Going Public with VX Formula—A Recipe for Trouble?

President Ford last month signaled the United States' intention to adhere to the Geneva protocol in foreswearing first resort to chemical warfare. But the genie is still not back in the bottle. Quite apart from the intentions of the U.S. government, whatever exactly they may be (see *Science*, 17 January 1975), chemical nerve agents and their manufacture have been so extensively discussed in the open literature that the governments who ratify the Geneva protocol do not possess an evident monopoly on their use.

There can be few more cost-effective ways of killing people than by nerve gases. A quart of VX, for example, costs about $5 to manufacture and contains several million man-lethal doses. Yet the general formula for VX was chalked up on a blackboard during a teach-in at an English university in 1969. England and the United States declassified the formula for VX in 1971, and the United States read it into the record of the Geneva disarmament conference.

VX is in some respects the most insidious of the nerve agents so far devised. Unlike GB, the other principal gas in the U.S. arsenal, VX is a thick oil that doesn't vaporize easily, a feature which makes for simpler handling properties. VX need not even be breathed to be lethal. A single drop applied to the skin is apparently enough to kill a man, and does so before he is aware of it.

It might be expected that governments with chemical warfare establishments would sooner put loaded firearms into the hands of infants than allow information on how to make VX be generally bruited about. But, to the contrary, the American and British governments, despite their elaborate security and classification apparatuses, have been unable to prevent a great deal of knowledge about nerve gases from escaping into the public domain. A recently published survey of openly available nerve gas literature compiled by Julian Perry Robinson, a chemical warfare expert at Sussex University, indicates just how extensive this information has become. Robinson discusses the main preparative routes for the synthesis of the GB and VX families. The open literature contains so much pertinent data that he has deemed it advisable to leave his reference citations incomplete.

Discretion the Better Part

Government officials argue that only a complete censorship of all publications on organophosphorus chemistry could have kept details of nerve gas preparation secret. The weakness of this argument lies in its failure to take into account the degrees of accessibility that exist even within the open literature, and which might make all the difference between the success and failure of free-lance manufacture. A modest habit of discretion —such as Robinson's leaving his literature citations incomplete—make an obvious difference in the rate at which nerve gas information is diffused among have-not countries, terrorist groups, and the like.

Discretion, however, is not a distinguishing feature of the military's handling of nerve gas data, if two recent incidents, one on either side of the Atlantic, are at all representative. In the first, the British government declassified, and the Patent Office published, two patents on how to make VX gas. A London newspaper drew attention last month to this remarkable lapse, whereupon the comptroller of the Patent Office had all copies withdrawn from public inspection—an action which, even if prudent, is reported to be beyond his statutory powers. Unfortunately, it seems likely to prove ineffectual as well as illegal. When the patents were first published last February, copies were automatically distributed to other patent libraries all over the world.

In a similar recent incident on this side of the Atlantic, military authorities seem to have been equally cavalier, though with less significant consequences. In advertisements published almost side by side in a government journal, the director of procurement at Edgewood Arsenal, Maryland, asked for notification of companies able to manufacture two particular chemicals. A third advertisement solicited interest in filling artillery projectiles with a propellant. It did not require conspicuous intelligence to see that the two chemicals were the components of a binary nerve gas weapon: when mixed together during the flight of the projectile, they form VX. [The significance of the advertisement was spotted by Representative Les Aspin's office (D–Wis.) and commented on by *Nature* Washington correspondent Colin Norman.]

"It Would Have Been Smarter"

An Army spokesman who asked not to be named conceded that "it would have been smarter" to advertise the two components in separate issues of the journal, which was perhaps the original intention. "There may have been some mix-ups either at [the journal] or Edgewood. If this did make possible the production [by others] of binary nerve gas, I would say it was a tremendous goof," the spokesman observed, adding that, of course, in his opinion it didn't.

As luck would have it, the Edgewood advertisement does not put much new into the public domain. Any competent organic chemist could guess the binary components of the various routes by which VX can be made. The Edgewood advertisement reveals which particular combination of binaries the U.S. Army is using. Robinson had guessed the combination correctly in his already published survey.

One of the two components of binary VX is an extremely unpleasant chemical, but nonetheless it presents a quite different personal risk to that of handling VX. The Army's spokesman contended that very careful control of mixing and temperature conditions was necessary to get respectable yields of VX—a consideration that is unlikely to be of pressing concern to a terrorist.

The flourishing state of public knowledge about VX points to all kinds and levels of folly, perhaps the chief of which, in practical terms, is that of rich countries such as the United States and England calling into existence a poor man's weapon, one of enormous power and one whose most probable use is not by but against themselves.—NICHOLAS WADE