VOL. 114, NO. 2, FEBRUARY 2018

HEALTH PHYSICS

THE RADIATION SAFETY JOURNAL

The Official Journal of
the Health Physics Society

SPECIAL ISSUE:

PROCEEDINGS OF THE 53RD ANNUAL MEETING OF THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS, MARCH 2017

www.health-physics.com

Wolters Kluwer

Paper

EMERGENCY RESPONSE TO RADIOLOGICAL RELEASES: HAVE WE COMMUNICATED EFFECTIVELY TO THE FIRST RESPONDER COMMUNITIES TO PREPARE THEM TO SAFELY MANAGE THESE INCIDENTS?

Robert J. Ingram*

Abstract—The emergency responder community trains for and responds to many types of incidents on a daily basis and has done so for years. This experience with fires, emergency medical calls, chemical spills, confined spaces, and other common calls for assistance has helped responders develop an understanding of the problems and a confidence in solving them. Radiation from an accidental release in a facility or during transportation, or from a terrorist incident that causes radioactive materials to be released from their containment vessel, remains a cause of concern and fear. Emergency responders are a segment of the general population and share some of the same fears of radioactive materials as the whole population. Radioactive material incidents are not a common 911 call type. Radiation training has been included in emergency responder training standards for several decades and covers a broad range of topics from simple awareness and recognition to technical knowledge of the materials, detection and identification capabilities, self-protection, medical effects, and countermeasures to overall public and environmental safety and health. The safety factor of the radiation community has been very good, but without the actual response confidence in handling previous incident releases, many responders remain fearful of radiation. A single source site where responders can post and read after-action reports on actual radiation incidents may help communicate health and safety information, building responder confidence. Competencies in standards do not always translate into compliance in training curriculum and exercises. The fire service has been the key local response agency to radiation accidents for many years and has developed training programs that meet the competencies found in 29 CFR 1910.120 [q], *How to Determine What Training is Required for Emergency Response Team Members*, and the National Fire Protection Associations Standard 472: *Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*. The majority of fire service responders in the United States are volunteers who often make decisions on what they train for based on the time available and their areas' hazard assessment. This has often caused radiation training to be limited at best. Communicating timely and accurate hazards and risks associated with radiation threats and incidents may increase the amount and level of training in response to these types of incidents. Many law enforcement and emergency medical services and other key disciplines did not address these standards requirements prior to 9/11, as they were considered outside their "normal" mission space. The change in the mission space caused by the new threat of radiological terrorism has required additional training and equipment. This training has started but will take time to impact the entire responder community, it will require funding for the training and equipment, and most of all, sustainment. Communicating the broad scope of capabilities necessary to safely manage a radiation incident and the requirement for all agencies to be involved may support the effort to train these disciplines in their new mission space. The serious and much publicized radiological incidents that have occurred during the lifetime of many of today's responder community (Chernobyl, Fukushima, and Three Mile Island) have added to this fear within the responder community. The majority of today's responder communities are between 21 and 50 y of age. In studies conducted in recent years by federal agencies, it was identified that this group did not receive the basics of nuclear information provided to the U.S. population at the start of the Cold War and the fear of a nuclear war. These studies have identified the gap that exists in understanding basic radiation terminology, protective actions including sheltering-in-place, informed evacuation, public messaging, and others. Despite studies like this, federal, state, and local public officials have been slow to communicate emergency action plans to the public for radiological and nuclear incidents. Emergency management agencies at all levels have action plans for natural events such as hurricanes, tornadoes, and coastal storms, and now they are including biological incidents and active shooters. Nuclear and radiological incident plans and protective actions need to be included and communicated to members of the public (and responders) in all media streams. Several federal agencies have been tasked with radiological and nuclear mission space, but this appears to remain fragmented without an organizing agency. The Domestic Nuclear Detection Office (U.S. Department of Homeland Security) remains in a detection and prevention mission and has provided a good amount of equipment, training, and coordination, but primarily among law enforcement organizations. The Federal Emergency Management Agency remains in the response mission but has limited outreach to the majority of response organizations. The U.S. Department of Health and Human Services (Assistant Secretary for Preparedness and Response) has stepped up its efforts in medical countermeasures, surge capabilities, and support services. All of this information and support comes to the responder community separately, and it is left to the local-level planners to piece it together. It needs to

*RJI Consulting, 16 Rimlet Drive, Commack, NY 11725-1931.

The author declares no conflicts of interest.

For correspondence contact the author at the above address, or email at **bobliny120@aol.com**.

(*Manuscript accepted* 30 *August* 2017)
0017-9078/18/0

DOI: 10.1097/HP.0000000000000757

importance of continuously developing equally impactful visual messaging tools that include a series of information graphics, educational videos, and websites to communicate important nuclear and radiological safety information.

One of the tools currently under development is plume maps for members of the public. Its need was highlighted during Fukushima when lack of information led several Japanese communities to evacuate into the radioactive plume. Currently, two federal teams, the Executive Briefing Products and the Public Plume Products Working Groups, are developing plume maps that will concisely convey critical health and safety information to decision makers and members of the public in the most comprehensible manner. These maps will provide a visual representation of areas where radiation may be found, potential impacts to the population, and infrastructure, agriculture, and water concerns. The goal of the maps and other visual tools is to help mitigate a lack of understanding of radiation science and risk among lay audiences that can lead to disproportionate levels of concern for their personal protection—either excessive concern or a lack thereof.

But along with combined written and graphic messaging products, good crisis communications need a cadre of messaging experts who will amplify the messages across all media. A gap recognized by the response community is the need to identify experts in risk communications and to train them on radiation protective actions, messages, and radiological response procedures. While the federal government will continue to maintain a field of experts on radiation response and protection, this cadre of skilled communicators alone would not be able to speak to the media, serve as "talking heads," and convey messages to inform the public on radiation response and protective measures critical in the early hours of an incident. Between the 24-h news cycle and the instant communication expectations of social media, the current limited number of radiation communication experts will not be able to support the span of the active outreach needs at the federal, state, and local levels.

To start addressing this critical need, the federal government is currently working to develop a cadre of experts through the Radiological Operations Support Specialist (ROSS) Program. A ROSS is not a federal official but a health physicist who has detailed knowledge of radiation science, including effects of radiological and nuclear emergencies; federal resources; how state and local emergency operations are implemented; and available communications resources and messages. While not dedicated to communicating radiological information, the ROSS can be an invaluable resource to a public information office in need of radiation expertise.

Aside from communications experts, federal exercises over the past 2 y have also identified a major challenge: the lack of a "lead" federal voice during response to an incident. This problem is attributed to the nature of varying types of authority structures among responding federal agencies as well as the understandable desire of the state and local leaders to maintain authority of an incident in their communities. Also identified as significant issues are the interagency language barriers and variances in federal-to-local vernacular, which can lead to communications challenges and confusion that in times of crisis could cause major disruptions.

The solution to this gap lies in identifying a single lead voice during a crisis. This one voice will ensure messaging consistency, help eliminate some of the variances in terminology between federal and local agencies, and serve as the central point for all information on a large-scale event. However, determining who that voice will be is a challenge during a transition year. New members of government need to be educated by communications experts and external validation groups on the statutory requirements, roles and responsibilities of their departments and their communication roles during a crisis. But before that can happen, a thorough review of current guidelines based on law and on the communications procedures must be done.

Should an intentional or accidental release of radioactive material occur in the United States, providing people with timely and accurate information is a crucial part of safeguarding public health and maintaining public trust. If information from credible sources is not readily available and believable, the public will turn to less credible and reliable sources for information.

REFERENCES

Federal Emergency Management Agency. Improvised nuclear device response and recovery: communicating in the immediate aftermath. Washington, DC: FEMA; 2013a. Available at ***https://www.fema.gov/media-library-data/20130726-1919-25045-0892/communicating_in_the_immediate_aftermath_final_june_2013_508_ok.pdf***. Accessed 24 May 2017.

Federal Emergency Management Agency. Communicating during and after a nuclear power plant incident. Washington, DC: FEMA; 2013b. Available at ***https://www.fema.gov/media-library-data/20130726-1919-25045-1433/communicating_during_and_after_npp_incident_june_2013_secure_.pdf***. Accessed 24 May 2017.

U.S. Department of Homeland Security. Annex N, radiological. In: Emergency support function 15: standard operating procedures. Washington, DC: DHS; 2016: N-1—N-26. Available at ***https://www.fema.gov/media-library-data/1469621171375-60d307a6345fad752633d2e2e21d1db2/ESF15_SOP_07.06.2016.3.pdf***. Accessed 24 May 2017.

Walker B. Crisis communications in the 24/7 social media world: a guidebook for CEOs and public relations professionals. Ithaca, NY: Paramount Market Publishing, Inc.; 2014.

be coordinated and communicated as one source. Communications remains the top challenge for the responder community as we look to the new administration for a plan for radiological and nuclear preparedness: communicating public messaging on radiation terminology, how members of the public can protect themselves and expected public agency actions; communicating a coordinated response plan that includes all levels and agencies; communicating the necessary training; andcommunicating the recovery actions that will have to take place.
Health Phys. 114(2):208–213; 2018

Key words: National Council on Radiation Protection and Measurements; accident handling; accidents, nuclear; emergency planning

HAVE WE communicated effectively to the first responder communities to prepare them to safely manage radiological releases? The answer is simple: we have not! Despite years of hard work at all levels of government and billions of dollars in training and equipment, we have not made a significant positive change in the capabilities of most first responder communities. We have distributed thousands of detection instruments, conducted thousands of training sessions, developed equipment and training guides and standards, supported response planning and posted dozens of federal websites with a lot of information. Yet we have only scratched the surface in preparing a very small percentage of the response community.

I believe my opinions are sound. I have 42 y in the fire service, with 35 in NYC. I have been assigned to hazardous materials/weapons of mass destruction planning and response since 1984. I have participated on several federal agencies work groups, developing radiation guidance documents for radiological dispersal device (RDD) and improvised nuclear device (IND) incidents. I have represented the responder hazardous materials community on radiation documents and standards with the National Fire Protection Association (NFPA), National Council on Radiation Protection and Measurements, American National Standards Institute, National Institute for Standards and Testing, and ASTM International. My experience as a hazardous materials trainer goes back over 25 y, and I have worked with the fire service, law enforcement agencies, emergency medical services, health and environmental professionals, and military personnel.

To make certain that the opinions presented here are more than my own, which I admit can be strong at times, I conducted a small survey with 28 of my peers across the country, representing several disciplines, 15 states, and 22 organizations. Some key points you should keep in mind regarding the survey and my participants while reading this article are:

- all participants are involved in chemical, biological, radiological, nuclear, explosive issues within their agencies;
- multiple disciplines are represented; i.e., law enforcement, fire service, emergency medical service, HazMat, bomb squad, military, etc.;
- assignments range from specialists to staff chiefs;
- average years of service among participants is 27+;
- survey questions asked participants for their perception of their own, their agency's, and the public's level of preparedness; and
- actions recommended for more effective preparedness include those of the survey participants and my own.

KEY OUTSTANDING COMMUNICATION ISSUE: PUBLIC INFORMATION AND FEAR

Post-Cold War aged citizens have not received the basics of radiological and nuclear information provided to the U.S. population at the start of the Cold War amid the concerns of a nuclear war. This information gap exists in understanding basic radiation terminology, protective actions of sheltering-in-place, shelter protection factors, informed evacuations, public messaging and safely managing the consequences of a radiation release, including managing fear. Despite identifying this gap, federal, state, and local public officials have been slow to communicate emergency action plans to the public for radiological and nuclear incidents. Emergency management agencies at all levels have action plans for natural events such as hurricanes, tornadoes, coastal storms, etc., and now they are including biological incidents and active shooters. Nuclear and radiological incident plans and protective actions need to be included and communicated to the public in all media streams.

The serious and much publicized nuclear incidents that have occurred during the lifetime of this post-Cold War age group—Three Mile Island (1979), Chernobyl (1986), and Fukushima Daiichi (2011)—have added to the public's fear. This fear was clearly observable in the actions of the public during the evacuation of the area around Three Mile Island and the run on U.S. West Coast pharmacies after the release from the Fukushima Nuclear Power Plant in Japan. Many of today's emergency responders are between 21 and 50 y of age and are a critical component of this post-Cold War American public. They too need to be better informed of the risks of radiation releases and trained to safely manage a response to an incident.

Every day the emergency responder community trains for and responds to many types of incidents. They have done so for years. This experience with fires, emergency medical calls, police actions, chemical spills, confined spaces, and other common calls for assistance has helped responders develop an understanding of the problems and a confidence in

solving them. Luckily, first responders do not commonly receive 911 calls for large radiation releases. However, that also means that they do not get an opportunity to gain experience and train for this type of response. Just like with members of the public, a radiological release from a facility accident, during transportation, or from a terrorist incident remains a cause of concern and some fear within the emergency responder community.

COMMUNICATING RADIATION INFORMATION TO EMERGENCY RESPONDERS

Radiation response education has been included in emergency responder training and standards for several decades. The curriculum covers a broad range of topics, including simple awareness and recognition, technical knowledge of the materials, detection and identification capabilities, self-protection, medical effects, and countermeasures to overall public and environmental safety and health.

Competencies in standards do not always translate into compliance in training curriculum and exercises. The fire service has been the primary local response agency to radiation accidents for many years and has developed training programs that meet the competencies found in the Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120 [q] (OSHA 2017) and the NFPA's Standard 472: *Competence of Responders to Hazardous Materials/ Weapons of Mass Destruction Incidents* (NFPA 2013). The majority of fire service responders in the United States are volunteers who often make decisions on what they train for based on the time available, the cost, and their areas' hazard assessment.

Prior to America's awakening on 11 September 2001, many response agencies did not believe they had a role in hazardous materials releases including radiation. These issues often caused radiation training to be limited to general awareness or operations-level knowledge as part of the overall emergency responder training.

OSHA and NFPA reference mainly defensive tactics at the operations level of hazardous materials response. Training to higher levels of response, the technician and specialist levels have traditionally been delivered to only members of hazardous materials teams. The majority of my peers surveyed are trained as technicians, but the initial response personnel receive only awareness or operations level training in their agencies. My peer group feel confident in their ability to respond safely to a radiation release (accidental and RDD)—remember, they are senior specialists and staff chiefs—but more than half believe the initial response personnel in their agencies lack confidence in their knowledge of radiation health risks and do not understand how to integrate radiation data into a safe response.

COMMUNICATING STANDARDS INFORMATION TO EMERGENCY RESPONDERS

Several standards developing organizations have developed many good standards for radiation release response guidance (ASTM 2015), detection equipment and training (specifically the American National Standards Institute's N42 series of documents), and RDD and IND response guidance (NCRP 2001, 2005, 2010). This information has been slow to reach the responder community. These organizations' documents are generally not in the responder library of "go to" sources of information. They are perceived as being more technical in nature and not field friendly. Although this was not done intentionally, emergency responder participation on the working groups developing these standards was limited at best. Participation of the first responder community in this standard setting was most about building bridges between groups that did not traditionally work with one another but realized we would need each other to improve our capabilities.

Federal funding support in the development process has opened the doors to allow a few of these standards to be distributed to the emergency responder community free of charge. This practice should continue in order to reach a larger number of smaller agencies and their field personnel.

COMMUNICATING THE RISK OF RADIATION RELEASES

We hear the concern of elected officials when planners recommend that we communicate more information about radiation and protective actions to the public. They are concerned that the public's first reaction will be, "What do you know that you are not telling us?" They also look at their budgets (which are all shrinking) and weigh the probabilities of the types of hazards their community must prepare for against the public services they already provide and new initiatives they have on their agenda. Making the decision to fund and develop capabilities for response to a radiation release is difficult if they are not aware of the risks and the effect fear can have on their citizens.

Many officials see the risk of an IND or RDD as being one for the major cities, not their smaller jurisdictions and certainly not a risk for which they need to budget and prepare. I offer this in response: the Oklahoma City bomb was not built in Oklahoma City, the 1993 World Trade Center bomb was not built in New York City, the 2010 car bomb that did not detonate in Midtown Manhattan was not built in NYC, and the Boston Marathon bombs were built in nearby Cambridge. In fact, most of the devices that have been used in intentional attacks have not been built in the target location. They all had to travel through smaller jurisdictions to reach the final target. These incidents involved traditional explosive devices but could have easily been a dirty bomb.

To prepare for this possibility we need to develop and communicate a higher level of radiation knowledge and preparedness to elected officials, emergency responders, and the public.

Many emergency response organizations remain uninformed and out of the intelligence loop that hosts the real knowledge of radiological and nuclear threats. We need to develop a much more robust network for sharing information to state and local officials and emergency planners. U.S. Department of Homeland Security (DHS) fusion centers have helped with unclassified distribution and some classified, but we still do not reach every response organization that deserves to have awareness.

Many federal agencies have been tasked with radiological and nuclear mission space, but this appears to be fragmented and without an organizing agency. The Domestic Nuclear Detection Office (DNDO) remains in a detection, prevention, and interdiction mission. DNDO has provided a good amount of equipment, training, and coordination, but their primary focus is law enforcement organizations. The Federal Emergency Management Agency (FEMA) remains in the response mission but has limited outreach to the majority of response organizations. The U.S. Department of Health and Human Service's Office of the Assistant Secretary for Preparedness and Response has stepped up its efforts in medical countermeasures, surge capabilities, and support services. All of this information and support comes to the responder community separately and it is left to the local-level planners to piece it together. It needs to be coordinated and communicated as one source.

Industrial use of radiation has increased in many areas of daily life. Manufacture and transportation of radioactive materials and waste has increased to meet this demand. Emergency managers and response organizations need to know the locations within their local communities that manufacture, transport, store, and use radioactive materials. Communicating the location of radioactive material may be enough to start highlighting the real risk of an accidental release. A more robust awareness and preparedness for both small and large accidental radiation releases will lay the foundation for developing better public and emergency responder preparedness for RDD and IND incidents. Reviewing the mission and increasing the funding for state emergency response commissions and local emergency planning committees can be a key part of improving this communication process.

EMERGENCY RESPONSE PLANS FOR ACCIDENTAL, RDD, AND IND INCIDENTS

I asked my peers to respond separately regarding response plans within their agencies for accidental releases, RDDs, and INDs. Having listened to many subject matter experts (SME) over the last 10 y present the consequences of a 10 kT ground burst in a major metropolitan area, I believe the IND plan needs to be very different from a traditional response of immediately moving toward the accidental or RDD release site. An IND plan should be based on:

- recognizing an IND has detonated by observing and recognizing the effects;
- ceasing all emergency response in the jurisdiction around the suspected release site (this may be several miles in all directions);
- broadcasting pre-scripted public messaging directing people to go inside and stay inside until directed otherwise;
- directing emergency responders to seek the best shelter possible and take radiation detection instruments and communications devices with them;
- keeping responders in the shelter for the 20–30 min we are told it will take for radioactive fallout to begin to return to ground level (downwind areas under the dangerous fallout zone will require longer sheltering times);
- during this shelter phase, responders should be using radiation detection equipment, recording exposure rate, location information/other observable conditions, identifying personnel status, and establishing communications with local operations centers where possible;
- after the initial sheltering for the fallout, attempting to monitor the shelter entrance to determine if it is safe to assess area conditions; and
- all of these steps will support federal modeling with ground truth instrument readings to best identify the dangerous fallout zone and begin to map and communicate a safe response.

Response to an IND is very different from the initial response to an accidental or RDD release of radiation. According to SMEs, after an RDD, most of the airborne radioactive material will return to ground level within the first 15 min. Radiation levels from an RDD are expected to be significantly less than those associated with an IND. Most injuries from an RDD are expected to be trauma type injuries, and radiation exposures can be managed with detection equipment and time, distance, and shielding factors. With this knowledge, emergency responders should move to the RDD release site to assist those victims with life-threatening trauma injuries and remove them from further radiation exposure.

More than half of my peers stated they have an accidental radiation release response plan. If you include those who responded that they have standard operating procedures (SOPs) in lieu of a formal plan, that number rises to about 75%. With only a little over one half having a developed plan for an accidental release, this supports the need (presented above) for a greater awareness of the increased use and transport of industrial radioactive materials.

Less than half of my peers stated they have an RDD response plan. This number also increases when we add in SOPs. Two organizations were actively developing an RDD plan at the time of the survey. One observation I made from the survey: several of those with RDD plans in place had federal support providing funding, information, and training. One program in particular, the DHS DNDO Secure the Cities Program, has been effective in providing information, equipment, training, and exercise support, but it has been limited in the number of cities it has been able to reach to date. Primarily a law enforcement mission as noted above, it does strongly recommend to the local law enforcement agencies that they include and coordinate with their local emergency response partners. Clearly, additional federal support to state and local governments is needed to assist all jurisdictions in developing accidental and RDD response plans.

A third of the survey respondents stated their jurisdiction had an IND response plan; a few were in the development stage. I had two observations when reviewing my data. First, one peer from my own agency responded that we have an IND plan. Our Office of Emergency Management facilitated a regional IND planning working group funded by a federal grant. The group consisted of representatives from many disciplines, many local jurisdictions, and at least two states. They did finalize a regional IND response plan. To my knowledge, no agency, including ours, has developed their own agency response plan that outlines their mission and what tactics they will use to accomplish them. My second observation: those with IND plans were nuclear power plant municipalities or Urban Area Security Initiative (UASI) Tier I cities that received federal and regional FEMA support developing their plans. These two programs have produced effective plans but are limited on how many cities they could work with based on the program mission. The UASI Program started with several tiers based on threat probabilities for all hazard and incident types. This totaled dozens of cities. The funding for the UASI Program remains critical to select target areas today, yet overall funding and the number of cities supported has decreased. IND planning information and support remains a big communications issue for many cities and their emergency response communities.

COMMUNICATING RESPONSE PLANS

Effective response plans are developed to address the mission space of an agency's responsibility, incorporated into their strategy, documented in policies and procedures, and included in training curriculum. Response personnel are then trained on the material and exercised. Exercises are followed by after-action reports and corrective actions in training and documents as deemed necessary. Sustainment of this response knowledge through refresher training and new exercises is critical and it should be available to all members of the agency.

Just over half of my survey peers who reported that they have an accidental or RDD plan are confident that the plan has been communicated to all field personnel in their agency. Several stated their plan was distributed to field personnel through SOPs while a few stated their plan is posted but up to the individual responder to read. A large percentage of these plans were developed in jurisdictions that have received support from the DNDO and UASI Programs mentioned above or have nuclear power plants. Of my peers who stated their RDD plans are interagency plans, not all of them have exercised those plans to evaluate the effectiveness of coordinating multiple agencies and levels of government. The issue remains that the majority of emergency response personnel across the country are not supported by DNDO, UASI, or nuclear power programs. We need to develop more effective networks that will communicate what has already been learned to all cities and in a shorter period of time.

SUMMARY OF RECOMMENDATIONS

Communication issues remain a challenge for the responder community as we work toward increased preparedness for radiological and nuclear incidents. We need to communicate radiation facts to the public and emergency response communities to effectively manage the fear of radiation. These facts should include pre-incident information as well as post-incident protective actions. Some recommendations for increased public awareness include additional Community Emergency Response Training; all hazards and protective action information added to school curricula at age-appropriate levels; and increased use of social media, websites, and videos to deliver radiation and other hazard information. We need to develop radiation response planning in all communities supported by risk and threat assessments and shared intelligence. Local planners and emergency managers would benefit from an effective single source federal website to support this planning activity. This site should host and coordinate the good radiation information already developed by many federal agencies but sitting on multiple sites.

Emergency responder training should, at a minimum be the operations level of response outlined in NFPA (2013) for all field personnel. This training should include radiation health and safety, detection equipment, data integration into initial action plans, regular exercising, and refresher training. Whether a transportation accident or an IND, the actions of first responders are crucial to minimizing dose to the public and maintaining public trust. First responders deserve the plans and training that will make them confident and effective in a radiological response.

REFERENCES

ASTM International. Standard practice for radiological emergency response. West Conshohocken, PA: ASTM International; ASTM E2601-15; 2015.

National Council on Radiation Protection and Measurements. Management of terrorist events involving radioactive material. Bethesda, MD: NCRP; Report No. 138; 2001.

National Council on Radiation Protection and Measurements. Key elements of preparing emergency responders for nuclear and radiological terrorism. Bethesda, MD: NCRP; Commentary No. 19; 2005.

National Council on Radiation Protection and Measurements. Responding to a radiological or nuclear terrorism incident: a guide for decision makers. Bethesda, MD: NCRP; Report No. 165; 2010.

National Fire Protection Association. Standard for competence of responders to hazardous materials/weapons of mass destruction incidents. Quincy, MA: NFPA; Standard 472; 2013.

Occupational Safety and Health Administration. Occupational safety and health standards. Hazardous waste operations and emergency response. Emergency response to hazardous substance releases. Washington, DC: U.S. Government Publishing Office; 29 CFR 1910.120[q]; 2017. Available at ***https://www.ecfr.gov/cgi-bin/text-idx?SID=a5c27b482a844062f0ca1dc902a8f450&mc=true&node=se29.5.1910_1120&rgn=div8***. Accessed 14 April 2017.

Paper

CRITICAL AREAS FOR IMPROVEMENT IN COMMUNICATIONS REGARDING RADIOLOGICAL TERRORISM

David Ropeik*

Abstract—**The fear of ionizing radiation exceeds the actual risk in many circumstances. Dramatic evidence from radiological events such as nuclear power plant accidents (Three Mile Island, Chernobyl, Fukushima) or the theft or misuse of radiological material (Goiânia), have established that fear of radiation contributes to immediate and late health effects. The academic, professional, and government individuals and organizations who either study radiation safety or who are responsible for preparing against a radiological terrorist attack understand this. Those experts are encouraged to do more to help protect members of the public against the damage that fear of radiation would do in the event of exposure to a radiological dispersal device by proactively educating the public that the actual risk of ionizing radiation is far lower than commonly believed. Perspectives are offered on why more of this work has not yet been done. Suggestions are offered on how to address those impediments and advance such public education efforts.**

Health Phys. 114(2):214–217; 2018

Key words: National Council on Radiation Protection and Measurements; accidents, nuclear; radiation, ionizing; risk communication

THE PROBLEM

Phobia n. *An extreme or irrational fear of or aversion to something.*

As a broadcast journalist from the 1970s through the 1990s, I reported on nuclear power issues like the Seabrook, Pilgrim and Yankee Rowe nuclear plants in New England; the Shoreham Plant in Long Island; and of course Chernobyl. The theme that ran through all my reporting about anything nuclear, the very reason why these stories were news at all, was the universally held belief that ionizing radiation was immensely dangerous. I never bothered to investigate the actual risk. I simply repeated, and thereby reinforced, the deep and widely held fear my whole generation had grown up with. I am embarrassed to think back at how shallow and how alarmist my reporting was and to realize the damage it did.

This all became clear to me when I researched a chapter on the risk of nuclear power for my first book, *RISK!!! A Practical Guide for Deciding What's Really Safe and What's Really Dangerous in the World Around You* (Ropeik and Gray 2002). At this point, I was working at the Harvard School of Public Health and had come to understand that in order to accurately assess the likelihood and severity of any risk, one needed to understand critical details like dose and hazard and exposure, central facts that few journalists even know to ask about and that I had never looked into. When I researched these details about the risk of ionizing radiation, I was stunned and ashamed.

I learned about the Life Span Study of the survivors of the atomic bombs in Japan, which estimated that acute exposure to significant doses of radiation increased the number of total deaths as of 2004 by only 1.2 % [527 excess solid cancer deaths (Ozasa et al. 2012) and 94 excess leukemia deaths (Radiation Effects Research Foundation, 2007a) attributed to radiation among 86,611 subjects]. (There were somewhat higher rates for specific types of cancer. These summary numbers represent the overall figures.) I learned that at lower doses, measureable rates of disease associated with ionizing radiation did not rise above the rates in a non-exposed population. I learned that exposure of pregnant women increased the rate of specific birth defects, but that no multi-generation genetic damage has been found among the children of the survivors being followed (Schull 2003; Radiation Effects Research Foundation, 2007b).

This so shockingly flew in the face of everything I thought I knew that I checked and checked and checked again, with multiple sources in academia, in government, in professional organizations, in industry… all of whom confirmed my general understanding of the Life Span Study findings. The actual risk of nuclear radiation was nowhere near as great as most people assumed and as I had suggested with my reporting.

Yet as I thought back across all the stories I had done about nuclear issues, many of which dealt specifically with

*Harvard University Extension School, Harvard University & Consultant, 21 Baker Avenue, Concord, MA 01742.

The author declares no conflicts of interest.

For correspondence contact: David Ropeik, Harvard University Extension School, Harvard University & Consultant, 21 Baker Avenue, Concord, MA 01742, or email at **dpr@dropeik.com**.

(*Manuscript accepted* 8 *September* 2017)
0017-9078/18/0

DOI: 10.1097/HP.0000000000000764