emphasise the safety features of the munitions, compared with conventional nerve gas weapons. An indication of the likely campaign comes in the note to Congress which said that "the binary munition offers a major advance in safety over current chemical munitions . . . their development is intended to obviate the hazards normally associated with the manufacture, transportation, storage, and disposal of the current family of lethal chemical munitions. An Army spokesman added last week that binaries "represent a quantum jump in safety".

The timing of the note to Congress is also worth noting. This week (on October 3 and 4), the House Armed Services Committee held two days of hearings on the storage and transportation of nerve gases. The reason for the hearings was essentially a public outcry that has arisen over the storage and possible relocation of nerve gas weapons at the Rocky Mountain Arsenal on the outskirts of Denver. The arsenal holds obsolete stocks of mustard gas, phosgene and GB in M-34 cluster bombs, which the Army has promised to destroy, together with a quantity of GB which forms part of the deterrent stockpile. Since the arsenal happens to be near to the North–South runway at Stapleton International Airport, Denver residents are understandably unhappy and want the stuff removed. Then, when word leaked out that the Army was considering shipping some of the nerve gas to Tooele Arsenal in Utah, an even louder outcry went up. The Army has the problem under study again, and its decision is likely to be announced at the hearings. It will not let a chance like that go by, however, for doing a little proselytising for its new, safe weapons.

So far, since there has been little public discussion of binary weapons, there has also been little public opposition to them. When it comes, however, it is likely to take two chief tacks. The first is whether or not the expense of making the stockpiles safer is justified. And the second is the effect of binary weapons on international agreements to limit the production and spread of chemical and biological weapons. The second argument is undoubtedly the more important.

As for the economic aspect, Dr Matthew Meselson, Professor of Biochemistry at Harvard, estimated last week that the total cost of developing binary weapons and detoxifying existing stocks of nerve gas could be as much as $500 million. He pointed out that so far, in spite of widespread public alarm, the Army has a good safety record with its nerve gas stocks, and he suggested that the money could be better spent elsewhere. The Army is likely to argue, however, that the development of binaries will actually save money because there would no longer be large costs associated with the maintenance of stockpiles of highly corrosive nerve agents. It is estimated, for example, that weapons packed with conventional nerve gases have a shelf life of only about 10 or 15 years. But Meselson is sceptical of that argument, pointing out that the weapons that have given trouble—some M-55 rockets and M-34 cluster bombs—have been either destroyed or are about to be detoxified, and maintenance costs of the stockpiles will shrink in any case.

The international implications are more difficult to predict. Although the United States has never ratified the Geneva Protocol of 1925, outlawing the use in war of chemical and biological weapons (see box), President Nixon's 1969 announcement that the US will relinquish first use of chemical weapons and abandon biological weapons entirely—including their production, storage and use—at least signifies that the United States is interested in international CBW control. The development of a new generation of nerve gas weapons could, however, damage that impression and make the UN Chemical Warfare disarmament talks, which have just completed their fifth fruitless session in Geneva, even more difficult.

Of great concern to some observers, is the effect that binary production could have on proliferation. Nerve gas weapons are costly to produce, chiefly because of the difficulty of building a plant to deal safely with the extremely toxic and corrosive chemicals. Production of the binary components for nerve agents does not, however, carry such a penalty—a country with an insecticide industry and some leaked American technology would probably be able to produce at least a binary G-agent, according to Julian Perry Robinson, chief author of the SIPRI study (see *New Scientist*, **58**, 4; 1973). One step further, the development of binary weapons may even open up the frightening possibility that nerve agents would be within the reach of terrorist organisations.

Hope for the Protocol

by our Washington Correspondent

ALTHOUGH the United States Army is pushing ahead with plans to develop a new generation of lethal nerve gas weapons (see accompanying article), some observers of the United States' chemical and biological warfare posture believe that the time may now be ripe for the government to ratify the 1925 Geneva Protocol on chemical and biological warfare. The protocol, which was negotiated after the extensive use of poison gas during the First World War, outlaws the use of chemical and biological weapons in war. But the United States has never ratified it.

When it was first submitted to the Senate for approval in 1926 (all such treaties entered into by the US must be approved by a two-thirds vote of the Senate), the protocol ran into opposition from the chemical industry and the American Chemical Society—which has since reversed its stand—and it was never acted upon. In 1969, however, President Nixon made his historic announcement that the United States would renounce the first use of chemical weapons in war and abandon biological weapons completely; the following year, he again sent the Geneva Protocol to the Senate for ratification. But it then fell foul of the Vietnam war.

Largely because the United States forces in Vietnam were using herbicides and CS, the Administration insisted that such agents are not covered by the protocol. (The British government has taken a similar position over CS.) But the Senate Foreign Relations Committee, under the chairmanship of Senator J. William Fulbright, maintained that such agents do fall within the scope of the protocol—a viewpoint which was affirmed by the UN General Assembly in 1969 by 80 votes to 3—and refused to act on it until the Administration altered its position. Until the Geneva Protocol is ratified, however, the United States will not ratify a treaty on biological weapons which was signed last year.

Three factors were suggested last week by sources on Capitol Hill and in the Arms Control and Disarmament Agency which may lead to a compromise between the Administration and the Senate on the matter of herbicides and tear gases, however. The first is the ending of the Vietnam war, which no longer puts the US in the embarrassing position of supporting CBW control at the same time as it is using chemical agents in war. The second is two internal reports prepared for the Department of Defense which indicate that the agents are of only marginal value in any case. And the third is the change of leadership in the State Department. As one Congressional source put it, with Kissinger and Fulbright lunching together every other day, anything can happen.