related benefits for a nuclear-weapon State would depend upon the extent and character of that State's existing nuclear weapons capabilities, the nature of any constraints on its weapon testing activities, and the level and nature of its PNE activity.

The general proposition was put forward that neither nuclear-weapon States nor non-nuclear-weapon States should be able to use a PNE programme to obtain nuclear weapons-related benefits not otherwise available to it. This means that any constraints on nuclear weapon tests by the nuclear-weapon States should be accompanied by appropriate constraints on PNEs, and by verification procedures adequate to assure that such constraints are being observed. None of the participants in our meetings disagreed with this general proposition.

The ultimate nuclear weapon testing constraint is, of course, an adequately verifiable CTB. During our meetings several States, including the United States, reaffirmed their commitment to this goal. If PNEs were to be accommodated under a CTB, a verification system would have to be devised capable of providing adequate assurance to all States that no weapon-related benefits were being acquired from PNE activities. Although there is general recognition of this problem, I think it is fair to say that we do not yet have a consensus on its solution. Further creative efforts to resolve the technical, legal and political issues connected with PNEs are needed in the context of further constraints on the testing of nuclear weapons. Many States, both those with and those without experience in the field of nuclear explosives, can contribute to this important task.

The United States believes that exchanges such as those that took place here this month can help to solve the difficult and important arms control problems posed by nuclear explosions for peaceful purposes.


INTRODUCTION

During the negotiations on a prohibition against development, production and stockpiling of chemical weapons, it was realized almost from the outset that it would be a difficult task to obtain meaningful and useable delimitations between different types of chemicals.

The need for differentiation stems from the obvious facts that, relatively speaking, only a few chemicals are useful as chemical warfare agents and that the overwhelming amount of chemicals have no
actual or potential warfare use. It would obviously be unnecessary, or
even damaging, to have too extensive a ban on chemical production.
However, no self-evident principles are available for delimitation.

Many attempts have been made during the years of negotiations to
solve the problem. Few attempts have been made to analyze more
closely the concepts involved (see, however, CCD/414, 21 August
1973) and to relate them to each other. It goes without saying that
various suggestions on delimitation have been presented, each con-
ected with some special application. In the practical negotiation work
it has turned out to be an increasingly difficult task to try to sort out
and to remember to what extent and on what grounds the different
approaches do or do not cover each other. A first attempt was made in
the Swedish working paper CCD/427, 2 July 1974.

The present working paper is an attempt at a more detailed analysis
of the matter indicating some common trends in international conven-
tions which might be useful in disarmament discussions. A model for
an overall view of the problem is presented. Efforts have also been
made to give the model some dynamic properties, in view of possible
future alterations and of alternative outcomes of negotiations.

A COMPREHENSIVE MODEL

Earlier Attempts

The presentation of the Japanese draft treaty CCD/420, 30 April 1974
with the explicit introduction of alternatives of exempted or absolutely
prohibited chemical agents made it necessary to try to get a com-
prehensive view of all the criteria and delimitation concepts. In the at-
tempt made at this in the Swedish working paper CCD/427 a so-called
Venn diagram (Fig. 1) was used, covering the concepts of Chemical

Warfare Agents, Dual-Purpose Warfare Agents, and the Chemical
Compounds for Peaceful Use. The relationship between the proposed
Japanese annexes and these concepts was demonstrated. This model

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1 Documents on Disarmament, 1973, pp. 524-529.
2 Ibid., 1974, pp. 222-227.
3 Further discussion and references are given in J. Lundin "Description of a model for
delimitating chemical warfare agents in an international treaty". FOA Reports, vol. 8,
No. 4, 1975. [Footnote in original.]
4 Documents on Disarmament, 1974, pp. 99-106.
5 Named after the mathematician Venn. The Venn diagram implies (in this case) that
each chemical compound can be assigned to a point within a bounded surface, see figure
below. [Footnote in original.]
turned out to be useful during informal discussions between experts and non-experts in chemistry.

It still seems to be widely felt that the chemical field is too complex to be covered by a treaty banning production of chemical weapons. Therefore, a wider application of the model will be made in the following, with the aim to show that this pessimism need not be justified.

**Application of a Comprehensive Model**

A model presented in the Swedish working paper CCD/427 did not treat all the criteria discussed earlier in the CCD nor did it indicate the dynamic aspects to be considered, i.e., a model must also describe the function and effects of a treaty over a time span. The concepts discussed in the CCD are listed in Table 1. In Fig. 1 an attempt has been made to analyze how these concepts interfere with each other and how their coverages overlap.

<table>
<thead>
<tr>
<th>Concepts, criteria and conditions constituting means of delimitation of chemicals to be covered by a treaty prohibiting development, production and stockpiling of chemical weapons.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose (of use)</td>
</tr>
<tr>
<td>Quantity (of production)</td>
</tr>
<tr>
<td>Verifiable production</td>
</tr>
<tr>
<td>Dual-purpose and Single-purpose</td>
</tr>
</tbody>
</table>

The areas allotted to the various concepts in Fig. 1 are not intended to represent the actual relations in size between the different groups. Instead, they are meant to indicate whether many or few chemicals can be expected to be found in a group. The capital letters in the figure denote the various concepts and show, in another way, where the different areas in Fig. 1b, c, d and f represent several concepts.

The consequences of the need for verifiability presented in the Japanese draft are illustrated in Fig. 1 e and f. The letter combinations in the appropriate areas show that all the combinations from Fig. 1 d are covered.

Fig. 1 g and h illustrate what the combination of the concepts of conditional and unconditional prohibitions and annexed lists of exempted and absolutely prohibited chemical warfare agent production might look like when a treaty comes into force.

Fig. 1 h shows how possible changes, after a number of years and after continued negotiations, e.g., at future review conferences, have resulted in a treaty which is comprehensive from all practical points of view. The annexed list of exemptions has diminished, and the list of absolutely prohibited chemical warfare agent production has grown as
large as might be possible from a practical point of view. The possible
direction in which this growth might have taken place is indicated by a
corresponding increase of the screened field covering the various areas.
It should be noted that possible future developments are marked in the
model (the dots in Fig. 1 h).

The principally important feature of Fig. 1 g and h is the demonstra-
tion of a simple and easily understandable way to construct a treaty
prohibiting development, production and storage of chemical weapons.

1 Production of temporarily exempted chemicals, listed in an annex,
is allowed when necessary for various reasons (thinly hatched area in
Fig. 1 g and h).

2 Unconditionally prohibited chemical warfare agent production is
listed in an annex and is made dependent on the degree of verifiability
(screened area in Fig. 1 g and h).

3 Production etc. whether controllable or not, of all chemical war-
fare agents and weapons which are not specifically mentioned in one of
the two lists of the annex, is prohibited according to the general purpose
and quantity criteria of the treaty text, (conditional prohibition, dense-
ly hatched area in Fig. 1 g and h).

It might be possible to diminish the number of agents exempted by
mentioning only those dual-purpose agents which actually have been
used, or might become suitable, as chemical warfare agents and per-
haps also single chemical warfare agents, explicitly needed or not yet
destroyed e.g., for deterrence by retaining a limited capacity for retali-
ation in case effective verification measures are still being built up. It
might also be necessary to make exemptions for agents which were not
yet destroyed.

It should be observed that all agents, also those listed as exemptions,
might still be subject to verification measures, in order to make com-
prehensive verification of, i.e., organophosphorus compounds.

A particular merit of such a list of exemptions would be that the
number of agents would eventually decrease, subject to subsequent
agreements to the effect that an increasing number of exceptions either
be transferred to a list of absolutely prohibited agents, or become pro-
hibited merely according to a general purpose criterion (see Fig. 1 h).

These advantages were discussed by Sweden in the CCD (CCD/PV,
652 15 August 1974).7 The simplicity of the model may by some seem to
be jeopardized by the risk that extensive and unmanageable lists of
substances will result. Before discussing this aspect it might be illumi-
nating to look at some other international agreements regarding
chemicals, with consideration to their relation to the model discussed
here.

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7 Documents on Disarmament, 1974, pp. 411–416.
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74, pp. 411-416.
Fig. 1. Representation of a model for delimitation of chemical warfare agents (CWA) in a comprehensive chemical disarmament treaty. The treaty is assumed to prohibit development, production and storing of chemical weapons, the provisions covering all CWA.

(a) Chemical substances are represented by two areas covering chemical warfare agents, denoted A and chemicals for other uses, denoted B. To indicate the vastness of the latter area the boundary is not closed.

(b) When applying the purpose criterion to the chemicals covered by the two areas A and B, respectively, it appears that some chemicals have purpose only as chemical warfare agents. They are single-purpose agents and still belong to area A. Others have also other purposes than as chemical warfare agents. They are thus dual-purpose and belong also to area B, i.e., part of A and part of B together cover the same chemicals, and the corresponding area can be denoted AB. In this area the quantity criterion applies. All other chemicals without any use for chemical warfare are covered by the remaining part of area B.

(c) If a toxicity criterion (C) is used to differentiate between more or less toxic chemical warfare agents one might get one sub-group of supertoxic chemical warfare agents (AC) and one group of less toxic agents (AD), separated by the agreed toxicity limit.

(d) The figure shows the result when the three previously discussed criteria are applied jointly.

(e)-(f) The verifiability criterion implies that only the production of those chemical warfare agents the (non-)production of which can be verified (e), shall be absolutely prohibited. Application of this criterion, gives the result shown in (f). It should be noted that parts of all the previously discussed areas can be covered by the verifiability criterion. This means that if the production of a particular group of chemicals (e.g., the organophosphorus compounds, to which the nerve gases belong) can be verified. This is illustrated in the model by showing all types of chemical compounds of such a group being covered by the verifiability criterion, even those belonging only to area B.

(g)-(h) Areas covered by proposed lists (in an annex to the treaty) of ( ) exemptions of substances from production prohibition, and ( ) of substances absolutely (or unconditionally) prohibited to produce are marked by thinly hatched and screened areas, respectively. Densely hatched areas ( ) cover chemicals which are not mentioned in the envisaged lists, but which are still prohibited to produce according to the purpose and quantity criteria (conditional prohibition).

(g) The situation when a treaty enters into force. A large list of exemptions can be conceived of. The list of absolutely forbidden agents will probably be relatively small.

(h) Shows how the content—but not the comprehensive scope—of the treaty may have changed over x years of continuing negotiations or review conferences, and with respect to new technical developments. The result is a small list of, militarily probably insignificant, exemptions and an extended list of substances the production of which is
model for delimitation of chemical warfare chemical disarmament treaty. It development, production and storing ions covering all CWA.

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—but not the comprehensive scope—of over x years of continuing negotiations or respect to new technical developments. allliterarily probably insignificant, exempt substances the production of which is absolutely prohibited. The increase in the content of the latter list may be the result of improved verification methods or other means which may facilitate their transfer to the list of absolutely prohibited agents. The model also indicates that the new CWA can be discovered or developed (dots in densely hatched area) and may instigate further negotiations.

Application of the Model to Other Conventions

Several times during this century, regulations of the use, production and handling of chemicals detrimental to human beings or to the environment have been agreed upon internationally. An analysis of the construction of these regulations shows that nearly all delimitation criteria dealt with in this working paper have been used in one or another of these earlier treaties. Table 2 sums up the content of some treaties in this field.

It should be observed that the list comprises treaties on the abuse of chemicals in peacet ime as well as on the use of chemical weapons in war. Among both types of agreement provisions occur for international verification measures and for international organizations to apply such measures, by making suggestions to member-states of the treaties. The number of substances actually covered by a treaty is substantially different for different treaties, varying from the general descriptions in the Geneva protocol and the Biological Weapons Convention, via the few chemicals mentioned in the Brussels Treaty (1954), to the several hundred agents covered in the Single Convention on Narcotic Drugs (1961) and the Codex Alimentarius (1969).

At present there is a strong trend towards monitoring both national and international agreements relating to the environment.

The United Nations Environmental Program is investigating the possibilities for building up an extensive International Register of Potentially Toxic Chemicals (IRPTC) and an International Reference Service (IRS) on environmental information. OECD has completed a project concerning Unintended Occurrence of Pesticides in the Environment discussing also international co-operation regarding toxicological information.

On the efforts on the national level, only those in Japan and Sweden will be mentioned here. Japan has instituted the Law Concerning Examination of Chemical Substances and Control of Their Manufacture, effective 16 April 1974 and the consequence hereof the compilation of a List of Names of Existing Chemical Substances to be used in Japan as a basis for further toxicological investigations especially about long

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1 Ibid., 1986, pp. 764-765.
4 18 UST 1497; 629 UNTS 204.
time effects of some of these substances. The list of 1974 comprised some 20,000 substances.

In Sweden a data-based information system on properties of chemicals to be allowed in production and in the environment is being set up. The Swedish Environmental Protection Agency will then license the production and use only of such chemicals as are not detrimental to Man and Nature. Special laboratories will be charged with analyzing products as a basis for the licensing. The system is expected to cover several thousands of chemicals. Many other countries are actively working along similar lines.

Altogether it is thus obvious that the trend today of watching the production and use of all kinds of chemicals is deliberate and purposeful. Consciousness about chemical weapons is, however, necessary, also among those who only work on the problem with peaceful activities.

Discussion of the Implications of the Model

The analysis presented in this paper of existing attempts to construct the scope of a treaty prohibiting the development, production and stockpiling of chemical weapons has aimed at showing that no principal technical difficulties need arise in the fulfilment of this task.

As a means for this analysis a model has been constructed which shows how different suggestions discussed so far in the CCD are interrelated and can be looked upon as parts of a common concept.

One special feature of the model presented is that it allows for a dynamic view on a production ban. It does so by showing that changes in the coverage of the treaty can be foreseen:

(a) the number of dual purpose agents and perhaps even warfare agents that may initially have to be exempted from the ban will diminish with time;

(b) the number of chemical warfare agents the production of which shall be unconditionally prohibited will rise along with improving conditions for verification.

The dynamic approach also ensures the possibility that the treaty can be built up gradually without loss to the over-all aim of reaching a comprehensive ban.

Comparisons with other international treaties regulating the use and control of chemicals show that they apply, to varying degrees, the same criteria as those discussed in the model. It can also be observed that some of these treaties manage to cover a large number of chemicals.

The model indicates that, in principle, both international and national measures have to be taken in order to ensure a meaningful treaty. Such measures obviously concern verification and forms for continuous evaluation of changing conditions, etc. Although no political steps are identified by the model, the comparison with other international treaties shows that the necessary steps have been taken before, with respect to chemicals in general as well as to chemical warfare agents.
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all as to chemical warfare agents.

<table>
<thead>
<tr>
<th>Year</th>
<th>Purpose</th>
<th>Type of property or description</th>
<th>Applied criteria (see also text)</th>
<th>Verification needs</th>
<th>Graded or amendable production (measures)</th>
<th>Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>Treaty</td>
<td>CWA</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1934</td>
<td>Treaty</td>
<td>BWA, LBA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1972</td>
<td>Treaty</td>
<td>BWA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1980</td>
<td>Convention</td>
<td>CWA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1982</td>
<td>Convention</td>
<td>CWA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>1981</td>
<td>Convention</td>
<td>CWA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 2: Types of criteria used in some international treaties covering use and production of chemicals.

(Continued on next page)
<table>
<thead>
<tr>
<th>Treaty (see also list of references)</th>
<th>Year</th>
<th>Purpose</th>
<th>Quantity</th>
<th>Applied criteria (see also text)</th>
<th>Graded or amendable prohibition (measures)</th>
<th>Verification needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convention on psychotropic substances</td>
<td>1971</td>
<td>Yes</td>
<td>Yes</td>
<td>Schedules of drugs grouped according to degree of dangerousness and actual use</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Protocol relating to intervention on the high seas in cases of marine pollution by substances other than oil</td>
<td>1973</td>
<td>Yes (handling)</td>
<td>—</td>
<td>Lists of substances for different uses and of different properties, in appendix</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Draft treaty of Japan in CCD prohibiting development, production and stockpiling of chemical weapons (CCD 420, 1974)</td>
<td>1974</td>
<td>Yes</td>
<td>Yes</td>
<td>Alternative lists of exempted or absolutely prohibited substances, respectively, in appendix</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
CONCLUSIONS

It should be possible to construct, on technical grounds, the scope of a comprehensive treaty banning development, production and stockpiling of chemical weapons in a manner meeting the political objections raised against previous attempts to this end.

The difficulties due to the fact that the chemical field is complicated and that a great number of chemicals might have to be considered when constructing the treaty can be alleviated considerably by applying to it the dynamic properties of the model described in this paper.

Likewise, the verification mechanism can be built up continuously allowing adaptive expansion to meet the demands expressed from time to time.

Address by President Ford to the Conference on Security and Cooperation in Europe [Extracts], August 1, 1975

We have sought a structure of European relations, tempering rivalry with restraint, power with moderation, building upon the traditional bonds that link us with old friends and reaching out to forge new ties with former and potential adversaries.

In recent years, there have been some substantial achievements.

We see the Four-Power Agreement on Berlin of 1971 as the end of a perennial crisis that on at least three occasions brought the world to the brink of doom.2

The agreements between the Federal Republic of Germany and the states of Eastern Europe and the related intra-German accords enable Central Europe and the world to breathe easier.

The start of East-West talks on mutual and balanced force reductions demonstrate a determination to deal with military security problems of the continent.

The 1972 treaty between the United States and the Soviet Union to limit anti-ballistic missiles and the interim agreement limiting strategic offensive arms were the first solid breakthroughs in what must be a continuing, long-term process of limiting strategic nuclear arsenals.3

I profoundly hope that this Conference will spur further practical and concrete results. It affords a welcome opportunity to widen the circle of those countries involved in easing tensions between East and West.

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3 Documents on Disarmament, 1972, pp. 197-205.