from natural disasters and other emergencies – especially chemical, biological, radiological, and nuclear (CBRN) incidents. To meet this expanded mission, EPA developed additional expertise in the area of CBRN research, response, and remediation through creation of what has become the CBRN Consequence Management and Advisory Team (CMAT) and the National Homeland Security Research Center (NHSRC).

> *The Environmental Protection Agency (EPA) shares its expertise to assist with a variety of hazmat incidents. Emergency management, remote sensing, and radiological and nuclear research are just a few of EPA's growing capabilities.*

The focus of both CMAT and NHSRC is to identify and close existing gaps involving key high-consequence/low-likelihood CBRN incidents. CMAT leads EPA's consequence management preparedness and response activities, which include environmental characterization, decontamination, clearance, and waste management efforts following CBRN incidents.

CMAT also is dedicated to providing 24/7 scientific and technical expertise to other agencies and organizations. NHSRC's scientists and engineers play a leading role in the development of innovative products and tools that result in numerous improvements in EPA's overall ability to respond to all phases of CBRN consequence-management activities.

Specialized Radiological & Water Expertise

EPA has several other highly specialized groups, including the Radiological Emergency Response Team (RERT). RERT provides advice and assistance related to: sample collection and monitoring; lab analyses; decontamination; site cleanup operations; waste treatment, storage, and disposal; data assessment and management; and risk communications. EPA also manages the nationwide RadNet system, which monitors the nation's air, drinking water, precipitation, and pasteurized milk on an ongoing basis to determine various baseline levels of radiation in the environment. RadNet has more than 120 stationary radiation air monitors in 48 states. Another 40 portable air monitors can be deployed anywhere within the country, as and when needed. The stationary monitors transmit near-real-time measurements of beta and gamma radiation 24 hours a day, seven days a week. RadNet has tracked radiation not only from atmospheric nuclear weapons tests but also from the 1986 Chernobyl (Ukraine) nuclear accident and the 2011 earthquake/tsunami/radiation disaster in the Fukushima area of Japan.

EPA's Regional Water Teams maintain limited capabilities to support emergency response efforts involving drinking water and wastewater utilities. One such effort, for example, involves the deployment of technical specialists at the regional response coordination centers (RRCCs), Joint Field Offices (JFOs), state emergency operations centers (EOCs), and/or other coordination centers.

Airborne Spectral Photometric Environmental Collection Technology (ASPECT)

EPA also is focusing greater attention on use of the remote sensing technology needed to detect and characterize radiological incidents. Remote sensing not only helps to minimize the potential harm to responding personnel but also optimizes use of the resources required to cope with such incidents. EPA's Airborne Spectral Photometric Environmental Collection Technology (ASPECT) program exemplifies the agency's philosophy by using an airborne sensor suite, which can be deployed within one hour of notification, to provide near real-time chemical, radiological, and situational data. The ASPECT program's standoff chemical and radiological detection capabilities, complemented by infrared and photographic imagery, can be made quickly available to assist local, national, and international agencies supporting the responses to hazardous-substance and/or radiological incidents.

ASPECT consists basically of a full suite of complex sensors and software, mounted in a twin-engine aircraft, and uses the principles of remote hazard detection to image, map, identify, and quantify a broad spectrum of chemical vapors and deposited radioisotopes. Airborne radiological measurements are conducted by using two fully integrated multi-crystal sodium iodide (NaI) and four fully integrated single-crystal lanthanum bromide (LaBr) gamma-ray spectrometers with a self-calibrating signal processor to generate a virtual detector output. Radiological spectral data, GPS (global positioning system) position, and radar altitude are collected at one-second intervals at all times during a survey. All of the radiological data accumulated is processed automatically through the use of airborne algorithms.

After the collection is complete, a broad spectrum of useful radiological products – including total counts, a sigma map, and an exposure map – is generated from the data collected. Concurrent high-resolution aerial digital imagery (both visible and infrared) also is collected and all products are quickly loaded into a geographical information system (e.g., Google Earth, ESRI, etc.). The data developed, which are validated by EPA's own "reachback" team, are typically ready for dissemination to the agency "customer" within about five minutes after collection.

Before, During & After – And for Many Years to Come

On the research side of the agency, EPA's NHSRC focuses special attention on radiological and nuclear remediation issues. The center is developing rapid methods for detecting radionuclides that require extensive chemical analysis, and focuses special attention on environmental matrices (soil, water, air filters), and the building of material matrices. The intent of using these highly advanced methods is to significantly shorten the time needed to characterize contamination after a wide-area radiological incident; additional methods for the decontamination of drinking-water infrastructure facilities are also being assessed.

In addition to these state-of-the-art (and beyond) programs, NHSRC is working: (a) to determine the usefulness of existing methodologies for waste minimization; and (b) to further develop other waste minimization processes – e.g., incineration, to significantly reduce the volume of waste contaminated with specific high-priority radionuclides (cesium-137).

Protecting public health and the environment before, during, and after a CBRN incident remains one of EPA's primary goals – and almost assuredly will be for the foreseeable future. EPA continues to focus planning and research efforts on CBRN incidents that impact cities, transportation facilities, water systems, sports facilities, and large outdoor spaces. Moving forward, EPA will continue to seek new opportunities to partner with other federal agencies, the state/local/tribal counterparts of those agencies, private industry, and the nation's universities. The continuing goal will be to leverage the cumulative knowledge and resources of each of those organizations in a multi-agency effort to address the nation's overall CBRN capability gaps and to improve operational readiness at the national level.

For additional information on:
RadNet, visit http://www.epa.gov/radnet

ASPECT, visit http://www.epa.gov/NaturalEmergencies/flyinglab.htm

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Erica Canzler is Director of the CBRN Consequence Management Advisory Team (CMAT) for EPA's Office of Emergency Management (OEM). The mission of CMAT is to provide scientific and technical expertise for all phases of CBRN consequence management and to maintain a 24/7 field response component. Prior to working with CMAT, she was the Homeland Security Coordinator for OEM. She received a Master of Arts degree in Government/Homeland Security with a concentration in BioDefense from Johns Hopkins University, a Bachelor of Arts degree in political science from Lafayette College, and a Certificate in Field Epidemiology from the University of North Carolina.

Additional contributions for this article were made by Eileen Mayer.

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Madhu Beriwal—IEM President and CEO Madhu with more than 25 years of experience in disaster and emergency management, homeland security, national defense, and the use of information technology.

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