COMMITTEE ON DISARMAMENT

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Working Paper on verification of a Chemical Weapons Convention sampling and analysis of chemical warfare agents under winter conditions

Background

In connection with the Norwegian participation in the ad hoc Working Group on Chemical Weapons and as a Norwegian contribution to the work of this group, a research programme, sponsored by the Norwegian Ministry of Foreign Affairs was initiated in 1981 on the sampling and identification of chemical warfare agents under winter conditions.

A primary objective of the research programme was to focus on some of the verification problems the Consultative Committee will have to solve. Methods for verification of the convention, including methods for sampling and analysis should be outlined preferably before the Convention enters into force. This would better enable the Committee to take immediate action on an investigation of an alleged breach of the convention.

Unless chemical weapons are used on a massive scale, definitive evidence will prove difficult to obtain due to the large number of different agents which may be selected and because military objectives may be achieved with limited amounts of agents. Further, many compounds may be highly volatile or be rapidly degraded, leaving only trace amounts at the site.

The procedures selected for sampling and analysis of residual amounts of chemical agents, must take into consideration climatic conditions and the terrain of the contaminated area. Because of Norway's geographical location and meteorological conditions, the programme was concentrated on sampling and identification of chemical warfare agents used under winter conditions, i.e. snow or ice-covered ground at subzero temperature.

1/ A limited distribution of a research report on sampling and analysis of chemical warfare agents under winter conditions, in English only, has been annexed to this document. Further copies can be obtained from the secretariat of the Committee on Disarmament.

These conditions are found in a large part of the world for more than four months of the year. Particular attention has been paid to carrying out the experiments under field conditions, and as far as possible to avoid the artificial conditions of a laboratory set up. The investigation has been based on a scenario in which chemical agents, nerve or mustard agents, have been used at low level (0,25 gm/m^2) against unprotected troops and civilians. The programme is aimed at outlining procedures to be used by an international group of experts which arrives at the scene for taking samples between one day and four weeks after an alleged attack, and examining the possibility they have for making a firm conclusion.

Results of the research programme

The analytical methods used and the results of the research programme are explained in the annex to this working paper. In summary, the experiments have shown that if a chemical attack with nerve agents or mustard occurs under winter conditions, the amount of agent present will rapidly decrease with time depending on the weather conditions. Part of the agent will be lost by evaporation from the ground and part by decomposition in contact with snow. The dominating meterological factor under winter conditions determining the rate of loss of agent is the wind speed. The loss of a nerve agent, like sarin, at low wind speed such as in a forest (1-2 metres per second) will be three times less than the loss at high wind speed (10 metres per second) often found in an open area. Another, but less important factor is the temperature. It was a surprise to learn that the decomposition of an agent in snow is much faster than in water. The decomposition of an agent like sarin will be five times faster at -1°C than at -10°C and 20 times faster at -1°C than at -20°C.

The possibility of drawing firm conclusions regarding identity of an agent is therefore highly dependent upon the time factor and the weather condition in the area. Practical field experiments showed that identification can be made by analysis of snow samples taken as long as two weeks after the attack, in some cases even more than four weeks after the attack. Identification of nerve agent such as Vx and soman can be achieved over a much longer period after an attack than for sarin and tabun. The verification of mustard under winter conditions is highly dependent on its original purity and whether it is mixed with other chemical agents.

Particular attention has been paid to sampling procedures. Experiments showed that some agents are rapidly lost from the snow surface, but may be recovered in deeper snow layers. None of the agents did, however, penetrate deep into the snow, even after a long time. Samples should therefore be collected from the top 10 cm layer below the original snow surface. Newly fallen snow covering the ground after an attack will prevent evaporation and increase the length of time chemical warfare agents may be reliably detected.

In a real situation the time between sampling and analysis of an agent will be of importance. The agent is stable after extraction into a dry organic solvent. The agent will also be preserved for a long period if transported in a closed vessel below -20°C. In both forms it is possible to store the samples for more than two weeks before analysis. Other means of preserving the sample will depend upon the chemical and physical properties of the agent and this needs further investigation.

Some of the decomposition products of the chemical warfare agents may be recovered from the environment a long time after the actual agents have disappeared. Typical examples are the hydrogen methyl phosphonates which are derived from nerve agent, G-type. Due to the physical properties of these decomposition products, identification of these compounds may be extended for a considerable length of time after an attack and thereby greatly enhance the chances for positive verification.

Concluding remarks

The Chemical Weapons Convention must contain adequate verification provisions. The verification measures should be two-fold, measures taken by states themselves and international measures. These two types of verification complement each other.

The Consultative Committee should be established at the entry into force of the convention. It should be a permanent body for the monitoring of the implementation of and compliance with the provisions of the convention. All State Parties to the convention should be represented in the Committee.

The Committee should be authorized to conduct on-site inspections, in order to fulfil its responsibilities. For this reason, it must be able to draw on the necessary technical expertise. The Consultative Committee should establish a pool of well qualified international experts from which a multilateral team of experts could be selected in each case.

The Consultative Committee should also as soon as possible after its establishment, adopt comprehensive verification procedures. The procedures should be flexible enough to take into account any new scientific achievements in this field. The regular updating of the procedure should be the responsibility of the Consultative Committee. Each phase of the implementation of the convention might require a separate verification procedure.

It is equally important that each representative to the Consultative Committee has the right through the chairman to request from States Parties such information and assistance as are necessary for effective verification.

In elaborating the procedures for on-site inspection it is necessary to take into account the time element. As the Norwegian research programme shows, the possibility to determine the presence of chemical weapons decreases rapidly with time, even under winter conditions.

In the second phase of the Norwegian research programme which will take part during the winter 1983, problems related to preparation of samples in the field, storage of samples until analyzed by an internationally recognized laboratory and the behaviour of other agents such as irritants will be investigated. Efforts will also be devoted to the possibility of using the decomposition products of chemical agents under winter conditions as additional evidence for identification since this may significantly extend the possibility for making firm conclusions for a long period after an attack.