Federation of American Scientists Working Group on Biological Weapons

---

Position Paper

Chemical Incapacitating Weapons Are Not Non-Lethal

"Oh, What a Lovely War, If No One Dies," exclaims the title of a recent New York Times article (William Broad, November 3, 2002) about so-called non-lethal weapons. But the fact is that chemical incapacitating weapons are as likely as bullets to cause death.

A number of events have brought "non-lethal" chemical incapacitating agents into the news recently, most prominently, their use in the rescue of hostages held in a Moscow theater in October 2002. The rescue of most of the hostages encouraged advocates of the military development of such weapons, but others were alarmed that 17% of the hostages died from the effects of the chemical agent, and almost all of their captors were executed by security forces while they were comatose, in violation of international law.

Approximately 120 of the hostages died. Is this level of lethality typical of incapacitating agents? Are truly non-lethal chemical weapons feasible? To investigate these questions we have developed a mathematical model to predict fatalities from such agents (see "Beware the Siren's Song: Why 'Non-Lethal' Incapacitating Chemical Agents are Lethal," Lynn Klotz, et al., March 2003). Applying this model to an incapacitating agent that is exceptionally safe by pharmacological standards (therapeutic index (TI) =1000),[1] delivered under ideal conditions to a uniformly healthy population, 9% of victims would die when the goal is to incapacitate almost everyone (99%) in a particular place (often an enclosed space), as in hostage rescue or urban military operations.

Considerably higher levels of lethality are predicted when typical pharmaceutical agents (TI= 100 or less?) are used as incapacitating weapons. This is exactly what happened in the Moscow hostage rescue, where lethality was 17%. The agent reportedly used was a derivative of the analgesic/anesthetic fentanyl.

In clinical settings, anesthetics are not usually fatal because dose can be precisely controlled, and any potentially fatal consequences can be managed—conditions that clearly would not obtain in military or police use. This is so even for exceptionally safe incapacitating agents, for several reasons.

First, it is difficult to deliver a chemical agent quickly and uniformly to a large area. Thus, concentration will not be uniform throughout the area. Where the concentration is higher, lethality will be greater; and where the concentration is lower, the agent will be less effective. The only practical way to maintain effectiveness in the face of uneven

---

[1] The safety of a drug is commonly expressed as its therapeutic Index (TI), which is the ratio of drug concentration causing 50% fatalities to the concentration causing the desired effect in 50% of cases. For an incapacitating agent, a TI of 1,000 means it will take 1,000 times more drug to kill 50% of victims than to incapacitate 50%. Most anesthetics have TIs well below 100.

concentration is to use enough agent to guarantee that the minimal concentration in any area exceeds that needed to achieve effective incapacitation. However, this will mean that some areas will contain higher concentrations of the agent, enough to cause significant lethality.

Second, the agent will need to act quickly, before the victims can react with defensive or offensive action. Anesthetics generally take at least a few moments to act. The requirement for faster incapacitation will require greater doses, and concomitantly will inflict more deaths.

Third, when aerosol agents (droplets or tiny particles) are used in enclosed spaces, they do not dissipate quickly and are likely to remain close to the original concentration for some time. Thus, the total dose that individuals receive will continue to increase until all casualties are evacuated, because even after incapacitation, the agent will continue to be inhaled. This overdosing can easily increase the planned dose by ten-fold or more, leading again to more deaths. This was undoubtedly a problem in Moscow.

None of these technical problems are likely to be soluble. But even if they were, there is the added complication of considerable variation within a population in sensitivity to the effects of any pharmaceutical agent. Typical civilian populations are quite heterogeneous, with very young, old sickly, malnourished, or otherwise more susceptible members. Again, since the minimal concentration of agent delivered must be based on the dose required to incapacitate the ideal healthy individual, the targeting of civilian populations or mixed civilian/military groups—which is specifically envisaged for these weapons—will inevitably lead to significant levels of death.

Taking all these effects into consideration, it is obvious that chemical incapacitating agents are anything but non-lethal. It should be of concern to the pharmaceutical and insurance industries that lawsuits may be filed if these agents should be used in a domestic situation, with significant fatalities. Non-combatants are the ones who will suffer the fatalities, because if these weapons are adopted, hostage-takers and terrorists will quickly learn to equip themselves with protective gas masks or antidotes.

For more information please contact:

Mark Wheelis, PhD
e-mail: mlwheelis@ucdavis.edu
Tel: 530 752 0562

Lynn C. Klotz, PhD
e-mail: lynnklotz@cs.com
Tel: 978 281 6015