The events of September 11, 2001, demonstrated that terrorists can orchestrate well-planned and complex attacks injuring significant numbers of innocent civilians and causing psychological distress among the rest of the population (Chin, 2007). Since then, the potential for chemical, biological, radiological, and nuclear terrorism has been widely acknowledged; the U.S. National Threat Advisory remains elevated, and many believe it is only a matter of time before the next terrorist attack occurs on U.S. soil (Homeland Security Department [HSD], 2008a). Currently, use of a radiological source in combination with a conventional explosive, a so-called “dirty bomb,” is considered to be one of the most pressing and vexing terrorist threats (Mettler & Voelz, 2002). In the event of such an attack employing a radiological dispersal device (RDD), rescue workers, first responders, and other health care professionals would be the worker populations at greatest risk of injury, potentially including radiological exposures and contamination. It is also possible that a radiologic attack could target or occur in the vicinity of any workplace, small or large business, or government agency. Occupational health nurses have critical roles to play with company workers in the immediate vicinity of a radiologic attack, who may experience radiologic hazards, traumatic injuries, or psychological sequelae. The purpose of this article is to educate occupational health nurses about the potential effects of RDDs and provide resources supporting occupational health nurses’ roles in such events occurring near or at their workplaces. Occupational health nurses are prepared to assess and treat RDD casualties using current information to identify signs and symptoms of exposed and contaminated RDD victims. Decontamination, treatment, and recovery methods for workers and businesses affected by an RDD event are described.
Detection and Measurement of Radiation

Unlike high levels of radiation exposure that may produce symptoms (i.e., nausea, vomiting, diarrhea, and swelling and redness of the skin), low levels of radiation exposure from radiological dispersal devices (RDDs) may not cause any observable acute symptoms (Centers for Disease Control and Prevention, 2005a). Radiation is not visible, does not have either odor or taste, and must be detected using special equipment designed to assess its presence or potential danger. The most common equipment used to detect small amounts of radioactive contamination is the Geiger Mueller (GM) survey meter, also known as a Geiger counter (Bushberg et al., 2007). This device can also assess whether an individual has been contaminated and the location of contamination on one’s body or clothing. Workers and emergency responders can also use dosimeters to measure any dose of radiation they may receive while working directly with contaminated individuals (Bushberg et al.).

Although a detailed discussion is beyond the scope of this article, in an RDD event, an occupational health nurse may encounter one or more of the three most common types of radiation: alpha, beta, and gamma. Briefly, alpha and beta radiation exist as particles, while gamma radiation is found in the form of rays (Cangemi, 2002). Alpha radiation is the least penetrating of the three. It is not considered dangerous unless alpha-contaminated particles enter the body, in which case it can damage internal organs. Beta radiation is more penetrating than alpha radiation but less so than gamma radiation. It can damage skin tissue and harm internal organs if it enters the body (Cangemi). Gamma radiation produces the greatest penetrating power of the three as it is a high-energy ionizing radiation that travels at the speed of light. It can cause skin burns, severely injure internal organs, and have long-term physiological effects (Cangemi).

Preparing for, responding to, and recovering from terrorist attacks employing RDDs. Moreover, nurses may also serve as first responders in radiologic emergencies, regardless of their work setting, by either responding to a radiologic emergency that occurs in the vicinity of their workplaces or serving as a formal volunteer deployed by a responding organization (e.g., Medical Reserve Corps) (Medical Reserve Corps, 2008). Many of the emergency planning activities in which occupational health nurses engage require frequent collaboration with other health care professionals and professionals from other disciplines to achieve a coordinated team response to an RDD event. As with all disasters, the three major phases of disaster management for an RDD event include planning and preparedness, response, and recovery (Haddow & Bullock, 2003). This article describes the occupational health nurse’s role in each of these disaster phases.

OVERVIEW AND HISTORY

Radiological disasters may be either unintentional or intentional. Unintentional radiological disasters include nuclear power plant leaks or “meltdowns” (e.g., Chernobyl [Bonte, 1988; Mettler & Voelz, 2002] and Three Mile Island [Mettler & Voelz]). Intentional radiological disasters differ from unintentional threats in that they are often associated with military conflict or terrorism (Mettler, 2005). Radioactive substances may be intentionally dispersed in the following ways: without use of explosives (e.g., medical grade isotopes); detonation of nuclear weapons (Dallas & Bell, 2007); attacks on nuclear reactors; or in combination with conventional explosives (i.e., an RDD).

During intentional radiological events, terrorists’ use of an RDD is the most likely threat (Mettler & Voelz, 2002). A terrorist’s use of an RDD involves the detonation of conventional explosives to disperse radioactive material over a relatively large geographic area, potentially affecting many individuals. Because of its explosive nature, an RDD event is likely to cause traumatic blast injuries to those in close proximity to the device (Bridges, 2006). In addition to physical trauma, psychological effects associated with the use of RDDs on those in the vicinity of the event, in the surrounding community, and even some distance away from the detonation site may include widespread fear, apprehension, confusion, and, less frequently, panic (Rosoff & von Winterfeldt, 2007).

CHARACTERISTICS OF AN RDD

An RDD is not a nuclear weapon; rather, it is a device that uses conventional explosives (e.g., dynamite or plastic) to spread radioactive dust, smoke, or other material to create radioactive contamination and terrorism (Bushberg et al., 2005; Centers for Disease Control and Prevention [CDC], 2005a; Coleman et al., 2008; Ring, 2004). In an RDD event, although many individuals could be exposed to radioactive agents, the risk of widespread contamination is less likely (Bushberg et al.). Furthermore, radiation levels, even in the immediate vicinity of an RDD blast, are generally considered insufficient to cause serious and potentially life-threatening acute radiation sickness (CDC; Ring).

Nevertheless, it is important to understand the distinction between radiologic contamination and exposure because this understanding will guide appropriate emergency response by occupational health nurses. Radiation exposure does not necessarily result in contamination from radioactive material (CDC, 2005b). Exposure to radiation occurs when radioactive waves or particles penetrate the body (i.e., a routine x-ray) (CDC). Radiation contamination occurs when radioactive material is present on or in the body (i.e., on the skin or one’s
Radioactive exposure and contamination are unlikely to pose the greatest physical health hazards in an RDD event, although radioactive contamination may be clinically significant depending on the amount and type of radiation released (Chin, 2007). The primary physical hazard from the detonation of an RDD is the initial explosion, which can cause blast-related fatalities and serious injuries in the vicinity of the blast (Bridges, 2006; CDC, 2005a). Any radioactive material that is dispersed by the RDD will likely result in mild exposure and contamination of some survivors and emergency responders. Rather than an RDD killing or injuring substantial numbers of workers, it would primarily result in economic and psychological consequences (Rosoff & von Winterfeldt, 2007). Because of the low lethality, small dose, and limited dispersion of radiologic material by an RDD detonation, the likely adverse effects may not go beyond the psychological impact on survivors and the affected community (i.e., “fear of radiation”). Furthermore, as was noted with the terrorist attacks of September 11, 2001, the acute psychological impact and secondary trauma associated with the attack may affect adults, children, and first responders some distance from the physical location of the RDD blast (Beaton, Murphy, Johnson, & Nemuth, 2004; Schuster, Stein, & Jaycox, 2002).

THE ROLE OF OCCUPATIONAL HEALTH NURSES
Planning and Preparing for RDD Events
Planning and preparing at local and state levels for RDD terrorist attacks are necessary because such an event may overwhelm public health infrastructures, health care systems, and resources and likely cause social and economic disruptions (Smith & Spano, 2003). In the planning and preparation stages of disaster management, occupational health nurses must collaborate with public health leaders and key community agencies to devise strategies to protect emergency responders, the public, and critical infrastructure. In addition, worker health and safety education and preparedness training are essential steps in protecting workers and promoting resiliency among disaster personnel (Reissman & Howard, 2008). By the time it is known that an RDD event has occurred, the workplace will have already experienced casualties, release of radioactive material, and progression of plume growth (i.e., the radioactive cloud and dust carried from the detonation site by prevailing winds) and little time will be available to evaluate and initiate possible countermeasures (Musolino & Harper, 2006). For these reasons, strategies for response and recovery efforts related to any radiological disaster, including an RDD event, must be planned in detail. Occupational health nurses may assume leadership roles in these planning efforts. First responders, emergency planners, and infrastructure owners can use these disaster plans to efficiently help injured workers minimize overall radiation exposure and control contamination of the public. Although health care professionals and public health workers may be competent to respond to the physical aspects of disasters, they may be less prepared to meet the psychological challenges. Therefore, such plans should also include a behavioral health component addressing the psychological impacts of disasters, the common psychological reactions likely to occur among RDD survivors, and the psychological signs and symptoms signaling the need for referral (Beaton, 2006).

Disaster exercises and protocol practice are as important as the plan itself. Ongoing preparedness efforts should include joint planning and exercises that incorporate practical strategies for worker and responder safety and health (Reissman & Howard, 2008). When possible, given time and cost considerations, occupational health nurses should work collaboratively with key local stakeholders (i.e., local health departments) to conduct periodic drills designed to prepare for and respond to an RDD attack (Bushberg et al., 2007; Chin, 2007). Occupational health nurse leaders can organize and conduct training, participate in and coordinate emergency drills, provide and maintain instrumentation and equipment such as Geiger counters and dosimeters, and conduct or participate in evaluations of drills (Washington State Department of Health, Office of Radiation, 2002). Occupational health nurses have the knowledge to anticipate likely hazards within planning scenarios and prepare asset inventories to efficiently facilitate safety decisions (Reissman & Howard). Preparing for an RDD event involves planning for relatively unique features of radiological terrorism, including education and acquisition of the skills needed to effectively triage and care for mass casualties (i.e., individuals suffering from blast injuries). Blast injuries result from explosions and have the potential to cause multi-system penetrating and blunt-trauma injuries (Bridges, 2006). Such planning should also include contingencies and assets needed to respond to the physical symptoms associated with a radiological event and the likely ubiquitous psychological reactions (Beaton & Murphy, 2002). Such activities will ensure that rescue workers, first responders, and other stakeholders, including public health officials and local health care personnel, are better prepared for such an emergency (Reissman & Howard) (Sidebar).

One of the major concerns of any business is the potential for extended operational shutdown or even closure after a major disaster. Workers will have related concerns about returning to work, customers or clients renewing their business, and decontamination procedures (Rosoff & von Winterfeldt, 2007). Many of these concerns may be unfounded and, given the nature of the hazard, require timely, credible risk communication. Because of each workplace’s vulnerabilities to an RDD event, occupa-
In October 2007, a TOPOFF 4 exercise consisting of an interagency training exercise simulated a terrorist dirty bomb attack on “U.S. soil.” In this exercise, the Homeland Security Department (HSD) simulated a plausible scenario in which terrorists simultaneously detonated radiological dispersal devices (RDDs) in two U.S. cities and the territory of Guam. The first of three coordinated RDD attacks occurred in Guam with the simulated detonation of an RDD, which, as part of this exercise, was presumed to cause large numbers of casualties and widespread radiologic contamination in a populous area near a Guam power plant (HSD, 2008b). Similar simulated RDD attacks occurred shortly thereafter (within hours) in Portland, Oregon, and Phoenix, Arizona.

This was the fourth in a series of TOPOFF exercises mandated by a 1998 law requiring the federal government to work with “top” state and local officials in strengthening emergency response preparedness efforts across multiple levels of government (Ring, 2004). The purpose of the TOPOFF 4 exercise was to test the emergency response systems in the participating cities, along with the health care response and the coordination of local and federal communication systems and officials. During this exercise, a simulated RDD was detonated at a predesignated site in Portland, Oregon. Actors, portraying victims, remained in the role and position they were assigned to play for the duration of the exercise. Following the simulated RDD detonation, all participants able to walk were instructed to mobilize in an area distant from the explosion for first responders to initiate triage. Victims were triaged by first responders at the disaster site, assessed for gamma ray contamination, and then triaged again at the receiving local hospital for emergency treatment by other health care professionals. Evaluations were conducted from both victim and health care worker perspectives, including observations of the coordination of strategy between top officials at every level of government as well as with other key agencies. Communication is a key factor in a successful exercise, especially when many first responders, numerous agencies (> 200), and the general public are involved.

This TOPOFF 4 exercise was critical for practicing response to an RDD attack to identify gaps and determine the need for improvement in response plans. Top officials in multiple agencies practiced their current response plans for an RDD attack, and with this exercise, gaps and areas for improvement were identified. In addition to identifying weaknesses in coordinating communication and dividing responsibility clearly among local, state, and federal agencies, this simulation underscored the need for uniform federal guidance concerning response and recovery in the event of radiological terrorism (Eraker, 2004). Further, TOPOFF 4 assisted first responders in preparing for other community-wide disasters and emergency situations.

Response

Many aspects of the response to a radiation event are similar to those of other mass casualty incidents, but additional issues related to radiation exposure and decontamination are also present (Coleman et al., 2008). However, radiation effects (i.e., radiation-induced cancers) are considered modest following this type of emergency. For example, an RDD event exposure would have an estimated lifetime health risk comparable to that of smoking five packs of cigarettes daily or an accident risk comparable to that associated with taking a hike for those most directly involved (Ring, 2004). In a risk analysis using a radiological plume model, initial findings of the consequences of a successful RDD attack on two U.S. cities suggested that high radiological doses are confined to relatively small areas, limiting potential adverse health effects to hundreds of latent cancers, even with a major release (Rosoff & von Winterfeldt, 2007). The radiation plume would, of course, depend in part on the magnitude of the RDD explosion and prevailing wind patterns, but atmospheric plume models could track its location and movement. It is generally believed that the amount of radiation in an RDD plume is of such a magnitude that authorities would advise citizens in the plume trajectory to “shelter in place” rather than evacuate (Ring).

Treatment of life-threatening or severe traumatic blast injuries of RDD survivors must take priority over health care provider concerns related to short-term radiation exposures (Bushberg et al., 2007). In most clinical settings (e.g., receiving hospitals), the amount of radiation to which they might be exposed by contaminated victims is considered minimal (Centers for the Study of Bioterrorism and Emerging Infections [CSBEI], 2002). Thus, response efforts involve treating victims’ traumatic blast injuries, decontamination, and other exposure-reduction methods, as well as addressing the acute and chronic psychosocial issues likely to arise during and following such an event.

Radiation exposure to victims of an RDD can be minimized by removing contaminated clothing and washing residual contamination off the skin and hair as soon as feasible (CSBEI, 2002; Ring, 2004). The risk to health care workers, other personnel, and work ar-
Decontamination Procedures in Radiologic Emergencies

In human survivors, three types of contamination can occur—external, internal, or shrapnel (Centers for Disease Control and Prevention [CDC], 2005c). The focus of decontamination should be to protect human survivors from exposure, minimize the impact of contaminants, and quickly restore the situation to normal (DePaolo, Whitaker, & Wood, 2007; Valentin & International Commission on Radiological Protection [ICRP], 2005). Three categories of decontamination procedures are essential in controlling radiological exposures including those for human survivors, universal precautions taken by responding health care personnel, and environmental decontamination. The following decontamination procedures are necessary in handling and caring for human survivors: establish an ad hoc triage area, survey patients with a radiation meter, remove patient clothing, and cleanse contaminated areas (CDC).

Establish an ad hoc triage area. Triage determines the degree of contamination, potential for secondary contamination, level of victim distress, and assignment of decontamination protocols and treatment interventions (Koenig et al., 2008). An ad hoc triage area has both a contaminated area and a clean area separated by a buffer zone (CDC, 2005c). When exiting the contaminated area, contaminated outer garments must be removed and the body surveyed with a radiation meter (CDC).

Survey patients with a radiation meter. Safe work in the presence of radiation requires the use of instruments to measure radiation using consistent technique and trained personnel (CDC, 2005c; DePaolo et al., 2007). Radioactive objects should be handled with forceps and stored in lead containers (CDC). Significant amounts of surface or imbedded radioactive material and its location should be recorded (CDC).

Remove patient clothing. Most of the external contamination on a worker can be eliminated by removing clothing (DePaolo et al., 2007). To remove patient clothing properly, carefully cut and roll clothing away from the face to contain the contamination (CDC, 2005c). Contaminated clothing should be double-bagged using radioactive hazardous waste guidelines, labeled, and saved as evidence (CDC).

Cleanse contaminated areas. Contaminated wounds should be washed with saline or water, whereas intact skin should be washed with soap and water starting outside the contaminated area and washing inward, being careful not to irritate or abrade the skin (CDC, 2005c). If facial contamination is present, flush eyes, nose, and ears and rinse mouth. Repeat washing until the radiation level is no more than twice background or the level remains unchanged (CDC). Cover wounds with waterproof dressings (CDC). Dispose of water used to decontaminate individuals through normal channels (i.e., via the sewer system), as it is unlikely that there will be effective water-holding systems in place during any mass casualty incident (CDC). For mass casualties, consider establishing separate shower areas for ambulatory and non-ambulatory survivors to decrease the number of staff required for the decontamination process (CDC; Koenig et al., 2008).

Universal precautions for responding health care personnel. Universal precautions must be used by responding health care personnel and include following the standard guidelines for protection from microbiological contamination (CDC, 2005c). These strategies include using personal protective equipment such as surgical masks (N95 masks, if available) and practicing hand hygiene (CDC). Hands and clothing should be surveyed frequently with a radiation meter (CDC). Pregnant staff and staff nursing infants should be assigned to other duties due to fetal sensitivity to radiation (CDC; Valentin & ICRP, 2005).

Environmental decontamination. After a radiological dispersal device attack, residual radioactive contamination may be present over an area of several to tens of city blocks (Sullivan, Musolino, & DeFranco, 2008). Environmental decontamination would require outside assistance, trained personnel, and specialized resources and assets (CDC, 2005d). In general, environmental decontamination would be considered outside the scope of occupational health nurse practice, requiring assistance from federal agencies such as Radiological Assistance Programs, the Department of Energy, the Environmental Protection Agency, the Nuclear Regulatory Commission, and the CDC. Generally, environmental radiologic contamination is readily located with monitoring devices, but is highly persistent and impossible to destroy and can only be removed as part of the recovery process (CDC, 2005d). One priority during any radiologic remediation effort is to ensure the safety and health of responding personnel. Another important consideration is to stabilize the contaminated zone to prevent the spread of the radiologic hazard. Depending on the type, size, and dose of the radiologic hazard, a contaminated workplace or even a much larger area may be uninhabitable for an extended period depending, in part, on the agreed upon target “safe” clearance levels (CDC).

Eas from radioactive contamination is minimal if universal precautions (gloves, eye protection, and gowns) are used. Educating health care workers about relatively low-magnitude radiological hazards with RDDs is crucial and allows them to promptly and confidently provide the needed acute patient care (Bushberg et al., 2007) (Sidebar).

Psychosocial issues are likely to be one of the main
clinical concerns during and following an RDD event at a workplace because employees, leaders, and customers may be fearful, anxious, and confused due to their limited understanding of the event. Occupational health nurses must be cognizant of this and prepare to respond to survivors’ psychosocial needs. They must also recognize the needs of the “worried well”—those who will seek care and self-refer to the nearest hospital but who may have experienced little or no radiation exposure, contamination, or injury and who may need and benefit from “psychological first aid” (CDC, 2006). Measures must be taken to prevent the worried well from overwhelming local emergency departments (Bushberg et al., 2007). The concern is that such psychological effects could result in a surge of victims who may request treatment even though it may not be indicated (Mettler, 2005). Psychological first aid during the initial 48 hours following an incident is recommended and includes addressing victims’ physical needs, providing social support, and assisting victims by enhancing their sense of self-efficacy (e.g., decision making) (National Child Traumatic Stress Network, 2006).

Recovery

Disaster recovery is a complex, challenging process requiring a team effort potentially involving all sectors of a community as well as outside assets and personnel (Anderson, 2008; Perce, 2007). Depending on the size and extent of the disaster, months to years may be required for businesses, communities, and infrastructures to fully recover (Perce). Thus, the recovery phase may be long, requiring skills, activities, and operations significantly different from those required during the response phase (Coleman, 2005).

Unlike most types of disasters, contamination-related health and safety issues including decontamination associated with radiological events make recovery potentially more complex and difficult (CDC, 2005a). In addition, exposure-reducing strategies can minimize the risk of radiation exposure to recovery workers, keeping exposure levels as low as reasonably achievable while realizing that some exposures may be “acceptable” to accomplish specific tasks (Bushberg et al., 2007). Further, disaster recovery for radiological disasters must include addressing the mid-range and long-term psychosocial impacts on survivors and their families. Every business organization is part of the surrounding community and is affected if the community infrastructure is impaired or collapses. In some cases, businesses must be prepared to recover with limited or no local community support, requiring ingenuity, flexibility, and creativity of occupational health nurses (Perce, 2007).

Because personal loss and fear may motivate employees to discontinue their employment following an RDD, occupational health nurses can monitor employee attitude, motivation, and behaviors and provide a valuable perspective for employers when increased attrition is anticipated (Perce). Other activities in which occupational health nurses may engage during the recovery phase include crisis intervention, worker referrals to employee assistance programs or other community resources, and coordination of after-event care.

RESOURCES AVAILABLE TO OCCUPATIONAL HEALTH NURSES

In response to a terrorist attack employing an RDD, occupational health nurses must know how to obtain accurate and authoritative knowledge regarding radiation exposures and contamination. They must be able to provide trauma care in response to blast injuries, while taking into account risks of contamination and exposures. Occupational health nurses must be able to provide psychological first aid to victims of RDDs and plan for and respond to the needs of the worried well.

Occupational health nurses and other health care professionals in acute care as well as public health settings should be aware of, and perhaps seek training or assistance from, their Radiological Assistance Program (RAP). RAP was established in the late 1950s as one of the federal emergency response resources, or assets, administered by the National Nuclear Security Administration. RAP is a federal program assisting agencies at the federal, state, tribal, and local levels with detection, identification, analysis, and response to events involving the release of radiation (U.S. Department of Energy, National Nuclear Security Administration [U.S. DENNSA], 2008). Such support services range from education and training (i.e., giving technical information or advice by telephone) to sending highly trained individuals and state-of-the-art equipment to accident sites to minimize radiological hazards (U.S. DENNSA). Occupational health nurses may also refer to their state Health Department’s Radiation Emergency Response Plan, which delineates the roles and responsibilities of agencies and stakeholders at the state and local levels in the event of a radiological emergency. RAP personnel and assets augment the state’s plan. Occupational health nurses can also refer to the CDC (2005c) website for clinician resources including information about blast injuries and their management, as well as resources for providing psychological first aid for RDD survivors. Educational competencies for registered nurses responding to mass casualty incidents have been developed and can be adapted to the workplace (International Nursing Coalition of Mass Casualty Educators, 2001). Other resources delineating the nature and scope of acute mental health support for disaster victims may be found at the National Institute of Mental Health (2005) website.

SUMMARY

Radiological emergencies, including an intentional terrorist attack employing an RDD or dirty bomb, present a host of daunting challenges to occupational health nurses, their workplaces, and the workers they serve. Occupational health nurses must understand the differences between radiologic exposure and contamination; the radiologic risks to themselves and to company workers associated with an RDD detonated in the vicinity of their workplaces; how to assess and treat associated blast injuries; and the role of psychological first aid and lon-
IN SUMMARY

The Role of Occupational Health Nurses in Terrorist Attacks Employing Radiological Dispersal Devices
Lobaton Cabrera, S., & Beaton, R. D.

1 Radiological emergencies, including an intentional terrorist attack employing a radiological dispersal device (RDD), present a host of daunting challenges to occupational health nurses, their workplaces, and the workers they serve.

2 Occupational health nurses need up-to-date information and requisite skills to effectively prepare for, respond to, and recover from an RDD event.

3 Occupational health nurses must understand the differences between radiologic exposure and contamination, the radiologic risks to themselves and workers, assessment and interventions for RDD victims, and signs and symptoms of individuals with RDD exposure and contamination.

ger-term counseling for workplace survivors of an RDD event.

This work was supported by grant number 1 D09HP08334-02-00 from the Health Resources and Service Administration, Department of Health and Human Services, Public Health Service Act, Title VIII, Section 811, awarded to the first author; a cooperative agreement from the Centers for Disease Control and Prevention through the Association of Schools of Public Health grant number U09/CCU024247-04; and University of Washington Education and Research Center grant number 5T42OH00843. The authors would like to acknowledge the contributions of Mary Salazar, EdD, FAAN, who reviewed an earlier draft of this manuscript, and Kara Mochan, RN, MN, who helped revise the manuscript.

REFERENCES


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The Role of Occupational Health Nurses in Terrorist Attacks Employing Radiological Dispersal Devices

Directions: Circle the letter of the best answer on the answer sheet provided. (Note: You may submit a photocopy for processing.)

1. Which of the following is the most likely threat during an intentional radiological event?
   A. Terrorists’ use of a radiological dispersal device (RDD).
   B. Dispersal without the use of explosives.
   C. Detonation of nuclear weapons.
   D. Attacks on nuclear reactors.

2. All of the following are characteristics of RDDs except:
   A. Likely to cause traumatic blast injuries to those in close proximity.
   B. Are a nuclear weapon that spreads radioactive material.
   C. The risk of widespread radioactive contamination is not likely.
   D. Radiation levels are usually insufficient to cause serious acute radiation sickness.

3. Which of the following forms of radiation has the greatest penetrating power, can cause skin burns and severely injure internal organs, and has long-term physiological effects?
   A. Alpha.
   B. Beta.
   C. Gamma.

4. Occupational health nurses collaborate with public health leaders and key community agencies to protect emergency responders, the public, and infrastructures during this phase of disaster management:
   A. Planning and preparedness.
   B. Response.
   C. Recovery.

5. An RDD event exposure would have an estimated lifetime health risk comparable to that of smoking ___ packs of cigarettes daily.
   A. 3.
   B. 5.
   C. 8.
   D. 10.

6. After an RDD attack, health care providers should prioritize this response:
   A. Treatment of severe traumatic blast injuries.
   C. Decontamination of health care providers.
   D. Treatment of acute psychosocial symptoms.

7. “Psychological first aid” during the initial ___ hours following an incident is recommended for disaster survivors.
   A. 8.
   B. 24.
   C. 48.
   D. 72.

8. Most of the external contamination of a worker can be eliminated by:
   A. Using universal precautions.
   B. Washing wounds with saline or water.
   C. Covering wounds with waterproof dressings.
   D. Removing clothing.

9. Referring workers to employee assistance programs is an occupational health nurse activity during the _____ phase of disaster management.
   A. Planning and preparedness.
   B. Response.
   C. Recovery.

10. This federal program assists agencies with detection, identification, analysis, and response to events involving the release of radiation:
    A. Radiological Assistance Program.
    B. Health Department’s Radiation Emergency Response Plan.
    C. Centers for Disease Control and Prevention.
    D. National Institute of Mental Health.
The Role of Occupational Health Nurses in Terrorist Attacks Employing Radiological Dispersal Devices

March 2009

(Goal: To gain ideas and strategies to enhance personal and professional growth in occupational health nursing.)

Mark one answer only!
(You may submit a photocopy of the answer sheet for processing.)

1. As a result of completing this module, I am able to:
   A. Describe the characteristics of radiological dispersal devices (RDDs).
   B. Discuss the three phases of disaster management for RDD events: planning and preparedness, response, and recovery.
   C. Identify the roles of the occupational health nurse in each phase of disaster management for an RDD event.
   D. List resources for occupational health nurses related to RDDs.

2. The objectives were relevant to the overall goal of this independent study module.

3. The teaching/learning resources were effective for the content.

4. How much time (in minutes) was required to read this module and take the test?

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