



## **Radiological Terrorism Introduction**

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#### **Introduction**

Hello, my name is Braxton DeGarmo and I am the Emergency Medicine and Primary Care consultant to St. Louis University's Center for the Study of Bioterrorism. In our effort to widen the scope of our educational materials for physicians and other healthcare workers, we have produced this informational CD-ROM on radiological weapons, their potential use by terrorists, and the medical management of such casualties.

#### **Nuclear WMD**

Unlike conventional air explosives and chemical weapons, the history of radiological devices as weapons dates back only 60 years. Scientific advances in the 1940's allowed us to split the atom and unleash the power of atomic fission. Two atomic bombs were dropped by the U.S. on Japan during World War II, causing Japan to unconditionally surrender to the Allied Powers and ending that war.

#### **Nuclear WMD**

As weapons of mass destruction, nuclear weapons alone have the distinction of being truly destructive. While chemical weapons may be highly disruptive and biologic weapons extremely deadly, only the atom bomb can destroy an entire city and make it uninhabitable for years. Even a "dirty bomb," the other widely touted radiological weapon, cannot cause such destruction and is more disruptive than deadly.

#### **Pros / Cons**

Nuclear weapons hold several advantages over other types of weapons. They are highly disruptive having the potential to make areas uninhabitable, and of all

weapons, they have the greatest fear or terror factor. The use of such weapons would also stimulate intense media attention. Finally, from the perspective of pure destruction, a nuclear bomb has vast power to immediately kill and obliterate a large area, taking its toll not only on human life but also on the infrastructure of the strike area.

## **Pros / Cons**

That said, there are also significant disadvantages for users of nuclear weapons. They are expensive to obtain and to maintain, unlike chemical and biological weapons, which can be produced at little expense. Because of the radioactive decay of all radioisotopes, a nuclear weapon has a relatively short half-life. Most nuclear bombs must have their plutonium or uranium recycled every seven years in order to maintain levels capable of achieving the critical mass necessary for a nuclear explosion. This upgrading adds to the difficulty and expense of maintaining these weapons.

Unlike chemical weapons, radiological weapons do not possess high levels of target control and containment. Although they can be precisely delivered to a target, they may not cause the planned level of destruction. A poorly maintained bomb might destroy only a portion of the target area, and changes in the wind might carry the radioactive fallout plume in undesired directions. And while destruction of an area's infrastructure might be seen as an advantage, it can also become a disadvantage to groups who do not seek to make the vicinity uninhabitable or unusable for a long time.

Another disadvantage is the risk of detection. Following the World Trade Center attack, greater attention has been paid to detecting radioactive materials. Most airports, seaports, and many border crossings into our country have added radiation detection capabilities. In fact, during times of high alert, the Coast Guard boards all ships bound for U.S. ports and scans them for radiation well before they could possibly bring a nuclear device into a major seaport.

Finally, maintaining total anonymity is difficult with a nuclear device. All radioisotopes possess a "signature" that exposes their point of origin. This signature makes it easier to trace the material and potentially point out who supplied it to the responsible terrorist group, making reprisals more likely.

## **Destructivity**

A nuclear weapon's ability to destroy lives and infrastructure far exceeds that of conventional, chemical, or biological weapons. In fact, even radioactive "dirty bombs" lack real destructive power and rely more on fear to disrupt a target society. With this in mind, understanding the goal of the terrorist, whether it is to harass or to kill, helps us determine which form of radiological weapon might be used.

## **Lethality**

Looking at the potential for death, it is easy to understand that the power of a nuclear blast has the potential to kill tens of thousands of people in a densely populated target area. On the other hand, detonation of a “dirty bomb” will result in relatively few deaths. Despite the potential for mass destruction, on a gram for gram or dollar for dollar scale, nuclear weapons remain less lethal and much more expensive than biological weapons. The efficacy or lethality of a nuclear blast falls between that of conventional and chemical weapons and the more deadly biological weapons. As you can see from the slide, where 320 million grams of conventional fuel-air explosives are required to produce heavy casualties within a square-mile area, it only takes 5,000 grams of fissionable material fashioned into a crude nuclear bomb to inflict a similar level of casualties. Yet, only 8 grams of anthrax spores can achieve the same outcome.

## **Availability**

So, should a terrorist group decide to strike with a nuclear weapon, just how easy is it to obtain one? Unfortunately, nuclear proliferation has become a problem. Nuclear weapons are no longer restricted to the major post-World War II powers. In recent times we have seen India and Pakistan come to the brink of a nuclear skirmish, and North Korea has recently resumed its own nuclear weapon development program. The presence of such development programs makes real the fear that a rogue state could have the potential of supplying such weapons or materials to terrorist groups. Also of significant concern are a great number of weapons unaccounted for after the fall of the Soviet Union. By one account, close to 100 1-kiloton ADMs, or atomic demolition munitions, the famed “suitcase nukes,” remain lost, and there is fear that these devices have found their way into Libya, Iran, Cuba and possibly terrorist hands. For a number of years word circulated within the weapons “black market” that some or all of these ADMs were available for sale. The validity of these claims and the identities of possible buyers cannot be ascertained. Fortunately, these devices are aging and may soon become obsolete. One final concern about nuclear bombs is that we now know that some well-financed terrorist groups have been conducting their own research into nuclear weapons. Al-Queda documents obtained in Afghanistan revealed that group’s early efforts at such research. Yet, this knowledge raises a further question. If these groups had already purchased such weapons from the “black market,” why the need for such research? Are they doing the research in order to develop their own weapons because they do not, in fact, have them? Or, are they trying to maintain weapons they currently possess? The lack of the answers to these questions underlies our fear of a terrorist strike using a nuclear device.

With respect to “dirty bombs,” radiological materials have widespread use within industry. Cobalt-60 is used for food and mail irradiation. Americium-241 is used in smoke detectors and oil exploration. Other isotopes are found readily in

numerous medical and academic research labs. The relative accessibility of these isotopes make the use of a “dirty bomb” much more likely than an all-out nuclear blast.

One other potential scenario must also be considered here. To avoid smuggling a bomb into the country, or stealing radioactive materials to construct a “dirty bomb,” terrorists could instead sabotage one or more of our nation’s nuclear power plants to produce a “granddaddy” of “dirty bombs.” Fortunately, following 9-11, access to these plants and even to their immediate areas has been tightly restricted.

## **Delivery**

Assuming the worst, that a large terrorist organization does now possess one or more nuclear devices, how easy would it be for them to deliver such a bomb to its target? Unfortunately, in our free society, delivery is not difficult. A 1-kiloton ADM weighs roughly 200 pounds and is fairly easily moved about, while a 10-kiloton bomb, the size of the bomb dropped on Hiroshima, could be readily moved by truck or boat. Before 9-11, many of our largest airports maintained radiation detection equipment in order to prevent the unauthorized movement of radioactive materials. Since 9-11, that program has been expanded to include our major seaports and some major border crossings. While this may help deter movement of a thermo nuclear weapon of mass destruction, the equipment is not fool-proof and might miss a smaller bomb or other materials that could be used in a “dirty bomb.” It is also impossible to totally seal our borders against the smuggling of such a device, so the threat remains.

## **The Terrorist Risk**

In considering the potential for a terrorist nuclear strike, there are five basic levels of risk. The lowest risk situation is that of threats by a group that has no real capability to develop or use such a weapon. Although they pose no actual threat, hoaxes by these groups can still cause significant disruption and tie up police and other agencies which must prove or disprove the claim. The next level involves groups that may have the capabilities to develop and use nuclear weapons but have been unsuccessful in obtaining them. A greater risk is posed by those groups that have obtained these weapons, or the materials to make them thus the highest risk level comes with the actual use of a nuclear weapon, with failed attempts falling just below their successful use.

Although there is much speculation about which terrorist groups have the technical expertise to assemble and maintain a nuclear weapon and about those that have obtained either weapons-grade isotopes or a bomb itself, no hard

intelligence has yet confirmed that any terrorist group possesses these weapons. And, fortunately, to date there have been few threats by any known terrorist organizations to use them.

### **The Terrorist Risk**

So, assuming there are some well-financed terrorist groups that do possess one or more nuclear weapons, why haven't we seen their use, or even the threat of such a strike? Some possible reasons include the fear of a severe backlash against those who would use such a weapon and their home nations. This is a particularly good deterrent to those groups seeking political or social legitimacy. And, although the risk is real, most experts agree that the likelihood of nuclear weapon use is low for several reasons. First, it is possible that nuclear weapons have not been as easily acquired as suggested by the media. These devices are expensive, especially when weighed against the relative low cost of biological and chemical weapons. They are difficult to maintain, requiring a high level of expertise and a ready source for the isotopes needed to recycle these weapons and retain their potency. Finally, while biological and chemical weapons can be moved around much more freely there is a much higher risk of detection with nuclear devices.

### **Defense**

Finally, we must realize that the risk, although deemed low, is still there and we have minimal defensive capabilities against such a strike. Prevention and detection are key to avoiding such a calamitous attack. It is to our benefit, and the world's, that we work to reduce nuclear proliferation, tighten security, limit access to uranium and plutonium, and improve our surveillance and detection capabilities if we are to prevent a terrorist strike with a nuclear device.