ely the Socialist states, while at the NATO open possibilities to Europe.

f political detente on our conti- cal summit meeting in Helsinki, urther stimulated. The urgency through concrete measures in task in Vienna—is, no doubt, on of the mutual requirements ed stability in Central Europe

y hope for a more constructive

ved our good will and readiness complex problem of forces and . I have earlier recalled a series and alluded to a new one in this n reasons—into any detail, I e desire to facilitate progress in s have again taken into account representatives and suggested t forces should, for the purpose round forces and in air forces. iportance and the discussion on itinued.

itive (Mishra) to the Confer- rmament: Peaceful Nuclear 975 [1]

scussions at the informal meet- ous delegations at the formal this exercise had not added in lge of the arms control implica- exercise to be undertaken were f the NPT as far as PNE were estion of arms control implica- an a technical one continued to ment heard in regard to indis- d for peaceful purposes and nu- hat what one was dealing with es.

His delegation had been happy to listen to various interventions, and had hoped for some enlightenment on the question under discussion. However, he had to conclude that, so many hours later, the Committee was still at the same point where it started.

One fact which had been made clear earlier was that the question of arms control implications of PNE referred primarily to nuclear-weapon States and non-nuclear-weapon States outside the NPT regime. Without tackling the main problem of a comprehensive ban on testing of nuclear weapons the international community could not even begin to think about any observation or control, much less supervision, of PNE. Therefore, the main question was that of a comprehensive ban on testing of nuclear weapons. It was only by considering that question that it would be possible to arrive at satisfactory arrangements in regard to PNE—whether they were conducted by nuclear-weapon States or non-nuclear-weapon States outside the NPT.

FRG Working Paper Submitted to the Conference of the Committee on Disarmament: Definition and Classification of Chemical Warfare Agents, July 22, 1975 [1]

I. AIM AND METHOD OF APPROACH

This Working Paper is intended to contribute towards solving the problem of *defining* and *classifying* chemical agents. Taking into account previous proposals, an attempt has been made to develop an evaluation method by which it will be possible, on the basis of objectively measurable criteria largely eliminating subjective evaluations, validly to assess the suitability of a chemical substance for use as a warfare agent.

Extending earlier proposals, the proposed method uses various toxicity categories and introduced additional (secondary) criteria indicating the suitability of agents for military use with a view to confining the number of substances to be banned to a realistic limit.

Both the toxic properties and the additional criteria are quantified. Finally, a simple mathematical formula for calculating evaluation numbers is described by which chemical substances can be classified according to military suitability.

II. EVALUATION CRITERIA

1. *Toxicity—the Primary Criterion*

Proceeding from a number of proposals made in the past (e.g., Japan:

[1] CCD/458, July 22, 1975.

CCD/374[2]; Canada: CCD/414[3]; USA: CCD/435[4]) toxicity is used as the primary criterion of the suitability of a chemical substance for use as a warfare agent. In view of the different physiological effects of the various chemical agents, it is suggested that the following toxicity categories [5] be used:

Category 1—respiratory toxicity
Category 2—percutaneous toxicity
Category 3—skin lesion

Introducing these three categories as separate criteria appears necessary because the toxicity of an agent may vary considerably between these three toxicity categories.

A number of substances will produce toxic effects of more than one category. For example, mustard gas which causes severe skin lesion is also highly toxic if inhaled, and VX is both a respiratory and a percutaneous agent.

Category 1, or respiratory toxicity is expressed as LCT_{50} (mg. min. m^{-3}) for a minute volume of 20 litres of air. Tentatively, 10 toxicity intervals have been defined and assigned index figures from 0 to 9 as follows:

Index figure IT	LCT_{50}
0	>20,000
1	~20,000
2	~10,000
3	~4,000
4	~1,000
5	~500
6	~250
7	~100
8	~30
9	<10

Category 2, or percutaneous toxicity is expressed as LD_{50} (mg : kg^{-1}). Again, as in the case of Category 1, 10 toxicity intervals have been tentatively defined and assigned index figures from 0 to 9 as follows:

[2] I.e., CCD/374, July 5, 1972.
[3] *Documents on Disarmament, 1973*, pp. 524–529.
[4] *Ibid., 1974*, pp. 330–335.
[5] The use of further categories of toxicity—as routinely determined for new substances (intravenous, intraperitoneal, oral toxicity)—in the first evaluation of a substance might be considered. These toxicities would then have a sort of monitoring function and would provide first indications of the possibly dangerous nature of substances. The collection and evaluation of toxicity data through animal experiments was extensively discussed in an earlier contribution to the CCD (USA: CCD/435). [Footnote in original.]

Index figure PT	LD_{50}
0	>100
1	~100
2	~ 80
3	~ 50
4	~ 20
5	~ 5
6	~ 1
7	~ 0.5
8	~ 0.1
9	< 0.1

Category 3 effects, i.e., skin lesions, are characterized and indexed as follows:

Assuming a dose of 1 mg of substance per square centimetre of skin, the various symptoms have been tentatively assigned index figures as follows:

Index figure DT	Symptom
2	erythema
4	superficial blisters
6	deep blisters
8	necrotic ulceration

2. *Secondary Criteria*

Many substances, though highly toxic, are not suitable for military use. To determine the military suitability of substances additional easily quantifiable criteria should be applied. As a working hypothesis, the following secondary criteria have been established:

Shelf life
Perceptibility
Volatility
Explosion stability
Resistance to atmospheric influences

The secondary criteria may take the values 0.1, 1 or 2. The factor 0.1 was chosen for practical reasons. Since a factor zero in a multiplication makes the product zero, the individual secondary criterion would be overweighted if zero were introduced as a factor into the calculation proposed in Section III below.

The *shelf life* (SL) of a substance indicates its tendency to decompose as a result of intermolecular or intramolecular reactions, its sensitivity to changes in temperature, its aptness to corrode containers and the possibility of chemically stabilizing it through additions. The characteristic shelf life of a substance has been defined as the time it takes, in a 20°C environment, for 50 per cent of it to be destroyed.

Ratings:

Shelf life of under 30 days	SL = 0.1
Shelf life of up to 2 years	SL = 1
Shelf life of over 2 years	SL = 2

The *perceptibility* (P) of an agent indicates the concentration at which its odour, colour or irritant effects will betray its presence.

Ratings:

Under 10 mg/m^3	P = 0.1
Up to 1,000 mg/m^3	P = 1
Over 1,000 mg/m^3	P = 2

The *volatility* of a toxic substance limits its suitability for military use. The degree of volatility largely depends on the boiling point which can usually be easily determined. The *boiling point* (BP) is defined in degrees Centigrade for 760 torr.

Ratings:

Boiling point under 0° C	BP = 0.1
Boiling point under 60° C	BP = 1
Boiling point over 60° C	BP = 2

Explosion stability (ES) is a measure of the stability of an agent in the event of an explosion of the carrier. It is expressed as the percentage by weight of the filler that remains effective after an explosion (a test would have to be agreed).

Ratings:

Under 10 per cent	ES = 0.1
Under 50 per cent	ES = 1
Over 50 per cent	ES = 2

The *resistance to atmospheric influences* (RA) indicates to what extent a substance is resistant to hydrolysis, the oxidizing effect of air and photochemical reactions caused by sunlight. It is expressed as the percentage by weight of a quantity of agent released which becomes ineffective within 1 minute.

Ratings:

Over 50 per cent	RA = 0.1
Up to 1 per cent	RA = 1
Under 1 per cent	RA = 2

III. CALCULATION

By combining toxicity data with quantified applicability criteria through a simple mathematical operation characteristic evaluation numbers are to be established for each individual substance.

The evaluation number N takes into account the suitability of a substance as a respiratory agent N1, as a percutaneous agent N2, and as a skin agent N3, and is obtained by addition as follows:

$$N = N1 + N2 + N3$$

SL = 0.1
SL = 1
SL = 2

agent indicates the concentration at
t effects will betray its presence.

P = 0.1
P = 1
P = 2

ance limits its suitability for military
ely depends on the boiling point which
l. The *boiling point* (BP) is defined in

BP = 0.1
BP = 1
BP = 2

easure of the stability of an agent in
rrier. It is expressed as the percentage
ns effective after an explosion (a test

ES = 0.1
ES = 1
ES = 2

nfluences (RA) indicates to what ex-
ydrolysis, the oxidizing effect of air
ed by sunlight. It is expressed as the
ty of agent released which becomes

RA = 0.1
RA = 1
RA = 2

th quantified applicability criteria
operation characteristic evaluation
ach individual substance.

into account the suitability of a sub-
s a percutaneous agent N2, and as a
ddition as follows:

	IT	PT	DT	SL	P	BP	ES	RA	N1	N2	N3	N
Chlorine	1	0	0	2	1	0.1	2	2	0.8	0	0	0.8
Mustard gas (H)	3	1	8	2	1	2	2	2	48	16	128	192
Nitrogen mustard gas (HN)	3	2	8	1	1	2	2	2	24	16	64	104
Lewisite (L)	4	2	6	1	1	2	2	2	32	16	48	96
Chloropicrin (PS)	1	0	2	2	0.1	2	2	2	1.6	0	3.2	4.8
Arsine (SA)	3	1	—	1	1	0.1	1	1	0.3	0.1	0	0.4
Hydrogen cyanide (AC)	3	1	—	1	1	1	1	2	6	2	0	8
Cyanogen chloride (CK)	2	1	—	1	0.1	1	1	1	0.2	0.1	0	0.3
Phosgene (CG)	3	0	—	2	1	1	2	2	24	0	0	24
Diphenylcyanosoarsine (DC)	4	1	—	2	0.1	2	2	2	6.4	1.6	0	8
Tabun (GA)	5	1	—	2	2	2	2	2	160	32	0	192
Sarin (GB)	7	3	—	2	2	2	2	2	224	96	0	320
Soman (GD)	7	7	—	2	2	2	2	2	224	224	0	448
VX	8	8	—	2	2	2	2	2	256	256	0	512
Q-mustard [1,2-bis-(2-chloroethylthio)ethane]	6	3	8	2	1	2	2	2	96	48	128	272
T-mustard [bis(2-chloroethylthioethyl)ether]	5	2	8	2	1	2	2	2	80	32	128	240
Phosgene oxime	2	2	6	1	0.1	2	1	1	0.4	0.4	1.2	2
Diphosgene	3	0	0	2	1	2	2	2	48	0	0	48
Diisopropylphosphorofluoridate (DFP)	2	2	0	2	2	2	2	2	64	64	0	128
Iron pentacarbonyl	1	0	0	1	1	2	1	1	2	0	0	2
Nickel tetracarbonyl	2	0	0	2	2	1	1	1	8	0	0	8
Carbon monoxide	2	0	0	2	2	0.1	2	2	3.2	0	0	3.2
α-Chloroacetophenone (CN)	2	0	4	2	0.1	2	2	2	3.2	0	6.4	9.6
α-Bromobenzylcyanide (BBC)	3	0	2	2	0.1	2	2	2	4.8	0	3.2	8
Diphenylchloroarsine (DA)	2	0	0	2	0.1	2	2	2	3.2	0	0	3.2
Ethyldichloroarsine (ED)	3	3	6	2	0.1	2	2	2	4.8	4.8	9.6	19.2
Methyldichloroarsine (MD)	3	3	6	2	0.1	2	2	2	4.8	4.8	9.6	19.2
Phenyldichloroarsine (PD)	3	3	6	2	0.1	2	2	2	4.8	4.8	9.6	19.2
Mustard-lewisite (HL) HL = 63% lewisite; 73% mustard gas	4	3	8	2	1	2	2	2	64	48	128	240
Adamsite (DM) DM = diphenylaminochloroarsine	2	0	2	2	0.1	2	2	2	3.2	0	3.2	6.4

The suitability numbers (N1, N2, N3) are obtained through multiplying the respective toxicity numbers by the product of the secondary criteria ratings.

Thus the number N is calculated by means of the following formula:

$$N = N1 + N2 + N3$$
$$= (IT \cdot SL \cdot P \cdot BP \cdot ES \cdot RA)$$
$$+ (PT \cdot SL \cdot P \cdot BP \cdot ES \cdot RA)$$
$$+ (DT \cdot SL \cdot P \cdot BP \cdot ES \cdot RA)$$

The separate evaluation of a number of aspects provides a clear indication of the properties and the toxicity of a substance so that a characteristic military suitability profile will be obtained for each substance.

IV. ILLUSTRATIVE EXAMPLES

To test the viability of the method described above the military suitability numbers of 30 substances [see p. 273] ranging from highly toxic commercial chemicals to agents whose data are available from scientific literature have been computed.

V. CONCLUSIONS

The approach described in this Working Paper should provide a practicable method of distinguishing between chemical warfare agents and other toxic substances.

As the table shows, the substances evaluated so far fall into two clearly distinguishable groups, one with high and one with low N values, the threshold value of the former being around 100. Substances whose N values exceed 100 might be described as particularly liable to be employed militarily. Irrespective of that, substances might be considered particularly suspicious if one of the three numbers, N1, N2 or N3, is higher than 50. Of course, the limits can be defined differently.

Thus the proposed approach would provide a sound basis both for a limited initial scheme banning only certain supertoxic agents and for a broader scheme covering a wider range of substances.

. . . .

Statement by the United States Representative (Martin) to the Conference of the Committee on Disarmament: Military Expenditures, July 24, 1975 [1]

Today I would like to address some issues raised in the Secretary-

[1] CCD/PV.675, pp. 6-11.