# Gimme shelter: The need for a contemporary civil defense program

By Lawrence M. Wein | 28 April 2010

Of the 15 terrorism and natural disaster scenarios used by the Department of Homeland Security for planning purposes, the first scenario is the most feared: Terrorists detonate a 10-kiloton improvised nuclear device at ground level in the National Mall in Washington at 10 a.m. on a weekday morning.

In an attempt to understand what can be done to mitigate the consequences of such an attack, I, along with Stanford graduate students Sylvie Denuit and Youngsoo Choi, constructed a detailed mathematical model of this scenario that includes the initial effects of the detonation, the radiation fallout in subsequent days, the traffic flow of vehicles exiting the city, and the behavioral responses with respect to shelter versus evacuation. (Our full study will appear in an upcoming issue of the journal *Risk Analysis*.)

The results are on the order of what happened in Hiroshima nearly 65 years ago: Approximately 80,000 people would die from the immediate effects of the blast and heat and the radiation generated in the first minute. (These numbers are rough estimates and depend upon a number of irreducible factors, including the precise weather conditions.) Additionally, fallout--radioactive material carried by the explosive force and prevailing winds for up to 20 miles--would kill 20,000-40,000 pedestrians (i.e., commuters and residents without access to a vehicle) and 20,000-60,000 people in vehicles. The lower range represents the case in which most people shelter in basements or large buildings (office or residential) for 12-24 hours after the blast; the upper range represents the case in which most people attempt to immediately evacuate (by foot or vehicle).

These 60,000 saved lives far exceed the number of lives that would be saved in our model by medical care. Transfusion support and antibiotics obviously have the potential to save many lives, but such care will be practically impossible in the aftermath of a nuclear terror attack.

More to the point, as a society, we have forgotten about the importance of sheltering--a mainstay of Cold War-era civil defense training. This is partly because there isn't a scientific consensus on the shelter versus evacuation decision. Recommendations range from "evacuate if you can do it quickly" to "everyone shelter-in-place." Subtler strategies include "shelter unless you're in an area that will receive a potentially lethal dose of radiation" and "evacuate if your shelter isn't very good and you can rapidly get away from the plume."

Our analysis suggests that there is only a tiny fraction of people who would be better off by evacuating. And we should note that these people won't know who they are when the decision about evacuation needs to be made. Accurate plume information--the cloud can be irregularly shaped due to different wind directions at different altitudes--and travel-time estimates won't be available, and the ability for the government to communicate to those impacted by the attack will be extremely limited, perhaps restricted to battery-powered radios.

And even if the information and communication were perfect, historical data suggests that citizen compliance to a government-managed evacuation would be far from perfect. Although just 3,500 people within a 5-mile radius of Three Mile Island were told to evacuate when the plant melted down in 1979, 200,000 people within a 25-mile radius actually evacuated. Further, a 2007 survey found that the self-evacuation after a dirty bomb attack would be 65 percent in the absence of government advice and 39 percent if the government advised against evacuation. Moreover, our traffic-flow calculations suggest that even if a small percentage of those who aren't supposed to evacuate do so anyway, all of the evacuees will be stuck in traffic jams and therefore, exposed to much more radiation, especially because vehicles provide almost no protection from fallout.

Thus, the only robust strategy is to advise everyone to shelter.

To start implementing such a planned response, the government must first relinquish control of consequence management to our citizenry and then initiate an aggressive public-education campaign. The irony is that U.S. government websites currently contain excellent advice--including "everyone should shelter"--but they have neglected to tell people about them. Consequently, Homeland Security needs to get its message out creatively (how about Kiefer Sutherland, a.k.a. Jack Bauer, as the department's primary spokesman?); simply ("stay indoors for 12-24 hours"); and broadly (ask companies near large cities to have simple sheltering strategies).

The cost for such an educational campaign would surely be less than what we spend on other catastrophic terror threats ($877 million contract for an anthrax vaccine). The bottom line: The public must be educated about this issue now, because it's a lesson we don't want to learn from experience.