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Staff
Martin Masiuk
Founder & Publisher
mmasiuk@domprep.com

Catherine Feinman
Editor-in-Chief
cfeinman@domprep.com

Kerri Kline
Project Manager
kkline@domprep.com

Carole Parker
Manager, Integrated Media
cparker@domprep.com

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Featured in This Issue

About the Cover: Chemical, biological, radiological, nuclear, and high-yield explosive (CBRNE) incidents require many considerations, which include public and mental health, safety and security, training and education, among other critical issues. By asking the experts what keeps them up at night, communities will be better informed as they prepare for a variety of emerging threats. (Source: ©iStockphoto/Rklfoto)

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The Things That Keep Experts Up at Night

By Catherine L. Feinman

DomPrep wanted to know what still keeps experts up at night. To answer this question, DomPrep hosted and Ron Vidal, a partner at Blackrock 3 Partners, moderated a panel discussion on 17 June 2016 at the Annual International Hazardous Materials Response Teams Conference in Baltimore, Maryland. This article summarizes that discussion.

Fire and hazardous materials (hazmat) teams train for responses to intentional and unintentional chemical, biological, radiological, nuclear, and high-yield explosive (CBRNE) incidents. Emergency managers and homeland security professionals try to predict these possible threats. Public health professionals monitor for any threats to life and health. Emergency medical services and hospital personnel prepare to treat contaminated and infected people. Emergency preparedness and resilience professionals face many emerging threats, which include but are not limited to:

- Intentional and unintentional disbursement of chemical agents
- Weaponized viruses and bacteria
- Radiological sources and exposure threats
- State and non-state nuclear threats
- Terrorist groups or lone wolves with high-yield explosives

Regardless the type of threat, one common concern was expressed by all panel participants when asked what keeps them up at night as they consider hazmat capabilities today compared to 5 or 10 years ago: In order to meet today's ever-changing threat environment, the next generation must be trained to the same or higher level as previous generations.

No Escape From Disaster

After the introductions of the panelists, Vidal began the discussion by pointing out that, "Before you, sits 250 years of collective experience across just about every spectrum of public safety. With vacations and time off, this equates to about 70,000 nights for the panel members to think about what keeps them up at night." This wealth of experience also brings a wealth of exposure to myriad stimuli, which poses challenges in addressing individual threats as well as many combinations of these threats.

Broad experience with civil unrest, train derailments, natural hazards, industrial incidents, and more gives Robert Maloney, emergency manager for Baltimore City, Maryland, a unique perspective when it comes to resource management and support. The intentional component adds a new dynamic to unintentional incidents. Maloney described how the challenges that emergency managers face as incidents occur with greater frequency or intensity are compounded by the fact that, "We don't have the luxury of turning off the TV."

The Incident Management System (IMS) is the standard framework for incident response, but effective incident management relies on people. Vidal raised the question about how to

build a good support system for the people responding to threats and hazards. Dr. George Everly Jr., co-founder of the International Critical Incident Stress Foundation, mentioned a staggering public health statistic about surge (increased demand for medical or psychiatric services), "Across disasters, on average, 25 percent of the civilian population will require some form of direct psychiatric intervention." Responders are also vulnerable, but on a different timeline. Everly stated that, "10 to 15 percent of responders have some measurable dysfunction or impairment (e.g., post-traumatic stress, job loss, domestic violence, divorce, suicides) as a result of working in significantly traumatic events." Incident response plans need to consider the physical and mental health and welfare of responders.

Conflicting Priorities

As threat profiles change, incidents are not just big-city problems. Joseph Leonard Jr. (commander, U.S. Coast Guard, retired), senior consultant of Global Preparedness and Crisis Management at the Center for Toxicology & Environmental Health (CTEH), described a train derailment of oil tank cars in a small Oregon town that resulted in cascading events including: fire; damage to a wastewater treatment plant and other critical infrastructure; responders directly affected by the incident or needing to care for their families; and outdated equipment. That scenario emphasized the significant new risks faced by small communities with limited resources and the need to include other groups in the response matrix, such as public works personnel as first responders. When faced with compounding and escalating problems, the needs of the whole community must be prioritized across the various combinations of responders.

On the personal side, responders are challenged with prioritizing between community and family needs. According to Erin Mohres, safety and security director with CNA, there needs to be a balance when incorporating emerging threats into a standardized approach, "One of the mistakes that responders see is changing direction and priorities based on what is in vogue at the time or seen in the media." With individual threats, there are many nuances to consider from the protection, planning, and response perspectives.

Mohres warned that planners and responders must be able to identify the real threats, which are not necessarily prioritized by public opinion. "It's about striking the balance. Figuring out how to meet the needs of multiple stakeholders, which we all have to do, but at the same time doing what you know is a priority based on your own experiences." One approach she suggested was to leverage requirements already in place, and then use those to integrate specific needs such as radiological/nuclear preparedness that senior officials may have to de-prioritize in an atmosphere of limited resources.

Perception vs. Reality

The interconnectedness of critical infrastructure, mobile networks, data centers, etc. can also have potential wide-scale implications for disaster response. An incident involving critical infrastructure could have far-reaching effects across the country. Christopher Wrenn, vice president of Americas sales for Aessense Corporation, noted that, for threat detection, one of the biggest issues is that, "Companies are just not going to be investing in homeland security because it is no longer a funding-rich environment that has the money to pay for new technologies. If one has to choose between paying for personnel or new product they

will pay for keeping their personnel. We can see dramatic shifts in the market with a big retraction both by Smiths and Environics to name just two."

Many people have become afraid of the wrong things, with the media portraying the nation as a hyper-violent place. Charles Bailey, assistant fire chief with the Montgomery County Fire/Rescue Service, described this concern as an "availability issue." He said that it feels like there are more threats because, "The world is more complex, interconnected, and tightly coupled than ever. You know about situations all over the globe you could not have known about in the past. In this way, it feels like there are more threats, but really, you just know more about the ones that were already there. People sometimes complain about a lack of imagination on the part of planners, as if their plans should have seen all the threats in advance, but it's not possible to imagine everything." There is a disproportionate impact based on the state of preparedness and resilience at any particular location.

Anthony Mangeri, director of strategic relations for fire services and emergency management and faculty member of the American Public University System, pointed out that risks have changed over time, "As funds diminish, many preparedness and response systems losing funding do not necessarily maintain the level of readiness from when funded." For managing unknown threats, Mangeri noted that emergency managers should not plan for events, "an incident may not fit the specific profile to activate a hazard-specific plan." Rather than planning for certain incidents, emergency managers should plan for consequences based on community factors that remain constant regardless the cause of the incident – for example, population, density, evacuation routes, and sheltering strategies.

With the media bringing attention to many problems that may have existed before but were not as visible, Maloney noted the sometimes unfair connection between job security and performance. "Unfortunately, the expectations when an incident happens in one place in the country and then happens to you – whether you are ready for it or have the money to prepare for it – your performance better be up to speed because, if not, you aren't going to be employed." This "perception vs. reality" is a challenge that agencies across the nation face.

Since it is not possible to plan for every threat, it is critical to consider the likelihood of threats, hazards, and risks within each community or jurisdiction. In doing so, resources, planning, and training can be applied where they are needed the most. Garry McCormick, battalion chief at Charlotte Fire Department, agreed that the causative events in the past, present, and future are not the same, but the commonalities for the consequences are similar – planning, evacuating, sheltering, etc. He noted that the key difference between response plans is the intent, "If you take the causative event out of it, the system is set up 'business as normal' for each community using an all-hazards approach, but what changes is the roles for each agency."

Technology vs. Critical Thinking

Emerging technology also raises threats in many areas. For example, Mangeri is concerned about the impact of technology on biologics, "As technology becomes cheaper and more accessible, the threat increases as those that intend to do us harm have access and means to attack."

Location also plays a role in severity of an incident. Glen Rudner, hazardous materials compliance officer at Norfolk Southern Corporation, described the concern he referred to as the "Tokyo or Japanese effect," which involves multiple simultaneous incidents (e.g., earthquake, tsunami, and nuclear incident), "We don't go far enough into our plans – such as mass evacuation and mass sheltering."

In urban areas, Maloney noted that public expectations during a disaster – such as grocery stores having food, phone service and electricity being operable, pharmacies being accessible and fully stocked – tend to be unrealistic. "In urban areas, the onus is on government to solve problems, but rural areas don't have the same expectations," he said.

When asked about statistical analysis, Mangeri stated, "Statistics plays a role the way triage plays a role in mass casualties. Triage and deployment of resources to do the most good is an essential part of emergency management. But understanding the threat and securing or developing the resources is also a major part of emergency preparedness."

Bailey made three interesting points on this topic:

- "Planning is a function that serves a primary socio-political role and is not necessarily directly tied in most cases to actual outcomes."
- "The western notion of a centralized command and control structure over a disparate number of emergencies is a failed notion and only begins to work on the consequence management side." Rather than imposing a structure on communities, he suggested that the focus should be on supporting the self-organization process that occurs naturally.
- "There should be less time spent writing detailed plans and more time learning how to assess the situation, how to make sense of what is happening, how to think, how the technology works, and how to communicate better."

Although several other panelists expressed disagreement with these points, there was consensus that a major concern for all planners is how to take care of citizens when an incident occurs. Everly warned that, "We have to be careful being hammers and seeing the world as nails," especially considering that, "compliance is essential when it comes to many of the threats we've been talking about." He continued, "The human vector becomes an essential extension of the contagion of that element whatever it is (panic, suicide, depression, and behavioral paralysis are all contagious)."

To address this issue, Everly worked with researchers to conduct a survey – published in 2013 in the *International Journal of Emergency Mental Health* – that defined five key questions that, if answered, would reduce 90 percent of public fear:

- What happened?
- What caused it?
- What are the effects?
- What are you doing about it?
- What are you doing to keep this from happening in the future?

He warned that, when these questions are not answered, people tend to make up their own answers. Once control of information is lost, it is difficult to regain it. In his experience working with survivors in 22 different countries, Everly noted that most people do not want government to fix the problem for them, but they do want the tools to fix it themselves, "Ultimately, our job is to empower people." As such, information sharing is critical.

Building a Legacy

On the topic of human resources, Wrenn expressed that the greatest CBRNE threat is a drain on training, as numerous hazmat professionals are promoted or retire. No magic technology can solve the problem, so incoming subject matter experts need to replace outgoing subject matter experts. As many "gray-haired people" retire, he urges young people by saying, "If you don't take the baton and run with it, shame on you."

According to Mangeri, this training challenge stems from "the way we have trained the past generation, with limited balance of critical thinking." He proposed that practitioners encourage ongoing training and remind people that a certification is just the beginning. Being experts on particular subjects requires basic understanding of the science behind these subjects, without becoming too dependent on the technology to do the thinking for responders.

Central to all of the things that keep the experts up at night is the people – those who respond and how they respond, those who are subject to the event and what to do with them, but Vidal noted, "Artificial intelligence and the machines that learn may be pushing us further apart. The nature of how people learn is changing."

"A simplistic view in training classes is that we've gone away from the basics," said Rudner. "The things that we learned as the 'gray hairs' and took for granted are the things that are extremely important learning points that are not being transferred to younger generations."

Although there was some disagreement on exactly what people need to know, Christina Flowers, U.S. sales account manager for BioFire Defense, summed up the solution as, "Nobody will know everything. The problem is when you make the assumption that you know everything there is to know, and you do not try to continue to learn more." If someone does not know how to interpret or understand something, they need to know who does.

The final challenge discussed was how to fill positions with people trained to an expected competency and level. In his 40 years as a college professor, Everly noticed that, "Kids today are just as bright as we were, but they are far more ignorant. They lack information (and experience). We failed to teach critical thinking. We have good test takers, but not always good thinkers. We now need to reintegrate not just the facts, but the thinking behind the facts."

As Mangeri explained this concept, "College is about learning why something occurs. Training is about applying what you've learned." And, the ability to effectively respond comes with experience applying knowledge in various situations. However, failure in training is acceptable when it allows people to learn and develop an understanding of the cause and effect of decisions. It is better to learn from such activities in training than in an active response.

The right combination of training, knowledge, money, and leadership can maintain continuity, but people need to take responsibility. People outside the incident response also need to have enough information. However, Mohres has found that, "There is an incredible amount of training materials for specific audiences. However, either the training is so high level that it dissuades you from wanting to learn more or it's so technical that nobody has the time. There needs to be a middle level of training material or technical assistance that the government officials, emergency managers, and homeland security people can use to better understand what the responders need." Training must be able to meet the needs.

Ongoing Challenges

So, to meet today's challenges, many things keep these experts up at night:

- There is a lot of pressure in emergency preparedness and resilience, so the thought of failure in the job and letting down coworkers or communities weighs heavy.
- Television and news outlets are not incentivized to tell the truth, thus often promoting fear and increasing consequences.
- So much information is available, but knowing how to use it and how to process it can paralyze decision-making abilities.
- Inaction at all levels of government and society expose societies to greater threats and consequences.
- As older generations retire, there is concern about who will be stepping up to fill positions and whether they will be ready to solve the ever-changing problems.
- The lack of understanding of biologics and integration of public health for highly infectious emerging diseases makes communities more vulnerable.
- Lack of integration and interoperability has been pushed but not implemented since 9/11, thus making response efforts less effective.
- There is a concern that someday organizations will have all the dots, but will not be able to connect them fast enough.
- Society cannot recover if the human element does not recover, but there is still a lack of understanding and appreciation of the human side of incidents.

Despite the above concerns, these subject matter experts also understand that potential solutions exist through better training, education, and leadership. The older generation needs to pass on their skills, knowledge, and training, and the younger generation needs to take advantage of every opportunity to learn more.

In This Issue

The authors in this edition of the *DomPrep Journal* address the concerns that keep them up at night with regard to CBRNE issues. George Everly leads this month's edition with the most important part of incident response: the people. CBRNE incidents introduce higher levels of stress and psychological toxicity that should not be ignored.

Education, training, and experience need to align with potential threats. Experience that is not passed on to younger generations, Christopher Wrenn warns, could hinder

the ability to maintain a steady state of preparedness. No city is immune to threats, but the nature of emergency management and the public's expectations are changing. Robert Maloney shares his experience of facing complex incidents that are sometimes compounded by simultaneous events.

Research on threats, hazards, and risks provides necessary information to help better prepare and equip communities for these growing complexities. For example, Erin Mohres and Darren Chen describe how to apply innovative approaches to prepare for radiological and nuclear incidents. Whereas, Joseph Leonard explains how a risk-based approach could help determine the appropriate level of training required for a particular area. Understanding the potential threats and learning how to spot suspicious activity could help save lives before a crisis occurs, as described by Jerome Kahan.

To ensure the proper level of response for an incident, Anthony Mangeri recommends categorizing hazmat teams based on their capabilities. The National Incident Management System is one tool used across the country to facilitate incident response. However, Charles Bailey points out that it may not be the best solution for every incident. Rounding out the issue is an article by Patrick Call describing the importance that manufacturers place on ensuring that responder tools are designed and function properly for use in hazardous environments. Addressing the things that keep the experts up at night should be the top priorities for any communities that want to ensure resilience for CBRNE and other emerging threats.

Special thanks to the following sponsors, panel participants, and writers who made this issue possible:
Charles Bailey, Assistant Fire Chief, Montgomery County Fire/Rescue Service
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Ron Vidal, Partner, Blackrock 3 Partners Inc.
Christopher Wrenn, Vice President of Americas Sales, Aessense Corporation

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Catherine Feinman joined Team DomPrep in January 2010. As the editor-in-chief, she works with subject matter experts, advisors, and other contributors to build and create relevant content. With more than 25 years of experience in publishing, she heads the DomPrep Advisory Committee to facilitate new and unique content for today's emergency preparedness and resilience professionals. She also holds various volunteer positions, including emergency medical technician, firefighter, and member of the Media Advisory Panel of EMP SIG (InfraGard National Members Alliance).

How to Address the Human Side of Critical Incidents

By George S. Everly Jr.

Most chemical, biological, radiological, nuclear, and high-yield explosive (CBRNE) critical incidents differ from more common hazardous materials (hazmat) events by virtue of four factors: broader scope, enhanced physical toxicity, malicious intent, and the potential to do the unimaginable. The net effect is new levels of stress and psychological toxicity.

When CBRNE incidents are specifically utilized in terrorist acts, however, the net psychological effects are even more toxic. It is important to remember that terrorism is psychological warfare. The true goal of terrorism is not to kill or destroy. The goal of terrorist incidents is to influence societal or governmental change by creating psychological terror. CBRNE terrorist tactics are merely enhanced means to the ultimate goal of creating psychological terror. If these assertions are correct, then an inescapable corollary emerges: greater efforts must be directed to preparing and fostering resilience among emergency and disaster response personnel in the face and wake of CBRNE incidents.

Shifting the Preparedness Focus

Frankly, the preparedness focus must expand from "things" to people – the human side of the enterprise. Recent neurological evidence illustrates that the most distressing incidents are not those that engender fear. Rather, they are those incidents that are unexpected and unimaginable. They are those incidents that break the rules, overstep boundaries, and violate the most deeply held beliefs. For such incidents, better psychological preparation is required. Sadly, advances in the physical side of preparedness have outshone advances in psychological preparedness . . . until now.

The future is promising. Building on cutting-edge neurological and psychological research, researchers now believe that humans have the ability to build psychological immunity to the debilitating effects of adversity (often called "psychological body armor") as

well as foster resilience (the ability to rebound from adversity) like never before. From the organizational perspective, and consonant with recommendations from the Institute of Medicine, organizations must learn to create a culture of resilience that employs resilient leadership training as well as resilience-oriented communications.

The steps toward *psycho-centric preparedness* (psychologically centered preparedness) seem clear. First, from the individual perspective, people must first acknowledge the extraordinary stress that first responders face, especially in the wake of CBRNE incidents. Information is power! Second, based on analyses of the neurology and psychology of such situations, preparedness and disaster response professionals must develop new neuroscience-based training programs for building personal immunity (psychological body armor) and resilience. With new insights revealed through analyses of the brain's dual cognitive processing mechanism, it is time to abandon reliance on concretized inflexible protocol-driven behavior. Rather, preparedness and disaster response educators must teach critical thinking skills that anticipate the unexpected and innovate and improvise to create new response options.

> ***"The goal of terrorist incidents is to influence societal or governmental change by creating psychological terror. CBRNE terrorist tactics are merely enhanced means to the ultimate goal of creating psychological terror."***

Psycho-Centric Preparedness Training

The final step is to educate preparedness professionals as to the existence of these new training technologies – for example, resilient leadership, psychological body armor, and resilience-based communication tactics, or *psycho-centric preparedness training*. Such training combines breakthroughs in neuroscience with critical thinking skills and resilience-based leadership and communication tactics. Only through including this new psycho-centric standard of care in public health preparedness and disaster response training will first responders and communities as a whole be best prepared to respond to a new era of critical incidents whether natural or human-made.

George S. Everly Jr., PhD, ABPP, FAPA, FAPM, CCISM, is an award-winning author and researcher. In 2016, he was ranked #1 published author in the world by PubMed in two fields: crisis intervention and psychological first aid. His paper on resilient organizational cultures was ranked #1 in its content domain by BioMed Library. He holds appointments as professor in the Department of International Health (adjunct) at the Johns Hopkins Bloomberg School of Public Health, associate professor (part time) in psychiatry at the Johns Hopkins School of Medicine, and professor of psychology at Loyola University in Maryland (core faculty). In addition, he is co-founder of the International Critical Incident Stress Foundation. He is considered one of the founding fathers of the modern era of the field of disaster mental health.

Plugging the Experience Drain in Hazmat Response

By Christopher Wrenn

As a metaphor for picturing the maintenance of preparedness, imagine a number of 5-gallon buckets, where each one represents some aspect of readiness – detection, personal protective equipment (PPE), communications, training, etc. Each bucket is filled with water and ideally each would stay filled representing a steady state of preparedness.

In reality, though, each of these buckets has a hole in it and they are all constantly leaking. Each bucket leaks at a different rate, and the hole sizes can vary unpredictably with time. The challenge is to keep each bucket from drying out. Unfortunately, the training bucket may be drying out for many response organizations. Specifically, detection skills are weakening across the first responder space. To examine the reasons for this loss of competency, the following success story illustrates how to move forward.

Passing the Baton

There was a lot of competency built up in the first responder space in the post-9/11 era. However, 15 years post-9/11, many of the professionals who honed their skills in the years after 9/11 have or are soon to retire and with them goes competency that many times is not replaced. For a number of reasons, it seems that the baton of gas detection expertise is not being passed onto the next generation. A lot of wisdom and knowledge is being lost.

In one scenario, a county hazardous materials (hazmat) team did a drill with a well-outfitted, well-trained, motivated, young federal response team. Before the federal team could finish turning on all of its cutting-edge detection technologies, the oldest guy on the county team had already solved the gas detection challenge of the drill using "old-school" colorimetric technologies. He was having a soda and resting before the new technology had even gone down range. Many hazmat responders reject colorimetric tubes as an old, unsophisticated technique that has a short shelf life.

When one gets "lost" during a challenging gas/vapor response, the *first* next step after common first-in five sensor multi-gas detectors should be tubes. There is a strong correlation between gas detection competency and routine usage of tubes. In a colorimetric tube course, entitled "The older I get the more I like tubes," when asked who has used tubes this year, mostly grey-haired students raise their hands. The lesson here is that sometimes older techniques and wise responders can beat youth and advanced technology.

Rotational Rules

As someone who has provided both product-specific and gas detection theory training to the hazmat space for over 20 years, true gas detection competency starts after five years of practice. One might be able to be trained to know how to turn on and run the wide array of detection technologies available to response teams in just two years of training. Truly understanding how a variety of detection technologies fit together in the big picture takes five or more years. One of the fundamentals about gas detection is that sometimes

the big picture is made up of many smaller pictures. However, organizations that rotate personnel at two- to three-year cycles make it difficult to maintain true competency because it is hard for them to assemble the big picture from many different technologies. They may not even know all the technologies they should be using. Wisdom is earned over time, not taught.

The "CSI Effect"

The CSI effect is a belief held by some that forensic science television dramas, such as *CSI: Crime Scene Investigation*, influence American jurors to expect more forensic evidence in order to convict defendants of crimes. In 2007, CSI Miami introduced a RAE Systems MiniRAE 2000 into its plot line for an episode ("A Grizzly Murder"). In that episode, the show overrepresented the photoionization detector (PID) to have the identification capabilities one would associate with a portable gas chromatograph/mass spectroscopy (GC/MS) device rather than the simple sniffer that a PID is in reality. As applied to the first responder/hazmat space, some people seem to believe that "magic" technological solutions can solve every problem. Reliance in this "magic" tends to be higher in younger generations rather than older generations.

Technology may even work against responders. Years ago, new hazmat team members were assigned the, potentially tedious, role of calibrating detectors by hand. This ultimately gave these people "muscle memory" from pushing the buttons and turning the dials of the detectors, and they gained competency and experience that ultimately benefited them during actual responses. They may have ultimately graduated to the role of the "detector person" for the team. With the advent of automatic calibration or "docking" stations, new team members do not gain hands-on experience during the relatively low-risk process of calibration. That calibration station is never going to graduate to become the detector guy!

The Ingredients to a Successful Long-Term Program

Throughout North America and the world, some programs are able to maintain a consistency of competency while others do not. Programs remain consistently good due to:

- *Money:* Ultimately, program success is based on money to pay for personnel, equipment, and training. More money makes it easier to remain successful.
- *Leadership:* Often a charismatic or politically connected leader can build a program and keep it going for years only to have it atrophy after their departure.

Massachusetts – A Success Story

An example of a state program that has consistently successfully maintained competency is the Commonwealth of Massachusetts (MA). In 1980, there was a phosphorous trichlorode spill in Somerville, MA, and the response was deemed less than adequate, which led to the

formation of a statewide hazmat response program. Now, 14 regional state response groups are available for hazmat response. Each responder receives a yearly stipend that counts toward his or her retirement. This provides both immediate incentive to conduct hazmat respond and a heavy incentive to stay with it into retirement. That way experience is not lost. Yearly training requirements maintain competency and the bar to enter is high. Yet, there is a waiting list to join the teams.

- Six Regional Response Teams are strategically located for a maximum of a 1-hour response anywhere in the Commonwealth. The regional teams also support local fire departments with technical information and specialized equipment.
- In 1982, the governmental officials created a task force to investigate the most uniform and cost-effective way to address hazardous materials emergency response. It was determined that a regionalized approach to response would be the most effective. The Commonwealth was then divided into six regions, by fire district, and a response team was staffed for each of the six districts.
- In 1994, through cooperative efforts of the Executive Office of Public Safety, Fire Chiefs' Association of Massachusetts, the Professional Fire Fighters of Massachusetts, and the Massachusetts Association of Hazardous Materials Technicians, a proposal was made to the state's administration and legislature for establishment of a funding mechanism to create a standardized regional response for the mitigation of all hazardous material incidents. A bond fund was issued for the creation of the program to establish a statewide, standardized, hazardous materials regional emergency response plan. The funding enabled the Commonwealth to provide state-of-the-art equipment and training.

Detectors Need Detectives to Make the Right Decisions

It is important to note that detectors are essentially dumb devices that sense and output a number. They are highly dependent on the person using the device to interpret numbers and make an educated assumption on what they mean. Even in the future (represented by the "Star Trek" TV shows and movies), they gave the tricorder to Spock, the science officer. Put another way, even the "magical" tricorder needed to be interpreted by the most intelligent person on the spaceship. Training, experience, and knowledge are the answer.

Christopher Wrenn is the vice president of Americas sales for AEssense Corp., a Silicon Valley developer and manufacturer dedicated to providing innovative technological solutions for plant growers worldwide. Previously, he was senior director of sales and marketing for Environics USA, a provider of sophisticated gas and vapor detection solutions for the military, first responder, safety, and homeland security markets. He was also a key member of the RAE Systems team. He has extensive experience teaching gas and vapor detection and has been a featured speaker at more than 100 international conferences. He has written numerous articles, papers, and book chapters on gas/vapor detection and received the following awards: 2011 "Outstanding Project Team Award," in recognition of outstanding service and dedication to the Real Time Detection Registry Team presented by the AIHA (American Industrial Hygiene Association) President; 2015, received the James H. Meidl "Instructor of the Year" award at The Continuing Challenge, Sacramento, CA presented by CA State Fire Marshal; and 2016, received the "Level A Award" from the International Hazardous Materials Response Team Conference "For your Leadership Service and Support to the Hazardous Response and Training Program." He can be reached at chriswrenn@att.net

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Innovative Approaches to Radiological/Nuclear Preparedness

By Erin Mohres & Darren Chen

Radiological and nuclear sources pose a wider variety of threats than many realize. By understanding the threat and leveraging federal requirements such as the Threat and Hazard Identification and Risk Assessment (THIRA), emergency managers can better equip themselves and their communities to prevent, protect against, and respond to incidents related to these threats.

In 2013, truck drivers were stopped at a gas station along the highway in Mexico when they were assaulted, and their truck was stolen. Unknown to the thieves, the truck was transporting a teletherapy machine for treating cancer, from a hospital in Tijuana to a waste-disposal site. The machine contained a Category 1 cobalt-60 source. Mexican authorities began a search and reported the theft to the International Atomic Energy Agency (IAEA). The radiological source was located days later in a nearby field; the capsule holding the source had not been opened, but it had been removed from its protective shielding. The strength of the cobalt-60 was reported to be 3,000 curies, strong enough to kill a person directly exposed to it. In this case, the thieves were located and determined not to have received dangerous exposure levels. The truck thieves in Mexico most likely had left behind the device after learning more about their stolen item, either from the warning labels or local news reports.

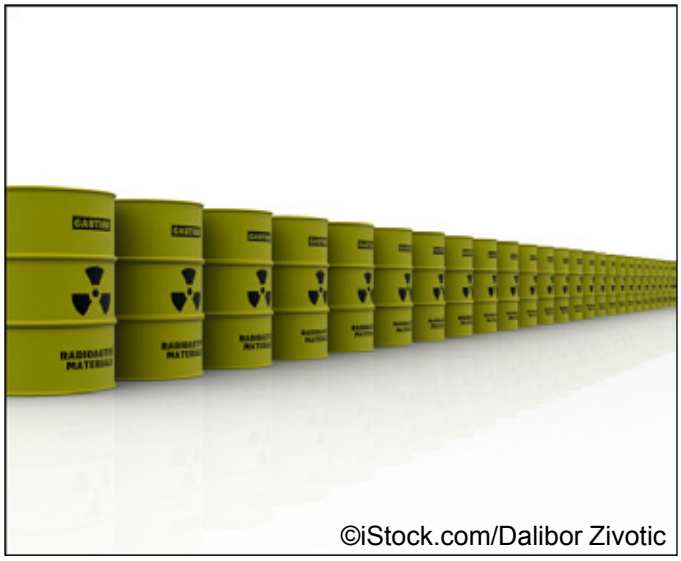
In the United States, public safety practitioners typically agree that consequences will be severe after an improvised nuclear device (IND) detonation, or even after a radiological dispersal devise (RDD) detonation, but there is often skepticism about the likelihood of the threat. Such skepticism poses challenges to state and local preparedness efforts. Increased awareness about IND/RDD threat and other radiological/nuclear-related incidents, as well as the pursuit of some innovative approaches to preparedness, may shed light on this often-overlooked set of threats.

The Threat

Legal sources of radiation that go missing. Legal, regulated radiological sources are more abundant than many realize. Radiological sources in medicine often use cobalt-60, cesium-137, or iridium-192. Major construction sites, research universities, and agricultural sites may also use sources of radiation, such as nuclear gauges, irradiators, and even reactors. In the United States, such sources are regulated by the Nuclear Regulatory Commission (as defined in the IAEA's Code of Conduct, Categories 1-5), based on their potential risk to human health if not managed appropriately.

Licensed radiological sources typically have specific security measures in place, but lost, stolen, or orphaned sources can be used in ways they were not originally intended, or can accidentally cause unintended consequences. Member countries voluntarily report thefts

to the IAEA. Although such thefts are relatively rare (especially thefts of Category 1 sources), these thefts do not need to be prevalent to warrant prevention and protection measures.



Intentional exposure. A former agent of Russia's KGB and its successor organization, the Federal Security Service, was granted asylum in the United Kingdom in 2000. He was a vocal critic of the Kremlin. In 2006, he suddenly became ill and entered a London hospital. His health steadily declined, and he died several weeks later. An investigation determined he had been poisoned by polonium-120, likely via a cup of tea. Traces of this radioactive material were discovered in London, Germany, Russia, and on passenger jets, resulting in hundreds of people needing (or wanting) to be tested.

This event has been unique in history, but its response required extensive public safety and medical resources from London authorities, including police to conduct searches and seal off a series of both public and private sites where radioactivity was found, forensics scientists to conduct sampling and testing, and public health and medical staff to test potentially exposed residents.

Insider threat. Simple online searches reveal a number of cases of insider threat in radiological/nuclear (rad/nuc) industries around the world, dating back to the 1970s, all of which could have had significant consequences. As both the threat itself and mitigation measures to combat such threats have evolved over time, a recent case at Los Alamos Plutonium Facility is interesting in its simplicity. In March 2009, a technician at the plant attempted to steal two ounces of gold used in research, which was worth approximately $2,000. The gold was contaminated with plutonium, and even though the technician attempted to decontaminate it, he set off a radiation portal monitor when trying to leave the plant. Had this attempted theft been successful, it could have posed a health threat to members of the public and required both a public safety and public health response. Fortunately, measures and processes were in place at this plant that prevented the successful theft.

Insider threat has become high profile in recent years. In fact, one of the outcomes of the 2016 Nuclear Security Summit that took place in April in Washington, D.C., was the Joint Statement on Insider Threat Mitigation, outlining a number of activities numerous countries will take "to establish and implement national-level measures to mitigate the insider threat." The case studies above are simply a sample of some of the types of rad/nuc threat that may be faced by state and local authorities in the United States. Next, resources are described that

may offer state and local government officials additional information on rad/nuc-related threat information.

Preparing for Rad/Nuc Events

In attempting to prepare for rad/nuc events, there is good news: a wealth of robust, technical resources is available to help agencies plan for and respond to such events. The challenge for state and local emergency management agencies is that navigating them and determining how to best incorporate them into local planning efforts is not always easy. It requires dedicated staff, ideally with background knowledge in this area and with sufficient management expertise to leverage existing governance structures and operations in an environment of scarce resources.

Key guidance documents. Literature abounds on rad/nuc topics, and rad/nuc response is a capability of many hazardous materials teams. For planners and emergency managers building new programs, a few sources that may be particularly useful include:

- *Planning Guidance for Response to a Nuclear Detonation*, 2nd edition, published in June 2010 by the Homeland Security Council Interagency Policy Coordination Subcommittee for Preparedness and Response to Radiological and Nuclear Threats. This document offers detailed planning information regarding shelter and evacuation, medical care, and population monitoring and decontamination. It organizes information by planning zones, helping emergency managers to understand what to expect and what actions to take within various distances of the nuclear detonation.
- *Response and Recovery Knowledge Product: Key Planning Factors – For Recovery From a Radiological Terrorism Incident*, published in September 2012 by U.S. Department of Homeland Security (DHS) Science and Technology. This document offers detailed planning information regarding public health and medical priorities, response operations, and waste management (among others). It also provides a detailed scenario based on a successful RDD detonation, along with narrative, map-based, and graphical information describing expected consequences.
- *Protective Action Guides and Planning Guidance for Radiological Incidents*, published in March 2013 by the Environmental Protection Agency. This document offers guidance to federal, state, and local authorities to inform decision-making regarding protective actions for the public, such as the need to evacuate, to shelter-in-place, or to avoid consumption of potentially exposed food and water. It is organized around phases, such as the early or emergency phase (hours to days after the incident), the intermediate phase (weeks to months), and the late or recovery phase (months to years, including site-restoration and cleanup). It takes practical considerations into account while incorporating scientifically based recommendations.

Case studies and modelling tools. Despite real-world rad/nuc emergencies being less prevalent than other threats – for example, natural hazards, or even improvised explosive devices – a few well-documented case studies provide insights and important details into what public safety officials might expect should their jurisdiction experience such a disaster, whether intentional or accidental. For example, in 1985, a private radiotherapy institute in Goiana, Brazil relocated, but it left behind a cesium-137 teletherapy unit in its old building. The building was subsequently partially demolished. Later, two people searching the site for scrap metal found the unit, took part of it home, tried to dismantle it, and ruptured the source capsule. Parts were then sold to a junkyard, some of which glowed blue in the dark, making it of particular interest to friends and family. After several days of passing this material around, exposed individuals became ill. Investigators identified the problem and its source, but in the end, several people died, and many others were injured, exposed, and evacuated. Over 100,000 people were screened.

"An investigation determined he had been poisoned by polonium-120, likely via a cup of tea. Traces of this radioactive material were discovered in London, Germany, Russia, and on passenger jets, resulting in hundreds of people needing (or wanting) to be tested."

Many safety measures have evolved since (and partially due to) this particular case study, which is still an important part of the knowledge base for any planner focusing on rad/nuc incidents. The IAEA prepared an extensive report on this event in 1988 titled, *The Radiological Accident in Goiana*.

In addition to applying case studies, modelling the impacts of rad/nuc events in a particular jurisdiction can provide more-detailed information on consequences that might have to be addressed. This may be beyond the capabilities or resources of many local jurisdictions, therefore, some pre-prepared modelling based on a set of assumptions – for example, a 10-kiloton improvised nuclear explosion – is publically available. In addition, useful, actionable outputs from models and studies such as those conducted by Lawrence Livermore National Laboratory and its staff can be found online.

The Domestic Nuclear Detection Office (DNDO). The volume, scope, and scale of rad/nuc planning and analysis resource material can be overwhelming, especially when an emergency manager is unclear how to judge the credibility of various sources, but help is available. The DNDO is a component of DHS and seeks to prevent nuclear terrorism by continuously improving capabilities to deter, detect, respond to, and attribute attacks, in coordination with domestic and international partners. It understands the enormous challenges faced by state and local agencies regarding rad/nuc threats – including potentially catastrophic consequences, coupled with significant resource constraints – and has invested in innovative approaches to support state and local agencies.

The Threat and Hazard Identification and Risk Assessment

As outlined in DHS's *Comprehensive Preparedness Guide 201* (CPG 201, 2nd edition in August 2013), the *Threat and Hazard Identification and Risk Assessment* (THIRA) is a four-step common risk assessment process that "helps the whole community . . . understand its risks and estimate capability requirements." Typically, states, territories, and major urban areas are required to submit an annual THIRA to the Federal Emergency Management Agency (FEMA), as well as tribes that receive homeland security grant funds. The THIRA may involve complex planning and analysis to be completed, including collection of input from multiple sets of subject matter experts and executive decision-makers.

DNDO identified that this requirement poses an excellent opportunity to support planning and analysis for rad/nuc scenarios. As such, it has developed a guidance document titled, *Assessing the R/N Threat: Guidance to Support the Assessment of Radiological/Nuclear Threats for Inclusion in the THIRA*. This document provides step-by-step instructions and examples to create rad/nuc scenarios and the corresponding core desired outcomes, impacts, targets, and required resources, organized by core capability, per CPG 201. DNDO also offers assistance directly to state and local agencies to explain, expand upon, and customize this guidance.

Fusion Center Support

Acknowledging that actionable rad/nuc threat information can be difficult to acquire, DNDO has engaged in multiple efforts to assist fusion centers and other state and local intelligence groups in accessing relevant real-world rad/nuc threat information and analysis. DNDO worked with the DHS Office of Intelligence and Analysis to prepare the *State/Regional Threat Assessment* report published on 4 September 2015 and is currently developing rad/nuc awareness training and technical assistance that will be available later in 2016. DNDO maintains the *Radiological/Nuclear Detection Guidance for FEMA Preparedness Grants* and manages the Joint Analysis Center, which provides threat information and products, among other assistance, to state and local partners.

For information about any of the DNDO products that support state and local rad/nuc preparedness described here, or for additional information about other DNDO support services such as training, exercises, and special event support, contact DNDO at dndo.sla@hq.dhs.gov

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Erin Mohres is a safety and security director with CNA, a nonprofit research and analysis organization. She supports U.S. Department of Homeland Security, Domestic Nuclear Detection Office programs and other federal initiatives focused on state and local emergency management efforts. She was an emergency manager for Miami-Dade County and the City of Fort Lauderdale. She received her MA in International Relations from the University of Miami and her BA in Political Science from the University of Illinois.

Darren Chen is a branch chief with the U.S. Department of Homeland Security, Domestic Nuclear Detection Office, and is responsible for developing national programs supporting state, local, tribal, and territorial radiological/nuclear detection capabilities. He was previously responsible for developing the Department's preparedness grant programs. He received his MA in homeland security and defense from the Naval Postgraduate School, his MS in crisis and emergency management from the George Washington University, and his BA in environmental sciences from the University of Virginia.

Where Incident Management Unravels

By Charles Bailey

The National Incident Management System (NIMS) is the mandated national framework for emergency incident management. It is a natural derivative of the Incident Command System developed in California after a particularly disastrous wildfire season in 1970. However, there are some notable reasons that it should not be considered the solution for all incidents.

NIMS is a mechanism for establishing control over events and for manipulating those events via a set of agreed upon objectives. Less obvious but equally important, NIMS represents a codified world vision – a thought process ostensibly applicable across the entire emergency response domain. Although space limitations preclude an exhaustive critique of NIMS, it may be instructive to consider where NIMS begins to unravel. This article addresses the validity of a universal application of NIMS across the full spectrum of emergency incidents.

Nonlinear Incidents

Not all emergencies are the same. They can vary in complexity and urgency by orders of magnitude. Emergency incidents can be described as the relationship between complexity, uncertainty, and resources. These three key factors are dynamic and the relationship between them varies. Time moderates each of the factors and the relationship between them. Time speaks to how long it takes for the causal relationships between the various factors to manifest. The relationships are complex but, given enough time, the relationships can be determined and moderated.

When it is possible to determine the boundaries of the event and to establish reliable causality between actions and outcomes – for example, the incident is not complex – and uncertainty is low, access to resources is the primary determinant of the ability to establish order. If complexity and uncertainty remain constant but resource availability is variable, outcomes will be negatively affected. Even perfect objectives and perfect execution are powerless in the face of inadequate resourcing. Given high complexity and low uncertainty, and an essentially unlimited supply of resources, the likelihood of success increases.

If the relationships inherent in emergency response interacted in the linear way described above – with the ability to isolate variables – then NIMS, with its emphasis on objective, forecast-based planning and hierarchical structures would be effective across the entire domain. However, the reality of emergency response is that these relationships have complex interactions and the variability of the key factors interacts in unpredictable ways.

The variability of these relationships demands that attempts at control by incident commanders be responsive, sensitive, and adaptable. Furthermore, the response organization has to be able to engage despite uncertainty, which requires:

- Rapid and continuous cycles of sensemaking and adjustment;
- The assumption that the current situational assessment is flawed along with the ability to maintain plans and resources in reserve to account for unforeseen contingencies; and
- Decentralized decision-making and the support of local initiative.

Static Assessments

The NIMS thought process rightly begins with an assessment of the situation. However, at some point and in order for the rest of the planning processes to occur, the assessment has to be accepted and acted upon. Once accepted and the team enters the "Planning P," the assessment becomes static. It has to become static or else it would be impossible to develop objectives, strategies, tactics, and the other administrative work required. However, the moment the assessment becomes static, there is an immediate disconnect between the reality of the central decision-makers and the reality of those executing the plan.

Any disconnect between the action and the central decision-makers is exacerbated when the relationships between complexity, uncertainty, and resources interact with time to create sudden nonlinear changes. NIMS requires the establishment of operational periods, usually 12 hours long, during which the accepted static assessment is adjusted by intelligence inputs and the objectives refined until such time as the assessment is required to become static once again. In every case, the incident has a "vote" and it typically casts that vote without regard for the plan or the limits of operational periods.

"During the initial phases of an incident when uncertainty is high, any attempt to apply the bureaucratic structures and processes of NIMS is likely to be counterproductive."

This reality does not mean that NIMS is a wasted cause, even when it is an operational period behind reality. It is both a wonderful tool and a wonderful thought process when it is applied at the right time and in the right context. The right time for NIMS is when the uncertainty is low and when variations in the system are bounded.

During the initial phases of an incident when uncertainty is high, any attempt to apply the bureaucratic structures and processes of NIMS is likely to be counterproductive. Successful outcomes in these situations require sensemaking, adjustment, and decentralization. Success requires rapid action and judgment that bureaucratic processes simply cannot provide.

Complex Interactions

In many cases, the plan – the "holy grail" of NIMS – only becomes apparent when commanders are able to derive system behavior by observing how their actions affected the system. To put this idea another way, sometimes the plan for achieving the end state is only possible once there are sufficient interactions – positive or negative – with the system to determine which end states are possible.

NIMS was not created in a vacuum. It is a natural extension of both Western management philosophy and Western scientific thought. It is a system designed to exercise control and

it requires the isolation of variability. It is because of this that during times of complex interactions between the key variables outlined earlier, NIMS is necessarily ineffective. NIMS fails at the boundaries of rationality.

Obviously, the entire story of NIMS and its appropriateness for emergency response is more nuanced than presented here. NIMS has a place and, to date, no better method for the management of recovery efforts has been established. However, the appropriate application of any administrative framework or thought process requires a deep understanding of the limitations of the process. Knowing this, emergency response agencies would be remiss if they did not invest in action "beyond NIMS." This means creating nimble response paradigms that capitalize on the ability of small teams of well-trained people grounded in organizational doctrine to quickly assess local situations, communicate their interactions and results, and capitalize on emergent opportunities, all while making rapid local adjustments, at least until the emergency is ready for NIMS.

Charles Bailey is an assistant fire chief for the Montgomery County Fire/Rescue Service in Maryland. His 25 years of service include assignments as a line fire officer, member on various specialty teams including Disaster Medical Assistance Team, the National Medical Response Team, Urban Search and Rescue Team, leader of Hazardous Incident Response Team (Hazmat), and operations manager of the Fire/Rescue Emergency Communications Center (911 Center). He is currently the Shift Operations Chief managing a shift of nearly 300 personnel spread over 500 square miles to serve a population of more than 1 million people.

Challenges of Evolving Threats & Changing Expectations

By Robert Maloney

The "things that keep me up at night" are much more numerous and remarkably different than emergency management 15 years ago. There is no time to rest. The nature of emergencies has changed, complicated by the fact that new threats of intentional incidents using chemical, biological, and other weapons must be considered in addition to accidental or natural incidents.

The frequency of incidents across the United States that require the activation of emergency operations centers and the utilization of emergency management plans has increased. This is certainly true in the Baltimore (Maryland) region, with the media disseminating information about emergencies like never before.

Past Expectations

Fifteen or more years ago, emergency managers spent their time worrying about specific incidents and how city resources would respond to an incident, save lives and property, and prepare for the next response. Preparedness was focused mostly on specific hazards, for example:

- What dangerous hazardous materials are most likely to affect our area?
- What needs to be done during a chlorine release?
- How do we stop a leak?
- Is sarin in fact a gas?
- How bad will the flooding downtown be if a 50-inch main ruptures?

The expectations of Baltimore's program from both elected officials and the public were much lower and the focus of emergency management much more narrow.

So much has changed since then, with more apprehension and uneasiness to efficiently and effectively function when it is "game time." The development of the science of emergency management has been remarkable and the expectations to use proven emergency management tactics are expected. They must be mastered using necessary readiness and training practices.

Modern Expectations

Stakeholders demand immediate and accurate information, so it is imperative that emergency management officials provide a structure that includes rapid dissemination. To effectively share information between stakeholders, Joint Information Centers are imperative. Public notification that involves new and changing technologies must also be utilized immediately to disseminate crucial information such as shelter in place and evacuation orders.

Financial implications must be considered when deploying resources, and mutual aid utilized for optimal response. As jurisdictions perform well, others are expected to do the same. The growing number of volunteers (people who want to help) requires coordination and integration with various other resources into response efforts, which include those that may not have been used in the past. For example, mental health providers can be utilized to reduce the likelihood of post-traumatic stress syndrome.

Today, the "wake up list" that emergency managers worry about is much different:

- Has our program trained enough disaster assessment teams and will they be ready when needed?
- Will our system accurately create situational awareness to help decision makers, even if there are multiple incidents occurring at the same time?
- Can we provide information to the media before social media and new types of news media create their own narrative that may be inaccurate?
- Will emergency personnel seamlessly activate the Integrated Public Alert & Warning System (IPAWS) even though it is seldom used on a daily basis?
- Have we exercised and trained enough to evacuate stadiums in the event of a catastrophe?

Being so tired at the end of the day, it is easy to say that nothing really "keeps me up at night" anymore. However, that simply is not true. Emergency managers worry that, when the people that count on their offices and staff need them, that they will be equal to the task.

Everyone must strive to perform and do the best they can under extremely challenging emergencies, and the more contemplation there is in advance – especially on threats and risks that can cause the most harm – the better the chance for success. The things emergency managers worry about may grow and reprioritize but the emergency management system and the people that work in this system have never been better or more committed to serve and protect. There is more expertise, education, technology, and most importantly spirit, and that should give everyone reason to rest easier to prepare each day to do this work, which is so worth doing.

Robert Maloney currently serves as Baltimore's emergency manager, responsible for citywide emergency preparedness and homeland security funding and coordination. He served as the City of Baltimore's deputy mayor of emergency management and public safety for Mayor Stephanie Rawlings-Blake from September 2012 thru January 2015. In this capacity, he coordinated the city's public safety, emergency management, and related operational agencies. He developed and managed Baltimore's Violent Crime Reduction Strategy, reducing both violent crime and property crime during his tenure. Prior to this position, he worked as the Baltimore City Fire Department chief of staff, emergency medical services lieutenant and firefighter/paramedic. He also served in the United States Naval Reserve as a petty officer second class functioning as a corpsman for the United States Marines. He served one tour of duty in Iraq. He has previously served on the FEMA National Advisory Council, the Governor's Emergency Management Advisory Council, the U.S. State, Tribal and Policy Advisory Council, and as the vice chair of the Baltimore City Veterans Commission. He earned his BA from Towson University and MS in Management Science from Johns Hopkins University. He can be reached at Robert.maloney@baltimorecity.gov

Suspicious Activity Reporting – A Job for Everyone

By Jerome H. Kahan

Law enforcement personnel operating in their communities have been trained to report suspicious activity sightings to their headquarters. Firefighters, emergency medical service providers, public health officials, and other first responders have been asked to "Remain Alert for Suspicious Activity." Now, every citizen and visitor plays a critical role in preventing terrorist threats.

Riders of the Metro in Washington, D.C., New York City, and other transit systems across the nation might see signs saying, *If You See Something, Say Something™*. The Department of Homeland Security (DHS) initiated this program in July 2010 to alert citizens to be on the lookout for indicators that could reasonably be interpreted as steps a terrorist or other violent extremist might take before committing an act of violence, and to be prepared to tell local authorities about these observations via a suspicious activity report (SAR). This campaign targets any person who may happen to see something suspicious in his or her surroundings.

However, the message also warns that, when suspicious activity turns into an emergency, observers (who may remain anonymous if desired) should immediately call 911 to contact the nearest police station, fire, medical, or ambulance service. These situations include times when weapons have been or are about to be used, explosives have been placed in or in front of a building or in a populated area, a suicide bombing is in the making, or a chemical or biological attack seems possible.

Identifying Suspicious Behaviors

The official SAR Functional Standard released in February 2015 contains a detailed list of 16 classes of behaviors "reasonably indicative of preoperational planning" by violent extremists for local law enforcement agencies to draw upon in assessing the degree to which such observed activities might warrant action. This list includes breach/attempted intrusion, aviation activity, materials acquisition, and other topics.

With some items similar to those found in the SAR Functional Standard, examples of non-emergency suspicious activities extracted from Tips for Reporting Suspicious Persons, Activities, etc. to Prevent Terrorism include:

- Intense surveillance and/or photographing of a particular site;
- Discreet use of cameras or video recorders;
- Extensive sketching or note taking;
- Probing of a facility's public access points;

- Questioning about a building's purpose and operations, beyond simple curiosity;
- Unauthorized attempts to obtain dangerous chemicals or biologic agent;
- Unusually bulky clothing that may be used to conceal weapons; and
- Unattended packages or vehicles left near crowded areas or in front of public transportation facilities.

Notwithstanding efforts to provide guidance, certain signs in transit facilities concede, "It can be difficult to know what 'something suspicious' looks like. Faced with uncertainly, dutiful citizens have responded to the government's *If You See Something, Say Something™* campaign feeling obliged to report "suspicious activities" even if they doubt that anything is actually wrong. The question here is whether to err on the side of caution or make a report just in case. Perhaps persons in this quandary should heed the saying, "When the hair on the back of your neck stands up, listen to it," and then contact authorities.

The SAR Process at Work

Any person observing something suspicious can tell a police officer or other uniformed authority, call the local police station, or even contact the Federal Bureau of Investigation (FBI) at one of its local field offices, where an agent will send it to the proper authority. Given that terrorists might target the nation's critical infrastructure – much of which is privately owned and operated – DHS has developed a special process for these homeland security partners to rapidly alert appropriate local police to suspicious or unusual activities via the Homeland Security Information Network (HSIN).

A fundamental precept of the SAR system is to share such threat-related information among state, local, tribal, and territorial (SLTT) agencies to assist all communities in dealing with violent extremism by discovering patterns of behavior and links among potential perpetrators. For this reason, the Nationwide Suspicious Activity Reporting Initiative (NSI) was developed as a standardized process for gathering, documenting, processing, analyzing, comparing, combining, and sharing suspicious activity reports across a range of participating SLTT law enforcements agencies and also with the FBI and other federal partners. This system might lead to assessments suggesting that a particular person is leaning toward or already undergoing radicalization, intending to join a violent extremist group, or planning to commit a violent act in a community, whereupon a Joint Terrorism Task Force led by an FBI special agent would likely intervene.

The initial step in this process is for the local police station's senior law enforcement officer to check the information received for completeness, which includes ensuring that each SAR describes in as much detail as possible what was observed, who or what was seen (distinguishing characteristics), where and when the action occurred, and why it seems to be suspicious. When appropriate, the officer in charge puts the data into official SAR format and sends the file to one of the dozens of Fusion Centers for review by a trained intelligence analyst to determine whether it meets the established SAR Functional Standard criteria as indeed having a nexus to violent extremism.

Only SARs that document behavior "reasonably indicative" of preparations for planning acts of violent extremism become part of the official SAR process. SARs that pass the test are entered into the national Information Sharing Environment (ISE), where they become accessible to authorized agencies at all levels of government for further analysis and integration with other intelligence information. A valuable node within the ISE is the FBI's nationwide eGuardian system, mainly fed by counterterrorism tips and leads, which sends information regarding potential threats or suspicious activities throughout the national law enforcement community. The five key steps in the SAR-NSI-ISE Process are shown in Figure 1., Reports that are not determined to be a threat may either be discarded or retained, perhaps combining new entries with pieces of information on suspicious behaviors already in the ISE to develop a new report for authorities to act upon.

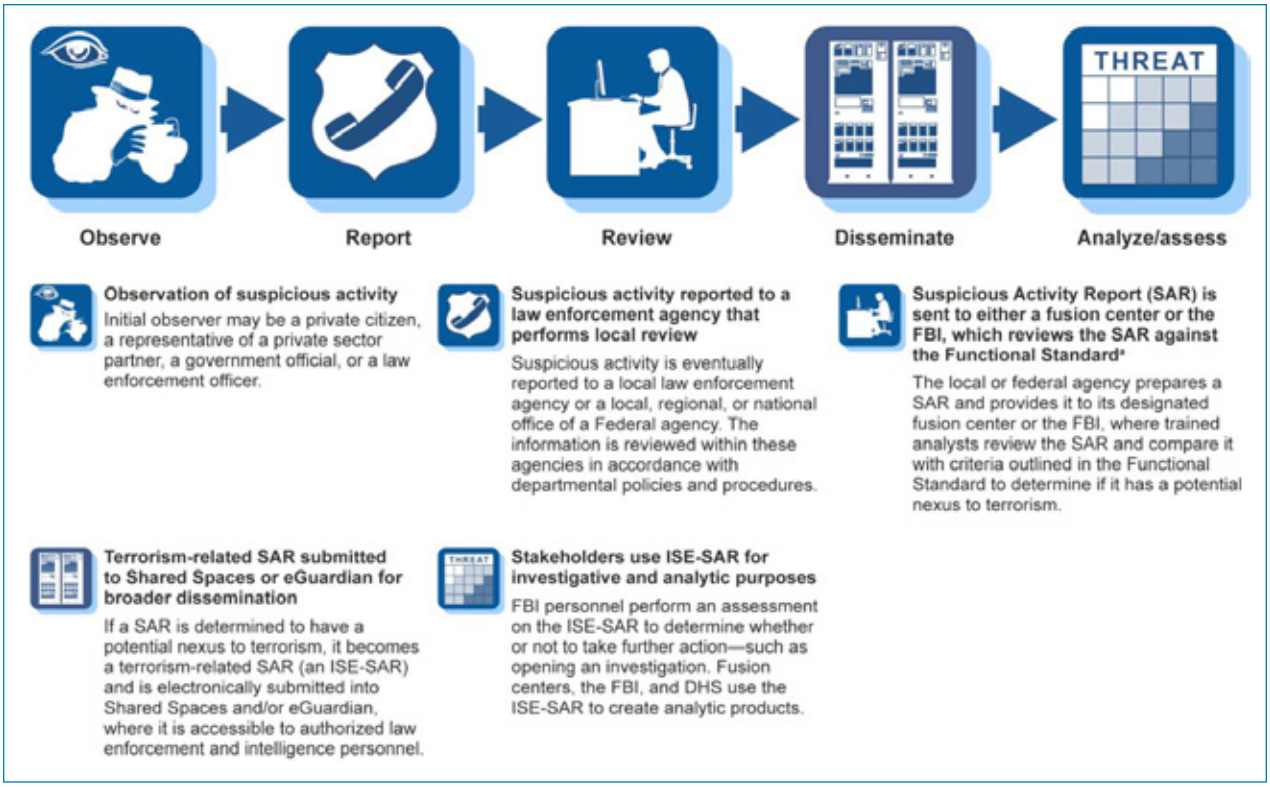

Fig. 1. Flow diagram depicting the nationwide process for collecting, disseminating, and utilizing terrorism-related suspicious activity reports (*Source:* Government Accountability Office, March 2013).

To help citizens and employees identify particular types of suspicious behavior, the FBI (with assistance from the Justice Department) launched a Communities Against Terrorism program, which consists of a series of 25 pamphlets. Each pamphlet offers general guidelines for spotting suspicious behavior in connection with different "threat areas," including: airport service providers, financial institutions, shopping malls, storage facilities, and even tattoo shops. Each brochure warns that, "Some of the activities, taken individually, could be innocent

and must be examined by law enforcement professionals in a larger context to determine whether there is a basis to investigate." Finally, these flyers recommend that citizens, "Make note of suspicious statements, people and/or vehicles, and if something seems wrong, notify law enforcement authorities." No doubt this series can be useful to citizens, workers, private businesses, and others throughout a community.

Law enforcement officials and first responders do their best to remain alert for and report suspicioius activities. However, this is indeed a job for everyone, including an alert citizenry and a vigilant community. Bad guys beware – it may become more difficult to plan and execute destructive actions!

Jerome H. Kahan is an independent analyst with over 40 years of experience on national and homeland security issues, including senior positions in the Foreign Service, the Brookings Institution, and the Homeland Security Institute. In addition to his publications, he has been an adjunct professor in the graduate school at Georgetown University and a member of the Council on Foreign Relations, with BS and MS degrees from Columbia University.

CBRNE Training – Part 1

By Joseph J. Leonard Jr.

In today's climate of austere budgets, federal, state, local, tribal, and private sector training managers need to get the most out of the scarce dollars that are available. A risk-based approach and assessment will help discern who needs what training, the specific levels of that training, and refresher training requirements.

There is no reasonable expectation that every jurisdiction will be capable of doing everything – the resources are just not there. In light of this, communities must often pool or share resources on a regional basis to meet today's all-threat/all-hazard environment.

One veteran hazardous materials (hazmat) responder once described weapons of mass destruction (WMDs) as "hazardous materials with attitude." The basis for any effective training program that addresses response to either WMDs or chemical, biological, radiological, nuclear, and explosive (CBRNE) incident response is training in building a solid foundation in hazardous materials response. This basic training provides the basic concepts that will serve as critical building blocks for more advanced tactics, techniques, and procedures. There are two principle guidelines in use in the United States today on which to base specific hazardous materials training:

- *The federal regulations* – Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operations and Emergency Response Standard (HAZWOPER); and
- *The internationally recognized voluntary consensus standard* – Voluntary consensus standards managed through the National Fire Protection Association (NFPA), particularly NFPA-472.

HAZWOPER

The OSHA's HAZWOPER can be found in 29CFR1910.120. Although initially published on 6 May 1990, these regulations have not been updated in over 25 years. The HAZWOPER regulations apply to five distinct response areas. The first four all fall under the training requirements set forth in 29CFR1910.120(e). The easy way to think of this is the "HAZWOP" portion of HAZWOPER. These training guidelines pertain to:

- Cleanup operations involving hazardous substances at uncontrolled waste sites;
- Corrective actions conducted at sites covered by the Resource Conservation and Recovery Act (RCRA) of 1976;
- Voluntary cleanup operations at sites recognized by governmental bodies as uncontrolled hazardous waste sites; and
- Operations conducted at treatment, storage, and disposal facilities regulated under 40CFR264-265 pursuant to RCRA or under agreement with the Environmental Protection Agency.

Personnel performing these tasks are referred to as "General Site Workers" and require 40 hours of initial training (colloquially called "40-Hour HAZWOPER"), three days of supervised "hands-on" training, and eight hours of refresher training annually. If the workers are performing a specific limited task or on work sites fully characterized with no hazardous substance levels above acceptable exposure limits, limited task, then 24 hours of initial training and one day of hands-on training is acceptable (the eight hours of annual refresher still applies).

Personnel performing tasks at transportation, storage, and disposal facilities that are dealing with RCRA waste also only need 24 hours of initial training (there is no hands-on training requirement, although the eight hours of annual refresher training applies). Training for site workers typically includes review of safety and health hazards associated with a particular site, use of personal protective equipment, work practices to minimize overall risk, engineering controls and equipment on site, medical surveillance requirements, and a review of the site safety and health plan. Managers and supervisors of these activities are required to attend an additional eight hours of training that covers topics such as the applicable safety and health program, personal protective equipment program, spill containment, and health monitoring. Finally, there is a provision for "equivalent training" if the employer can document work experience or training that meets this standard. A site-specific review is still required.

The last category of training requirements are listed in 29CFR1910.120(q) and apply to emergency response operations for releases (or substantial threat of releases) of hazardous substances, regardless of the location (this is the "ER" portion of HAZWOPER). There are five levels of training under the emergency response guidelines along with a designation of "specialist employee." As CBRNE or WMD incidents are, by their very nature, emergency response operations, the following focuses on that portion of the regulation.

The first level, known as First Responder-Awareness (FRA), is for persons likely to witness an actual or potential hazardous materials incident and who can initiate notification procedures. No further actions are expected by personnel at the First Responder-Awareness level. There is no training time requirements associated with the First Responder-Awareness level. Training at this level includes:

- An understanding, recognition, and identification of what hazardous substances are, along with their associated risks;
- Potential outcomes associated with hazardous materials incidents;
- Roles and responsibilities of personnel trained at this level; and
- Notification requirements.

The next level is First Responder-Operations (FRO). These personnel are generally among those first responders to releases or potential releases of hazardous substances to protect life, property, and the environment. They operate in a defensive fashion, meaning that they do not actively try to stop the release, and attempt to control it from a safe distance and try to minimize the spread of the release. This is the level for most members of the fire service as well as specially trained personnel from law enforcement, emergency medical services (EMS), public works and engineering, and entities with similar response duties. A

minimum of eight hours of training (above the First Responder-Awareness level) is required to complete this level of training and topics should include:

- Hazard and risk assessment techniques;
- Selection and use of personal protective equipment;
- Hazardous materials terminology;
- Basic containment, confinement, and control techniques;
- Decontamination procedures;
- Working understanding of chemical toxicology; and
- Incident termination procedures.

Hazardous Materials Technicians are personnel who respond with the actual intention of stopping the release, operating in a more aggressive fashion than those at the FRO level. These are personnel such as public safety hazardous materials response teams or industrial emergency response teams. They have a minimum of 24 hours training over and above the FRO level training. This training addresses:

- Implementation of a response plan;
- Classification, identification, and verification of unknown materials using field survey equipment;
- Operating with the incident command system;
- Use of personal protective equipment;
- Hazard and risk assessment techniques;
- Skills to perform advance control, containment, and confinement techniques;
- Decontamination techniques and procedures; and
- Termination of the incident.

Within 29CFR1910.120(q), Hazardous Materials Specialists support Hazardous Materials Technicians. They have specialized knowledge, typically of various substances (such as chlorine or ammonia). They can also serve as liaisons or agency representatives to governmental response and/or regulatory authorities. They have a minimum of 24 hours of additional training equal to or above that of the Hazardous Materials Technician. They need to:

- Know how to implement the local response plan;
- Be familiar with the state response plan;
- Understand how to select and use personal protective equipment;
- Know hazard and risk techniques;
- Be able to perform specialized control, containment, and confinement techniques;
- Know how to implement decontamination procedures;

- Know how to develop a site safety and health plan; and
- Have a working knowledge of chemical, radiological, and toxicological terminology and behavior.

On-Scene Incident Commanders are persons designated by the authority having jurisdiction to take management control of actual incidents. They need to be trained and current to at least the FRO level before being designated as On-Scene Incident Commanders. This additional training, at least 24 hours beyond the FRO level, should include:

- Details on how to implement and operate within their employer's incident command system;
- Details on the emergency response plan as well as the local and state emergency response plans;
- Information on the hazards and risks associated with response operations in chemical protective clothing; and
- How to implement and direct decontamination operations.

NFPA-472/1072

The National Fire Protection Association (NFPA) is the internationally recognized body that develops voluntary consensus standards for the fire protection, safety, and emergency response communities. There are currently about 380 codes and standards maintained by the NFPA. The main advantage that these standards have over regulations such as 29CFR1910.120 is that they are not only more comprehensive in scope, but are updated on a far more regular basis, typically every four to six years, to provide for greater currency. Additionally, there are far more details on actual performance tasks to be demonstrated as part of NFPA-compliant training, some of which are exceptionally specific.

"There are currently about 380 codes and standards maintained by the NFPA. The main advantage that these standards have over regulations such as 29CFR1910.120 is that they are not only more comprehensive in scope, but are updated on a far more regular basis."

Another major difference is that NFPA-472 establishes no training hour requirements or durations. As a competency-based standard, it is entirely up to the authority having jurisdiction and training provider or authority having jurisdiction to establish the requirements for competency and certification. However, they need sufficient time to effectively cover the material. For example, the Hazardous Materials Technician course is often 80 hours in length, using the International Association of Fire Fighters curriculum. This extra time gives trainers more freedom to properly cover course materials while also giving the participants enough time to demonstrate knowledge and skills.

NFPA has several standards pertaining to hazardous materials response and weapons of mass destruction training, including:

- NFPA-472: Standards for Professional Competence of Responders to Hazardous Materials and Weapons of Mass Destruction Incidents
- NFPA-473: Standard for Professional Competence of EMS Personnel Responding to Hazardous Material Incidents
- NFPA-475: Recommended Practice for Responding to Hazardous Material Incidents/Weapons of Mass Destruction Incidents
- NFPA-1072: Standard for Hazardous Materials/Weapons of Mass Destruction Emergency Response Personnel Professional Qualifications

NFPA-472 forms the foundation for all of these, and this is the standard examined here. Like 29CFR1910.120, NFPA-472 has similar levels of training, from "First Responder at the Awareness Level" through "Incident Commander," along with some additional ones. First Responder at the Awareness Level is for personnel who may discover actual or potential hazardous materials incidents, call for assistance, and isolate the area and deny entry until relieved by higher authorities. These personnel are expected to be able to:

- Detect the presence of actual or potential hazardous materials and weapons of mass destruction;
- Survey incidents from a safe location to identify potential hazardous materials and weapons of mass destruction;
- Collect hazard information; and
- Implement protective actions, such as evacuation or shelter-in-place.

The next level is First Responders at the Operations Level. These personnel are trained to respond to protect life, property, and the environment from an actual or potential release. In addition to meeting all of the requirements at the First Responder at the Awareness Level, all personnel at this level must be trained to meet specific competencies, including:

- Surveying for hazardous materials or weapons of mass destruction;
- Predicting likely behavior of a materials and its container;
- Collecting and analyzing hazard and response information;
- Estimating potential harm;
- Developing response objectives;
- Reviewing and selecting response options;
- Determining need for and use of personal protective clothing (chemical protective clothing and respiratory protection);
- Reviewing decontamination concerns;
- Establishing and enforcing scene control;
- Preserving evidence;
- Implementing the incident command system;
- Evaluating the progress of a response;
- Communicating response status; and
- Terminating the incident.

Unlike OSHA, the NFPA Technical Committee believes that First Responder-Operations should be the minimum level for hazardous materials responders. In addition, the Technical Committee believes that personnel should be trained to perform their assigned tasks as determined by the authority having jurisdiction – no more and no less. To meet this challenge, NFPA-472 also outlines mission-specific competencies for the First Responder-Operations level responder. They include:

- The use of personal protective equipment;
- Mass decontamination procedures;
- Technical decontamination procedures;
- Evidence preservation and sampling;
- Product control skills;
- Air monitoring and sampling;
- Victim rescue and recovery; and
- Response to illicit laboratory incidents.

Next is Hazardous Materials Technician, who are those persons who respond to hazmat/WMD incidents with the intention of controlling the release. These persons must meet the competencies at the First Responders at the Operations Level as well as the following:

- Surveying for hazardous materials and/or weapons of mass destruction;
- Collecting and interpreting hazard and response information;
- Describing the condition of a container involved in an incident;
- Predicting likely behavior of materials and their containers where multiple materials are involved;
- Estimating the likely size of an endangered area;
- Identifying response objectives and potential response outcomes;
- Selecting and using personal protective equipment (chemical protective clothing and respiratory protection);
- Selecting and implementing decontamination procedures;
- Developing and implementing a plan of action;
- Performing incident command duties;
- Conducting control functions identified in an incident action plan;
- Evaluating the effectiveness of control functions and decontamination efforts; and
- Terminating the incident (including assisting with a debrief/incident critique and documenting the incident.

Here is where NFPA diverges slightly from 29CFR1910.120. Rather than having Hazards Materials Specialists, NFPA recognizes the next level as "Hazardous Materials Technician with a Specialty." Within the 2013 Edition of NFPA-472, these include specialties for tank cars (rail cars), cargo tank (tank truck), intermodal tank, marine tank and non-tank vessel,

flammable liquids bulk storage facility, flammable gases bulk storage facility, and radioactive material. Additional specialties proposed by the NFPA-472 Technical Committee for inclusion in the 2018 update are currently under consideration. Each of these specialties has various competencies associated with them.

Incident Commander's in NFPA are similar to their HAZWOPER counterparts in that they are persons designated to assume control of and manage incidents to a successful conclusion. Their competencies include:

- Collecting and interpreting hazard and response information;
- Estimating potential outcomes;
- Identifying response objectives and potential response outcomes;
- Approving the level of personal protective equipment;
- Developing and implementing an incident action plan;
- Implementing and working within the incident command system;
- Directing resources (both public sector and private sector);
- Serving as the focal point for information exchange with the media and elected officials;
- Evaluating incident progress;
- Transferring command and control and/or terminating the incident;
- Conducting a debrief and/or critique of the incident; and,
- Documenting the response.

Private Sector Specialist Employees are persons designated by their private sector employer to aid in a response (both onsite and offsite) by providing technical expertise to the authority having jurisdiction. These are the equivalent to the OSHA Specialist Employee and, under the National Incident Management System (NIMS), may be referred to as Technical Specialists. There are three levels, designated as Specialist Employee C, Specialist Employee B, and Specialist Employee A. Specialist Employee Cs work in the support/cold zone and are trained to the Awareness level. Specialist Employee Bs are trained to at least the Awareness level as well as to the Specialist Employee C level and may work in the hot/exclusion zone. Specialist Employee As are trained to at least the Awareness level as well as to the Specialist Employee B level. They are expected to be able to perform to the Hazardous Materials Technician level on their company's property.

Finally, there are standards of competence for Hazardous Materials Officer and Hazardous Materials Branch Safety Officer, both of which are tactically oriented within the incident management system.

Final Thoughts

In today's austere environment where training budgets are limited, those who oversee required training need to make some hard decisions on where to commit scarce resources. This simple concept is true for a Fortune 500 company or a small, municipal government. In order to best meet a jurisdiction's needs, ask some basic questions:

- What tasks am I required (by law, regulation, policy, etc.) to do and to what level?
- Are my personnel trained and equipped to do these tasks? Are they current and proficient?
- If the answer is "No" to the second question, then what do I need to do to be in compliance with the laws, regulations, policies, etc. discussed in the first question?

Equipped with this knowledge, members of the public and private sectors can conduct training and gap analyses and review what they need to do to attain appropriate compliance. If no personnel will be entering a "hot zone," then there is no need to go beyond the First Responder-Awareness Level described in 29CFR1910.120(q) for the vast majority of staff. There may be a need for a few at the First Responder-Operations Level to conduct some defensive actions and others at the On-Scene Commander Level, but that is generally sufficient for the vast majority of entities in the public and private sector.

Likewise, training managers for large municipal fire departments may need to ensure that their entire compliment of firefighters are trained to the First Responder-Operations Level as described in NFPA-472. All Chief Officers and other key field supervisors will likely be trained to the On-Scene Commander Level. Still more may be trained to the Hazardous Materials Technician or Specialist levels, based on the specific needs of the community.

A private sector response contractor may have to be more diverse. Personnel working on hazardous waste sites should be trained in accordance with 29CFR1910.120(e), while those who participate in emergency response activities should be trained to at least 29CFR1910.120(q). If the company specializes in a particular aspect of response, such as tank cars, then perhaps it would be appropriate to train emergency response personnel as Hazardous Materials Technician with a Tank Car Specialty as described in NFPA-472.

"CBRNE – Part 2" will look at more specific training requirements and opportunities for chemical and biological response training.

For additional information:
Hazardous Materials/Weapons of Mass Destruction Response Handbook NFPA-472 and NFPA 473, *2013 Edition.*
Hazardous Materials Managing the Incident, Fourth Edition *(Noll and Hildebrand with Rudner & Schnepp).*
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CDR Joseph J. Leonard Jr. (USCG, ret.) is a 30-year veteran of the Coast Guard and is a senior consultant with the Center for Toxicology and Environmental Health's Global Preparedness and Crisis Management Division. He serves as the chair of the Greater Harris County Local Emergency Planning Committee, is a member of the NFPA-472 Technical Committee, and actively serves in the U.S. Coast Guard Auxiliary. He holds designations as a Master Exercise Practitioner, Professional Continuity Practitioner, Certified Emergency Manager, Certified in Homeland Security-V, and Certified in Homeland Security-Emergency Medical Response, and as a Certified National Threat Analyst. He has a BA in History from the Virginia Military Institute and an MS in Engineering Technology from Murray State University.

Using Typing to Define Hazmat Team Capabilities

By Anthony S. Mangeri

The only way to be prepared is to be well trained and well educated, which are essential components to effectively respond to and mitigate threats from chemical, biological, and radiological incidents. Evidence-based response requires the knowledge of the threat, training in skills needed to be effective, and the ability – based on sound judgment – to apply the appropriate knowledge and skills to ensure an effective response.

These three requirements are the basis for the Occupational Safety and Health Administration's (OSHA) training standards for hazardous materials (hazmat) response training. In today's world, it is essential to understand the chemical, biological, and radiological threats that communities and responders face. Emergency responders require a substantial knowledge of natural sciences, mathematics, and technologies to maintain competency for chemical, biological, radiological, nuclear, and high-yield explosive (CBRNE) responses. Like many training requirements and life safety codes, emergency response training for hazmat incidents began with the need to have standardized training to address expected competencies based on the potential risk and response role.

All emergency service personnel – from cadet through command – are required to have a basic understanding to recognize that an incident has occurred, identify the threat, and notify environmental responders. Emergency responders such as firefighters have the added responsibility to be trained to take defensive measures without contacting the chemical released and to establish command to manage the incident.

Standardizing Response

In the 1980s, the National Fire Protection Association (NFPA) developed and published consensus standards (NFPA 472) to identify competency standards for emergency responders. NFPA 473 focuses specifically on competency standards for emergency medical service providers.

In 1990, OSHA issued regulations referred to as Hazardous Waste Operations and Emergency Response (HAZWOPER). The regulations found in 29 CFR 1910.120 were focused on providing health and safety requirements for employees involved in the management, clean up, and emergency response to hazmat incidents. Much of the regulations were designed to protect the health and safety of workers after events such as the Love Canal cleanup in New York in the early 2000s and the 1984 Union Carbide disaster in Bhopal, India.

Hazmat technicians and specialists are specifically trained to respond to and take measures to manage emergencies. Hazmat technicians are trained to identify the class of materials being released and to take actions to mitigate the threat by stopping the release and reducing the threat to life, environment, and property. Specialists are those that have developed a specialized knowledge of a specific product, class of material, or type of response such as rail tank car response.

Since the creation of the HAZWOPER regulations, there has been a shift in the threat to many communities requiring response. In addition to toxic industrial chemicals and materials, there is an increase in concerns related to clandestine laboratories, and the intentional release of chemical, biological, and radiological agents by those that mean to do harm.

Training Hazmat Personnel

Hazmat technician training varies across the country. According to OSHA regulations, the minimum requirement for a hazmat technician is a 40-hour course with defined competencies. However, many have migrated to a curriculum that is 80 to 150 hours to address the competencies found in the revised NFPA 472, which now includes weapons of mass destruction incident response.

In an interview on 22 July 2016, Fire Chief James McLaughlin, Warwick Fire Department, remembers when he took his first Hazmat Technician course. The class was 80 hours and provided the basics in chemistry and offensive techniques to control releases. Today, the 64 members of Warwick Fire Department's hazmat team are required to complete a course of study that exceeds 120 hours. In addition, the team must complete a minimum of 40 hours of refresher training annually.

> ***"Hazmat technicians are trained to identify the class of materials being released and to take actions to mitigate the threat by stopping the release and reducing the threat to life, environment, and property."***

Education for tomorrow's hazmat responders may very well begin high school. U.S. students have continually lagged behind the rest of the world in science and math literacy. Many school districts, colleges, and universities are working to incorporate science, technology, engineering, and math (STEM) literacy into their curriculum.

The Program for International Student Assessment (PISA) conducts a study of the competency of young students in math, science, and reading. PISA completed a study in 2015 and will release the data by the end of 2016. However, a 2013 *Wall Street Journal* article by National Education Reporter Stephanie Banchero, entitled U.S. High-School Students Slip in Global Rankings, reviewed PISA's 2012 test scores. She found that U.S. students' STEM literacy has remained generally stagnant since 2000 with students' science literacy dropping four places from 20 to 24.

Creating a Better Understanding

Not all hazmat teams are trained and equipped to respond to weapons of mass destruction. And not every hazmat technician is trained to respond to the deliberate release of these weapons. In 2005, the Federal Emergency Management Agency published Document 583-4 (Typed Resource Definitions: Fire and Hazardous Materials Resources), which provides the criteria for typing hazmat entry teams. In the document, FEMA guidance, which is not mandatory, types hazmat teams based on their capability:

- A Type III team is one that is responding to known chemical.
- A Type II team is one that is expected to respond to and be able to identify and mitigate unknown chemical releases.
- A Type I team is one that is trained and equipped to respond to unknown chemical releases as well as incidents involving CBRNE weapons.

Given the need for an understanding of the natural sciences involved in hazmat response, hazmat technician training should be modified to provide a significant understanding of chemistry, biology, and even general physics as it relates to both industrial chemicals and weapons of mass destruction.

Anthony S. Mangeri, MPA, CPM, CEM, is the director of strategic relations for fire services and emergency services and is on the faculty of the American Public University System. He has more than 30 years of experience in emergency management and public safety. He has been a volunteer firefighter and Emergency Medical Technician for more than 25 years. He earned the rank of assistant chief-safety officer, serving as the fire department's health and safety officer for three years. He has completed Hazardous Materials Technician training and numerous courses in biologic threat response. He has also completed a Fellowship in Public Health Leadership Initiative for Emergency Response sponsored by the Center for Public Health Preparedness. In addition, he sits on the ASIS Fire & Life Safety Council.

The Goal That Keeps Equipment Manufacturers Up at Night

By Patrick Call

First responder safety is the immediate goal when approaching and operating in an emergency response scenario. Not only does keeping personnel safe keep experts up at night, it is a priority for equipment manufacturers responsible for the design, function, and purpose of responder tools used in dangerous situations and environments.

Equipment manufacturers have a responsibility to understand and maintain responsiveness to the challenges routinely encountered by first responders. For suppliers of field-ready chemical, biological, radiological, nuclear, and explosives (CBRNE) sensors, the three critical areas of focus to keep operators safe during emergency response missions are operator training, user interface, and integrated command and control.

Operator Training

Training is of paramount importance with respect to the proper implementation of technology, particularly in a high-consequence deployment. The primary emphasis for effective training is broken into two key areas including understanding the basic functionality of the instrumentation and the context of operation (CONXOPS).

Effective training relies on developing a deep understanding of the fundamental mechanisms of equipment operation. As an equipment operator becomes familiar with the operation and limitations of the technology, better decisions can be made in real-time operational scenarios to maximize effectiveness. For example, some radiation detection and identification products employ common on-device and web-based user interfaces, terminology, and operational processes such as menu structure and data retrieval functions. The unified approach results in faster and more efficient training programs applicable to a range of instruments. Instant familiarity across instruments enables the operator to focus on the mission and not the instrument.

CONXOPS is defined as the application of additional information, whether environmental or sensor related, to give a more substantial assessment of the situation. This concept can be used in conjunction with the standard agency concept of operations (CONOPS) to enable more effective response relative to a specific instrument. CONOPS are often preset by the agency and require the users to operate in a very specific manner, while CONXOPS are often dynamic based on the current situation.

For example, the CONOPS might dictate that the responder perform a task based on the standard drawdown plan relevant to the specific situation. However, applying CONXOPS and understanding all the elements of the situation including environmental considerations enables the operator to optimize the approach. With respect to training, manufacturers should not attempt to influence or modify the agency CONOPS, but rather they should actively train the users to apply all available information to optimize the safety and effectiveness of the action.

User Interface

The simplicity and uniformity of the user interface must be emphasized as a key design element across multiple disciplines of sensors. The motivation for an easy and uniform user interface is directly related to maintaining operator proficiency. Deployment models range from instruments that require operation nearly every shift, to instrumentation that is used in rare but highly consequential instances. In the latter deployment scenarios, staff turnover or time gaps between training and operation amplify the need for simple and intuitive interface design.

For example, on-screen prompts for explosives trace detectors could walk users through each step of the operation. Even if the operator has not used the system in a few weeks or a few months, the on-screen guided commands enable the user to quickly execute a mission without any additional training. Technology advances have also enabled on-device video training giving users access to 24/7 training tools. The interface can be used to conduct a self-guided refresher training at any time by working through each step in the operation and maintenance of the instrument from a simple menu structure on the instrument.

Integrated Command & Control

Next-generation operational effectiveness will depend on broad integration of information from multiple sensors in a deployment. Sensor data will need to be integrated with readings and information related to location and general environmental factors to provide greater situational awareness for the operator. As technology continues to advance, there will be less emphasis on individual users working with isolated sensor data and more emphasis on integrating information from multiple sensors and disciplines to achieve much higher operational effectiveness.

In some cases, iPhone and Android mobile apps already deliver reach-back capability through Bluetooth. This allows the frontline responder to share information from the emergency site with partner responders. The ability to instantly communicate threats remotely provides responders with advanced warning, enhances situational awareness, and enhances the capacity to perform real-time support analysis and verification. These communication features also support interagency communications between first on-scene firefighters, hazardous material response specialists, law enforcement, and forensic specialists.

First responder safety is the immediate goal. It keeps everyone in the chain up at night. As such, equipment manufacturers are focused on the areas of operator training, user interface, and integrated command and control to improve emergency response missions.

Patrick Call has been in the hazmat industry since 1997. He was an original employee of MesoSystems Technology Inc., a company focused on developing biological threat sampling and detection products for the first responder community. While there, he authored 12 United States patents related to bioaerosol collection. His contributions led to an R&D 100 Award for one of the 100 most significant inventions of 2004. MesoSystems was acquired by ICx Technologies and more recently FLIR Systems Inc. He is currently a regional manager for the CBRNE Detection division of FLIR Systems Inc., which has created identiFINDER R-series radiation products and the Fido X2 explosives trace detector.