Understanding the Risks and Realities of Nuclear Terrorism

Reports of attempted and possible terrorist threats have become part of our daily media diet. All are bad, but for many Americans the nightmare scenario is nuclear—threats involving "dirty bombs," "loose nukes," and attacks on nuclear facilities.

Anxiety over such possibilities isn't going to go away soon, but we can try to put the threats we face in some perspective. Different scenarios for a nuclear attack have different likelihoods of happening—and very different consequences. By educating ourselves about these risks, communities and individuals can devise better prevention strategies and avoid panic—and possibly more deaths—if an attack occurs.

A Guide to This Backgrounder

This backgrounder is intended to provide answers to the most frequently asked questions about nuclear terrorism, beginning with a summary of the main nuclear threats facing us today. As an understanding of radiation is essential to this discussion, a section on the subject follows, and includes the main types of radiation and their more common sources. This is followed by a section on the damage that could be expected from the different scenarios, ending with a discussion on what is generally known about how to respond to and prevent these threats. The appendix lists organizations that can be contacted for additional information on the topics discussed and includes specific contacts for both the general public and members of the media. Also available from CISAC are individual fact sheets on specific issues related to nuclear terrorism.

This backgrounder references a number of government agencies and nongovernmental organizations (NGOs) working to reduce the threat of nuclear terrorism. In an effort to provide readers with a balanced look at the problem, the groups included are representative of the wide spectrum of views on this subject. By providing this information, CISAC is not endorsing these organizations or their websites. Similarly, this list is not exhaustive, and the omission of a site or group is not, in any way, an editorial comment.

The Threats

Nuclear terrorism can take many forms, from an attack on a nuclear power plant to the theft and detonation of a nuclear weapon. However, it is important to remember that each nuclear terrorism scenario has a differing degree of likelihood, as well as very different consequences.

"Dirty Bombs"
A radiological dispersal device, commonly known as a "dirty bomb," is a conventional explosive or bomb containing radioactive material that disperses the material when detonated. It is not a nuclear bomb and does not involve a nuclear explosion.

The use of this type of bomb by a terrorist group is seen as one of the more likely nuclear terrorism scenarios because of the relative availability of low-level radioactive sources. (There are hundreds of thousands of radioactive sources for medical, home, and industrial use all around the world.) However, most of the medical sources are low-level, decay rapidly, or, as is the case for large cobalt sources, are encased in machinery that is difficult and/or dangerous to move.

Other sources range from the tiny ones used in home carbon-monoxide detectors—sources that are far too weak to be useful in a dirty bomb—to those very high-intensity sources used in industrial irradiation facilities. Although the latter could potentially cause great harm if used to create a dirty bomb, there are far fewer of them and they can be very dangerous to anyone handling them improperly, despite their protective shielding. Therefore, it would not be easy for a terrorist to get hold of enough nuclear material for an "effective" dirty bomb (that is, one likely to cause casualties due to the effects of radiation) or to put it in a suitable form for delivery.

However, even in countries such as the United States, where all radioactive sources strong enough to do damage are inventoried and controlled, theft—especially by insiders—is possible, and smuggling of radioactive sources obtained from other countries is also possible.

Attacks on Nuclear Facilities
Attacks on nuclear facilities, such as nuclear reactors, could bring about serious disruptions, large economic loss, and have potentially significant health impacts. The fear is that an explosion or fire at, or a crash into, one of these facilities could result in a massive release of radioactive material.

However, these types of attacks are unlikely to cause many immediate deaths or put large numbers of people at increased risk of cancer. U.S. nuclear power plants are generally downwind of or at crosswinds to large population concentrations and are designed to withstand extreme events, such as earthquakes and hurricanes. In addition, the likelihood of a terrorist gaining access to a power reactor is also decreased by the multiple safeguards in place and automatic shutdown systems that protect the core of the reactor. Other reactors, such as research reactors, are also potential terrorist targets. While much smaller and containing much less radioactive material, they are often located in densely settled areas and are not as well protected as power reactors.

Attacks on associated facilities, such as spent-fuel storage areas, are also a concern. These storage areas are generally not as well protected against extreme events as nuclear reactors. They are, however, generally difficult targets for either hijacked airplanes or trucks because spent fuel is usually stored in pools tens of feet under water.

It should be noted that, while this backgrounder is devoted to nuclear risks, many other industrial sites, including power plants, could cause considerable damage if attacked and, in general, are not as well protected as nuclear power reactors.

Attacks Using Nuclear Weapons

Nuclear weapons, however detonated, can destroy cities or large parts of them. If a terrorist were able to obtain enough highly enriched uranium or plutonium, he could theoretically build a nuclear bomb. This would be extremely difficult, however, for a group that did not have some degree of protection and backing from a host government, given the high degree of technical expertise needed to build these types of weapons. Other scenarios include terrorists stealing nuclear weapons from countries whose stockpiles are more vulnerable then those in the United States.

Although the effects of this type of attack would produce catastrophic casualties, this is probably the least likely scenario because of the difficulty involved in stealing or building, and subsequently successfully detonating, a nuclear weapon.

Understanding the Risks

Much of the fear associated with these types of attacks is due to the fact they involve the spread of radioactive material. Therefore, before discussing the risks and damage associated with these types of attacks, it is useful to have an understanding of radiation, its sources, and its effects on the human body.

A Radiation Primer

Radiation is any form of energy propagated as rays, waves, or energetic particles that travel (radiate) from their source. Radiation can travel through the air or a material medium. Nuclear radiation in particular is that given off during the course of radioactive decay in the form of beta and alpha particles, neutrons or gamma rays.

Radioactive materials are composed of atoms that are unstable. An unstable atom gives off its excess energy until it becomes stable. The energy emitted is radiation. The process by which an atom changes from an unstable state to a more stable state by emitting radiation is called radioactive decay or radioactivity.

Although radiation cannot be detected by the senses (sight, smell, etc.), it is easily detected by anyone with appropriate instruments that can detect even the smallest levels of radiation.

Radiation is often divided into ionizing and non-ionizing radiation. Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to change them chemically, is referred to as "non-ionizing radiation." Examples of this kind of radiation are radio waves and visible light.

Radiation that falls within the "ionizing radiation" range has enough energy to actually break the bonds that tie electrons into the atoms or molecules that make up ordinary substances. This is the type of radiation that people usually think of as “radiation” when dealing with nuclear dangers. Although this type of radiation can be harmful, it is important to remember that we also take advantage of its properties for medical treatment, such as to kill cancer cells, and in many manufacturing processes.

Compared with other types of radiation that may be absorbed, ionizing radiation deposits a large amount of energy into a small area. All ionizing radiation is capable, directly or indirectly, of removing electrons from most molecules. This property of ionizing radiation lies at the root of both its usefulness and its dangers.

There are three main kinds of ionizing radiation:

- Alpha particles, which include two protons and two neutrons
- Beta particles, which are essentially electrons
- Gamma rays and x-rays, which are pure energy (photons)

Sources of radiation
Everything on earth contains small amounts of radioactive atoms, left over from the creation of the world (such as uranium and radium) or made by interactions with cosmic radiation (such as carbon 14 and tritium). People receive some natural or background radiation exposure each day from the sun and radioactive elements in the soil and rocks. This dose varies in different parts of the world due to differences in elevation and the effects of the earth's magnetic field. Even the human body itself emits radiation.

It is estimated that natural sources of radiation make up approximately 80 percent of the average annual dose to the U.S. public. Manmade sources of radiation such as household appliances and medical and dental x-rays account for the remainder. The most significant source of manmade radiation exposure to the public is from medical procedures such as diagnostic x-rays, nuclear medicine, and radiation therapy. Other common manmade sources include mining residues, microwave ovens, televisions, smoke detectors, and cigarette smoke.

Radiation is measured in many ways. The common measure used in the United States to relate an amount of radiation to its potential health effects in humans is the rem. Since the vast majority of the radiation sources to which we are normally exposed are far below 1 rem, we often use the term millirem, where 1 millirem is 1/1,000 of a rem.

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), composed of scientists from twenty-one nations, provides evaluations on sources and effects of radiation. It also publishes a report on the annual average exposures per person worldwide, which are as follows:

- Natural background radiation: 240 millirem worldwide (300 millirem in the United States)
- Diagnostic medical radiation: 40 millirem (60 millirem in the United States)
- Coal combustion: 2 millirem
- Nuclear power: 0.02 millirem (0.05 in the United States)

For radiation to begin to damage DNA enough to produce noticeable health effects, exposure must dramatically increase—to 20,000 millirem. Above 100,000 millirem, diseases manifest.

There are millions of radioactive devices in the United States. The most common types of radioactive materials found in the United States are:

Cobalt-60 - Used to irradiate food to kill pathogens and in cancer treatment.
Cesium-137 - Used in medical and scientific equipment.
Americium-241 - Used in smoke detectors and engineering gauges that measure moisture content in asphalt.
Tritium - Used for emergency exit signs that glow in the dark.
Iridium-192 - Used in cameras that detect flaws in concrete and welding.
Nickel-63 - Used for chemical analysis.

Many recent news reports have focused on the thousands of cobalt-60 rods used in food sterilization centers, due to the potential damage they could cause if used as part of a dirty bomb. However, federal nuclear officials and sterilization industry representatives believe that it would be extraordinarily difficult for terrorists to steal and use the 18-inch-long rods. This is because an individual handling an unshielded single source rod would receive a lethal (death within weeks) dose in about a minute, and an incapacitating (immediately deadly) dose in about twenty minutes.

Radiation in Professional Life
Millions of people encounter radiation above normal background levels as a natural part of their jobs. These include doctors, nurses, radiographers, astronauts, dental hygienists, researchers, pharmacists, welders, and airplane and jet crews. The doses received can be up to several rem of exposure over the course of a year. In the United States, the federal government limits the acceptable annual occupational dose to 5,000 millirem (5 rem).

Medical Uses
Medical uses of radiation are roughly broken into therapy and diagnosis. Therapy is primarily used for treating cancer, but in the past has been used for other treatments. Most of the dose is received in a small area of the body. Diagnosis runs from fairly routine x-rays to injections of radioactive material and imaging. These doses can be several hundred millirem for diagnosis and up to several hundred rem locally for treatments. The physician who prescribes radiation treatments and diagnosis weighs the risk of the radiation against the benefit of the treatment.

Effects of Overexposure
Radioactive materials—if handled improperly—or radiation released into the environment can be dangerous because of the harmful effects of certain types of radiation on the body. The longer a person is exposed to radiation and the closer the person is to the radiation, the greater the risk. People who are exposed to relatively high levels of ionizing radiation (above 10,000 millirem) are at a higher risk to develop cancer than the general population. Those exposed to acute high doses to radiation can also develop radiation sickness. Signs and symptoms associated with the digestive system are those seen earliest and at the lowest exposure levels. Symptoms include loss of appetite, nausea, fatigue, vomiting, and diarrhea. Death from acute high doses is also possible. With effective treatment, however, individuals exposed to as much as 1,000,000 millirem can be expected to recover. It is also important to know that radiation sickness is not a communicable disease.

Dose (in mrem)	Effect
25,000–100,000	Temporary blood changes
35,000	Loss of appetite, nausea
More than 50,000	Temporary sterility in males
100,000	Double the normal incidence of genetic defects
100,000–300,000	Vomiting, diarrhea, reduced resistance to infection
200,000–300,000	Serious radiation sickness
300,000–500,000	Death in 50% of who do not receive treatment for radiation sickness
More than 300,000	Permanent sterility in females
400,000–1,000,000	Acute illness and early death within days for those who do not receive treatment

Although not conclusively established, lower levels of exposure are presumed to result in an increased risk of cancer over the long term. In the United States, it is assumed that an exposure of 1,000 millirem increases the long-term (lifetime) risk of cancer by 1/20 of 1 percent. It is important to note that this presumed increase in cancer risk at low doses has never been scientifically established, and that this presumption is used as conservative guideline.

The Damage

The level of damage caused by dirty bombs, attacks on nuclear facilities, and nuclear weapons varies significantly.

Nuclear Explosions
The worst nuclear terrorism scenario, by far, would involve the use of nuclear weapons. The energy released by a nuclear explosion alters the environment in a variety of ways. In the immediate region of the detonation, the main effects are due to the blast wave and the thermal pulse or heat flash. The blast wave can destroy or damage buildings, spread debris, and overturn trees. The thermal pulse can ignite exposed combustible materials, causing many sustained fires. These are the main direct effects. The magnitude of the effects is different depending on whether the explosion occurs on the ground or above the earth.

What's distinctive about nuclear weapons is not so much the radioactivity as the raw explosive power. Information about the damage of these weapons is based on scientific research and historical experience. We know, for example, the effects of the Hiroshima and Nagasaki bombs. Roughly 100,000 people were killed in each city, but most of the casualties and damage were a result of the blasts and fire. Radioactivity added to the misery, but it was far from being the main killing agent.

It's true that the radioactivity could have been worse if the bombs had been used differently, as they could be in a terrorist attack. The Hiroshima and Nagasaki bombs were detonated high above the ground to maximize overall damage, but that also greatly reduced fallout.

If a nuclear weapon were detonated at ground level, the area destroyed and the casualties probably would be smaller, even though ground particles would get picked up and made radioactive and then dumped downwind for hundreds of miles. More people would survive, in part because they could escape the radiation, especially if we devised adequate evacuation or shelter-in-place plans. Plans dating from the Cold War exist in many U.S. localities, though they may need review and updating.

Radiological Dispersal Devices – "Dirty Bombs"
Dirty bombs are not nuclear weapons. They possess only a fraction of the explosive force. The damage that would be caused by a radiological dispersal device would be significantly less than that of a nuclear explosion. It would, however, still cause casualties and contaminate the area surrounding the explosion. Just as with a conventional explosive, some people in the immediate vicinity of the blast may be killed immediately. Anyone nearby would know that a bomb had exploded, but would not know that it was a dirty bomb until authorities announced they had detected it. A human being cannot smell, taste, see, or feel radiation.

Dirty bombs also do not have as much radioactivity as nuclear weapons. Nuclear weapons create radioactivity in the process of the explosion. In dirty bombs, the radioactivity would have to be placed into the bomb ahead of time. How much can be loaded without promptly killing the people who load the material depends on several factors, including the kinds of radioactivity and shielding used. This is important to remember, as the materials that can potentially cause the most damage if used in a dirty bomb are also the most lethal to the terrorists themselves, greatly increasing the likelihood that they will become sick or die.

Beyond the casualties caused by the blast itself, immediate casualties due to radiation are unlikely; however, long-term health risks may increase. The increase will depend on the radioactive material used, the size of the explosive, the wind conditions, and the effectiveness of the response. Most people outside of the blast area would not absorb enough radiation to cause radiation sickness, and even those who did would likely recover.

Still, dirty bombs would cause serious problems. Some would be a result of fear. The psychological impact of spreading radioactivity, whatever its actual harm, is difficult to estimate. The public would also face significant cleanup challenges. The buildings and ground where the explosion occurred would have to be decontaminated. If there is much fallout, a larger downwind area might also have to be decontaminated. The methods for successful decontamination are well understood due to experience mitigating radiation accidents; however, the cleanup will be time-consuming and costly.

Nuclear Facilities

The third kind of possible terrorist action is a direct attack on nuclear reactors or on other nuclear facilities, such as enrichment, storage, and spent-fuel reprocessing facilities as well as the transport between them. The nightmare scenario of many is an airliner flying into a nuclear reactor or spent-fuel pool and causing another Chernobyl-type explosion. Other potential threats include terrorists gaining access to a reactor and insider sabotage at nuclear facilities.

Again, this is a serious concern; it is one most governments have done much about, and they are planning to do more. But the damage associated with this type of attack would be far less than from a nuclear explosion in a city—and pulling off such an attack would be hard. First, airliners are now much tougher to take over. In addition, the great majority of reactors are encased in concrete shells several feet thick. While not designed to withstand a hit from a modern large airliner, most were designed with aircraft crashes in mind. The effect will be considerably lessened before anything can get through to the interior.

Reactors have emergency cooling systems that are designed to work even in case of accidents that cut off electric power, and that would greatly reduce the risk of the radioactive central core melting and spreading the radioactivity. It is likely that earthquake sensors, required in all reactors, would trigger automatic shutdown to protect the core.

Other sites, such as spent-fuel ponds, are not as well protected. However, hitting them is also difficult, especially with a large airliner, given that they are low and don't present as easy a target as a tall building. The radioactivity in spent-fuel ponds is much less than in the reactor core, is generally under many feet of water, and is often below grade. Nonetheless, a crash into a spent-fuel pond could release considerable amounts of radiation, albeit far less than from a successful attack on a reactor. Additionally, any release of radioactivity would likely be slow, providing time for people outside the targeted area to evacuate.

The Chernobyl accident has caused considerable concern among Americans living near nuclear power plants. However, it is important to keep in mind several things that make that type of accident much less likely in the U.S. First, the design used in that facility is very different from the design used in America, where redundant safety mechanisms are included in plant operating systems. In addition, the health problems at Chernobyl were unnecessarily exacerbated by the government's refusal to provide accurate information about the health hazards created by the accident, denying the affected populations the potential opportunity to protect themselves through time, distance, and shielding.

The public health risk from an attack at a nuclear power plant would come from the fallout of radioactive material and the resulting exposure to radiation, and would depend on the amount released from the plant, wind direction and speed, and weather conditions (rain, snow, etc.). In the event that any release of radiation occurs, the levels of radioactivity are monitored by authorities from federal and state governments, and the plant itself, to determine the potential danger.

What To Do in an Attack: Response Guidance

One of the special features of radioactivity is that it can be detected down to the level emitted by our own body, and well below. So, no matter how small the amount, people will know whether or not they have been contaminated by radiation. In the event of an attack, the health-care community has been trained to recognize what levels are considered damaging and require medical attention.

Each of the scenarios outlined earlier will require a different response by local, state, and federal authorities. However, in each scenario, the most accurate information concerning the best steps for the public to take will likely be disseminated through radio and television, and those with access should follow the instructions given by emergency officials.

Steps to take in the event of a dirty bomb attack

The first step to take is to get inside (or stay inside), then listen to the radio or television for further information. Follow a "shelter-in-place" plan, which includes turning off fans, air conditioners, and forced-air heating units that bring in fresh air from the outside. Use these systems only to recirculate the air already in the building. If you are outside, get into a building as soon as possible in order to reduce the amount of dust that gets on you.

If you are close to the explosion and covered with residue, do not stray far from the site. First responders will decontaminate those closer to the event more quickly then those fleeing. Even if it takes some time for authorities to respond, you are more likely to receive better treatment from the first response teams than at the hospital. If you are able to identify the source of the radiation and wind direction, however, you should keep as much distance as possible between yourself and the source, and try to stay upwind from the source. In the case of dirty bombs, keep in mind that if you are far enough away to survive the initial explosion, the amounts of radiation will most likely be so low that a few hours of exposure will not be enough to harm you.

If you are covered with residue do not get into your car, do not take mass transit, and do not go home. You are likely to contaminate your car and spread radiation to your family. Traffic controls may be implemented to enable emergency vehicles to get to the scene of the bombing, so avoid driving.

Radioactive dust can be washed off the skin, and potentially contaminated clothing should be put in plastic bags, placed in a separate area, and turned in to authorities for proper disposal. If you are outside of your home and potentially exposed to the dust from the blast, take off your shoes and outer layers of clothing outdoors. Use a hose to rinse off your underclothes and body before going indoors to reduce the chance of contaminating the inside of your home.

Special Considerations for Those Living Near Nuclear Facilities

Under federal law, people living in the vicinity of a nuclear power plant are required to be advised annually regarding how they should respond and the procedures that they should follow in the event of a nuclear emergency. State and local governments, with support from the federal government and utilities, develop plans that include a plume emergency planning zone within a radius of ten miles from the plant and an ingestion planning zone within a radius of fifty miles from the plant. The plans also delineate evacuation routes, reception centers for those seeking radiological monitoring, and location of congregate care centers for temporary lodging.

Radiological emergency plans call for a prompt alert and notification system. If needed, this prompt alert and notification system will be activated quickly to inform the public of any potential threat from natural or manmade events. This system uses either sirens, tone alert radios, route alerting, or a combination to notify the public to tune their radios or television to an Emergency Alert System (EAS) station. The EAS stations will provide information and emergency instructions for the public to follow. If you are alerted, tune to your local EAS station, which includes radio stations, television stations, NOAA weather radio, and the cable TV system.

Special plans must be made to assist and care for persons who are medically disabled or handicapped. If you or someone you know lives within ten miles of a nuclear facility and would require special assistance in an emergency, FEMA recommends notifying and registering with your local emergency management agency.

In the most serious cases of emergencies at nuclear facilities, evacuations will be recommended based on particular plant conditions rather than waiting for the situation to deteriorate and an actual release of radionuclides to occur.

Steps to Take in the Event of a Nuclear Explosion

In the event that a terrorist was able to detonate a nuclear weapon, there is little that those closest to such an explosion could do to protect themselves. If, however, you are far enough from the blast to react, and realize that a nuclear explosion has taken place, you should drop and cover immediately. This is your best bet to avoid the initial radiation and the “thermal pulse” given off after the explosion, which can cause people outdoors to experience severe burns. In addition, try to avoid looking at the blast. Light from explosion can burn permanent dark spots into the retina. It is possible that you, and those around you, may be blinded for up to an hour after a blast.

Once the blast subsides and the light dims, remain under cover. This is because the intense heat of the explosion will then produce a “blast wave.” A blast wave can be as strong as 4,000 mph, and can do as much or more damage than the initial blast in highly populated areas. Your chances of surviving this type of blast increase by simply staying on the ground. The blast wave is followed by heavy winds, the result of the vacuum created as the blast wave moves quickly upward.

Once you have realized that a nuclear explosion is taking place, and have taken cover and/or dropped to the ground, do not get up for at least two full minutes. After two minutes, it is important to find shelter if you have not already done so. This is because the material sucked up during the blast (which creates the mushroom-shaped cloud often associated with a nuclear explosion) will begin to fall back down as radioactive debris within minutes of the blast. This debris can be carried by the wind and spread over a wide area, depending on weather conditions. Cars are inadequate protection from radioactive fallout (but better than no protection), and those in their automobiles should try to find better shelter as quickly as possible.

The best place to be during fallout is underground (this includes basements and underground parking garages). If you cannot get underground, windowless rooms can provide some protection. If you are in a situation where it is impossible to take shelter inside, look for a heavy underpass to stand under, or, in a completely flat area, dig a thin, deep trench.

Stay in the shelter for at least twenty-four hours. After that time, remain in the shelter until you receive confirmation from authorities that your area is free of fallout (via radio or other emergency notification systems). If you do not have a radio and have not received notification from authorities that your area is safe, assume it is not. If possible, remain in the shelter for at least one week. If it is absolutely necessary, after the third day you can leave the shelter to find food, but only for thirty-minute intervals.

In this type of emergency, eat and drink only those products in sealed containers. Bottled water and canned food are best, as other foods may have been contaminated. Wash the outside of each item if possible. Do not eat any non-packaged animal, fruit, or vegetable products, and be sure not to drink standing water.

In the event of any type of terrorist attack, because of the overwhelming demands on first responders, it is important to remember that you should not call 911 unless you have a life-threatening emergency.

Things You Can Do Ahead of Time to be Prepared for an Attack
Make a list of important local numbers, such as the non-emergency numbers for the police department and fire department. Keep it by the phone and make copies for yourself and your family to keep in your wallets. Write down phone numbers and contact information for your family. Keep one copy by the phone and provide others to family and friends. Make sure that everyone has the phone number for the family's emergency out-of-state contact person.

Because of the multiple hazards in communities, including natural and technological events, each family member should have a car or desk kit of personal support items. Lists of recommended items are available from local Offices of Emergency Services. Keep an extra change of clothes and shoes on hand, soap and shampoo to wash away contamination, a three- to five-day supply of prescription medications required by family members, and drinking water. In addition, familiarize yourself with the emergency plans of your office building or other work location. No matter where you live, ask your local officials and first responders about their plans to handle a radiological dispersal device attack, or any accident involving radioactive material. These officials can give you more specific information about the emergency plans and possible evacuation routes for your community.

Things you can to ahead of time to be prepared if you live near a nuclear power plant
Those who live near nuclear facilities can become more prepared by becoming familiar with their local emergency plans. Residents within the ten-mile emergency planning zone regularly receive emergency information materials (via brochures, the phone book, calendars, utility bills, etc.). These materials contain educational information on radiation, instructions for evacuation and sheltering, special arrangements for the handicapped, contacts for additional information, etc. Residents should be familiar with these emergency information materials. In addition, the Federal Emergency Management Agency recommends those living near nuclear facilities:

- Attend public information meetings. You may also want to attend the meetings that are held after FEMA has conducted a mock emergency exercise, which include the media and the public.
- Contact local emergency management officials, who can provide information about radioactivity, safety precautions, and state, local, industry, and federal plans.
- Ask about the hazards radiation may pose to your family, especially with respect to young children, pregnant women, and the elderly.
- Learn your community's warning systems.
- Learn emergency plans for schools, daycare centers, nursing homes—anywhere family members might be.

Government Response Plans
After dealing with injuries and casualties caused by the initial blast, authorities would focus on the treatment of radiation sickness, containment and monitoring, evacuation, and decontamination. Federal, state, and local governments have in place plans and procedures for responding to radiological emergencies. The Federal Emergency Radiological Response Plan, for example, outlines the federal government's plan for responding to radiological emergencies, including acts of nuclear terrorism, and specifies the responsibilities of each federal agency that may have a significant role in such emergencies. As part of this plan, federal agencies periodically assist state and local governments with planning and training activities designed to improve response capabilities.

Preventing Nuclear Terrorism
A crucial step in preventing nuclear terrorism is to protect, control, and account for nuclear weapons and materials at their sources. A report released in June 2002 by the National Academy of Sciences concluded that in working to prevent nuclear terrorism, "the first challenge … for the United States and its allies [is] to improve security for weapons and special nuclear material wherever they exist, but especially in Russia." Additionally, accounting for and securing possible "loose nukes" in Russia and elsewhere is equally important, and a number of government agencies, international organizations, and NGOs are working toward these goals.

Given the threat posed by nuclear terrorism, ongoing and newly created initiatives are underway to account for and secure the materials used to make nuclear weapons.

How the public can help
Several governmental and nongovernmental organizations are working to prevent nuclear terrorism, some of which are listed below and in Appendix A. These organizations can provide additional information on a variety of issues related to nuclear terrorism and efforts to prevent it. The public can further these efforts by learning about the issues and becoming involved in these organizations' activities, and also by expressing support to their elected representatives for federally funded programs aimed at reducing the threat.

The federal government has also created the **Citizen Corps,** through which federal agencies will work with state and local officials to help citizens organize community-based efforts to prevent, prepare for, and respond to all types of potential disasters, including terrorist attacks. Information about the Citizen Corps is available on the website http://www.citizencorps.gov/, and from your local Office of Emergency Services.

Government efforts to prevent nuclear terrorism

The Nuclear Regulatory Commission (NRC) regulates radioactive material, including source material (uranium and thorium); special nuclear material (enriched uranium and plutonium); and by-product material (material made radioactive in a reactor, and residues from the milling of uranium and thorium). There are about 21,000 licensed organizations in the United States that use such material. NRC and state regulations require licensees to secure radioactive material from theft and unauthorized access. They also require reports of lost or stolen material. The NRC receives about three hundred reports per year of lost or stolen radioactive material. To better account for all sources, the NRC has initiated a program to register certain high-risk devices and is considering the implementation of additional security measures.

As a precaution, no-fly zones were imposed over all nuclear power plants after September 11, 2001.

Nuclear Emergency Search Team (NEST)

NEST, under the Department of Energy, comprises specialists from Lawrence Livermore, Los Alamos, and Sandia national laboratories. The team is dispatched in the event of nuclear accidents or terrorist attacks involving nuclear weapons. NEST teams also perform periodic searches in randomly selected cities, in areas that local officials feel are the most likely to have hidden contraband. The team uses sophisticated devices to detect radiation emissions. The team has also deployed its detectors at many high-profile events, including the Salt Lake City 2002 Winter Olympics.

Under the **Defense Threat Reduction Agency** (DTRA), Department of Defense resources, expertise, and capabilities are used to address the present and future threat of weapons of mass destruction. The agency's Cooperative Threat Reduction program is designed to help the countries of the former Soviet Union destroy nuclear, chemical, and biological weapons of mass destruction and associated infrastructure, and to establish verifiable safeguards against the proliferation of those weapons.

The Group of Eight countries (G-8) formally agreed in June 2002 to a plan to provide $20 billion during the next ten years for nuclear nonproliferation programs in the former Soviet Union. The plan, called the Global Partnership against the Spread of Weapons and Materials of Mass Destruction, includes scrapping chemical weapons, dismantling decommissioned nuclear submarines, disposing of fissile material, and employing former weapons scientists.

International Organizations and NGOs working to prevent nuclear terrorism

The **International Atomic Energy Agency** (IAEA) approved an action plan to combat nuclear terrorism in March 2002. The plan is designed to upgrade worldwide protection of nuclear and other radioactive materials, recognizing that the first line of defense against nuclear terrorism is the strong physical protection of nuclear facilities and materials.

The Nuclear Threat Initiative (NTI) was founded by Ted Turner and former senator Sam Nunn to reduce the threat posed by nuclear weapons. NTI's activities focus on funding projects that can be replicated on a larger scale by governments and the private sector, promoting dialogue, building common ground, and increasing public awareness of the threats.

Appendix A - Additional Resources

Internet Resources

General Information on Radiation and Nuclear Power

The United Nations Scientific Committee on the Effects of Atomic Radiation
http://www.unscear.org/
UNSCEAR, composed of scientists and consultants from twenty-one nations, provides evaluations on sources and effects of radiation.

The Environmental Protection Agency - EPA Radiation Homepage
http://www.epa.gov/radiation/index.html
This site contains general information on radiation and nuclear materials for students, journalists, and the public. It also includes information about the agency's radiological emergency response team.

Nuclear Regulatory Commission (NRC)
http://www.nrc.gov
This site details the role and responsibilities of the NRC, and includes general information on radiation and nuclear power. The site also includes a schedule of NRC public meetings. In addition, the site contains proposed rulemakings and petitions for rulemakings that have been received by the NRC. Background files on proposed rules and petitions are available on the site. Through the site, the public can officially comment on these petitions and proposed rules in lieu of sending written comments to the NRC.

U.S. Food and Drug Administration
Consumer Information from the Center for Devices and Radiological Health
http://www.fda.gov/cdrh/consumer/index.html
This guide from the FDA details the government's role in regulating radiation-emitting electronic products and lists a number of common items that emit radiation. The site also includes information on frequently asked questions about radiation-emitting products such as cell phones and microwaves.

Union of Concerned Scientists (UCS)
http://www.ucsusa.org/index.html
Among its many programs, the Union of Concerned Scientists has initiatives focused on nuclear energy and nuclear weapons. Much of the group's work focuses on monitoring the performance of nuclear plants and the actions of the Nuclear Regulatory Commission. The group researches alleged safety problems at individual plants and has criticized regulators for not taking effective action. The group regularly files petitions to the NRC and testifies before Congress about these issues. UCS also advocates deep cuts in nuclear forces and reducing the alert status of nuclear missiles.

Additional Information on Nuclear Terrorism

The Project on Managing the Atom—Harvard University
http://ksgnotes1.harvard.edu/bcsia/mta.nsf/www/home
Harvard's Project on Managing the Atom is designed to encourage interdisciplinary thinking about nuclear problems and to promote exchanges and dialogue between researchers, policymakers, and nongovernmental organizations active on these issues. The project's goal is to develop and promote sound, nonpartisan, forward-looking recommendations for managing current and future nuclear challenges. The site includes a special section devoted to "Preventing Nuclear Terrorism."

International Physicians for the Prevention of Nuclear War (IPPNW)
Briefing on Threats of Nuclear Terrorism
http://www.ippnw.org/NukeTerrorism01.html
A group of Soviet and American doctors founded IPPNW in 1980 to educate health professionals, political leaders, and the public about the medical consequences of nuclear war. IPPNW is a nonpartisan global federation of medical organizations dedicated to research, education, and advocacy relevant to the prevention of nuclear war. To this end, IPPNW seeks to prevent all wars, to promote nonviolent conflict resolution, and to minimize the effects of war and preparations for war on health, development, and the environment.

Council on Foreign Relations—Terrorism Q&A
http://www.terrorismanswers.com/home
This site, sponsored by the Council on Foreign Relation and the Markle Foundation, provides fact sheets about various terrorism topics, including "loose nukes" and "dirty bombs."

Information on Nuclear Nonproliferation Programs

Office of Defense Nuclear Nonproliferation
http://www.nnsa.doe.gov/
This office within the National Nuclear Security Administration (NNSA) seeks to promote nuclear nonproliferation, reduce global danger from weapons of mass destruction, advance international nuclear safeguards, and eliminate inventories of surplus fissile materials usable for nuclear weapons.

Initiatives for Proliferation Prevention (IPP)
http://ipp.lanl.gov/
The IPP is a cooperative program designed to engage former Soviet weapons scientists, engineers, and technicians currently or formerly involved with weapons of mass destruction (or underlying technologies) on non-weapons-related projects. It also seeks to identify and create nonmilitary commercial opportunities for former Soviet WMD-related technologies.

Center for Nonproliferation Studies (CNS), Monterey Institute of International Studies
http://cns.miis.edu/
The CNS site provides access to various publications and databases related to the proliferation of weapons of mass destruction, including detailed information by region.

Appendix B - Contacts for Journalists

Center for International Security and Cooperation (CISAC) Experts

George Bunn
Consulting Professor
Areas of Expertise: Protection of nuclear materials; arms-control treaties
Phone: 650-725-2709
Email: gbunn1@stanford.edu

Laura Donohue
Visiting Fellow
Areas of Expertise: Terrorism and counterterrorism; civil liberties and counterterrorism
Phone: 650-725-5364
Email: donohue2@stanford.edu

Michael May
Professor, Emeritus
Areas of Expertise: Radiological weapons; nuclear weapons policy
Phone: 650-723-9733
Email: mmay@stanford.edu

Scott Sagan
Co-director
Areas of Expertise: Nuclear strategy; proliferation of weapons of mass destruction
Phone: 650-725-2715
Email: ssagan@stanford.edu

Fritz Steinhausler
Visiting Professor
Areas of Expertise: Protection of nuclear materials; nuclear smuggling
Phone: 650-725-0936
Email: fjs@stanford.edu

Dean Wilkening
Director, Science Program
Areas of Expertise: Container security; chemical and biological weapons
Phone: 650-723-9742
Email: wilkening@stanford.edu

Lyudmila Zaitseva
Visiting Fellow
Areas of Expertise: Protection of nuclear materials; nuclear smuggling
Phone: 650-725-0936
Email: fjs@stanford.edu

Nongovernmental Organizations

Natural Resources Defense Council
40 West 20th Street
New York, NY 10011
Telephone: (212) 727-2700
Fax: (212) 727-1773
http://www.nrdc.org/nuclear/default.asp
Experts: Christopher E. Paine; Robert S. Norris; Matthew G. McKinzie; Geoffrey Fettus
Areas of interest: nuclear weapons and waste
Contact them through their press contact, Elliott Negin
Phone: 202-289-2405
Email: enegin@nrdc.org

Nuclear Energy Institute
176 I Street, N.W., Suite 400
Washington, D.C. 20006
Phone: 202-739-8009
Fax: 573-445-2135
http://www.nei.org
Contact: Mitch Singer, 202-739-8009 or swp@nei.org
Area of interest: the commercial nuclear energy industry
The site also contains an index of more than 100 experts in nuclear energy at
http://neiapps.nei.org/experts/index.asp.

Union of Concerned Scientists
2 Brattle Square
Cambridge, MA 02238-9105
Phone: 617-547-5552
Email: ucs@ucsusa.org
http://www.ucsusa.org

Government Agencies
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
Phone: 202-564-9290
http://www.epa.gov/radiation/contact.htm

U.S. Department of Energy
1000 Independence Ave., S.W.
Washington, DC 20585
For media inquiries, call 202-586-5806

U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

Phone: 301-415-7000
http://www.nrc.gov
Contact the public affairs office at 301-415-8200 or opa@nrc.gov
A list of regional contacts is available at:
http://www.nrc.gov/what-we-do/public-affairs/contact-opa.html

California/Bay Area
Office of Emergency Services, San Jose
855 North San Pedro St., #404
San Jose, CA 95110-1718
Phone: 408-277-4595
Fax: 408-277-3345
Contact: Dr. Frances Edwards-Winslow
e-mail: frances.winslow@ci.sj.ca.us
http://www.ci.san-jose.ca.us/oes

Governor's Office of Emergency Services
Coastal Region Office
1300 Clay Street
Oakland, CA 94612
Phone: 510-286-0895
Contact: Leonard Miller
Email: Leonard_Miller.oes@oes.ca.gov

Governor's Office of Emergency Services
3650 Schriever Avenue
Mather, CA 95653
Phone: 916-845-8400
Fax: 916-845-8441
Contact: Information/Public Affairs (duty officer)
http://www.oes.ca.gov/

Appendix C – Contacts for the Public

In California

State of California—Safety Information and Referral Line
www.oes.ca.gov
The Governor's Office of Emergency Services (OES) operates the Safety Information and Referral Line to provide nonemergency information on terrorism and related issues. Call 1-800-550-5234 (TTY 1-800-550-5281) for recorded messages twenty-four hours a day. Trained technicians are available to answer questions directly during peak hours.

Nationwide

Environmental Protection Agency—National Response System
http://www.epa.gov/oerrpage/superfund/programs/er/nrs/index.htm
During an emergency, the National Response System can be accessed twenty-four hours a day by calling the National Response Center (NRC) at 1-800-424-8802. For non-emergencies and planning activities, state and local responders can access the NRS through their EPA Regional Removal Manager. For EPA's counterterrorism programs, the Emergency or Deputy Emergency Coordinator can be contacted at 202-260-8600.