

of highly concentrated solutions of CW agents, or of undiluted CW agents necessitates more work in technical safety and adequate basic research.

### 3. METAL-CATALYZED DECOMPOSITION

The catalytic splitting of organophosphorus esters especially by heavy-metals has been known for some 20 years. The first observations were made in connexion with the loss of effect of phosphoric ester preparations in cupriferous containers. Apart from it, biochemical studies have shown that organophosphorus esters are catalytically splittable by a number of metals, e.g. even by lanthanides. Especially the hydroxy-aquo complex as well as the aminohydroxo and alkyl-amino complexes of copper have shown to be extraordinarily effective for splitting acyl-substituted phosphoric and phosphonic esters.

In this field the highly effective tetraalkyldiamino-copper complexes are practically important.

It is suggested by the rapidity and completeness of catalytic ester splitting achieved by these copper complexes, because the solubility of such complexes and the possibility of fixing these compounds to carriers should promote investigations of detoxification for concentrated CW agents of the G- and V-type.

### IV. *Final remarks*

It should not and cannot be recommended here which of the mentioned catalytic detoxification methods of highly toxic organophosphorus CW agents would be especially convenient technically and economically.

However, in assessing the measures for CW disarmament required, the catalytic processes of detoxification deserve at any rate greater attention than the so far employed processes using an excessive surplus of detoxicants.

Upon concluding it should be stressed that the possibilities of catalytic splitting exemplified by organophosphorus CW agents can also be extended to other groups of CW agents. Research into this direction, in our view, could have promising prospects for obtaining technically usable results.

### **Czechoslovak Working Paper Submitted to the Conference of the Committee on Disarmament: Some Medical Aspects of the Chemical Weapons Problem and Its Perspectives, July 8, 1976<sup>1</sup>**

Much effort has been undertaken to elaborate an exact definition of CW agents.

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<sup>1</sup> CCD/508, July 8, 1976.

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There are two possible approaches to this question: first, the chemical and toxicological one; and second, the medical one.

Military calculations are, in fact, based on chemical and toxicological characteristics. However, it should be emphasized that any chemical substance becomes a chemical warfare agent only after it has been incorporated into a chemical weapons system. We understand the tendency to make the definition as exact as possible. In spite of this, the purpose criterion has a principal significance and cannot be omitted.

In the course of the last expert meeting in the CCD, in July 1974, one of the most discussed questions was the possibility of using the acute lethal dose ( $LD_{50}$ ) as a complementary criterion which could facilitate a more exact definition of CW agents. We criticized the overestimation of this criterion.  $LD_{50}$  is, no doubt, important for toxicology, and it is an objective laboratory value. Our point is, however, that the acute toxicity of a substance, irrespective of purely methodological problems, does not express the real danger of this substance for the population, which is a target of a chemical attack. It is evident that less toxic agents may be used in larger quantities; that they may be used repeatedly; and that their effects may combine with other effects of war—wounds, stress, malnutrition, etc.

There are still other important points. One of them is the availability of medical aid. The effective treatment of an acute poisoning is always a medical emergency: the antidotes must be given immediately, and in many cases they must be supported by artificial respiration, and still other medical treatment. However, it is impossible to do this in the field in mass-casualty situations. These questions are in great detail analysed in the Yugoslav working paper CCD/503, distributed on 6 July 1976.<sup>2</sup> Thus, the availability of medical aid may be more important for the effect of a chemical attack than the type of the chemical agent applied.

Other extremely important aspects are the side and the delayed effects of CW agents. We mentioned this very briefly in our discussion here in 1974. In the meantime, the significance of the problem was emphasized by the new monograph published by SIPRI and prepared by Professor Lohs of the GDR. The questions of the delayed effects of the enormously large-scale use and consumption of many chemical substances represents a major problem of modern medicine and of all biological sciences. Carcinogenic, embryotoxic and teratogenic effects are being discovered with increasing frequency in substances, which have no or at least very low acute toxicity, and which were supposed to be practically harmless. It is generally known that this was the case with some new medical drugs in several countries.

Thirty years ago, when the information about new chemical agents, such as tabun, soman, sarin, etc. was published, their extremely high toxicity was what impressed the public most. At that time, however,

<sup>2</sup> *Ante*, pp. 443-449.

very little was known about the carcinogenicity and teratogenicity of substances, and the enormous expansion of modern chemical industry was only at its beginning. Only much later, people began to realize the immense hazard of mass exposure to chemicals. We feel that to disregard this aspect of the CW problem would amount to a dangerous mistake.

A chemical war creates completely new dimensions in the use of chemical substances which, in turn, considerably changes the importance of interrelations between individual factors. The herbicides and defoliants, used in the Vietnam war, are substances commonly applied in agriculture. In civilian life, their task is to destroy weeds in as selective way as possible and are, therefore, applied highly diluted and accompanied by a number of protective measures. Nevertheless, it is becoming more and more clear that even this careful mode of application represents serious ecological risks. The same substances, when used for military purpose, are designed to destroy all vegetation in a given area with utmost efficiency and speed. The actually used doses were ten- and more-times higher than those for agricultural purposes and the total amount per hectare was about 30-times higher. The same is valid for other agents. As Perry Robinson recently mentioned,

during the height of the Vietnam war, the daily American consumption of CS as a harassing incapacitant exceeded all the CS that has yet been used in Northern Ireland.

This experience only confirms to what extent the military approach increases potential risks of the use of these substances.

One ought to be also aware that we still have very incomplete information of the basic mechanism of damages to the genetic apparatus, namely, the carcinogenic and/or teratogenic effects. The laboratory methods of testing are rather complicated and their results are only approximate. Besides, the delayed effects are always multifactorial. It means that the effect does not depend solely on the chemical characteristics of the chemical agent, but also on other additional factors, influencing the metabolic degradation of the agent in the human organism. It is well known that there are differences in the metabolism in humans and in animals; this is one of the reasons of the extreme difficulties in studying these problems in the laboratory. In addition to this, the metabolism of each individual is influenced by a number of specific factors: there are, for instance, hundreds of thousands of people for whom sugar is identical with a poison, because their insulin system activity is impaired and this substance cannot be "normally" digested and utilized. These are the reasons why it is extremely difficult, and often simply impossible, to detect in time the delayed effects of a chemical substance.

These examples were intended to demonstrate that—in addition to acute toxicity—the chemical warfare agents have also other characteristics, which might become extremely important. One ought also to

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That we still have very incomplete information about the nature of damages to the genetic apparatus, and about the teratogenic effects. The laboratory results are very complicated and their results are only partially understood. They depend not only on the chemical characteristics of the agent, but also on other additional factors, such as the adaptation of the agent in the human body. There are differences in the metabolism of the agent. This is one of the reasons of the extreme variability of the results in the laboratory. In addition, the response of an individual is influenced by a number of factors. For instance, hundreds of thousands of people are killed with a poison, because their insulin is deficient. This substance cannot be "normally" used. One of the reasons why it is extremely difficult to detect in time the delayed effects

is to demonstrate that—in addition to chemical weapons agents have also other characteristics which are extremely important. One ought also to

be aware that there is no correlation between toxicity and delayed effects. There is no doubt, however, that the organophosphorus CW agents and also herbicides and incapacitating agents all belong to the category of chemical substances with a great risk of carcinogenic and teratogenic activities.

We intend to focus attention on the fact that the problem of CW has still other aspects of increasing importance. There are, in fact, many identical features in CW problems and in the problems of the misuse of new scientific developments for military purposes. These great problems need adequate solutions.

### Statement by the United States Representative (Martin) to the Conference of the Committee on Disarmament: Chemical Weapons, July 13, 1976<sup>1</sup>

Since the last few weeks of the spring session, the CCD's discussions of chemical weapons limitations seem to have taken on a new vigour. This morning I would like once again to address this question, and in particular to comment on the results of the informal meetings with chemical weapons experts which took place last week.

Coming at a time when there seems to be renewed optimism that effective solutions to the remaining problems can be found, these meetings were particularly appropriate. I would like to express my appreciation to the delegation of the Federal Republic of Germany, which first suggested that the meetings be held, as well as to all the experts who participated.

A most important contribution to the growing feeling that progress is being achieved was made by the leader of the United Kingdom delegation, Lord Goronwy-Roberts, in his statement just before the informal meetings began. My delegation welcomes his announcement that the United Kingdom delegation plans to table a draft comprehensive CW convention later this session.<sup>2</sup> I believe that the British effort to bring elements of previous drafts together with fresh ideas for effective limitations is the sort of pragmatic, constructive approach which is most likely to lead our work to a successful result. My delegation will look forward to the introduction of the United Kingdom draft.

Past informal meetings with chemical weapons experts have laid a sound and impressive technical foundation for the Committee's work. My delegation believes that the meetings last week, in which 22 experts from 13 countries took part, advanced our work in a number of important respects. Valuable contributions were made in 11 new

<sup>1</sup> CCD/PV. 711, pp. 7-9.

<sup>2</sup> *Ante*, pp. 432-441.